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AN ASSESSMENT OF THE CONCEPT ATTAINMENT MODEL IN MIDDLE SCHOOL MATHEMATICS TEACHING*

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Abstract

The main purpose of this study is to assess a concept attainment model in middle school mathematics teaching. Both quantitative and qualitative research methods were used in this study. Quantitative research method was used to analyze students' mathematics achievement and mathematics process skills. Qualitative research method was used to investigate attitudes of teachers towards the attainment of mathematics concepts and the proposed concept attainment model, and those of students towards mathematics learning through learning activities based on the proposed concept attainment model. For quantitative research, an experimental study was conducted. One of the quasi-experimental designs, viz., the nonequivalent control group design, was used in this study. The subjects were randomly selected from Grade Seven in BEHS Phado, BEHS (Branch) Quarter (2) Phado, BEHS (Branch) Myoe Chaung, BEHS Myoe Ma, BEHS (Branch) Hnget Thike, and BEHS (Branch) La-Ka-Ya 3. There were (581) Grade Seven students in the experiment. For qualitative research, the students who participated in the experimental groups and the teachers who taught the experimental groups were randomly selected. The instruments used in this study were pretest, posttest, questionnaire, and interview. Learning materials for this study were selected from Grade Seven mathematics textbook, Volume 2. According to the pilot testing, the internal consistency of pretest question was 0.782. The data were analyzed by using independent samples *t* test and one-way analysis of covariance (One-Way ANCOVA). According to results, differences in mathematics achievement and mathematics process skills were significantly found between the two selected groups. The qualitative data also supported the findings from the quantitative study. Finally, research findings proved that the proposed concept attainment model has positive contribution to middle school mathematics teaching.

Keywords: Models, Model of Teaching, Concept, Concept Attainment, Concept Attainment Model

Introduction

Mathematics is an intricate subject where various parts of the content are so interrelated to each other. In the field of mathematics, it can be found some different words: concept, skill, theory, model, etc. Medin (2000, cited in Santrock, 2006) proposed that concepts are elements of cognition that help to simplify and summarize information. If a student has a wrong concept about one part, he will find the difficulty to make progress in others. Otherwise, the erroneous procedure may develop into a habit. Therefore, it is sure that concept attainment is essential for improving students' mathematics learning and skills.

Objectives of the Research

The main objective of the research is to assess the concept attainment model in middle school mathematics teaching.

Specific objectives are as follows.

1. To construct a new concept attainment model for middle school mathematics teaching
2. To create learning activities based on the proposed concept attainment model for middle school mathematics teaching

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3. To assess the impact of concept attainment model and learning activities on students' mathematics achievement and mathematics process skills
4. To make suggestions and recommendations for the improvement of mathematics teaching

Research Hypotheses

The hypotheses of this study are as follows.

H_1: There is a significant difference between the mathematics achievement of students who are taught with the proposed concept attainment model of teaching mathematics and the mathematics achievement of those who are taught with formal instruction.

H_2: There is a significant difference between the mathematics process skills of students who are taught with the proposed concept attainment model of teaching mathematics and the mathematics process skills of those who are taught with formal instruction.

H_3: Students who are taught with learning activities based on the proposed concept attainment model may have positive attitudes towards mathematics learning.

H_4: Teachers who taught the experimental groups may have positive attitudes towards the attainment of mathematics concepts and the proposed concept attainment model.

Scope of the Research

The following points indicate the scope of the study.

1. This study is geographically restricted to two regions: Bago and Mandalay.
2. Participants in this study are Grade Seven students from the selected schools in the (2017-2018) Academic Year.
3. This study is confined to methodology of middle school mathematics teaching in Myanmar.
4. The content area covers five chapters from the prescribed mathematics textbooks Volume 2, Geometry, for Grade Seven.

Definition of Key Terms

Definitions of key terms are presented as follows.

Models. Models are prescriptive teaching strategies designed to accomplish particular instructional goals (Zubair, 2012).

Model of teaching. A model of teaching is a plan that can also be utilized to shape courses of studies, to design instructional material, and to guide instruction (Zubair, 2012).

Concept. Concept represents a category of objects which share common properties (Archer, 1969, cited in Zubair, 2012).

Concept attainment. Concept attainment is the process of finding and defining attributes of a given class, that is, identifying examples and non-examples of a category (Bruner, 1956, cited in Prabhakaram, 1998).

Concept attainment model. Concept attainment model is a model of teaching, designed to help students learn concepts for organizing information and to help students become more effective at learning concepts (Bruner, 1956, cited in Zubair, 2012).

Statement of the Problem

One of the problems encounter in current mathematics classroom is that some teachers still use teaching methods which stress mainly upon memorization with the primary focus placed on test scores. They teach mathematics concepts just for examinations but not for understanding. Another problem is that some teachers have fewer opportunities to create learning activities to develop their students' mathematics process skills such as problem-solving, reasoning and proof, communication, connection, and representation. Hence, mathematics teachers need to analyze how to teach concepts.

Significance of the Research

Chauhan (1996) states that a concept is the basic unit of all types of learning. Concepts in mathematics are the basic building blocks for thinking, particularly higher-level thinking. If students attain concepts, they can classify objects and ideas, and then they can derive rules and principles. It allows students to think and process abstractly. So, mathematics teachers need to emphasize how to teach mathematics concept. Therefore, it is necessary to develop a new concept attainment model and to assess its effectiveness in middle school mathematics teaching. This study will fulfil the needs of mathematics education in Myanmar and will meet the objectives of teaching mathematics.

Review of Related Literature

Educational Philosophy

Educational philosophies related to this study are progressivism, cognitivism, and constructivism.

Dewey, first an advocate of progressive education, placed great emphasis on actions and experience (Hook, 1986, cited in Hessong & Weeks, 1991). Since, progressivism places more emphasis on experience and experiment, they stress on learning by problem-solving or by scientific inquiry instead of memorization.

Cognitivism considers learning as a change in cognitive thinking and focuses on internal mental processes that change the way people conceptualize, realize, and understanding their environment (Ertmer & Newby, 2013). In concept attainment, students observe, and identify attributes of each until they develop a tentative hypothesis (definition) about the concept.

Constructivism equates learning with creating meaning from experience (Bednar, 1991, cited in Ertmer & Newby, 2013). In constructivism, social communities have a strong impact on constructed meaning. According to Vygotsky (n.d., cited in Sang, 2003), the idea of zone of proximal development (ZPD) is the pupils' performance, under the help of adults or cooperation from their peers. Vygotsky's zone of proximal development is presented in Figure 1.

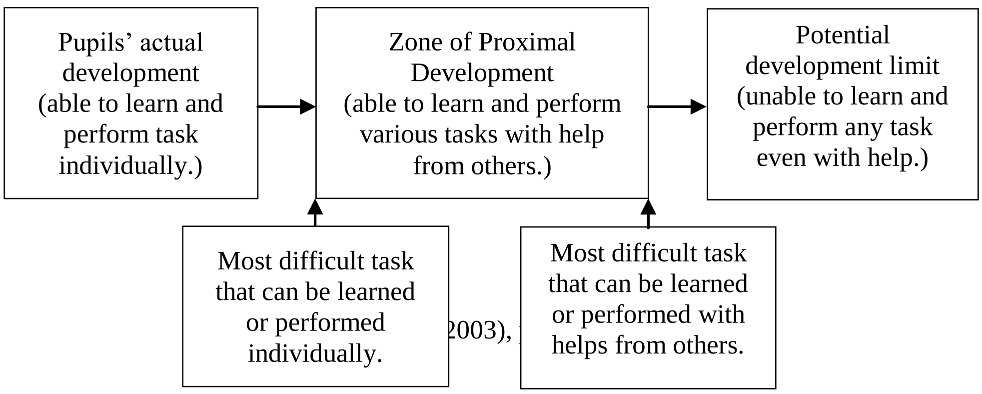


Figure 1 Zone of Proximal Development (ZPD)

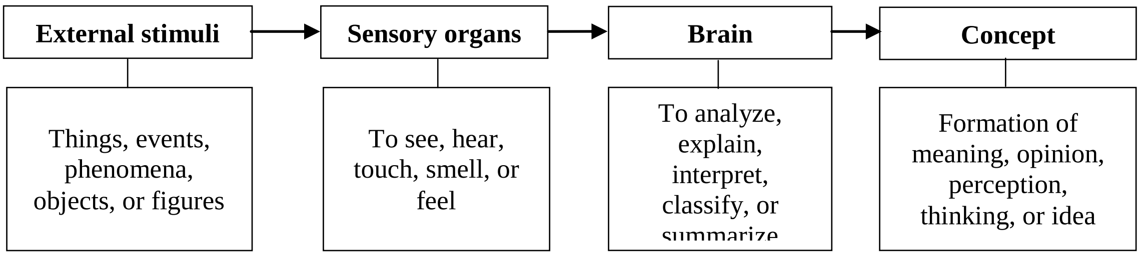
Cognitive Teaching and Learning Theories

Cognitive theories mainly stress on the acquisition of knowledge and growth of the mental structure and emphasize on the conceptualization of the students learning process.

According to Piaget's cognitive development theory (Sang, 2003), concept learning is closely related with the children's age level: sensory-motor stage (0-2 years), pre-operational stage (2-7 years), concrete operation (7-12 years), and formal operation (after 12 years). The children's cognitive development in each stage is an important factor that influences the formation of concrete or abstract concepts.

Gagne (1977, cited in Sang, 2003) put forward eight types of learning based on the learning process and arranged from simple to complex: signal learning, stimulus-response learning, learning through chaining, learning through verbal association, learning through multiple discrimination, concept learning, principle learning, and problem-solving. In order to be mastered in concept learning, understanding of definitions or observations of objects related to the concepts is crucial.

According to Bruner (1973, cited in Sang 2003), the most important function of concept formation is to categorize information into general characteristics. It is closely related to perception. The perception process begins from the external stimuli which have been perceived by human sensory organ, and transmitted to the brain via the sensory nerves to interpret the information received, followed by the classification into categories based on their special characteristics. Figure 2 briefly illustrates the process of concept formation via the perception process.



Source: From Sang (2003), p. 89.

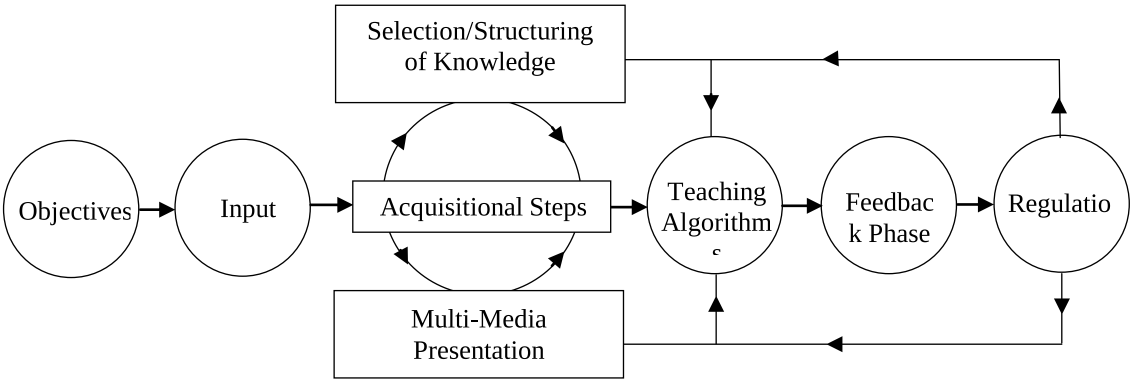
Figure 2 Process of Perception and Concept Formation

Landa's theory specifies that students ought to be taught not only knowledge but the algorithms and heuristics of experts as well. They also have to be taught how to discover algorithms and heuristics on their own. The teacher or the pedagogue must first set up the algorithm or algorithms of the activity he wishes to form and should introduce pupils to algorithms and other intellectual activity applicable to a variety of scientific subjects and fields (Khin Zaw, 2001).

Models of Teaching

In this research, Talyzina's cognitive-cybernetic or neocybernetic model, Glaser's basic teaching model, and Bruner's concept attainment model are taken into considered.

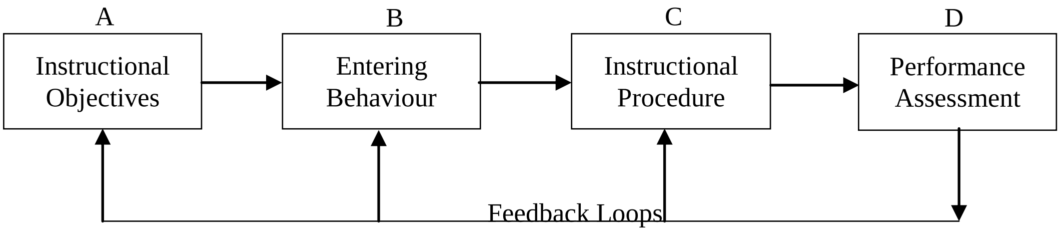
Talyzina's cognitive-cybernetic or neocybernetic model bases on step-by-step approach or stage-by-stage formation of intellectual activities. Talyzina's cognitive-cybernetic or neocybernetic model is composed of eight steps and it is illustrated in Figure 3.



Source: From Khin Zaw (2001), p. 42.

Figure 3 Professor Dr. Talyzina's Cognitive-Cybernetic or Neocybernetic Model

Glaser's basic teaching model was given by Robert Glaser (1962, cited in Singh, Sharma, & Upadhya, 2009). It consists of four major components namely instructional objectives, entering behaviour, instructional procedures, and performance assessment with feedback links. Figure 4 illustrates Glaser's basic teaching model of teaching.



Source: From Joyce and Weil (1972), p. 216.

Figure 4 Glaser's Basic Teaching Model

Bruner, Goodnow, and Austine (1956, cited in Zubair, 2012) developed a concept attainment model. Concept attainment model has three variations, namely: reception model, selection model, and unorganized material model. The reception model is more direct in teaching students the elements of a concept and their use in concept attainment. The selection model permits students to apply this awareness of conceptual activity more actively by using their own initiation and control. The third variation of this model transfers concept theory and attainment activity to a real life setting using unorganized data (Joyce & Weil, 1980).

Mathematics process skills. Mathematics process skills are the skills that can be acquired through the processes of problem-solving, reasoning and proof, communication, connection, and representation (National Council of Teachers of Mathematics [NCTM], 2000). In 2000, this council proposed five process skills that should be incorporated into the mathematics curriculum at every grade level. These skills are (a) problem-solving, (b) reasoning and proof, (c) communication, (d) connection, and (e) representation. Mathematics teachers should try to give learning opportunities for their students to acquire these mathematics process skills.

Strategies of Concept Attainment

The concept attainment strategies are divided into selection and reception strategies based upon learning conditions.

In selection strategies, the teacher presents unlabelled examples of the concept and the students inquire as to which of the presentations are examples and non-examples and attempt to construct positive examples on their own. With reception strategies, the learner's major area of freedom is in the hypotheses he chooses to adopt. The teacher presents examples of the concept that are labelled 'yes' or 'no'.

Previous Related Research

Five related studies are presented to determine whether concept attainment model is more effective than any other teaching method.

The first one, "Effectiveness of Concept Attainment Model on Achievement in Arabic Grammar of Standard IX Students", was a thesis conducted by Shamnad (2005). Its findings revealed that concept attainment model was definitely better than the conventional method for student achievement.

The second one was conducted by Anjum (2014), namely, "A Study of Effect of Concept Attainment Model on Achievement of Geometric Concepts of VIII Standard Students of English Medium Students of Aurangabard City". This study revealed that there was a significant difference between concept attainment model and traditional method on the achievement of students in understanding of geometric concepts.

The next one, "Effect of Concept Attainment Model of Teaching on Achievement in Physics at Secondary Stage", was a research conducted by Kaur (2014). This study pointed out that concept attainment model of teaching is superior and effective in terms of physics concept understanding of students in comparison to conventional method.

Jones and Hilaire (2014) conducted "Concept Learning in the Undergraduate Classroom: A Case Study in Religious Studies". In this case study, Bruner's concept attainment model was explored in the undergraduate religion classroom. It suggested that by asking questions that force learners to engage in higher-order thinking and place judgments on the concepts they are learning, greater conceptual understanding will occur.

The last one, "To Study the Effectiveness of Concept Attainment Model of Teaching on Achievement of Secondary School Students in Chemistry", was a study conducted by Kaur (2017). The results showed that students exposed to concept attainment model possessed higher score than the students taught through traditional method.

Proposed Concept Attainment Model for Middle School Mathematics Teaching

In proposed concept attainment model, there are five main components (see Figure 5). Detailed description is presented as follows.

Planning for concept attainment activities. Firstly, the teacher selects a concept. Then, the teacher identifies specific objectives to develop the selected concept. And then, the teacher selects exemplars and non-exemplars of the concept. After that, the teacher sequences them and selects appropriate medium to present the selected concept.

Assessing prerequisite skills. The second step of this model is assessing prerequisite skills of the students. If students' prerequisite skill is not enough to go on to the next step, the teacher has to fulfil and make their background knowledge strengthen. If their prerequisite skill is enough, it is ready to implement concept attainment activities.

Implementing concept attainment activities. When the teacher orients reception activity, he presents exemplars and non-exemplars of the concept one-by-one. At each encounter, the learners analyze and compare their attributes in positive and negative instances. Then, students list them. And then, students generate hypothesis with regard to the concept. Finally, students state definition of the concept according to its attributes.

In selection oriented activity, the teacher presents an array of unlabelled exemplars. Students may ask about their own exemplars in order to attain the concept. The students also control the sequence of the exemplars by choosing the ones they want to inquire about. And then students generate hypothesis.

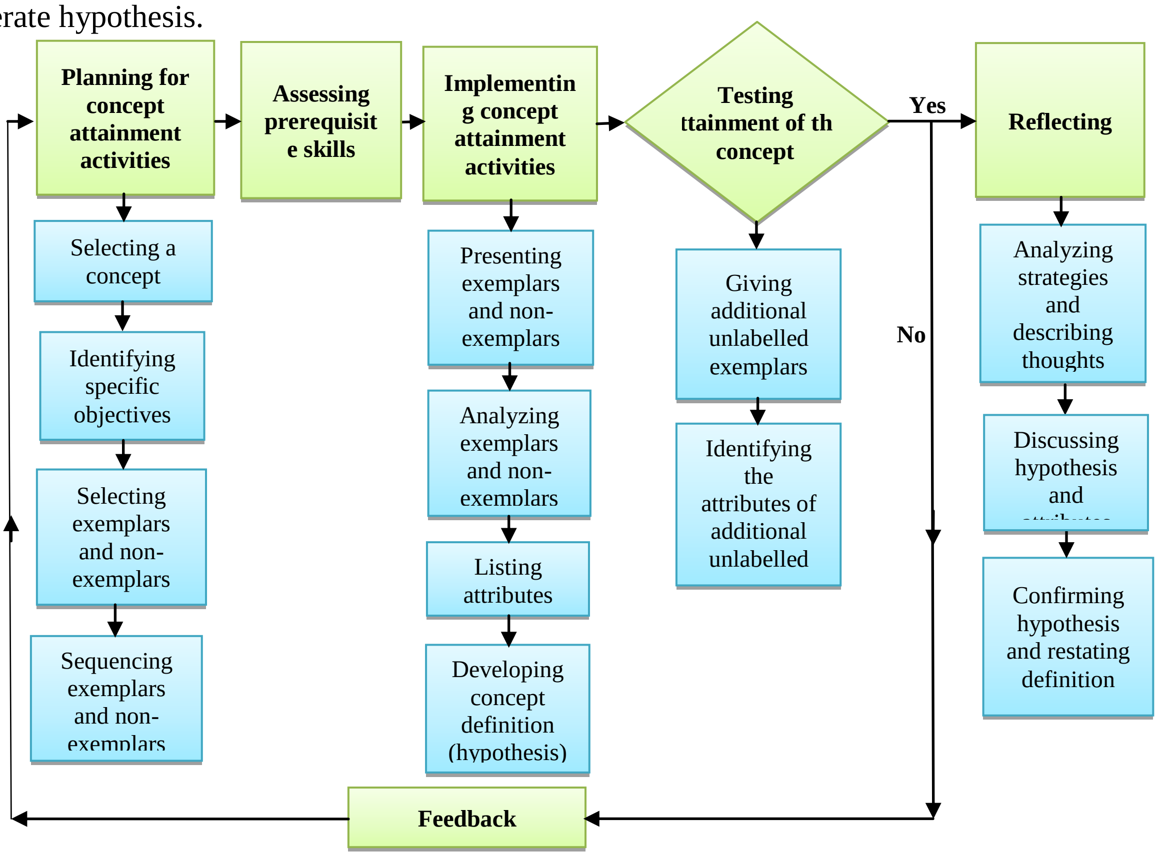


Figure 5 Proposed Concept Attainment Model

Testing attainment of the concept. The teacher gives additional unlabelled exemplars to test attainment of the concept. After testing attainment of the concept, the teacher has to check students' answers. If the students' answers are right, they can proceed to the next step, reflecting. If not, the teacher will provide feedback.

Providing feedback or reflecting. Providing feedback is necessary for the students who do not get the concept. If they attain the concept surely, they can move to reflecting. In reflecting, the teacher asks the students to analyze the strategies. Students describe their thoughts and discuss the hypothesis and attributes. Finally, the teacher confirms hypothesis, names concept, and restates definition according to essential attributes.

Research Method

Both quantitative and qualitative research methods were used in this study.

Quantitative Research Method

Quantitative research method was used to analyze students' mathematics achievement and mathematics process skills. One of the quasi-experimental designs, viz., the nonequivalent control group design was used.

Population and sample. Grade Seven students from the selected schools were selected as the subjects. Table 1 shows population and sample of the quantitative study.

Table 1 Population and Sample

Selected Region and Township	Name of School	No. of population	No. of Subject
Bago Region (Kyauktaga Township)	BEHS Phado	101	101
	BEHS (Branch) Quarter 2 Phado	81	81
	BEHS (Branch) Myoe Chaung	112	112
Mandalay Region (Yemethin Township)	BEHS Myoe Ma	279	135
	BEHS (Branch) Hnget Thike	65	65
	BEHS (Branch) La-Ka-Ya 3	87	87
Total		**725**	**581**

Instruments. Pretest and posttest were used as quantitative research instruments.

Pretest. The pretest question consists of (30) multiple choice items. Test items were constructed based on Grade Six mathematics textbook (Volume 2). The total score for pretest is (30) marks. Time duration is (45) minutes, (1) period.

Posttest. There are two main parts in the posttest question. The first part contains (30) multiple choice items and the second contains (10) short questions. They were constructed from prescribed mathematics textbooks (Volume 2) for Grade Seven. The total score for posttest is (60) marks and time duration is one and a half hours.

Learning activities. To construct learning activities for concept attainment, (20) concepts were selected from Grade Seven mathematics textbooks (Volume 2).

Procedure. Firstly, a pilot study was conducted and the internal consistency of pretest question was 0.782. And then, full-scale study was conducted from July 2017 to January 2018. In full scale study, only (16) periods were taken to give treatment in accordance with the monthly course. A pretest was conducted before the experimental groups were given treatment. In full scale study, (16) concepts were selected to give treatment. After that, posttest was administered in the last week of January 2018.

Qualitative Research Method

Qualitative research method was used to investigate attitudes of teachers and students.

Population and sample. Students who participated in the experimental groups and teachers who taught the experimental groups were selected as the subjects.

Instruments. Questionnaire and interview were used.

Questionnaire. Five-point Likert scale with '5' stands for strongly agree and '1' stands for strongly disagree, was used to indicate the attitudes towards each item.

Interview. The first part of interview question is about the demographic information and the second one is about the attitude of teachers towards the proposed concept model.

Procedure. The questionnaires were distributed to the participants in the last week of the experiment. It took the students about (20) minutes and the teachers about (30) minutes. For interview, a semi-structured interview form was created. The interview took about (15) minutes. It is firstly audiotape recorded, and then transcribed.

Analysis of Data

The Statistical Package for the Social Science (SPSS) Version 23 was used to analyze the quantitative data. The data were analyzed by using the independent samples *t* test and

one-way analysis of covariance (One-Way ANCOVA).

Research Findings

Quantitative Research Findings for Pretest

Table 2 shows *t* values for pretest scores of Grade Seven students.

Table 2 *t* Values for Pretest Scores

School	Group	*N*	*M*	*SD*	*MD*	*t*	*df*	Sig. (2-tailed)
S1	Experimental	50	10.54	4.55	2.27	3.44	99	.001**
	Control	51	8.27	5.56				
S2	Experimental	40	10.05	3.27	-0.24	-0.36	79	.722 (ns)
	Control	41	10.29	2.84				
S3	Experimental	56	12.71	2.61	2.82	7.17	110	.000***
	Control	56	9.89	1.37				
S4	Experimental	66	16.70	3.79	6.64	12.40	133	.000***
	Control	69	10.06	2.18				
S5	Experimental	32	12.06	2.88	2.88	3.76	63	.000***
	Control	33	9.18	3.27				
S6	Experimental	43	12.88	3.31	2.11	3.59	85	.001**
	Control	44	10.77	2.00				

Note. S1 = BEHS Phado; S2 = BEHS (Branch) Quarter 2 Phado; S3 = BEHS (Branch) Myoe Chaung; S4 = BEHS Myoe Ma; S5 = BEHS (Branch) Hnget Thike; S6 = BEHS (Branch) La-Ka-Ya 3; ns = not significant.

**$p < .01$. ***$p < .001$.

The results showed that there were significant differences between entry behaviour of the two selected groups in S1, S3, S4, S5, and S6. Therefore, their posttest scores will be analyzed by using one-way analysis of covariance (One-Way ANCOVA). But in S2, there was no significant difference between the pretest scores of the two groups. Therefore, its posttest score will be analyzed by using the independent samples *t* test.

Quantitative Research Findings for Posttest

Table 3 presents *t* value for posttest scores of Grade Seven students in S2.

Table 3 *t* Value for Posttest Scores of Grade Seven Students in S2

	Group	*N*	*M*	*SD*	*MD*	*t*	*df*	Sig. (2-tailed)
PS	EG	40	4.63	3.56	1.12	1.48	79	.144 (ns)
	CG	41	3.51	3.22				
RP	EG	40	4.08	4.40	1.91	2.43	79	.018*
	CG	41	2.17	2.32				
CM	EG	40	7.60	1.93	0.82	1.89	79	.063 (ns)
	CG	41	6.78	1.98				
CN	EG	40	5.08	1.61	2.32	6.87	79	.000***
	CG	41	2.76	1.43				
RE	EG	40	7.20	2.51	2.00	3.39	79	.001**
	CG	41	5.20	2.80				
MA	EG	40	28.58	10.88	8.17	3.72	79	.000***
	CG	41	20.41	8.76				

Note: PS = Problem-Solving; RP = Reasoning and Proof; CM = Communication; CN = Connection; RE = Representation; MA = Mathematics Achievement; ns = not significant.
*$p < .05$. **$p < .01$. ***$p < .001$.

According to the results presented in Table 3, the mean scores of reasoning and proof, connection skill, representation skill, and mathematics achievement of the experimental group were significantly higher than those of the control group. It showed that the use of the proposed concept attainment model had a significant influence on those skills. But there were no significant differences between the problem-solving skill and the communication skill of the two groups.

Table 4 shows summary of ANCOVA results for the problem-solving skill on posttest of Grade Seven students in S1, S3, S4, S5, and S6.

Table 4 Summary of ANCOVA Results for Problem-Solving Skill on Posttest of Grade Seven Students in S1, S3, S4, S5, and S6

School	Tests of Between-Subjects Effects					Unadjusted Mean		Adjusted Mean	
	Source	*df*	*F*	Sig. (2-tailed)	Partial Eta Squared	EG	CG	EG	CG
S1	Pretest	1	0.23	.634	.002	8.66	7.35	8.63	7.39
	Group	1	10.01	.002**	.093				
	Error	98							
S3	Pretest	1	0.02	.900	.00	8.84	7.36	8.85	7.45
	Group	1	19.58	.000***	.15				
	Error	109							
S4	Pretest	1	1.23	.270	.009	8.09	6.42	8.30	6.22
	Group	1	15.76	.000***	.107				
	Error	132							
S5	Pretest	1	0.28	.600	.004	7.94	5.09	7.98	5.05
	Group	1	70.29	.000***	.531				
	Error	62							
S6	Pretest	1	14.41	.000	.15	5.84	4.64	5.39	5.07
	Group	1	0.25	.620	.00				
	Error	84							

Note. **$p < .01$. ***$p < .001$.

According to the results presented in Table 4, there were significant differences between the problem-solving skill of the two groups in S1, S3, S4, and S5 according to F (1, 98) = 10.01, p = .002, partial eta squared = .09; F (1, 109) = 19.58, p = .000, partial eta squared = .15; F(1, 132) = 15.76, p = .000, partial eta squared = .11; and F (1, 62) = 70.29, p = .000, partial eta squared = .53. But in S6, there was no significant difference according to F (1, 84) = 0.25, p = .620, partial eta squared = .00.

Table 5 describes ANCOVA results for skill of reasoning and proof on posttest of Grade Seven students in S1, S3, S4, S5, and S6.

Table 5 Summary of ANCOVA Results for Skill of Reasoning and Proof on Posttest of Grade Seven Students in S1, S3, S4, S5, and S6

School	Tests of Between-Subjects Effects					Unadjusted Mean		Adjusted Mean	
	Source	***df***	***F***	**Sig. (2-tailed)**	**Partial Eta Squared**	**EG**	**CG**	**EG**	**CG**
S1	Pretest	1	0.02	.887	.000	5.24	3.06	5.23	3.01
	Group	1	30.57	.000***	.238				
	Error	98							
S3	Pretest	1	0.04	.846	.00	10.70	9.18	10.72	9.15
	Group	1	11.05	.001**	.09				
	Error	109							
S4	Pretest	1	0.91	.341	.007	7.73	3.78	7.88	3.63
	Group	1	88.04	.000***	.400				
	Error	132							
S5	Pretest	1	0.04	.842	.001	7.75	4.48	7.77	4.47
	Group	1	63.05	.000***	.504				
	Error	62							
S6	Pretest	1	10.52	.002	.11	5.21	3.48	4.78	3.90
	Group	1	1.52	.221	.02				
	Error	84							

Note. $^{**}p < .01$. $^{***}p < .001$.

Table 6 presents ANCOVA results for communication skill on posttest of Grade Seven students in S1, S3, S4, S5, and S6.

According to the results presented in Table 5, there were significant differences between the skill of reasoning and proof on posttest of the two groups in S1, S3, S4, and S5 according to F (1, 98) = 30.57, p = .000, partial eta squared = .24; F (1, 109) = 11.05, p = .001, partial eta squared = .09; F (1, 132) = 88.04, p = .000, partial eta squared = .40; and F (1, 62) = 63.05, p = .000, partial eta squared = .50. But in S6, there was no significant difference according to F (1, 84) = 1.52, p = .221, partial eta squared = .02.

Table 6 Summary of ANCOVA Results for Communication Skill on Posttest of Grade Seven Students in S1, S3, S4, S5, and S6

School	Tests of Between-Subjects Effects					Unadjusted Mean		Adjusted Mean	
	Source	*df*	*F*	Sig. (2-tailed)	Partial Eta Squared	EG	CG	EG	CG
S1	Pretest	1	0.35	.852	.000	6.88	5.06	6.87	5.07
	Group	1	30.88	.000***	.240				
	Error	98							
S3	Pretest	1	0.30	.587	.00	9.13	8.66	9.09	8.70
	Group	1	2.92	.090	.03				
	Error	109							
S4	Pretest	1	3.30	.072	.024	7.85	5.87	8.14	5.59
	Group	1	32.88	.000***	.199				
	Error	132							
S5	Pretest	1	0.22	.643	.003	6.63	4.61	6.58	4.65
	Group	1	22.22	.000***	.264				
	Error	62							
S6	Pretest	1	1.17	.283	.01	8.70	7.93	8.63	8.00
	Group	1	2.94	.090	.03				
	Error	84							

Note: $^{***}p < .001$.

According to the results presented in Table 6, there were significant differences between the communication skill of the two groups in S1, S4, and S5 according to F (1, 98) = 30.88, p = .000, partial eta squared = .24; F (1, 132) = 32.88, p = .000, partial eta squared = .20; and F (1, 62) = 22.22, p = .000, partial eta squared =.26. But in S3 and S6, there were no significant differences according to F (1, 109) = 2.92, p = .090, partial eta squared = .03 and F (1, 84) = 2.94, p = .090, partial eta squared =.03.

Table 7 shows ANCOVA results for connection skill on posttest of Grade Seven students in S1, S3, S4, S5, and S6.

According to the results presented in Table 7, there were significant differences between the connection skill of the two groups in S1, S3, and S5 according to F (1, 98) = 80.70, p = .000, partial eta squared =.45; F (1, 109) = 12.16, p = .001, partial eta squared = .10; and F (1, 62) = 52.44, p = .000, partial eta squared = .46. But in S4 and S6, there were no significant differences according to F (1, 132) = 0.77, p = .381, partial eta squared = .01; and F (1, 84) = .09, p = .765, partial eta squared = .00.

Table 7 Summary of ANCOVA Results for Connection Skill on Posttest of Grade Seven Students in S1, S3, S4, S5, and S6

School	Tests of Between-Subjects Effects					Unadjusted Mean		Adjusted Mean	
	Source	*df*	*F*	Sig. (2-tailed)	Partial Eta Squared	EG	CG	EG	CG
S1	Pretest	1	0.77	.381	.008	7.36	4.43	7.31	4.48
	Group	1	80.70	.000***	.452				
	Error	98							
S3	Pretest	1	1.81	.181	.02	9.21	8.64	9.16	8.69
	Group	1	12.16	.001**	.10				
	Error	109							
S4	Pretest	1	0.46	.501	.003	6.09	5.58	6.00	5.67
	Group	1	0.77	.381	.006				
	Error	132							
S5	Pretest	1	0.14	.705	.002	5.84	3.27	5.87	3.24
	Group	1	52.44	.000***	.458				
	Error	62							
S6	Pretest	1	4.18	.044	.05	7.79	7.64	7.66	7.64
	Group	1	0.09	.765	.00				
	Error	84							

Note: $^{**}p < .01$. $^{***}p < .001$.

Table 8 shows ANCOVA results for representation skill on posttest of Grade Seven students in S1, S3, S4, S5, and S6.

Table 8 Summary of ANCOVA Results for Representation Skill on Posttest of Grade Seven Students in S1, S3, S4, S5, and S6

School	Tests of Between-Subjects Effects					Unadjusted Mean		Adjusted Mean	
	Source	*df*	*F*	Sig. (2-tailed)	Partial Eta Squared	EG	CG	EG	CG
S1	Pretest	1	0.00	.999	.000	9.00	6.08	9.00	6.08
	Group	1	38.81	.000***	.284				
	Error	98							
S3	Pretest	1	0.06	.812	.00	8.96	7.73	8.97	7.71
	Group	1	16.34	.000***	.13				
	Error	109							
S4	Pretest	1	0.13	.718	.001	8.97	6.49	8.92	6.54
	Group	1	36.13	.000***	.215				
	Error	132							
S5	Pretest	1	0.00	.966	.000	9.59	6.97	9.56	6.97
	Group	1	25.40	.000***	.291				
	Error	62							
S6	Pretest	1	6.96	.010	.08	10.09	6.08	10.06	9.82
	Group	1	0.19	.668	.00				
	Error	84							

Note $^{***}p < .001$.

According to the results presented in Table 8, there were significant differences between the representation skill of the two groups of S1, S3, S4, and S5 according to F (1, 98) = 38.81, p = .000, partial eta squared = .28; F (1, 109) = 16.34, p = .000, partial eta squared = .13; F (1, 132) = 36.13, p = .000, partial eta squared = .22; and F (1, 62) = 25.40, p = .000, partial eta squared = .29. But in S6, there was no significant difference according to *F* (1, 84) = 0.19, *p* = .668, partial eta squared = .00.

Table 9 shows ANCOVA results for the mathematics achievement on posttest of Grade Seven students in S1, S3, S4, S5, and S6.

Table 9 Summary of ANCOVA Results for Mathematics Achievement on Posttest of Grade Seven Students in S1, S3, S4, S5, and S6

School	Tests of Between-Subjects Effects					Unadjusted Mean		Adjusted Mean	
	Source	*df*	*F*	Sig. (2-tailed)	Partial Eta Squared	EG	CG	EG	CG
S1	Pretest	1	0.29	.590	.00	37.14	25.98	37.04	26.08
	Group	1	104.12	.000***	.52				
	Error	98							
S3	Pretest	1	0.02	.892	.00	46.84	41.68	46.81	41.71
	Group	1	48.32	.000***	.31				
	Error	109							
S4	Pretest	1	1.68	.197	.01	38.73	28.14	39.24	27.65
	Group	1	111.22	.000***	.46				
	Error	132							
S5	Pretest	1	0.06	.815	.00	37.75	24.42	37.80	24.83
	Group	1	179.69	.000***	.74				
	Error	62							
S6	Pretest	1	14.88	.000	.15	37.63	33.48	36.28	34.80
	Group	1	0.61	.438	.01				
	Error	84							

Note: ****p* < .001.

According to the results presented in Table 9, there were significant differences between the posttest scores of the two groups in S1, S3, S4, and S5 according to *F* (1, 98) = 104.12, *p* = .000, partial eta squared = .52; *F* (1, 109) = 48.32, *p* = .000, partial eta squared = .31; *F* (1,132) = 111.22, *p* = .000, partial eta squared = .46; and *F* (1, 62) = 179.69, *p* = .000, partial eta squared = .74. But in S6, there was no significant difference according to *F* (1, 84) = 0.61, *p* = .438, partial eta squared = .01.

Figure 6 shows comparison of mean scores of mathematics process skills and mathematics achievement on posttest.

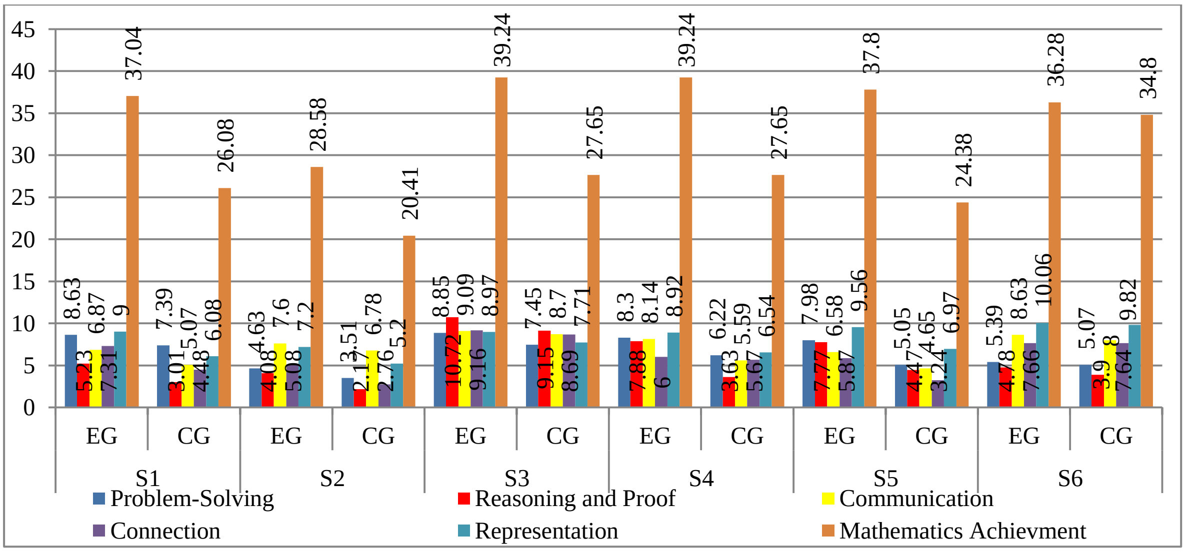


Figure 6 Comparison of Mean Scores of Mathematic Process Skills and Mathematics Achievement on Posttest

Percentage of responses from questionnaire. According to the responses of the teachers and the students, percentage of agreement and disagreement were calculated for all items in the questionnaires.

Students' attitudes towards learning activities based on the proposed concept attainment model. In the questionnaire, items 1 to 4 dealt with developing students' collaborative skills, items 5 to 8 are about developing inquiry skills, items 9 to 12 dealt with developing self-confidence, and the last items 13 to 16 dealt with developing mathematics process skills. Responses of students and teachers on these items are expressed in the following Table 10.

Table 10 Attitudes of Students and Teachers towards Learning Activities based on the Proposed Concept Attainment Model

No.	Statement	Students						Teachers					
		N1	Percentage (%)					*N2*	Percentage (%)				
			Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree		Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1.	Sharing thoughts, ideas, and opinions to friends	287	12.5	73	11.5	2.7	0.3	6	16.7	66.6	16.7	0	0
2.	Listening carefully to others' thoughts, ideas, and opinions	287	24.5	61.3	12.5	0.7	1	6	33.3	50	16.7	0	0
3.	Collaborating with others	287	27.9	60.6	8.4	2.4	0.7	6	33.3	66.7	0	0	0
4.	Helping others who do not have the first idea of the lesson	287	28.6	60	6.6	4.5	0.3	6	33.3	66.7	0	0	0
5.	Discovering various concerns about a problem	287	18.1	57.8	13.6	8.7	1.8	6	16.7	66.6	16.7	0	0
6.	Discovering the possible ways to solve a problem	287	26.1	57.8	9.4	5.7	1	6	16.7	83.3	0	0	0
7.	Inquiring to acquire new knowledge	287	30.3	56.4	10.8	1.8	0.7	6	16.7	66.6	16.7	0	0
8.	Inquiring not only mathematics field but also other fields	287	33.7	51.6	10.5	3.5	0.7	6	16.7	66.6	16.7	0	0
9.	Contrasting the right and the wrong of an idea	287	13.6	61.7	23.3	1.4	0	6	16.7	83.3	0	0	0
10.	Solving difficult problems	287	13.9	65.9	17.4	2.8	0	6	16.7	66.6	16.7	0	0
11.	Explaining clearly thoughts, ideas, and opinions to friends	287	18.5	62.7	15.3	3.5	0	6	33.3	66.7	0	0	0
12.	Developing confidence in discussing the lesson with my teacher in the class	287	19.9	48	25.8	5.6	0.7	6	33.3	66.7	0	0	0
13.	Developing connection skill and the skill of reasoning and proof	287	15	59.2	21.6	3.5	0.7	6	16.7	83.3	0	0	0
14.	Developing problem-solving skill	287	25.8	58.9	12.9	2.1	0.3	6	16.7	83.3	0	0	0
15.	Developing communication skill	287	25.8	60.6	10.1	3.5	0	6	33.3	50	16.7	0	0
16.	Developing representation skill	287	26.1	54.1	15.3	4.2	0.3	6	16.7	83.3	0	0	0

Note: *N1* = number of students who participated in the experimental groups; *N2* = number of teachers who taught the experimental groups.

Grade Seven teachers' attitudes towards the attainment of mathematics concepts. The attitudes of the teachers who taught the experimental groups towards the attainment of mathematics concepts are firstly presented in terms of ten items. Teachers' responses on these items are expressed in Table 11.

Table 11 Grade Seven Teachers' Attitudes towards the Attainment of Mathematics Concepts

No.	Statement	*N*	Percentage (%)				
			Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1.	Mathematics concepts are the most important things for developing mathematics process skills.	6	50	50	0	0	0
2.	Only when mathematics concepts are attained, one will be able to keep on studying mathematics theorems, corollaries, and properties.	6	50	50	0	0	0
3.	Only when mathematics concepts are attained, one will be able to keep on studying difficult lessons.	6	33.3	66.7	0	0	0
4.	Only when mathematics concepts are attained, one will be able to solve mathematics problems successfully.	6	66.7	33.3	0	0	0
5.	Only when mathematics concepts are attained, one will be able to prove mathematics problems.	6	33.3	66.7	0	0	0
6.	Only when mathematics concepts are attained, one will be able to communicate clearly his thoughts and opinions to others.	6	33.3	66.7	0	0	0
7.	Only when mathematics concepts are attained, one will be able to connect the relationships among axioms, postulates, theorems, corollaries, and properties.	6	33.3	66.7	0	0	0
8.	Only when mathematics concepts are attained, one will be able to read and understand the meanings of pictures, graphs, and symbols.	6	16.7	66.6	16.7	0	0
9.	Only when mathematics concepts are attained, one will be able to study mathematics happily.	6	50	50	0	0	0
10.	Only when mathematics concepts are attained, one will be able to value and appreciate mathematics.	6	66.7	33.3	0	0	0

Note: *N* = number of teachers who taught the experimental groups.

Findings from open-ended responses. At the end of attitude questionnaires for teachers, three open-ended questions were added. The first one is about the contributions of the proposed model towards the development of mathematics teaching. The second one is about the difficulties they met while implementing learning activities through this model. The last one is to write down their opinions and attitudes towards this model. According to their responses, all teachers propounded that this model made provision for teaching of mathematics. Some students could not participate along with the activities at the beginning and the common difficulty was time limitation. In addition, prepared learning activities based on this model and teaching aids were very excellent. And students were very interested in teaching through this model.

Findings from interview. Three teachers who taught the experimental groups in the selected schools were interviewed. The first one is from School 1. BA (History) is her first degree and total service is (14) years. Among (14) years, the service for mathematics teaching is (10) years. The second one is from School 2. Her first degree is BA (History). Her total service is (25) years and the service for mathematics teaching is above (10) years. She finished both primary teachers training course and junior teachers training course. The last one is from School 4. Her first degree is BSc (Chemistry). Her total service is (10) years and the service for mathematics teaching is four years. They all finished primary teachers training course and junior teachers training course, but the last teacher also finished first year of BEd corresponding course.

They said that some students could not analyze and compare the attributes of concepts at the beginning. After three periods, they developed how to analyze, how to compare, and how to develop a concept. They changed their learning styles and actively participated in teaching-learning process. During this study, the students developed their collaborative skills, self-confidence, inquiry skills and mathematics process skills. Based on their experiences of teaching with the prepared learning activities, they made a precious suggestion that each teaching-learning activity should take about (50) minutes. In conclusion, they propounded that it is very suitable and valuable approach for teaching of mathematics.

Summary of Research Findings

Quantitative research findings and qualitative research findings from six selected schools are summarized as follows.

Summary of quantitative research findings. Except from S6, differences in mathematics achievement and mathematics process skills were significantly found between the experimental groups and the control groups.

Summary of quantitative research findings from students' questionnaires. Students' responses towards the learning activities expressed that the students in the experimental groups developed positive attitudes towards their learning.

Summary of quantitative research findings from teachers' questionnaires. Teachers' responses expressed that they had positive attitudes towards the attainment of mathematics concept and towards the proposed concept attainment model.

Summary of qualitative research findings. According to interview responses, the teachers were not in line with their major specializations. But they had many experiences in teaching and they devoted their time and effort in implementing those activities. They said that all the prepared learning activities and materials were very useful for teaching of mathematics. And they propounded that the proposed model was very suitable and valuable approach for teaching of mathematics.

Discussion

In terms of the statistical results, the students' performance had significant difference on the achievement of mathematics process skills and on overall mathematics achievement. According to quantitative research findings, it can be concluded that students' true attainment of mathematics concept make them acquire mathematics process skills. According to the responses of teachers and students, they had positive attitude towards the proposed model. These results of qualitative study also supported the findings of the quantitative study which were consistent with the findings of the five related studies.

Suggestions

To make students' progress in developing mathematics achievement and mathematics process skills, teachers should create effective classroom environment with many opportunities. Skills and concepts once developed must be maintained through reapplication and not allowed to deteriorate through disuse. Since students do not learn with equal facility or at equal rates, there must be provision for individual differences. If the instruction is to attain a maximum of usefulness, it must be carried on with the deliberate purpose of securing maximum of transfer.

This research study is not perfect and suitable for all situations. In this study sample schools were randomly selected from Bago and Mandalay Regions. Further research should be carried out for the rest states and regions for replication. It partially provides to improve middle school mathematics teaching methodology to some extent, however the results of this study do not represent to crowded classrooms. So, new mathematics teaching approach for large classrooms should be developed. According to time limitations, this research was conducted for only five units from mathematics Volume 2. Further research should be carried out for mathematics Volume 1. In this study, the effectiveness of the proposed model was evaluated through five mathematics process skills. It can also be evaluated according to Bloom's taxonomy of instructional objectives.

Conclusion

The results of quantitative study and qualitative study supported its major hypotheses. According to the findings of the research, it is hoped that this proposed model can be useful to some extent for mathematics teaching. Through the proposed model, the students will attain mathematics concepts easily and happily. If they are taught through the process of concept attainment, they can learn faster, maintain for a long time, and transfer it to new situations. It will also be beneficial to teachers. This study will hopefully serve as a future reference for researchers in other subject areas. Based on these findings, future researchers can conduct further researches on the effectiveness of concept attainment model.

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A STUDY OF THE AWARENESS AND ATTITUDE OF THE PRIMARY TEACHERS TOWARDS THE NEW PRIMARY MORALS AND CIVICS CURRICULUM IMPLEMENTATION

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Abstract

The aim of the study is to investigate the level of awareness and attitude of the primary teachers towards the new morals and civics curriculum implementation. This focused on Grade One teachers from East District of Yangon Region who were selected using simple random sampling method. Descriptive survey method and quantitative approach were used in this study. As the research instrument, the Trainee Teacher Attitude Questionnaire developed by The University of Plymouth (2007) and Questionnaire on Consultation of Morals and National Education Curriculum developed by Tovmasyan and Marcie Taylor Thoma (2008) were based and developed to use in this study. There are (71) total items of 5-Likert scales and (12) open-ended questions. Total of (329) Grade One teachers participated in this study. According to this study, the results point out that the awareness and attitude of the Grade One primary teachers the (89.47%) of school group is at the moderate level and (10.53%) of school group is at the high level in implementing the new primary morals and civics curriculum. The results also point out that the level of implementation of Grade One primary teachers from school group towards new primary morals and civics subject is (42.10%). The implementation done by the private school group and the monastic school group are higher than that of other school groups. According to the subscales, the mean score of assessment session is lower than the mean score of awareness and attitude level and implementation level. These results also show that the awareness and attitude of the Grade One teachers impact on their daily teaching.

Introduction

Education is defined as the process of educating or teaching. In earlier times, education was primarily a means for survival. Gradually, however, people came to use education for a variety of purposes. Today, education may be used not only for purposes of survival but also for better use of leisure time and refinements in social and cultural life. The fundamental purpose of education is to develop the knowledge, skill, or character of students. The system of education at all levels has changed, is changing and will continue to change as and when it is required. People live in a time of extraordinary and accelerating change. Also, knowledge of moral practices and ethical standards acceptable by society, ability to be a good citizen, attitude and skills for living, ability to think creatively continue to emerge and evolve. In this changing world, those who understand social studies and have moral values will have significantly enhanced opportunities, options for shaping their futures. Moral values open doors to good citizens but the lack of moral values keeps those doors closed. Moreover, it is regarded as one of the important subjects because it shapes the mind and prepares students for social communication and critical thinking skills to be good citizens.

In preparing for assuming roles of children as citizens of a democracy, children of today will need to acquire some of the same skills as did preceding generations of students. They must understand the basic principles and aspirations that undergird democracy, and they must recognize the ties that bind and the issues that can separate as a pluralistic nation. Myanmar, is

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leading to become a democratic country, morals and civics subject becomes one of the independent subjects in new primary school curriculum.

As teacher is the person who prepares the students' future, the role of the teacher is very important in implementing the curriculum that leads to overcome the challenges to be good citizens in the changing global society. Thus, it is important to investigate the awareness and attitudes of primary teachers in new primary morals and civics curriculum implementation.

Purposes of the Study

The main purpose of the study is to study the awareness and attitude of primary teachers towards new primary morals and civics curriculum implementation. The focus will be on Grade One teachers who are implementing the current new primary morals and civics curriculum.

The research questions are as follows:

Q $_{1}$: Which level of knowledge on morals and civics subject is possessed by the primary teachers?

Q $_{2}$: Which part is advantageous and which part is challenging in teaching new morals and civics subject in daily teaching?

Q $_{3}$: What are primary teachers' views and experiences on morals and civics subject implementation in their daily teaching?

Q $_{4}$; Is there a relationship between teachers' awareness and attitudes and implementation towards new morals and civics subject?

The Scope of the Study

This research has its own particular limitation. The first limitation is related to the fact that the participants in the study are from only Yangon Region. All the participants are Grade One teachers from the four selected townships of the East Yangon District (2017-2018 AY). The selected townships are Thingangyun Township, South Dagon Township, North Dagon Township and South Okkalapa Township. The second limitation deals with the area of the curriculum implementation. The area is limited to study the new morals and civics subject. The third limitation deals with the Grade. There are five Grades in primary education level. But in this study, the implementation on Grade One new curriculum will be involved. There is no limitation on gender and working service of the primary teachers. There is also no limitation on training because all of the Grade One teachers had attended the workshop on new curriculum implementation.

Definition of Key Terms

Awareness - Actions directed at people to improve understanding and skills, and influence behavior (Rathus, 1998).

Attitude - Attitudes are beliefs and feeling about subjects, people and events that lead people to behave in certain ways (Quattrone, 1982).

Morals - Morals can be defined what is "right" and "wrong" behavior within society, providing a guide for individuals to follow. It is what many believe the main underlying and unifying principle that allows for improvement in man and civilization at large (Black, 2014).

Moral

Education - A moral education is one that is morally justified in social structure, curriculum content, pedagogy, and approved human interactions (Noddings, 2008).

Civics - Civics is the study of the theoretical, political and practical aspects of citizenship, as well as the rights and duties; the duties of citizens to each other as members of a political body and to the government. (Wikipedia, n.d.).

Curriculum - Curriculum is a dynamic programme that is expected to address the changing needs and aspiration of any society (Igwebuike, 2008).

Review of Related Literature

Moral and Civics Education

Morals can be defined what is considered "right" and "wrong" behavior within society, providing a guide for individuals to follow. It is what many believe the main underlying and unifying principle that allows for improvement in man and civilization at large (Black, 2014). While ones have developed their own ideas of what they accept as "right" and "wrong" once they've become adults and can largely define these concepts in terms of specific behaviors. As children, they must acquire this concept as they develop (Black, 2014). Civics education is the foundation for global citizenship.

Nowadays, civic education programmes have become an increasingly important means for countries to educate citizens about their rights and responsibilities. Morals and civics education is prescribed in school curriculum in most of the countries in the world.

Moral and Civics Education in Myanmar

In Myanmar, moral education was started from the Pinya Era. During the time of King Thihathu, the year 704 ME, minster, Saturingabala, selected a testament of moral from several ones and translated it into Parli language. And then he divided it into seven units to be obeyed and performed for people. This includes what is the wisdom, the man of good and bad character, and friendship, and woman, and King and General. This can be assumed as the first moral education in Myanmar.

The second era that moral education developed is Innwa. In this era, the two monks, Shin Maharsilawuntha and Shin Maharrahttatharra, were populated as famous poets. They narrated the rules and the things to be followed by the youths to become a good person. According to the Shin Maharsilawuntha, concerning with the moral education, he described about the physical behavior and his suggestions led to good habits of living, good speech or verbal communication and eating manner, etc. His advice was practical and useful for everyone.

According to Shin Maharrahttatharra, he suggested his pupils not only to study the academic knowledge but also to follow the good habits for their lives. Therefore, moral education, in the period of Myanmar Kings, intended to be man of good characters in his life (cited in ဦးသန်းထွတ်၊ ၂၀၀၃).

Prior to the introduction of civics subject in 1945, there was no subject in the curriculum that aimed to develop civic and political knowledge, Myanmar tradition and Buddha's discipline, Myanmar literature and History.

Civic education was described as the core subject in primary and post primary level according to the Similar Education Project in Pre Independence Era (1945-1947). And then, general education framework developed in 1950. In (1950-1953), civic education was taught from primary to high school level. In (1960-61), according to Pyi Taw Thar Education Project, civic education was taught in middle school level. From (1961-62 to 1967 AY), Revolution Council allowed to teach civic education in primary level. In high school level, civic education was one of the core subjects. In 1967, civic education was not determined as a curriculum.

In the time of the Republic of the Union of Myanmar, moral education was set as separate subject and taught as the clinical development studies in primary school curriculum. The new curriculum implemented from 1985-86 to 1988, moral education was prescribed as clinical development studies in middle and high school level.

In 1988, according to the situation of the State, Myanmar education curriculum was re-enacted. According to this re-enacted curriculum, morals and civics was taught as a branch of general studies in lower primary level and social studies in upper- primary level. Today, according to the education reform, in (2016-17AY), morals and civics education was taught in KG as a part of curriculum. In (2017-18 AY), morality and civics subject was taught as a core subject.

There are (16) units in Grade One morals and civics subject in new curriculum. The learning values, objectives and teaching learning procedure according to the units are described in the teachers' guide. In Unit-1, Po Po's Family, the learning area is related to self and the learning value is to understand the value of respect to family members. The unit objective is to be able to respect parents and family member. In Unit-2, Help Parents and Elders: The learning area of this unit is related to self and the learning value is to help parents and elders. The unit objective is to help parents and elders at home. In Unit-3, Good Manners at Home: The learning area of this unit is related to self and the learning value is having good manners. The unit objective is to keep good manners at home. In Unit-4, Never Tell Lies: The learning areas of this unit is related to self and the learning value is saying good speech. The unit objective is to understand everyone should say good speech. In Unit-5, Phyu Phyu's Regret: The learning area of this unit is related to self and the learning value of this unit is recognizing rules and regulation. The unit objective is to recognize rules and regulation that should be followed. In Unit-6, Being Dutiful: The learning area of this unit is related to self. The learning value is “Appreciation and respect to Duty”. The unit objective is to be able to take duties carefully. In Unit-7, Follow Conducts by Little Brother: The learning area of this unit is related to self. The learning value is “Deciding right and wrong”. The unit objective is to be able to decide the right and wrong. In Unit-8, Honesty of Little Boy: The learning area of this unit is related to self. The learning value is “to appreciate good practice for returning thing to its owner”. The unit objective is to get good practice on valuing own things and other’s belongings. In Unit- 9, Have Polite Communication with Others: The learning area of this unit is related to others. The learning value of this unit is “Having polite communications with others”. The unit objective is to communicate politely with others. In ,Unit-10 Someone to Trust: The learning area of this unit is related to others. The learning value of this unit is “Having empathy each other”. The unit objective is to be able to empathize each other. In Unit-11, A Person Who Sympathizes Others: The learning area of this unit is related to others. The learning value of this unit “understands each other with sympathy”. The unit objective is to have sympathy in communicating others. In Unit-12, Pue Su Finds

Fairness: The learning area of this unit is related to others. The learning value of this unit is "Communicating fairness and empathy others". The unit objective is to have relationship with others by fairness. In Unit-13, Code of Conducts by Pupils: The learning area of this unit is related to others. The learning value of this unit is "Respecting Teachers". The unit objective is to give respects to teachers. In Unit-14, Loving Myanmar: The learning area of this unit is related to group/ society. The learning value of this unit is "To recognize native region, ethnic races who live in the country". The unit objective is to recognize native and its nation. In Unit-15, Good Morning: The learning area of this unit is related to nature/ universe. The learning value of this unit is "Valuing natural environment". The unit objective is to be able to value natural environment. In Unit-16, Keep Our Environment More Beautiful: The learning area of this unit is related to nature/ universe. The learning value of this unit is "thanks to blessing of nature". The unit objective is to value the natural environment.

Curriculum Development and Implementation

To implement the current development, a leader must have a vision and a long-term plan that outlines resources, professional development and sense of how to work with communities and families. In designing the long-term plan, several things must be kept in mind. The goal of the school must be accounted for; standards and guidelines according to State and local regulation must be known; and the foresight to predict change that may happen in standards and government regulations are all parts of the leader's job in curriculum implementation. Having a strategy and developing that strategy to foster leaders throughout the community should also be a sound part of curriculum implementation.

Often times the community and families of students feel left out of the educational planning process. Implementing the community and families into curriculum development makes them feel included and a part of the educational process within their world. Everyone is necessary in order to develop a successful curriculum. Teachers, policy makers, principles, families, caregivers, and parents are all seeking the common goal of educating children to be better community members and build a better world. Curriculum implementation requires including everyone in the planning process of what our children need to learn in order to make them successful (Bondi, 1979).

Awareness and Attitude of Primary Teachers

According to Wikipedia, "Awareness" is the quality or state of being aware: knowledge and understanding that something is happening or exists. Another research also described students' awareness includes the understanding and knowledge about the certain thing.

Basic awareness of one's internal and external world depends on the brain stem. Bjorn Merker, an independent neuroscientist in Stockholm, Sweden, argues that the brain stem supports an elementary form of conscious thought in infants with Hydranencephaly. "Higher" forms of awareness including self-awareness require cortical contributions, but "primary consciousness" or "basic awareness" as an ability to integrate sensations from the environment with one's immediate goals and feelings in order to guide behavior, springs from the brain stem which human beings share with most of the vertebrates. Psychologist Carroll Izard emphasizes that this form of primary consciousness consists of the capacity to generate emotions and awareness of one's surroundings. People can become conscious of a feeling that they can't label or describe a phenomenon that's especially common in pre-verbal infants.

Changes in awareness, the ability to consciously detect an image when presented at near-threshold stimulus varies across presentations. One factor is "baseline shifts" due to top down attention that modulates ongoing brain activity in sensory cortex areas that affects the neural processing of subsequent perceptual judgments. (Wikipedia, n.d).

Attitudes are beliefs and feeling about objects, people and events that lead people to behave in certain ways. A person's attitude about strangers, for example, can influence how that person feels and behaves around. If a person believes that strangers are dangerous, that person is likely to feel afraid around strangers and may try to avoid situations where he or she is likely to meet new people.

Attitudes are a major aspect of social cognition. In fact, people attitudes may be the primary motivator for how people behave and how people view the world. Attitudes are such an important aspect of psychological lives because they foster strong emotions such as love or hate (Shavitt, 1990; Snyder& De Bone, 1989, cited in Rathus, 1998). Attitude can also vary greatly. Negative attitudes such as prejudice, can lead people to harm others. Positive attitudes, such as attraction, can encourage people to help others.

Attitudes develop in a variety of ways. Conditioning, observational learning, cognitive evaluation and the use of cognitive anchors all play roles in the development of attitudes. Learning through conditioning plays an important role in acquiring attitudes. Most psychologists agree that attitudes usually come first and then behavior follows (cited in Rathus, 1998).

The definition of attitudes suggests that people's behavior is always consistent with their attitudes. People often behave in ways that contradict their attitudes. Attitudes are more likely to guide behavior when people are aware of them, particularly, if the attitudes are put into words and spoken (Fazio, 1990; Krosnick, 1989, cited in Rathus, 1998). People are also more likely to be aware of attitudes that affect them emotionally (Wu & Shaffer, 1987).

Research Method

This study aims to study the awareness and attitude of primary teachers towards new primary morals and civics curriculum implementation. The research design of the study is a descriptive research design.

Procedure

After getting the approval of the Head of the Methodology Department, the District Officer of East District Education, Yangon Region was met and reported. Then, for research study, according to the help of the TEOs from selected townships, the survey study was carried out to all of the Grade One teachers from the selected townships by the help of TEOs and DTEOs of each township. The questionnaire with instructions were distributed to the (329) participants from (4) townships and five major school groups; (1) Basic Education High Schools, (2) Basic Education Middle Schools, (3) Basic Education Primary Schools, (4) Private Schools and (5) Monastic Schools) . The questionnaires take approximately 45 minutes. Two weeks later, the data were collected from townships with the help of TEOs. The data was analyzed by using descriptive statistics (mean, standard deviation, and percentage) and inferential method. These methods represent the research questions about the level of knowledge on new morals and civics subject possessed by the primary teachers and the level of implementation on new morals and civics curriculum. All of the participants' responses were gathered in accordance with survey procedure.

Instrumentation

The questions on awareness and attitude of primary teachers towards new morals and civics curriculum comprise five domains: Curriculum Framework of Morals and Civics Subject, Areas of Morals and Civics Subjects, Contents of New Morals and Civics Subject, Textbook and Resources of New Morals and Civics Subjects and Assessments. There are (46) items concerning the Awareness and Attitude of Primary Teachers towards New Morals and Civics Curriculum. In addition, one open-ended question for each domain is used to express the participants' idea for certain area.

Another instrument is the questionnaires Implementation of Primary Teachers on New Morals and Civics Curriculum. This includes 25 items and eight open-ended items.

The items and open questions were translated into Myanmar. The validity of research instruments was determined by five experts from Methodology Department, Yangon University of Education, one expert from Educational Theory Department, Yangon University of Education, one expert from Educational Psychology Department, Yangon University of Education, one expert from History Department, Yangon University of Education, one expert from Department of Myanmar Language, Yangon University of Education and each expert from (CDT) Curriculum Development Team, and (CREATE, Curriculum Reform and Teacher Education for Primary Level of Education Project) . According to their suggestion, test items were modified again. Then, pilot study was done with fifteen Grade One teachers from Practicing Middle School, Yankin Education College, Practicing Middle School, Thingangyun Education College and Basic Primary Schools from East Dagon Township on January, 2018 in order to determine the relevancy, appropriateness and clarity of the items included in the survey questionnaires. The population and sample size were shown in the table 1.

Table 1 Population and Sample Size

<table>
<tr><th></th><th>Selected Township</th><th>School Group</th><th>Number of Grade 1 Tteacher</th><th>Total</th></tr>
<tr><td rowspan="15">East Yangon District</td><td rowspan="5">Thingangyun (T)</td><td>Basic Education High Schools</td><td>7</td><td rowspan="5">83</td></tr>
<tr><td>Basic Education Middle Schools</td><td>11</td></tr>
<tr><td>Basic Education Primary Schools</td><td>52</td></tr>
<tr><td>Private School</td><td>8</td></tr>
<tr><td>Monastic Schools</td><td>5</td></tr>
<tr><td rowspan="5">South Dagon (SD)</td><td>Basic Education High Schools</td><td>8</td><td rowspan="5">129</td></tr>
<tr><td>Basic Education Middle Schools</td><td>34</td></tr>
<tr><td>Basic Education Primary Schools</td><td>61</td></tr>
<tr><td>Private School</td><td>7</td></tr>
<tr><td>Monastic Schools</td><td>19</td></tr>
<tr><td rowspan="5">North Dagon (ND)</td><td>Basic Education High Schools</td><td>-</td><td rowspan="5">59</td></tr>
<tr><td>Basic Education Middle Schools</td><td>4</td></tr>
<tr><td>Basic Education Primary Schools</td><td>49</td></tr>
<tr><td>Private School</td><td>4</td></tr>
<tr><td>Monastic Schools</td><td>2</td></tr>
</table>

	Selected Township	**School Group**	**Number of Grade 1 Tteacher**	**Total**
	South Okkalapa (SD)	Basic Education High Schools	6	58
		Basic Education Middle Schools	9	
		Basic Education Primary Schools	39	
		Private School	1	
		Monastic Schools	3	
Total				**329**

According to the table, the number of participants in South Dagon township is much more than that of other townships this is because this research emphasizes on the Grade One teachers. Therefore, the number of participants in South Dagon Township is much more than that of other townships.

Data Analysis

The data were analyzed by using descriptive statistics (mean, standard deviation, and percentage) and independent samples "*t*" test. The independent samples "*t*" test was used to compare the level of attitude and understanding on new morals and civics subject and the level of their daily teaching.

Research Findings

This study is designed to find out the level of attitude and awareness of Grade -1 teachers towards new primary morals and civics curriculum implementation and their practice or implementation in their daily teaching experience from four selected townships of East Yangon District.

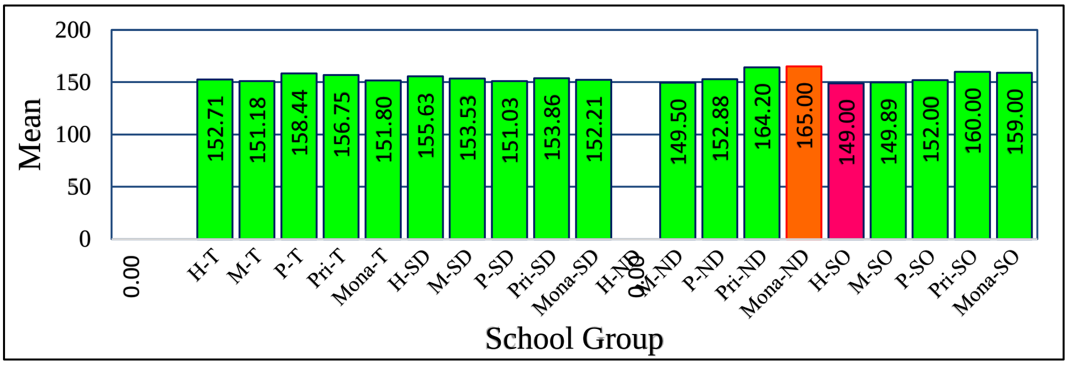


Figure 1 Mean Scores of Grade One Primary Teachers' Level of Awareness and Attitude towards New Primary Morals and Civics Curriculum Implementation

According to the mean values of Grade One teachers' attitude and awareness towards new morals and civics curriculum implementation, the total average mean value is (153.54) and the standard deviation is (9.855). The highest mean among school group is (165) and the lowest mean value is (149). This result indicates that the attitude and awareness of the Grade One teachers from Monastic school group in North Dagon Township is better than any other school groups. At the other hand, the attitude and awareness of the Grade One teachers from High school group from South Okkalapa township is not as good as the other school groups.

The attitude and awareness of teachers from monastic school group is at the moderate level in implementing new primary morals and civics curriculum.

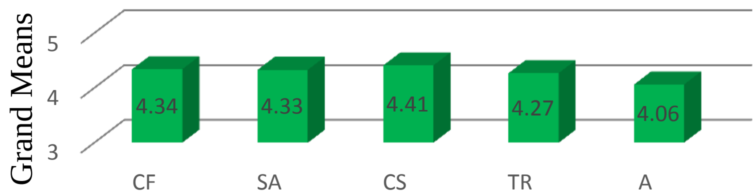
According to the open-ended questions from each domain, the Grade One teachers' answers describe their awareness and attitude towards new morals and civics curriculum implementation. In the first domain, concerning with the curriculum framework, the teachers stated the following options as the effectiveness of teaching morals and civics subject to children.

- It is good affect for the children to get good character by listening to the story because the children enjoy listening to it.
- By teaching morals and civics subject, students can get good ethics, good abilities for good citizenship. Therefore, this subject can support to become a good citizen.
- Morals and civics subject can support to get good ethics, morals, attitude, physical and mental development, relationship with other and good manners.
- By teaching morals and civics subject, students can get the good ethic, morals, and relationships with each other and students' need such as civics, principles, rules, rights and responsibility.

All of those options represent the importance of morals and civics education. Although the teachers were asked to give suggestion on awareness of morals and civics subject, most of the teachers do not suggest because they accept the areas and contents described in new morals and civics subject. One of the teachers described that she wished to add more lessons. Another teacher described that more pages for questions and answer session should be added to the textbook.

Another finding that is concerning the level of the Grade One teachers' awareness and attitude towards new primary morals and civics curriculum implementation for each sub domains is described in the following figure.

The total mean values of domains are presented in the following figure.



CF= Curriculum Framework SA= Subject Areas, CS= Contents of Subject TR= Textbook and Resources A= Assessment

Figure 2 Grand Mean Values of Grade One Primary Teachers' Level of Awareness and Attitude towards New Primary Morals and Civics Curriculum Implementation in terms of Sub-domains

According to this figure, the Grade One teachers have more knowledge about the contents of lessons. The awareness and attitude concerned with the assessment is lower than that of any other sub-domains in implementing new morals and civics curriculum.

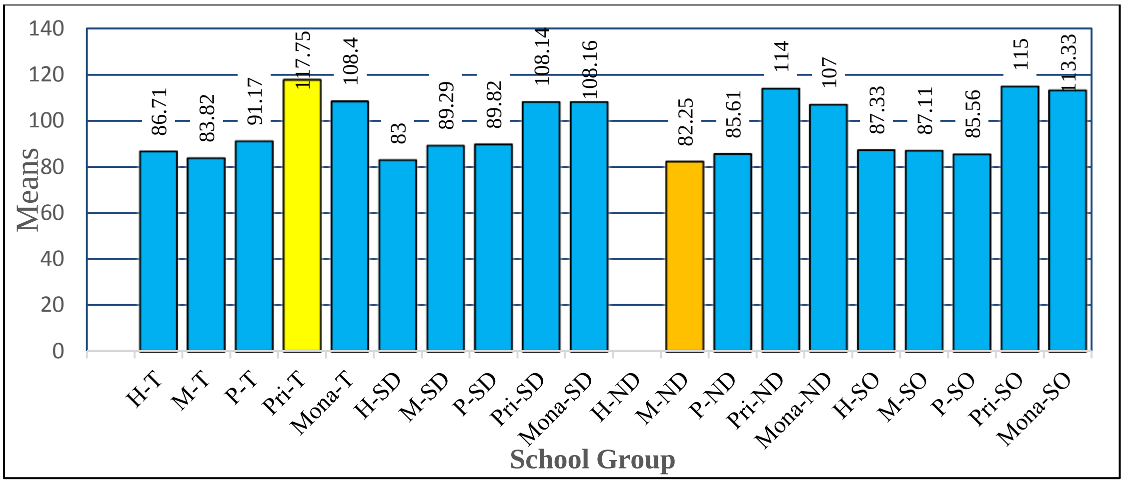


Figure 3 Mean Scores of Grade One Primary Teachers' Level of Implementation on New Primary Morals and Civics Subject in Daily Teaching

The total average mean scores and standard deviation were (91.33) and (11.825) respectively. If the mean scores of Grade One primary teachers' implementation on new primary morals and civics subject is higher than (103.155), it indicates that the level of implementation on new primary morals and civics subject is high. If the mean scores of Grade One teachers' implementation on new primary morals and civics subject teaching is lower than (79.505), it indicates that the level of implementation is low. If the mean score is between (103.155) and (79.505), this school group would be moderate level of implementation on new primary morals and civics subject in daily teaching. There is no low school group in the level of implementation on new primary morals and civics subject.

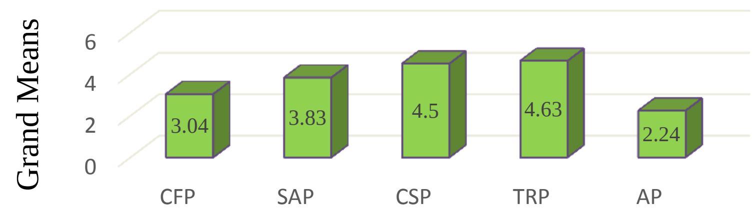
One of the question on implementation process describes the teaching learning materials used in teaching morals and civics subject. Most of the teachers point out the pictures from the textbook and some describe the natural environment. The others describe chart and real materials as the teaching learning materials in their teaching.

The next question for implementation is related to advantages and disadvantages of teaching morals and civics subject. Advantages described by the teacher are as follows: students can get good manners and they can become ones who follow the discipline; students can become more sympathetic than earlier; students are interested in teaching morals and civics because of colorful pictures depicted in their textbook and come to understand very well; students can become cleverer while teaching morals and civics subject, students can get good relationship between them because of discussion and presentation during the teaching morals and civics subject. Most of the teachers described that there is no disadvantages of teaching morals and civics subject. Some described that by discussing during the teaching process, there may be waste of time and some students cannot discuss because of the large class size.

The teachers described the challenges and difficulties of teaching morals and civics subject. Some teachers did not identify any difficulty although they encountered it. Some of the teachers described about the challenges that the students were not interested in teaching morals and civics because of the large class size. Some teachers described the students' diverse intelligence and some described that the students talked very noisily during the learning. Some teachers expressed that the students should be encouraged to be interested in subject matter. They said, it is one of the challenges in teaching morals and civics subject. Some teachers said that teaching the foundling students was also one of the challenges in teaching morals and civics subject. Some of the teachers described that there is no textbook and they explained delay delivery of textbook at the beginning of school year.

The last question of implementation session is about the assessment. The teachers are asked how they assess their students in classroom during teaching morals and civics subject,. The teachers described that they asked the students one by one and group by group while teaching. Some teachers used rubric to assess the level of students' knowledge. Some teachers used the pictures and stories for assessment during their teaching. Some teachers coped the pictures from the textbook and hang the pictures on the wall and explained about them once a week. Some teachers said they assessed the students' understanding and the behavior.

The level of implementation on new morals and civics subject is presented in the following figure by showing five different domains on implementation.



CFP= Curriculum Framework Practice, SAP= Subject Areas Practices, CSP= Contents of Subject Practice, TRP= Textbook and Resources Practice, AP= Assessment Practice

Figure 4 Grand Mean Scores of Grade One Primary Teachers' Level of Implementation on New Primary Morals and Civics Subject in Daily Teaching in terms of Sub-domains

According to this figure, (Figure 4), Grade One teachers can implement well in the area of subject matter and the use of textbook. This means that the Grade One teachers' implementation towards new morals and civics subject is good and they effectively use the textbook in daily teaching. But, the implementation concerning the assessment is lower than other domains in new moral and civics curriculum implementation process. This means that implementation on assessment, the assessment style and the use of assessment process is weak in new morals and civics curriculum implementation.

The relationships between the level of Grade One teachers' awareness and attitude towards new primary morals and civics curriculum implementation and the level of implementation in their daily teaching on new morals and civics subject can be learned in the following table.

Table 2 Correlations between Awareness and Attitude and level of Implementation in New Morals and Civics Curriculum Implementation

Variables	CF total	SA total	CS total	TR total	A total	CFP total	SAP total	CSP total	TRP total	AP total
CF total	1	.601**	.180**	.430**	.029**	-.099	.224**	.326**	.295**	-.097
SA total		1	.217**	.589**	.003	-.063	.270**	.346**	.263**	-.046
CS total			1	.336**	-.041	.087	.149**	.151**	.123*	.045
TR total				1	.061	-.064	.280**	.343**	.259**	-.110*
A total					1	-.176**	-.048	-.049	.007	-.148**
CFP total						1	.439**	-.061	-.125*	.846**
SAP total							1	.397**	.326**	.431**
CSP total								1	.631**	-.149**
TRP total									1	-.166**
AP total										**1**

******Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Note.

CFtotal = Total mean scores of Awareness and Attitude on curriculum framework
SAtotal = Total mean scores of Awareness and Attitude on curriculum areas
CStotal = Total mean scores of Awareness and Attitude on unit
TRtotal = Total mean scores of Awareness and Attitude on Textbook
Atotal = Total mean scores of Awareness and Attitude on assessment
CFPtotal = Total mean scores of implementation on curriculum framework
SAPtotal = Total mean scores of implementation on curriculum areas
CSPtotal = Total mean scores of implementation on Topic/Units
TRPtotal = Total mean scores of implementation on Textbook
TRPtotal = Total mean scores of implementation on Assessment

Table 2 reveals that the level of awareness and attitude of the Grade One teachers is related to their implementation level towards new morals and civics subject. There is a relationship between the awareness and attitude of the Grade One teachers and their implementation process.

The awareness and attitude of curriculum framework is the highly correlated with the awareness and attitude of curriculum area and the implementation on Topic/Units. The awareness and attitude of Topic/Unit is highly correlated with the awareness and attitude on textbook and the implementation on Topic/Units. The awareness and attitude on textbook is highly correlated with the implementation on Topic/Units. The awareness and attitude on assessment is negatively correlated with the implementation on curriculum. This means that although the level of awareness and attitude on assessment is good, the implementation level is not good or although the level of awareness and attitude on assessment is not good, the implementation level is good. Therefore the level of awareness and attitude of the Grade One teacher is lower than other domains in this research.

Research findings and interpretations from four selected townships are as follows:

1. The level of awareness and attitude towards new morals and civics curriculum implementation by the Grade One teachers is high in most of the domains.
2. The level of awareness and attitude towards new morals and civics curriculum implementation by the Grade One teachers is moderate in the assessment domain.

3. The level of implementation on new morals and civics subject by the Grade One teachers is high in most of the domains.
4. The level of implementation on new morals and civics subject by the Grade One teachers is low in assessment domain.
5. The level of awareness and attitude towards new morals and civics curriculum implementation is related to the implementation level. The awareness and attitude on textbook and resources is significantly correlated with the implementation on textbook in their daily teaching.
6. The awareness and attitude on assessment is negatively correlated with the implementation in daily teaching.
7. The level of implementation on new primary morals and civics subject by the Grade One teachers of private and monastic school group from four selected townships is higher than that of other school group teachers.
8. There are many advantages of teaching morals and civics subject, such as, students can get good manners, ethic, morals and principles.
9. Teacher's guide published by Ministry of Education can contribute to the effective teaching morals and civics subject.

Discussion, Suggestions and Conclusion

Discussion

Awareness and attitude questionnaire is used to identify the Grade One teachers' ideas and perceptions on new primary morals and civics curriculum implementation. It consists of five subscales: Curriculum Framework, Curriculum Areas, Contents involved in new curriculum, Textbook and Teachers' Guide published by the Ministry of Education and Assessment. After collecting the data, the analysis of the study is carried out by using the descriptive statistics and Pearson Correlation. In order to determine the level of awareness and attitude of the Grade One teachers and the level of these teachers' implementation on new primary morals and civics curriculum, descriptive analysis is used. Basing on the descriptive analysis, the mean score of the awareness and attitude of the Grade One teachers from monastic schools in North Dagon Township is the highest. It can be said that the awareness and attitude of the Grade One teachers is higher than that of other school groups. The school group that achieves the second highest mean value of implementation on new primary morals and civics curriculum is monastic school group.

In the previous research findings conducted by Win Yee Lo (2006) from Hong Kong, all interviews argue that teachers are the key factor to facilitate morals and civics at the primary school and they take the most profound role in pedagogy. According to the descriptive data, it is found out that there are 120 (36.5% of the participants) Grade One teachers who have not trained for teaching Grade One new morals and civics curriculum but most Grade One teachers who teach morals and civics curriculum received the training provided by Ministry of Education.

According to the result of this study, Grade One teachers can implement well except the assessment on morals and civics curriculum implementation. The correlation between the awareness and attitude towards new primary morals and civics implementation and the level of implementation on their daily teaching are negatively correlated in some sub-domains. This means that if the level of implementation on teaching morals and civics subject is high, the level of awareness and attitude towards new morals and civics can be low or if the level of implementation on teaching morals and civics subject is low, the level of awareness and attitude towards new morals and civics can be high in some domains. Teacher's guide is fairy supported for teachers who are implementing the new curriculum for effective teaching.

From this research finding, the assessment portion is a little difficult for the Grade One teachers who are implementing the new curriculum. This is because; the assessment of morals is more difficult than the assessment of civics and other core subjects such as Mathematics, English. Although the behavior of the students can be assessed, the attitude of the students cannot be assessed. Therefore, the assessment style, ways to assess and reasons for assessment are needed in teaching morals and civics subject. There are required to discuss according to the nation's norm. This indicates it needs more research for knowing about the factors which influence on implementation on primary morals and civics subject.

Suggestions

The main aim of education is helping students to acquire necessary abilities to reach the knowledge instead of transferring knowledge to them. Furthermore, education aims to provide individuals with cultural, social and personal developments, and to develop students' abilities such as asking questions, co-operation, and problem solving. The following points are suggested with respect to this study.

- In order to implement new curriculum innovation, the teacher should have high level of awareness and attitude towards new curriculum.
- Teacher should create an environment, which is favorable for the students' development.
- Teachers need professional development in teaching certain subject
- Lesson planning, teaching and learning activities, should be planned depending on the curriculum framework and learning objectives.
- Teachers should encourage students to study and think deeply by studying the textbook in teaching morals and civics subject
- Teachers should cooperative with the parents for assessment such as helping parents at home, taking responsibility in home activities such as cleaning the home or their room, washing their dishes, good behavior /good manner at home, etc.
- Teachers should discuss with the parents about the lessons and how to facilitate and support to get moral values that nurturing and training in school and then advice teachers how to develop/ record their children manners, speed and behavior.
- All of the stakeholders should cooperate for planning and teaching for their daily teaching to gain the subject objectives.
- All of the stakeholders should monitor about the teachers' implementation
- Teacher educators should know the teachers' needs who are implementing the new curriculum.
- Supervisors from each school, township and district should know the condition of the subject implementation.

In order to achieve the implementation of new primary curriculum, it is necessary to develop teachers' awareness and attitude. This study proves that the Grade One teachers who possess the high level of awareness and attitude towards new curriculum implementation. However, the results of this study do not represent other levels of Basic Education. Hence, further research is quite necessary.

Conclusion

Education must prepare students for their living at present and in the future. In education, effective teaching-learning process provides to achieve the educational goals. Teachers are the main stakeholders who implement the new curriculum. Curriculum is a social artefact.

Curriculum refers to the knowledge and practices in subject matter areas that teachers teach and that students are supposed to learn. A curriculum generally consists of a scope, or breadth of content, in a given subject area and of a sequence of concepts and activities for learning. The teachers who implement the new curriculum should be aware of the scope, or breadth of content, in a given subject area and of a sequence of concepts and activities for learning to meet the aims of the curriculum. The teachers are situated at the major role of the implementation process.

For building a democratic country, Myanmar needs civic-minded people who own civics qualities and good morals. One of the aims of the primary education of the newly adopted Myanmar National Curriculum Framework is to develop basic knowledge, skills, and attitudes, aesthetic appreciation, and behavior which are assumed to be the basic characteristics of a good citizen. Therefore, the teachers who implement the new curriculum need to know the curriculum framework.

Curriculum change presents teachers, schools and boards of management with a unique opportunity to engage in professional development, improving learning outcomes, and preparing children for the challenges and opportunities of the future. The task of the curriculum implementation is complex: it requires in-school management teams, principals and boards of management to lead the implementation of change in the school as an organization. Curriculum change takes place in the classroom and it involves teachers translating curriculum documents into practice, embracing new teaching programs and methodologies, and providing a broader range of learning experiences for their pupils (Eamon Stack, 2005 cited in an Evaluation of Curriculum Implementation in Primary Schools). Therefore, all the stakeholders: the teachers, teacher educators, principals, supervisors, education officers need to cooperate in implementing new curriculum to meet the aims of the curriculum framework.

A significant minority of teachers are experiencing difficulties in their daily teaching. Each teacher must have professional qualification to nurture good citizenship. The teachers have to develop an in-depth knowledge of appropriate teaching methodologies and approaches. So, they can become familiar with the objectives and values for not only the morals and civics subject but also for the aims of the curriculum framework. The stakeholders and supervisors need to engage more systematically in curriculum implementation and to support the teachers to be qualified.

For these purposes, the main aim of the research is to study the awareness and attitude of primary teachers towards new primary morals and civics curriculum implementation. The design adopted in this study is a descriptive research. The instrument used in this study is attitude and awareness questionnaire. The questionnaire is constructed basing on the Trainee Teacher Attitude Questionnaire developed by The University of Plymouth (2007) and Consultation of Moral and National Education Curriculum developed by Curriculum Development Institute (Yerevan, 2008). The validity of the questionnaire was determined by the expert judgments. After receiving the validity of these instruments, a pilot testing was conducted. Basing on the result of the pilot test, some items were modified. The major study was conducted in East District of Yangon Region. The sample districts for the study are selected by using simple random sampling technique. Four townships from East District were stratified and randomly selected. All the participants in this sample were Grade-1, primary teachers.

According to the result of the study, it was found that the Grade One teachers from the monastic school group have the highest mean value and the high school groups have lowest mean value. It can be also said that most of the Grade One teachers from monastic school group possess better awareness and attitude towards new primary morals and civics curriculum implementation and most of the Grade One teachers from high school group possess weak awareness and attitude towards new primary morals and civics curriculum implementation. It can also be interpreted that the most of the Grade One teachers have moderate level of awareness and attitude towards new primary curriculum implementation. From this research, the stakeholders, supervisor, teacher educators and teachers need to be aware of good attitude to the curriculum framework, text area, contents, new textbook and resources and assessment style for reaching the effective curriculum implementation. Teachers are the main curriculum implementers, while at the same time students, parents, school administrators can directly or indirectly involve in the implementation process (Makewa, et al, 2015).

Teachers differ from their teaching according to the class and ability level of competency. There is an additional guidance for schools on how to adapt the curriculum to meet the diverse needs of individual pupils and groups of pupils, especially in multi- level classes. To get higher order thinking skills, teachers need to support their students to express their own ideas.

The classroom size puts a little impact on classroom activities and the implementation on new curriculum. Textbook exerts a dominant influence on teaching and learning. Discussion, presentation and observing the pictures in the textbooks are the tasks provided for the pupils' deep understanding.

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စာရိတ္တနှင့်ပြည်သူ့နီတိ(ပထမတန်း) ဆရာလမ်းညွှန်။(၂၀၁၇)။ ရန်ကုန်။ ပြည်ထောင်စုသမ္မတ မြန်မာနိုင်ငံတော်အစိုးရ၊ ပညာရေးဝန်ကြီး ဌာနနှင့် ဂျပန် နိုင်ငံတကာ ပူးပေါင်း ဆောင်ရွက်ရေးအေဂျင်စီ။

သန်းထွတ်၊ ဦး။ (၂၀၀၃)။ **အတိတ်ကိုအတိတ်မှာဘဲထားခဲ့ပါရစေ**။ ရန်ကုန်မြို့၊ ရွှေဟသာ ပုံနှိပ်တိုက်။

AN INVESTIGATION INTO THE EFFECTIVENESS OF PROJECT BASED LEARNING ON STUDENTS' ACADEMIC PERFORMANCE IN ECONOMICS AT THE HIGH SCHOOL LEVEL

Hninn Hninn Thet[1], Than Than Hsint[2]

Abstract

The major purpose of this research was to study the effects of project based learning on economics students' academic performance at the high school level. This study was conducted with both quantitative and qualitative research methods. Quantitatively, an experimental study was used to compare the students' economics achievement between the control group and experimental group. The posttest only control group design was used in this study. In this experimental study, the subjects were Grade Ten students selected from No.(1) BEHS Thanlyin and No.(3) BEHS Tharketa. For this study, (120) Grade Ten students were selected from both schools by random sampling method. These students were divided into two groups: control and experimental. The experimental group was treated with project based learning and the control group was taught as formal instruction. Subsequently, a posttest was administered to two groups. Independent samples *t*-test was used to test whether there was a significant difference between experimental group and control group. Examination of the means and *t*-test at No.(1) BEHS Thanlyin (t=12.17, df= 58, MD=5.10, p <.001) and No.(3) BEHS Tharketa (t=11.40, df=58, MD=4.80, p <.001). The results indicated that there was a significant difference between the two groups. The qualitative data also supported the findings from the experimentation. In this study, students from the experimental group from two selected schools were given a questionnaire. It develops of (15) items five-point likert-scale. The results showed that the students expressed their willingness to learn in project based learning and they had positive attitudes towards this project based learning. Research findings proved that project based learning has positive contribution to the economics teaching at the high school level.

Keywords: Project Based Learning, Attitude, Economics, Achievement

Introduction

"Education is the process of living through a continuous reconstruction of experiences. It is the development of all those capacities in the individual which will enable him to control his environmental and fulfill his potentialities" (Dewey, 1916). That is why, Education is a fostering, a nurturing and a cultivating process of the human life. It is absolutely necessary in today's society. It is one of the most important things in life because without education, it cannot contribute to the world better. It gives people a knowledge of the world around them and helps them build opinions. It is the process of gaining information about the surrounding world while knowledge is something very different.

Today, economics issues are drawing the attention of every citizen directly or indirectly. It is, therefore, appropriate for economics to be included as a distinct area of study in the system of school learning particularly. The aims of teaching economics are to enable students to acquire knowledge in daily life, intellectual abilities, problem solving skills and interest in how to manage of their earn and their household management in their life. To accomplish these aims, teachers need the abilities to create some hands-on problem solving and activities based on students' experience in the teaching learning situation. Teaching of economics can be achieved

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through the varieties of activities and avenues. Thus, learning becomes more flexible and dynamic. Learning is a process of active engagement with experiences. To get such experiences, students have to construct the contextual knowledge of the classroom and communicate with the world outside. To be able to do so, learners must see the world in every single moment.

Project based learning is student-centered and driven by the need to create an end-product. However, it is the route to achieving this end-product that makes project work so worthwhile. The route to the end-product brings opportunities for students to develop their confidence and independence and to work together in a real-world environment by collaborating on a task. It draws together students of mixed abilities and creates opportunities for individuals to contribute in ways which reflect their different talents and creativity (Fried-Booth, 2002). So, in order to become successful teaching-learning situation, teachers need to apply project based learning in the teaching of economics.

Purposes of the Study

The main purpose of the study is to investigate the effectiveness of the project based learning on the achievement of Grade Ten students in teaching economics. The specific purpose of this study are as follows:

- To examine the effectiveness of project based learning in teaching economics,
- To compare the achievement of the students in economics between the students who receive project based learning and those who do not receive it,
- To investigate students' attitudes towards project based learning, and
- To give suggestions for the improvement of teaching learning situation of students in Grade Ten economics according to the results of the study.

Research Hypotheses

1. There is a significant difference between economics achievement of students who receive instruction with project based learning and those who do not receive.
2. There is a significant difference between economics achievement of students who receive instruction with project based learning and those who do not receive, in performing knowledge level questions.
3. There is a significant difference between economics achievement of students who receive instruction with project based learning and those who do not receive, in performing comprehension level questions.
4. There is a significant difference between economics achievement of students who receive instruction with project based learning and those who do not receive, in performing application level questions.
5. There is positively students' attitude towards project based learning in the experimental group.

Definition of the Key Terms

- **Project based learning** -Project based learning (PBL) is a student-centered instructional approach used to promote active and deep learning by involving students in investigating real-world issues in a collaborative environment (Yam & Rossini, 2010).

- **Attitude -** Attitude defined as a disposition to respond favorably or unfavorably to an object, person, institution, or event (Ernest, 1989, cited in Özdemir, 2006). Attitudes related to liking, enjoying, and interest in project based learning.
- **Economics**-Economics is a science which studies human behaviour as a relationship between ends and scarce means which have alternative uses (Lionel, 1932).
- **Achievement** -Achievement is the ability to demonstrate accomplishment of some outcome for which learning experiences were designed (Özdemir, 2006).

Scope of the Study

The following points indicate the scope of the study.

- This study is geographically restricted to Yangon City Development Area.
- Participants in this study are (120) Grade Ten students from selected schools during the Academic Year (2018-2019).
- This study is intended to investigate the effects of project based learning on the achievement of Grade Ten students in teaching economics.
- The content area is limited from chapter (9)" Industrial Sectors of Myanmar" from Grade Ten Economics textbook prescribed by the Basic Education Curriculum and Syllabus and Textbook Committee, 2018-2019.

Theoretical Framework

Theoretical Framework of Project Based Learning

Project based learning is based on the sound theoretical foundation. There are multiple theories that reside at the base of project based learning. Project based learning is in line with pragmatism, a philosophy stressing the merits of learning from the real world and concentrate things rather than abstractions constructivist framework. A theory of learning is a vision that educators have to explain the complexity of human learning. Several theorists' perspectives on learning as follows: William Heard Kilpatrick, Piaget's cognitive theory and Vygotsky's social learning theory and John Dewey's pragmatic pedagogical creed played a major role in development as well.

Origins of Project Based Learning

In the first half of the 20th century, the word" project" has its roots in American philosophy. The term "project" occurs in pedagogical dictionaries and methodology books in different combinations, e.g. Project Teaching, Project Method, Project Approach, Project based Approach, Project centered Approach, Project based learning often abbreviated as PBL. Although many variations have been occurred, project based learning aims to bring practically designed experience into the classroom. The project gives students an opportunity to work in a team environment and apply theory learned in the classroom.

Project based learning is the outcome of the pragmatic educational philosophy of John Dewey, the well-known American philosopher and educationist. This method was developed and applied practically by Dr. William Heard Kilpatrick of the Columbia University (Zubair, 2012). One of the approaches suggested by such pragmatic educators as William Heard Kilpatrick is the "project approach" to learning. This is a systematization of the general approach Dewey used at the laboratory school. According to Kilpatrick, a project approach results in the student's receiving a general education. Projects are decided by individual and group discussion, with the teacher as moderator. Children cooperate in pursuing the goals of the project (Ozmon & Craver, 1986).

Project based learning is an authentic model or strategy in which students plan, implement, and evaluate projects that have real-world applications beyond the classroom. It is an instructional method centered on the learner. Students developed question and are guided through research under the teacher's supervision. It is a comprehensive approach to classroom teaching and learning that is designed to engage students in investigation of complex, authentic, problems and carefully designed products and tasks. The use of project based learning in class is possible after providing the information that is needed for the project. The classroom activities should be student-centered, cooperative, and interactive (Moursund, 1999, cited in Bas, 2011). It engages students in gaining knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks. It enhances the quality of learning and leads to higher-level cognitive development through the students' engagement with complex and novel problems.

Nature of Project Based Learning

In the field of education, the word "project" has come to mean any unit of activity, individual or group, involving the investigation and solution of problems that is planned and carried to a conclusion by a pupil or pupils under the guidance from the teacher. Project based learning defined as using authentic, real-world projects, based on highly motivating and engaging question, task, or problem to teach students academic content in the context of working cooperatively to solve the problem (Barell, 2007, 2010; Baron, 2011; Grant, 2010,cited in Bender, 2012). Student inquiry is heavily integrated into project based learning, and because students typically have some choice in selecting their group's project, and the methods they would use to solve that project, they tend to be more highly motivated to work diligent toward a solution to the problem (Drake & Long, 2009; Malon, 2010, cited in Bender, 2012).

Schneider (2005) described that project based learning is a teaching and learning model that emphasizes student-centered instruction by assigning projects. It allows students to work more autonomously to construct their own learning and culminates in realistic, student-generated products.

In every project, a pupil is facing numerous questions or problems concentrating on the same unifying idea. A project changes the school life (Chlup, 1939, cited in Rousova', 2008). Project wok lends itself to many different approaches in a variety of teaching situations. The collaborative process, relying as it does on the involvement and commitment of the individual students, is the strength of a project (Fried-Booth, 2002).

Major Steps in Project Based Learning

Project based learning requires multiple stages of development to succeed Zubair (2012) proposed six steps sequence of activities for developing meaningful project work in the classroom. The functions of each proposed steps are as follows.

Step 1: Creating/ Providing the Situation

In this step, the students themselves should define, state and choose their problems. Of course, the teacher's function would be to provide real and worthwhile situations. The teacher has to discover the interests, needs taste and aptitudes of children according to their needs and interests.

Step 2: Choosing and Purposing

The project based learning selected must be such as to satisfy a definite need or purpose. The students themselves choose the project. The teacher should not be hurry in choosing project. Many situations should be provided to children. Decision should always democratic. The teacher should merely guide and not thrust his/her opinion. The children must feel that the project is of their choice.

Step 3: Planning

The teacher should draw the attention of the students to the need of the planning before undertaking the activity. The task of planning is quite difficult. Good planning leads to better result. Different proposal should be discussed and alternatives considered. Students should be tasked to write down the plan in their project diary.

Step 4: Executing the Plan

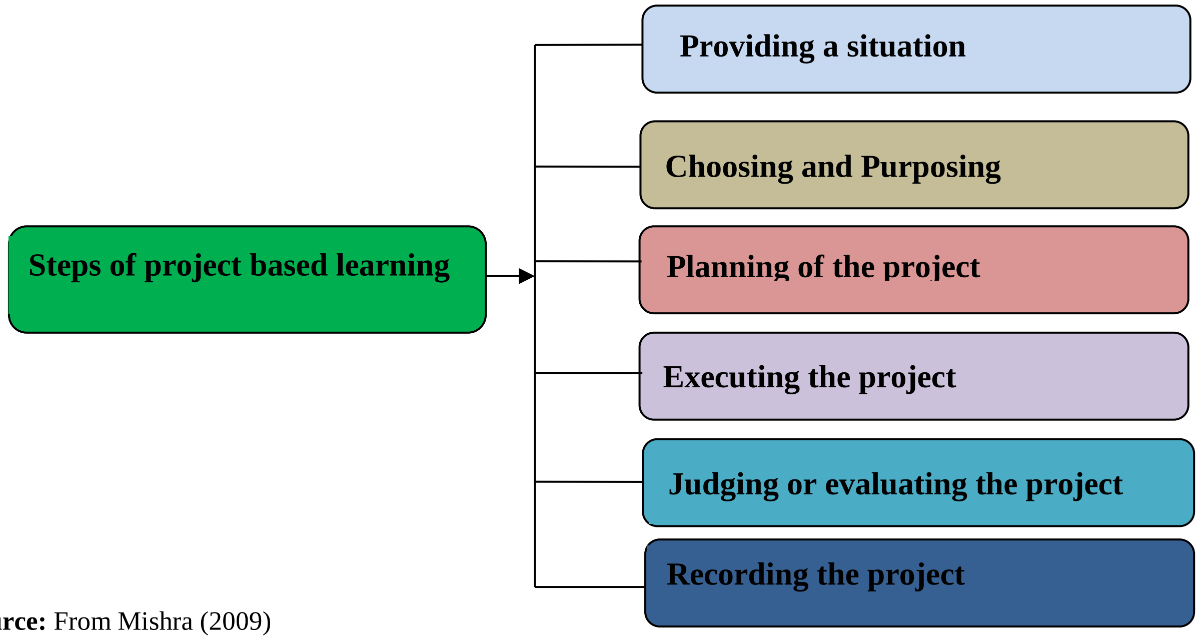
This step is the longest of all and requires a lot of work. The whole project is to be executed through the co-operative efforts of all students. The various activities of the projects should be divided according to the individual interest and abilities of the different children in the class. The teacher should give sufficient guidance to students. Teachers should not dictate them.

Step 5: Judging

The work is to be reviewed when it is completed. Lessons must be learnt from the mistakes that have been made in the various steps of a project. The students must learn to criticize constructively their own work. Self-criticism is valuable form of training. The students should find out what things they have learnt from the project.

Step 6: Recording

This is also an important step of the project because the work done should be recorded also. The children maintain a complete record of the project work. While recording the project some points like how the project was planned, what discussions were made, how duties were assigned, how it was evaluated etc. should be kept in mind. These steps can be shown by the following figure.



Source: From Mishra (2009)

Figure 2.1 Steps of Project Based Learning

Research Methodology

Population and Sample size

Two Basic Education High Schools in Yangon Region were selected as the sample schools for the experimental design by using simple random sampling method. These sample schools were No (1) BEHS Thanlyin and No (3) BEHS Tharketa. All the participants in the sample were Grade Ten students. In both schools, only 60 students were selected by random sampling method from Grade Ten in the academic year 2018-2019.

Table 1 Population and Sample Size

Name of School	No. of Population	No. of Student
BEHS (Thanlyin)	379	60
BEHS (Tharketa)	371	60

Research Design

The design adopted in this study was one of the true experimental designs, namely, the posttest only control group design (Gay, 2003).

Table 2 Experimental Design

Assignment	Group	No. of Students			Treatment (X)	Posttest (O)
		BEHS (Thanlyin)	BEHS (Tharketa)	Total		
Random (R)	Experimental	30	30	60	Project Based Learning	EA
	Control	30	30	60	Formal Instruction	
Total		**60**	**60**	**120**		

Note. EA = Economics Achievement

Instrument

The instrument used for this study was a posttest (Achievement test). The students had to answer all questions and there was no choice. The test was constructed based on Grade Ten Economics Textbook with the advice and guidance of the supervisor. In the question used for posttest, (5) items were true or false items, (5) items were completion items, (5) items were multiple choices items, and (5) items were short questions. The allocated time for posttest was (45) minutes, and the given marks were (25) marks (see Appendix C). The test items were constructed on the first three levels of Bloom's Taxonomic levels of cognitive domain, i.e, knowledge, comprehension, and application. The posttest was validated with (5) experts in the Department of Methodology. After that, the posttest items were modified again according to their suggestions. The pilot test was administered with (64) Grade Ten students (economics combination) at No.(1) BEHS, Dawpon. The allocated time for this test was (45) minutes. To show the internal consistency of the test, the reliability coefficient, Cronbach's Alpha, was computed and its value was (0.703).

To examine the students' attitude, students' attitude questionnaire towards project based learning was constructed based on Chang*, Wong and Chang (2011). In this research, attitude questionnaire towards project based learning was modified and constructed in Myanmar language with advice and guidance of the supervisor. It consists of (15) positive items. After preparing them, expert review was conducted by five experts who have special knowledge about the questionnaires in the field of Methodology. It consists of (15) items five-point likert-scale. The statements of these items were described by five responses: strongly disagreed, disagreed, uncertainly, agreed and strongly agreed. To examine students' attitudes, feelings, and experiences, a questionnaire was constructed with advice and guidance of the supervisor. It consists of (15) items five-point likert-scale. The statements of these items were described by five responses: strongly disagreed, disagreed, uncertainly, agreed and strongly agreed. Arbitrary scoring weights (1, 2, 3, 4 and 5) were assigned for the responses.

Procedure

This study was to investigate into the effectiveness of Project Based Learning on students' academic performance in economics achievement of Grade Ten students. Students were divided into two groups in each school: the control group and the experimental group. There were 30 students in each group. For the control group, the teacher taught students as usual in the classroom. The experimental group was provided a treatment by using Project Based Learning. For the experimental group, the teacher used the phases in Project Based Learning. At the end of the treatment period, all the selected students had to sit for the posttest in both schools. And then, a follow up program was found out by a questionnaire to interpret students' attitudes, feelings, experiences and opinions about Project Based Learning.

Data Analysis

The data were analyzed by using a descriptive statistics and independent samples "t" test. The independent samples "t" test was used to compare the achievement of students who learned by Project Based Learning and that of students who learned by formal instruction. In order to determine the significant differences, the independent samples "t" test was used with Statistical Package for Social Studies (SPSS) 22.0.

Findings

This section is concerned with findings of the selected students' achievement on the posttest questions, the summary of the findings and interpretations of the study. The data obtained from the posttest were analyzed by using the independent samples *t*-test to compare the differences between the experimental and the control groups. Following tables show the results of *t*- test, the mean scores, standard deviations and mean differences of both groups.

Table 3 *t* Values for Posttest Economics Achievement Scores

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (Thanlyin)	Experimental	30	22.00	1.14	5.10	12.17	58	.000***
	Control	30	16.90	1.98				
BEHS (Tharketa)	Experimental	30	21.37	1.42	4.80	11.40	58	.000***
	Control	30	16.57	1.81				

Note: ***$p < .001$

The mean scores of the experimental groups were significantly higher than that of the control groups in each school (see Table 3). It showed that there was a significant difference between students who were taught by Project Based Learning and those who were taught with formal instruction on the overall scores of science achievement in each school.

Table 4 *t* Values for Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (Thanlyin)	Experimental	30	10.33	0.80	1.55	7.13	58	.000***
	Control	30	8.78	0.89				
BEHS (Tharketa)	Experimental	30	9.97	1.13	1.00	3.75	58	.000***
	Control	30	8.97	0.93				

Note: ***$p < .001$

Results of knowledge level questions showed that the mean scores of the experimental groups were significantly higher than that of the control groups in each school (see Table 4). It showed that there was a significant difference between students who were taught by Project Based Learning and those who were taught with formal instruction on the scores of knowledge level questions in each selected school.

Table 5 *t* Values for Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (Thanlyin)	Experimental	30	10.00	0.74	2.50	9.89	58	.000***
	Control	30	7.50	1.16				
BEHS (Tharketa)	Experimental	30	9.57	1.07	2.24	6.94	58	.000***
	Control	30	7.33	1.40				

Note: **$p< .001$

According to the scores on comprehension level questions, the mean scores of the experimental groups were significantly higher than that of the control groups in each selected school (see Table 5). It showed that there was a significance difference between students who were taught by Project Based Learning and those who were taught with formal instruction on the scores of the comprehension level questions in the selected schools.

Table 6 *t* Values for Scores on Application Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (Thanlyin)	Experimental	30	1.67	0.76	1.07	4.86	58	.000***
	Control	30	0.60	0.93				
BEHS (Tharketa)	Experimental	30	1.87	0.51	1.54	9.20	58	.000***
	Control	30	0.33	0.76				

Note. ***$p< .001$

As regards with the scores on the application level questions, the mean scores of the experimental groups were significantly higher than that of the control groups in each school (see Table 6). It showed that there was a significant difference between students who were taught by Project Based Learning and those who were taught with formal instruction on the scores of the application level questions in each selected school.

Summary of Quantitative Research Findings of Experimental Study

The results of research findings from two selected schools were as follows:

(1) There was a significant difference between students who were taught by project based learning and those who were taught as usual in all the selected schools on the scores of overall economics achievement. It can be interpreted that the use of project based learning has significant effect on overall economics achievement of the students.

(2) There was a significant difference between students who were taught by project based learning and those who were taught as usual on the scores of knowledge level questions. It can be interpreted that project based learning can improve students' memorization rate and recall the information more easily.

(3)There was a significant difference between students who were taught by project based learning and those who were taught as usual on the scores of comprehension level questions. It can be interpreted that project based learning could bring about the improvement of students' ability to understand cause and affect relationships. And project based learning can also encourage students’ conceptual understanding.

(4) There was a significant difference between students who were taught by project based learning and those who were taught as usual in all the selected schools on the scores of application level questions. It can be interpreted that project based learning can bring about the development of students' ability to apply their learning in new situation. Therefore, project based learning has positive contribution to economics teaching at the high school level.

Students’ Attitudes towards Project Based Learning

The attitudes, feelings, experiences and opinions of students were examined by a questionnaire which consists of 15 items four point Likert-scale. For (15) items, strongly agreed,

agreed, disagreed and strongly disagreed percentage were shown in two selected schools such as No (1) BEHS Thnlyin and No (3) BEHS Tharketa.

(1) The first item deals with the students selecting the topic in accordance with their interest. In both schools, (46.7%) of the students strongly agreed and others over half of the students (53.3%) agreed to this item.

(2) The second item deals with by Project based learning increases their interest in learning Economics. In both schools, (70.0%) of the students strongly agreed, (28.3%) agreed, but some others were uncertain about (1.7%) to this item.

(3) The third item deals with students who can easily ask their peer about what they do not understand about project work. In both schools, (45%) of the students strongly agreed, (48.3%) agreed and only (6.7%) uncertainly to this item.

(4) The fourth item deals with students who are easy to work collaboratively with other students to finish project work successfully. In both schools, (35%) of the students strongly agreed and some others were (65%) agreed to this item.

(5) The fifth item deals with students who exchange ideas with their peers during the project work procedure. In both schools, (46.7%) of the students strongly agreed and over half of the students were (53.3%) agreed to this item.

(6) The sixth item deals with students who like working on projects in a group. In both schools, (55%) of the students strongly agreed, (41.7%) agreed and others (3.3%) uncertainly to this item.

(7) The seventh item deals with by Project Based Learning helps them to transfer what they learnt in the classroom to outside the classroom. In both schools, over half of the students were (61.7%) strongly agreed, but some others were (36.7%) agreed and only (1.6%) uncertainly to this item.

(8) The eighth item deals with students who think project based learning can improve their information searching skills. In both schools, most of the students (60.0%) strongly agreed but some others were agreed (40.0%) to this item.

(9) The ninth item deals with students who think project based learning can facilitate their active learning. In both schools, (65.0%) of the students strongly agreed, (35.0%) agreed to this item.

(10) The tenth item deals with students who think project based learning can promote their learning motivation. In both schools, (55.0%) of the students strongly agreed, (43.3%) agreed and (1.7%) uncertainly to this item.

(11) The eleventh item deals with students who think project based learning can foster their problem solving skills. In both schools, most of the students (66.7%) strongly agreed and almost one-third of the students (31.7%) agreed and only (1.7%) uncertainly to this item.

(12) The twelfth item deals with students who think project based learning can help them to learn the important subject knowledge. In both schools, (45.0%) of the students agreed, (45.0%) agreed and (10.0%) uncertainly to this item.

(13) The thirteenth item deals with students who think project based learning can promote their interpersonal skill. In both schools, (63.3%) of the students strongly agreed, (35.0%) agreed and (1.6%) uncertainly to this item.

(14) The fourteenth item deals with students who think project based learning can enhance their future learning..In both schools, (58.3%) of the students strongly agreed, (35%) agreed and (6.7%) uncertainly to this item.

(15) The fifteenth item deal with students who will suggest that the course could continue to use the project based learning in the future. In both schools, (70.0%) of the students strongly agreed but (23.3%) of them agreed and only (6.7%) uncertainly to this item.

According to the results of (15) items five-point likert-scale, the attitude of students have positive attitudes towards project based learning in both selected schools.

Summary of Qualitative Research Findings

In this research, the qualitative study for students from the experimental group of two selected schools was carried out with a questionnaire. It consists of (15) items five-point likert-scale. In this study, it was found that learning by doing increased students' conceptual understanding. Moreover, this learning also developed students' self-reliance and self-confidence. Most of students expressed that they were very happy by using hands-on activities. They gained the habit of cooperation with others. By relating previous experiences with the new experiences, it can promote their logical thinking skills. Moreover, students learned economics concepts with extra activities that were related to the lesson. Therefore, they had mastered their learning. Moreover, students expressed that their knowledge was increased and they had willingness to learn more from experience than as usual. Therefore, project based learning has positive contribution to the economics teaching and learning at the high school level.

Discussion

According to the results, there were significant differences between the experimental and control groups according to the comparison of the mean scores on knowledge, comprehension and application level questions for two selected schools. The mean scores of economics students who were taught by project based learning were significantly higher than that of students who were taught with formal instruction in each achievement level. It can be concluded that students who were taught by project based learning improve knowledge retention, interest in inquiry and conceptual understanding. All the students in the project based learning group performed in solving the problems which are presented in the classroom and give the benefit of all members of the group. When learners are confronted with problems which they must solve, they are forced to reason and think critically in order to solve the problems. The activities of project based learning were very active, interesting, and enjoyable for the students.

In addition, the students' ability to use learned material in new and concrete situations to answer correctly. The students need to be able to apply the rules, methods, concepts, and principles in new situation. This could be achieved because the students who got the treatment by the teacher using the project based learning helped to easily resolving dissensions that arise during their learning process. As a result, they had to think in an active manner in order to blend their thoughts in answering the comprehension and application level questions.

Project based learning activities should play significance, beneficial role in any economics classroom. Moreover, observation skills can improve. Social skills can also develop as the students share perceptions and knowledge with others. Students may begin to look forward to classes and connect previous knowledge and experiences with the new concepts. In this research, as shown above project based learning has significant effect on the economics achievement of the students. They can apply the knowledge and skills to their everyday life. The findings point out that the means of students who were taught by project based learning was significantly higher than those who were taught as usual.

To know students' attitudes, feelings, and experiences about project based learning, (15) items five-point likert-scale were used. They felt that they were very happy by using project based learning. They gained the habit of collaboration with others. They also developed self-confidence and self-esteem. Moreover, they actually introduce economics concepts not only memorization but also promote their interpersonal skills. By using project based learning, students' learning rate and their attitudes toward learning economics were promoted. Students become more interested in economics learning. According to these students' attitudes, feelings, and experiences, it is significant that project based learning has positive effect on economics learning.

Suggestions

Today, economics education demands experience that lead towards the intellectual, psychological and social growth of high school level students. Learning from experience or step by steps learning as project based learning can achieve these growths. This project based learning focuses on learning by doing. Students must be involved in hands-on activities to improve their knowledge and experiences. In Myanmar schools, teacher should endeavor to provide a variety of experiences and activities for students.

Project based learning engages students as active learners, fostering a high degree of participation and relevant student's contribution to class discussion. It encourages students to improve 21st century skills. In order to achieve this learning successfully, small class size is required. Small classes can help students engage in their activities more widely and teachers can facilitate those classes more easily. Thus, decreasing the number of students in the classroom enables the teacher to implement modern methods of teaching, especially project based learning.

Conclusion

Project based learning promotes critical thinking, and decision making skills. Nowadays, many educators have suggested that many benefits mount up from engaging students in project based learning. The project based learning is the strategic use of challenging outdoor and indoor experiences to stimulate insight and interest. This learning makes learners to be active in the classroom, self-explorative, gain insight into situation, acquire problem solving skills and have self-understanding of the environment. Students can get better chances for learning to interact with real life experiences.

To improve economics education, teaching learning situations and learning approaches are very important. Students' engagements are central role to improve economics education. The project based learning is not only the bridge between theory and practices but also connect between the classrooms and outside the classrooms. Students can apply theory in their real life situations. This learning promotes deeper understanding of economics concepts. Moreover, this project based learning is applicable to all students who have different learning styles. Thus, it is an applicable and useful for the development of economics teaching. Furthermore, many economics teachers to reach their teaching learning situation more effectively by using project based learning. The effective use of the project based learning has significant effect on the overall economics achievement of the students. Therefore, project based learning surely has positive contribution to the economics teaching at the high school.

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AN ANALYTICAL STUDY OF COOPERATIVE LEARNING MODEL IN THE TEACHING OF MYANMAR LANGUAGE WRITING SKILLS

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Abstract

The main purpose of this research is to investigate the effectiveness of Cooperative Learning Model in Myanmar Language teaching and learning of Grade Eight students in Myanmar. Instruments of quantitative research were based on the new instructional model of Cooperative Learning. Ten sample lesson plans were constructed. The target population is Grade Eight students in Yangon Region. Stratified random sampling method was used. Four sample schools were selected by using random sampling method. In each school, students were randomly selected and assigned to two groups. Quasi-experimental designs were applied in the experimental research and it took about ten weeks. Descriptive statistics was used to calculate students' mean score, standard deviation in narrative and descriptive writing skill of students. Also the percentage of students' attitude questionnaires were descriptive in data analysis. Furthermore, independent samples *t*- test and ANCOVA were used to test the significant level. Moreover, Pearson correlation was applied to analyze the correlation of the variables. And, questionnaires for students and teachers were conducted to find out teachers' and students' attitudes towards Cooperative Learning Model. The qualitative research was conducted with students' and teachers' interview questions for teachers and students. The result of this study shows that there was a significant difference in the writing skill of students between those who are taught by Cooperative Learning Model and those who are not. There also was relationship between students' narrative writing skill and descriptive writing skill. An overall analysis of these findings seems strongly indicate the presence of Cooperative Learning Model's positive pedagogic impact on teaching of Myanmar language writing skill.

Keywords: Cooperative Learning, Model, Learning

Introduction

Teaching is the profession where the success of the teachers depends on the ability of the students but there have been such teachers who have made even the worst of students the best of learners. The dynamics of teaching is a crucial factor in how much students learn (Herr, 2008). It is evident that understanding of a subject taught by a teacher depends on the methods of teaching adopted by that teacher. Methods make the material easier to comprehend and assimilate. A teacher would only pay attention towards his methods only when he is completely dedicated towards his profession and if his profession is his passion. Learning is the acquisition of new behavior that strengthening or weakening of old behavior as the result of experience. Students benefit from effective teaching and learning strategies inside and outside the classroom. Learning often takes place best when students have opportunities to express ideas and get feedback from their peers. Students take action and interact with others to construct the contextual knowledge of the classroom.

At present time, there is very little emphasis on writing in the language class. Writing is more careful, prestigious and permanent than speech. Language is the vehicle of thoughts. Man uses language as a means of communication. Burmese is the language people use in their day-to-day life for expressing ideas, for communication, for making transaction and for doing calculations. To learn a language, it is necessary to achieve four skills: listening, speaking, reading and writing. For achieving skills in Myanmar language as well, it is necessary to achieve these four skills.

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Unlike speaking, writing provides ones with a way not only to generate ideas before presenting them to an audience, but also to scrutinize the ideas and language they produce; this revision, this seeing again, lets them receive feedback from themselves and others and make changes and corrections. If teachers simply ask students to analyze, manipulate, and imitate given texts, they are not allowing them to grapple for that fit between content and form that all students need to grapple with. Writing consists of many constituent parts and teachers need to consider which ones will be the most important for a course: content, organization, originality, style, fluency, accuracy, or using appropriate rhetorical forms of discourse (Richards & Renandya, 2002).

Statement of the Problem

Traditional approaches to language teaching gave priority to grammatical competence as the basis of language proficiency. They were based on the belief that grammar could be learned through direct instruction and through a methodology that made much use of repetitive practice and drilling. The approach to the teaching of grammar was a deductive one: students are presented with grammar rules and then given opportunities to practice using them, as opposed to an inductive approach in which students are given examples of sentences containing a grammar rule and asked to work out the rule for themselves. It was assumed that language learning meant building up a large repertoire of sentences and grammatical patterns and learning to produce these accurately and quickly in the appropriate situation (Richards, 2006).

Today people place little emphasis on the importance of writing. It is very important to practice writing because it is one of the objectives of teaching Myanmar language in schools. However, it is a problem that most students learn by heart summaries of the *Zataka* written by teachers in Grade Eight. Although students may like to write summaries of the *Zataka* by themselves, they do not have confidence to present their own writing. They are afraid of reducing their scores if they did not write the same as the summaries given by teachers. As a result, many students find it difficult to write summaries of the *Zataka* themselves. Therefore, they just learn by heart summaries of the *Zataka* given by teachers and try to reproduce them accurately. Later, students cannot express their own thoughts and ideas in their own words effectively and efficiently. Unfortunately, this problem still remain unsolved completely till now.

Once a basic command of the language was established through oral drilling and controlled practice, the four skills were introduced, usually in the sequence of listening, speaking, reading and writing. Techniques that were often employed included memorization of dialogues, question-and-answer practice and substitution drills. One central belief of current pedagogy is that learners differ from one another in important ways (Robinson, 2002, cited in Bootzin, Bower, Zajonic & Hall, 1986). One area of difference lies in the tendency of some learners to prefer to learn in social settings. All learners need to know how to succeed in such settings, and cooperative learning provides opportunities for students to develop and practice the strategies they need to work with others.

Sharing knowledge can support each other and hence, it leads to better understanding. Cooperative learning strategies are the teacher's approaches to using information, selecting resources, and defining the role of the students, including specific practices used to accomplish a teaching objective (Borich, 2007). Therefore, educators believe that cooperative learning strategies are one of the most effective learning strategies in teaching Myanmar. Now in Myanmar language teaching, a systematic approach to teaching writing is needed to enhance students' writing skills and to help teachers to overcome their difficulties in teaching writing.

Therefore, the main problem this study investigated is if teaching model which is based on cooperative learning strategies will actually bring out better achievement of the students in teaching Myanmar.

Objectives of the Research

The major objectives of the study can be briefly described as follows.

1. To develop a new teaching model which is based on cooperative learning for Myanmar Language teaching for middle school students
2. To analyze the applicability of the model in middle school Myanmar Language Teaching
3. To compare students' achievement between two groups: experimental group and control group
4. To explore the interrelationships between Grade Eight students' narrative and descriptive writing skills
5. To investigate students' attitude towards cooperative learning model
6. To give suggestions for improving middle school Myanmar Language teaching based on the data obtained from the study

Research Hypotheses

1. There is a significant difference between the Myanmar achievement of the students who are taught by cooperative learning model and those who are not.
2. There is a significant difference between the Myanmar achievement of the students who are taught by cooperative learning model and those who are not in performing narrative writing.
3. There is a significant difference between the Myanmar achievement of the students who are taught by cooperative learning model and those who are not in performing descriptive writing.
4. There are interrelationships between the Grade Eight students' narrative and descriptive writing skills.
5. There is a positive attitude towards cooperative learning model among the students in the experimental group.

Definitions of the Key Terms

- **Cooperative Learning** - Cooperative learning is the term used to describe instructional procedures whereby learners work together in small groups and are rewarded for their collective accomplishments (Johnson & Johnson, 1998).
- **Model -** a model of teaching is a plan or pattern that can be used to shape curricula, to design instructional materials and to guide instruction in the classroom and other settings (Siddiqui & Khan, 2009).
- **Learning** - Learning is the acquisition of new behavior the strengthening or weakening of old behavior as the result of experience (Smith, 1962, cited in Schunk, 2004).

Scope of the Study

The research has its own particular limitations. The first limitation is the geographical area. This study is geographically restricted to Yangon Region. The second limitation is related to the participants of the study. Participants are Grade Eight students from the selected schools during the period 2017-2018 Academic Year. The third limitation is the content areas of the subject. The content area is limited to *Zataka*.

Significance of the Study

This study is expected to help students perform better in Myanmar language writing by cooperating in the class. In order to promote students' writing skills and to help teachers to overcome their difficulties in teaching writing, a cooperative approach to teaching writing is needed in Myanmar language teaching. The contribution of this study will demonstrate that the cooperative learning model to teaching and the learning materials really work. Students will develop both writing skills and their social skills will develop through cooperative learning.

Mg Khin Min (2013) also points out that writing essay is not in its right place, training ground for students' writing skills because many students read others' readily written essays by heart. This issue is not a new one. It was also discussed in the meeting held by Basic Education Curriculum Syllabus and Textbook Committee, and Myanmar Language Commission in November, 1975. In this meeting, senior and junior assistant teachers who teach Myanmar stated that students read essays by heart for exam and some teachers also asked students to do so. As a result, students found it difficult to write even a page of essay themselves. If students try to write essay in cooperation with other students, they will get a lot of ideas for writing essays. In this way, students will develop not only their writing skills but also their social skills and cooperation with other students. So, this study would be beneficial not only middle but also high schools Myanmar language teachers and students as this study would provide necessary information on how to teach writing and how to write effectively through cooperation with others in class.

Theoretical Framework

Perspectives of Cooperative Learning

Basically cooperative learning is a model of learning where the student can work in group. It is very essential to be done because the student needs other people to do something as the social creature. They also need another student to help them to solve something. Sharan (n.d., cited in Huda, 2011) agreed with other researcher who said student's performance is more effective when they work in small groups than they work in traditional classroom. By working in group, it can increase students' achievement and socialization and also repair their perception and attitude about the important of learning and socialization. There are several theoretical perspectives that support cooperative learning model. They are:

(1) Motivational perspective

This perspective assumed that cooperative learning must be based on group reward and goal structure. If cooperative learning activities is implemented correctly, it can create a condition where they can succeed to get group goals if the other group member is successful too to get the goals. They can support the other friends to give maximal efforts to get goals.

(2) Social cohesion perspective

This perspective said that cooperative learning will influence to student achievement if they can make cohesively (help each other) in each group member. Student help the other group member overall because they feel care to success of group.

(3) Cognitive perspective

This perspective said that interaction between students will increase student achievement if they can process information mentally than motivationally.

(4) Developmental perspective

It comes from Jean Piaget and Lev Vyogotsky. The Piagetian perspective said that when student work together, socio - cognitive will be appear and produce cognitive disequilibrium. It can increase student ability to think, reason, and talk. Vyogotsky perspectives state that knowledge is a social product.

(5) Cognitive elaboration perspective

This perspective said that elaboration can be a cognitive exercise to increase student learning. The most effective technique of elaboration is explaining the topic to other. In some research shown that student can learn more by giving explanation to other.

Cooperative Learning Effects. There are three effects of cooperative learning according to Arends et. al (2007). Those effects are:

(1) Effects on Academic Achievement

Cooperative learning strategies have positive effects on academic achievement for all students, but particularly for students with poor academic histories. Students of higher ability are benefited more when working in cooperative groups as compared to individualistic or competitive classrooms. Slavin reported significantly higher levels of achievement in language arts and mathematics when they compared students in an elementary school that used cooperative learning with their peers in a traditional elementary school.

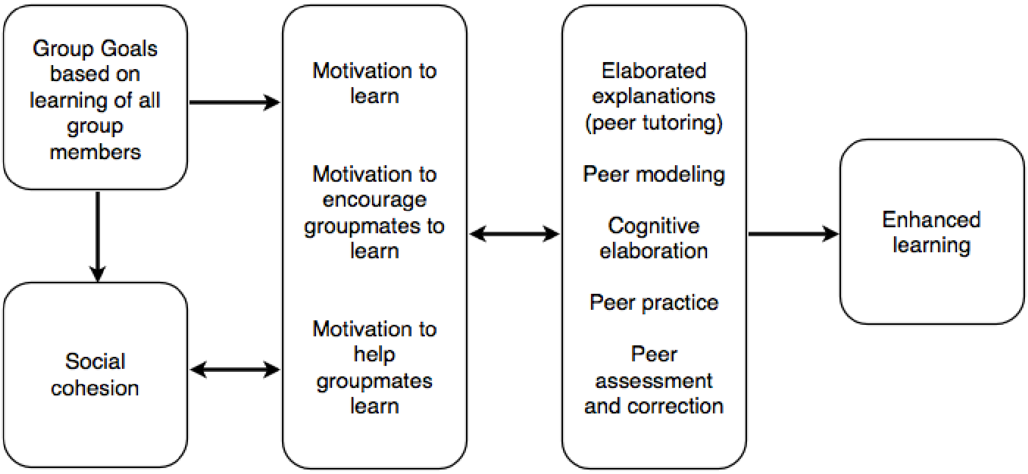
(2) **Effects on Cooperative Behavior**

Studies conducted by Sharan and his colleagues showed clearly that instructional methods (whole group teaching versus cooperative learning) influenced students' cooperative and competitive behaviors. Cooperative learning generated more collaborative behavior than did whole-class teaching. Students from cooperative learning classrooms displayed less competitive behavior and more cross-ethnic cooperation. Johnson and Johnson also reported considerable positive effects on social learning and personal esteem when comparisons were made between cooperative and individualistic classroom organizations. Dozens of studies have demonstrated that, when students are allowed to work together, they experience an increase in a variety of social skills; they become more capable of solving problems, better able to take the role of the other, and are generally more cooperative and willing to help and reward others.

(3) Effects on Acceptance of and Tolerance for Diversity

The use of cooperative learning strategies has also been shown to result in better intergroup relations. Sharing responsibility and interaction produces more positive feelings towards tasks and others. Slavin also reported that heterogeneous groups learn more, form more positive attitudes toward the learning tasks, and become more positive toward individuals who are different.

Model of Cooperative Learning. Researcher would like to investigate the effective-ness of Slavin's model of cooperative learning. Slavin's (1996) model of cooperative learning is foundational to promote social interaction and learning.



Source: From Smith & Ragan. (1999)

Figure 1 Slavin's Integrated Model of Cooperative Learning

Social cohesion seemed to be the component of Slavin's model with the most significant effect on the student experience, a finding supported by both the quantitative and qualitative analyses. Slavin proposes three different motivational factors at work in cooperative learning environments: motivation to learn, motivation to encourage group-mates to learn, and motivation to help group-mates to learn. Of these three factors, the activity appeared to provide participants with motivation to learn as well as motivation to help group-mates to learn. The activity also provided motivation for participants to encourage group-mates to learn.

Basic Types of Cooperative Learning Group

There are three basic types of cooperative learning groups – formal cooperative learning groups, informal cooperative learning groups and base groups.

(1) Formal Cooperative Learning Groups

These groups may last from several minutes to several class sessions to complete a specific task or assignment (such as doing a set of problems, completing a unit of work, writing a report, conducting an experiment, or reading and comprehending a story, play, chapter or book). The members are carefully chosen for heterogeneity to maximize learning and minimize 'group think'.

(2) Informal Cooperative Learning Groups

These groups are temporary, ad hoc groups that last for a few minutes, one discussion or class period. The members are often chosen randomly and will rotate on a regular basis. Their purposes are to focus learner attention on the material to be learned, create an expectation set and mood conducive to learning, as well as help organize in advance the material to be covered in a class session. They can ensure that learners cognitively process the material being taught and provide closure to an instructional session. They may be used at any time but they are especially useful during a lecture or direct reading. The length of time that most learners can attend to a lecture before they begin to drift away is around (20) to (25) minutes. These groups help break up the lecture and allow learners to process the content as they take part in class.

(3) Base or Home Groups

Base groups are long-term cooperative learning groups with stable membership. Learners are chosen for base groups in a manner that will guarantee a good mix of academic levels in the group. These groups are set up to so that members provide support to each other so that all can succeed academically. For example, they may pick up handouts for each other if one of the group members is absent, and they will coach each other to prepare for individual tests. The use of base groups tends to personalize the classroom, improve attendance and also improve the quality and quantity of learning.

Research Method

As the objectives were set at the beginning of the study, teaching writing materials and activities, model and lesson plans were developed based on cooperative learning model for teaching writing. They were aimed at improving middle school students' writing skills in Myanmar language. To test them to see if they are effective or not, a quantitative study, an experiment, was performed. A questionnire survey, was conducted to find out the attitudes of students and teachers towards the new teaching model. A qualitative study, interviews were also conducted to find out the attitudes of students and teachers towards cooperative learning model.

Sample Size in the Research

The research was carried out in Yangon Region. In Yangon Region, there are four districts: East, West, South and North. One township from each district was selected by random sampling method. And then, one school from each township was chosen by using simple random sampling method. For the experiment, (98) students from B.E.H.S (4) Hlaing, (120) students from B.E.M.S (2) Shwepyithar, (99) students from Yankin Practising Middle School and (98) students from B.E.H.S (2) Kyauktan were selected.

Research Design

The research design applied in the quantitative study is the nonequivalent control group design which is one of the quasi-experimental designs. According to L. R. Gay (1987), this design is used if it is not possible to randomly assign subjects to groups. But an advantage of this design is that possible effects from reactive arrangements are minimized since classes are used as it is. Subjects may not be aware that they are involved in a study. So, the experiment was conducted by using existing classrooms. From each selected school, two classrooms were chosen and each two were randomly assigned to two groups: experimental group and control group.

Instrumentation

Since the study is aimed at investigating the impact of cooperative learning model to teaching writing in Myanmar language at the middle school level, the researcher developed a pretest and a posttest, and the marking schemes for them. Pretest consists of (6) items to measure basic writing skills. The total score of pretest is (50) and the time allowed for the test is 1:30 hours. Posttest consists of (5) items to measure narrative and descriptive writing skills. The total score of posttest is (100) and the time allowed for the test is 2:30 hours. To examine the students' and teachers' attitude towards the developed cooperative learning model for teaching writing, questionnaires were constructed under the guidance of supervisor and co-supervisor. Five-point Likert scale with (5) items from strongly agree to strongly disagree, was used to indicate the attitude towards cooperative learning model. They were developed under the guidance of supervisor and co-supervisor. In order to establish validity, they were presented to teacher educators and academicians. According to their valuable suggestions, necessary modification in pretest and posttest were made.

Learning Materials

Learning materials consist of (6) *Zataka* stories from the prescribed textbook. In addition, story, event, field trip and biography were added for narrative writing. For descriptive writing, definite description and aesthetic description were added. It is assumed that these learning materials can cover the narrative writing and descriptive writing skills at the middle school level. These learning materials and activities were written under the constant supervision of supervisor and co-supervisor. They all were examined by five expert teachers in both methodology and academic fields. They made valuable suggestions and recommendations from their different points of view for the improvement of the learning materials and activities. Their critical comments and suggestions regarding style, format, appropriateness and wording were very helpful. At their valuable suggestions, necessary modifications in learning materials were made. Some words are replaced by more understandable words.

Key Variables

The independent variables in this study were the different instructions of teaching writing. Therefore, the independent variable for the experimental group was instruction, using cooperative learning and for control group was instruction, without using it. The dependent variable was students' score on the posttest.

Procedure

Before cooperative learning model was used in teaching, lesson plans were developed. In order to evaluate the feasibility of the instruments for full-scale study, pilot experiment was conducted at Basic Education Middle School, Hlaing Township from 12th June to 10th July 2017. The time taken for teaching including testing before and after was (20) periods which last (45) minutes each. According to the experiences of pilot study, necessary changes in testing and planning for experimental study were made. After pilot study, some wordings in tests were changed. Pilot teaching also gave better ideas for the preparation of handouts and teaching aids for experimental study. In the light of pilot study, necessary changes were also made in lesson plans.

Conducting full-scale experimental study was started in all four selected schools in July, 2017. At the beginning of the study, all participants in both groups were pretested to check the equivalence of the two groups. It took (1:30) hours, (2) periods. Then the experimental groups were treated with the developed cooperative learning model for teaching writing while the control groups were taught as usual. The two experimental groups in B.E.H.S (4) Hlaing and B.E.M.S (2) Shwepyithar were taught by the researcher. And the rest in B.E.H.S (2) Kyauktan and Yankin Practising Middle School were given treatment by other two Myanmar language teachers from these schools. They were given learning materials to study in advance. They had been advised how to teach writing according to cooperative learning model for teaching writing and lesson plans. The total time taken for treatment was (40) periods. After the treatment periods, posttest was administered to all students in experimental groups and control groups to measure their writing skill achievement. The experimental study finished in October, 2017. After teaching them, the researcher developed posttests in order to investigate whether cooperative learning was really effective in students' writing skills. There are two main components in the posttest: narrative writing and descriptive writing.

To examine the attitude of students and teachers towards the developed cooperative learning model for teaching writing, questionnaires were developed under the guidance of supervisor and co-supervisor. Five-point Likert scale with (1) stands for strongly disagree and (5) assigned to strongly agree, was used to indicate the attitude towards cooperative learning model. The questionnaire was sent to all students who participated in experimental groups in all four selected schools. The teachers helped to distribute the questionnaires and collect the questionnaires in their schools. It took about (20) minutes to complete the questionnaire. It was completed at the last week of teaching experiment.

Analysis of Data

The Statistical Package for the Social Science (SPSS) version (24) was used to analyze the quantitative data. The data were analyzed by the independent samples *t*-test and ANCOVA to compare the differences between the experimental groups and control groups. Moreover, Pearson correlation was calculated to find out the relationships between students' narrative writing skill and descriptive writing skill. Percentage of responses was used to know the attitudes of the students involved in experiment towards the new teaching approach after the instruction. Interview was used for the qualitative study.

Research Findings

This study was conducted to investigate the effectiveness of cooperative learning model in the teaching of Myanmar language writing skills. Both quantitative and qualitative research methodologies were used in this research as a mix method: the QUAN-Qual Model. Therefore, the findings of the research, both quantitative and qualitative study, were discussed. The data analysis was carried out, using the Statistical Package of the Social Science (SPSS) version 24.

Quantitative Research Findings

Quantitative research findings include the data analysis of pretest scores, overall posttest scores and individual scores in two parts of the posttest: test on narrative writing skill and test on descriptive writing skill.

Analysis of Pretest Scores. The data obtained from pretest were recorded system-atically and analyzed by using the independent samples *t*-test to determine whether there is a significant difference between the experimental groups and the control groups. The results are shown in the following table.

Table 1 *t* Values for Pretest Scores in Overall Writing Skill Achievement

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
S1	Experimental	50	38.24	3.836	0.24	.337	96	.737 (ns)
	Control	48	38.00	3.176				
S2	Experimental	60	39.72	1.914	0.45	-1.338	118	.184 (ns)
	Control	60	40.17	1.768				
S3	Experimental	51	42.37	1.697	1.53	4.369	107	.000***
	Control	48	40.84	1.954				
S4	Experimental	51	41.75	1.598	1.02	-3.112	96	.002**
	Control	47	42.77	1.645				

***Note*:** ns = not significant
**p <. 01
***p <. 001

S1= B.E.H.S (4) Hlaing
S2= B.E.M.S (2) Shwepyithar
S3= Yankin Practising Middle School
S4= B.E.M.S (2) Thanlyin

In school 1 and school 2, the results show that there was no significant difference between the experimental groups and the control groups for scores on pretest (p > .05) because the mean scores of the experimental groups and the control groups were nearly the same in these two schools. This means that the two groups in two schools were equivalent. Therefore, their scores on posttest will be analyzed by using the independent samples *t*-test.

In school 3 and school 4, the results show that there was a significant difference between the experimental groups and the control groups for scores on pretest ($p < .05$) because the mean scores of the experimental groups and the control groups were different in two schools. This means that the two groups in two schools were not equivalent. Therefore, their scores on posttest will be analyzed by using the analysis of covariance.

Table 2 *t* Values for Posttest Scores in Overall Writing Skill Achievement for School 1

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2- tailed)
Narrative Writing Skill	Experimental	50	34.54	6.55	11.62	7.519	96	.000***
	Control	48	22.92	8.65				
Descriptive Writing Skill	Experimental	50	12.82	6.47	7.28	5.690	96	.000***
	Control	48	5.54	6.18				
Overall Writing Skill	Experimental	50	47.36	11.15	18.90	7.541	96	.000***
	Control	48	28.46	13.59				

***Note* :** *** $p < .001$

Table (2) shows mean scores of the posttest on narrative writing skill, descriptive writing skill and the overall posttest mean scores of control and experimental groups in school 1. According to the results, there was a significant difference between control and experimental groups in school 1 since the posttest mean scores on narrative writing skill, descriptive writing skill and the overall posttest mean scores of experimental groups were significantly higher than those of control group ($p < .001$). It means that experimental group could perform better than control group in overall writing skill achievement for school 1.

Table 3 *t* Values for Posttest Scores in Overall Writing Skill Achievement for School 2

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2- tailed)
Narrative Writing Skill	Experimental	60	36.85	3.89	13.35	15.020	118	.000***
	Control	60	23.50	5.68				
Descriptive Writing Skill	Experimental	60	23.32	4.14	15.07	16.629	118	.000***
	Control	60	8.25	5.67				
Overall Writing Skill	Experimental	60	60.17	6.59	28.42	19.438	118	.000***
	Control	60	31.75	9.21				

***Note*:** *** $p < .001$

Table 3 shows the mean scores of the posttest on narrative writing skill, descriptive writing skill and the overall posttest mean scores of control and experimental groups in school 2. According to the results, there was a significant difference between control and experimental groups in school 2 since the posttest mean scores on narrative writing skill, descriptive writing skill and the overall posttest mean scores of experimental groups were significantly higher than those of control group ($p < .001$). It means that experimental group could perform better than control group in overall writing skill achievement for school 2.

Table 4 Means and Standard Deviation for Posttest Scores in Writing Skill Achievement for School 3

Skill	Group	N	M	SD	MD
Narrative Writing Skill	Experimental	51	34.33	5.086	2.05
	Control	48	32.28	6.735	
Descriptive Writing Skill	Experimental	51	13.90	3.557	4.95
	Control	48	8.95	4.47	
Overall Writing Skill	Experimental	51	48.24	5.722	7.02
	Control	48	41.22	9.546	

According to the scores of the questions for students' writing skill achievement on narrative writing skill, descriptive writing skill and overall posttest mean scores, the mean of experimental group was significantly higher than that of control group on descriptive and overall writing skill but there was no significance on narrative writing skill in school 3. The mean scores of experimental groups were significantly higher than those of control group ($p < .001$). It means that experimental group could perform better than control group in overall writing skill achievement for school 3 (See Table 4).

Table 5 Means and Standard Deviation for Posttest Scores in Writing Skill Achievement for School 4

Skill	Group	N	M	SD	MD
Narrative Writing Skill	Experimental	51	45.86	2.97	4.41
	Control	47	41.45	2.09	
Descriptive Writing Skill	Experimental	51	20.90	3.57	4.50
	Control	47	16.40	2.18	
Overall Writing Skill	Experimental	51	66.76	5.17	8.91
	Control	47	57.85	3.24	

According to the scores of the questions for students' writing skill achievement on narrative writing skill, descriptive writing skill and overall posttest mean scores, the mean of experimental group was significantly higher than that of control group in School 4. According to the results, there was a significant difference between control and experimental group in School 4 since the posttest mean scores on narrative writing skill, descriptive writing skill and overall posttest mean scores of experimental groups were significantly higher than those of control group ($p < .001$). It means that experimental group could perform better than control group in overall writing skill achievement for school 4 (See Table 5).

Summary of Findings

The results of the experimental study can be summarized as follows.

1. There were significant differences between experimental groups and control groups on the scores of the overall writing achievement in all four selected schools.
2. There were significant differences between experimental groups and control groups on the scores in narrative writing skill achievement in all four selected schools.
3. There were significant differences between experimental groups and control groups on the scores in descriptive writing skill achievement in all four selected schools.
4. Most of the students had a positive attitude towards the cooperative learning model and learning materials.

The cooperative learning model to teaching writing has positive effect on the students' narrative and descriptive writing skills. Moreover, the study explored the relationship between students' narrative writing and descriptive writing skills by using the Pearson Correlation Coefficient. As the Pearson Correlation Coefficient between students' narrative writing skill and descriptive writing skill is (.697) in School 1, (.783) in School 2, (.278) in School 3, (.539) in school 4, it can be concluded that the relationship between the students' narrative writing skill and descriptive writing skills had positive relationship in all the selected schools, except school 3.

Discussion

The main objective of this research is to develop a cooperative learning model for teaching writing and to investigate the impact of this model on students' writing skills. After the cooperative learning model has been developed, lesson plans were developed. They were first taught to the pilot group for (12) periods. Then, the exercises were taught to the experimental groups in four schools from July to October in 2017. After teaching them for about three months, the researcher developed posttests in order to know whether cooperative learning was really effective in students' writing skills or not. There are two main components in the posttest-narrative writing and descriptive writing. Finally, the qualitative research findings were carried out with the help of interviews.

Results of the study pointed out that the use of cooperative learning techniques in teaching writing can improve students' writing skills. The posttest scores of the selected schools (School 1 and School 2) were analyzed by using *t*-test for independent samples and the posttest scores of (School 3 and School 4) were analyzed by using analysis of covariance (ANCOVA). The mean scores of all the experimental groups in the selected schools were higher than those of the control groups. The results showed that students' writing skills were significant at $p < .001$ level in all schools. So, these results supported hypothesis (1): There is a significant difference between achievement of Myanmar by the students who are taught by cooperative learning model and those who are not.

In comparing the mean scores of narrative writing skill between experimental groups and control groups, there were significant differences between these groups. Students' narrative writing skills were significant at $p < .001$ level for narrative writing skill in schools 1, 2 and 4 and $p < .01$ level in school 3. So, these results supported hypothesis (2): There is a significant difference between the achievement of Myanmar by the students who are taught by cooperative learning model and those who are not in performing narrative writing. In descriptive writing skill, students' writing skills were significant at $p < .001$ level. All the experimental groups in all the selected schools did better than the control groups. These findings supported hypothesis (3):

There is a significant difference between the achievement of Myanmar by the students who are taught by cooperative learning model and those who are not in performing descriptive writing.

In general, the results of analyzing data showed that all the experimental groups did better in writing than the control groups. According to the statistical data of the posttest scores, it was concluded that the performance of the experimental groups in all selected schools were better in writing than that of the control groups.

Finally, the relationship between students' narrative writing skill and descriptive writing skill showed that there was a relationship in all schools. The direction of coefficient in all schools was positive. This means that if students' narrative writing skill is good, their descriptive writing skill is also likely to be good or vice versa. Therefore, this finding reveals that there is a relationship between the students' proficiency of narrative writing skill and that of descriptive writing skill. Moreover, findings from the questionnaire and interview prove that students have positive attitude towards the cooperative learning model. To sum up the findings mentioned above, it is found that the cooperative learning model has positive impact on students' writing skills. In other words, cooperative learning model can improve the students' writing skills.

During this study, it was found that the use of the cooperative learning model in teaching writing had several advantages. The students were more interested in learning Myanmar language and enjoyed writing. Moreover, the students in cooperated group felt comfortable and enhanced their writing skills by sharing and discussing their background knowledge. It can be generalized that the students with lesser abilities learn more by working alongside those who have greater abilities. To sum up, the students should be encouraged to participate in the cooperative tasks in language learning.

Cooperative learning is now widely recognized as one of the most promising practices in the field of education. Moreover, a synthesis of research on cooperative learning strategies found out that these strategies improve the achievement of students and their interpersonal relationships. Many researches showed the benefits of cooperative learning. But in Myanmar, it is still necessary to do more researches on cooperative learning to investigate its effects on Myanmar students as they are used to be traditional teaching method.

Suggestions

According to the findings, it can be interpreted that cooperative learning model operates significant support for the students' writing skills. Many researches showed the benefits of cooperative learning. In Myanmar, more researches on cooperative learning should be carried out to investigate its effects on Myanmar students as teachers are still used to be teacher-centered instruction.

According to the results of this research, the use of cooperative learning model in teaching writing can enhance students' writing skill. This study indicated that giving students opportunities to write the summary of *Zataka* cooperatively in the classroom can enhance students' writing skill. Students had the opportunity to work together and from each other in groups. Stronger students helped the weaker ones. The results of the study are in line with the suggestions of Kessler's (1992) who stated that students can understand better the text and take valuable feedback from each other, working in pairs or groups. Students in cooperated groups developed considerable commitment and became less dependent on the teacher. They did not passively sit in and take in what the teacher said. They participated actively in their writing activities. Thus, it is suggested that cooperation and active participation of the students should be taken into account for the development of students' writing skills.

The second suggestion is that some awareness should be taken into consideration when implementing cooperative learning in language teaching although most research results offer positive perspectives of cooperative learning. One weakness of using cooperative learning is that it is time consuming for students to learn materials in a cooperative way and to work together in groups. The allocated time for each *Zataka* is generally four periods and each period takes (45) minutes. Within this allocated time, all language skills such as listening, speaking, reading and writing have to be taught to the students. The existing time allotment may not be adequate to teach all language skills with cooperative learning model. In this study, cooperative learning model is used only in teaching writing. If teachers get sufficient time, all language skills should be taught, using cooperative learning model. Moreover, teachers should be aware of time limitation in order to make group more meaningful.

The third suggestion is that the class-size should be small enough to carry out cooperative learning environment. The ratio of teachers and students is one of the problems in implementing cooperative learning environment. There are about fifty to sixty students in most classes. Students had to sit in tight. During the study, it was found that it was difficult to arrange the classrooms to be comfortable in cooperative structure. Because of the insufficient number of teachers, classrooms, buildings and furniture, there are about fifty to sixty students in each classroom of some schools in Myanmar.

The next suggestion is that teachers should emphasize the rules and duties for cooperative learning in class and remind group members to precisely rate the contribution of each group member. One of the greatest challenges of cooperative learning is its reliance on a positive group dynamic to function as its highest efficiency. Conflict between individuals can diminish a group's ability to work together. If a student does not want to work in a group, the teacher should discuss the advantages that students can derive from learning in groups and overcome resistance to group activities. When students work in groups, they should do their best to make sure everyone is involved. Moreover, the class activities should be well planned in advance to ensure the learning process is really based on cooperative learning.

According to the results of the research, it was found that students' narrative writing skill and descriptive writing skill are positively correlated. Therefore, teachers and curriculum developers need to develop plans to support not only students' narrative writing skill but also descriptive writing skill. By relating the narrative and descriptive writing skills, the students' language learning will be supported to a great extent. So, it is suggested that to be able to improve students' narrative and descriptive writing skills, teachers should use cooperative learning model.

Recommendations

1. In the study, the sample schools were randomly selected only from Yangon Region. Further research should be carried out in the other states and regions so that the results will be more generalized.
2. The study was mainly based on cooperative learning model to investigate its impact on students' writing skills. Further research should focus on comparison between different

techniques of cooperative learning in order to determine if other cooperative learning techniques are equally effective in producing desired learning outcomes.

3. Cooperative learning techniques were used in teaching Myanmar writing at Grade Eight. Another research should be made in teaching other language skills and the other content areas at the Middle and High School levels for more representative results.
4. A quasi-experimental design had to be used because there was no chance to assign subjects randomly to group. Further research should be carried out in other states and regions and conducted by using true-experimental design to get more valid results and to be more reliable than the present results.

Conclusion

The purpose of the study is to investigate the influence of cooperative learning model on teaching writing. The sample schools were selected from Yangon Region by using stratified random sampling method. One school from each stratum was randomly chosen and a quasi-experimental design was used in this study. As there had no right and chance to assign subjects randomly to group, the experiment was conducted by using the intact groups existing in the schools (two classrooms from each school were chosen randomly). The experimental groups from the selected schools were taught writing by using cooperative learning technique. The control groups were taught writing by using existing teaching methods used by most schools. According to the statistical data of the posttest scores, it was concluded that the performance of the experimental groups in all of the selected schools were better in writing skills than that of the control groups.

The results of qualitative study also support the results of quantitative study. According to the findings of qualitative study, it was found that most of the students had a positive attitude towards the cooperative learning model to teaching writing. The most important fact is that both teachers and students who participated in the research accepted the fact that this model contributes to the improvement of students' Myanmar language writing skill.

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ခင်မင်၊ **မောင်**၊ (ဓနုဖြူ)။ (၂၀၁၃)။ **စာစီစာကုံးနေရာမှန်ပြန်ရောက်ရေး**။ ပညာတန်ဆောင်၊ အတွဲ ၆၂၊ အမှတ်(၁) စာမျက်နှာ ၃၈–၄၁။ ရန်ကုန်၊ ပညာတန်ဆောင်။

APPENDIX A

Proposed Model of Cooperative Learning for Teaching Writing

ဤသင်ကြားရေးဆိုင်ရာနမူနာပုံစံသည် Slavin (1995) ၏ Cooperative Learning Model, Robert Glaser ၏ Basic Teaching Model နှင့် Gerlach and Ely Model တို့ကို အခြေခံ၍ တည်ဆောက်ထားပါသည်။ ဤနမူနာပုံစံတွင် သင်ခန်းစာရွေးချယ်ခြင်း၊ ရည်ရွယ်ချက် ချမှတ်ခြင်း၊ သင်ကြားရန် အဆင့်ဆင့်ကြိုတင် ပြင်ဆင်ခြင်း၊ ကျောင်းသားများ၏ ရှိပြီးသား အသိပညာ ဗဟုသုတများကို နှိုးဆွပေးခြင်း၊ ကျောင်းသားများအား အုပ်စုလိုက် ရည်ရွယ်ချက် များချမှတ်စေခြင်း၊ ရေးသားရန် လှုံ့ဆော်ခြင်း၊ အုပ်စုတွင်ရှိသော သက်တူရွယ်တူအချင်းချင်း နမူနာပြခြင်း၊ စာရေးနည်းအဆင့်ဆင့် အတိုင်းရေးသားခြင်း၊ လုပ်ဆောင်ချက်များကို စစ်ဆေးခြင်းနှင့် လိုအပ်ချက်များကို ခွဲခြမ်းစိတ်ဖြာခြင်းဟူ၍ ကဏ္ဍ(၁၀)ခုပါဝင်သည်။

(၁)<u>သင်ခန်းစာရွေးချယ်ခြင်း</u>– ဤနမူနာပုံစံကိုအသုံးပြု၍ ကျောင်းသားတို့သည် ပူးပေါင်း ဆောင်ရွက်ခြင်းဖြင့် အရေးအသားစွမ်းရည်များ တိုးတက်လာစေရန် သင်ခန်းစာများကို ရွေးချယ်ပါသည်။ ကျောင်းသားတို့၏ ဖြစ်စဉ်ပြအရေးအသားတိုးတက်စေရန်အတွက် ပုံပြင်၊ ကိုယ်တွေ့အဖြစ်အပျက်၊ လေ့လာရေးခရီးနှင့် အတ္ထုပ္ပတ္တိတို့ကို ရွေးချယ်ခဲ့ပါသည်။ သရုပ်ဖော် အရေးအသား တိုးတက်စေရန် အတွက် အတိအကျ သရုပ်ဖော်ခြင်းဆိုင်ရာ သင်ခန်းစာများနှင့် ရသစာပေဆန်ဆန် သရုပ်ဖော်ခြင်းဆိုင်ရာ သင်ခန်းစာများကို ရွေးချယ်ခဲ့ပါသည်။ ထို့ပြင် သတ္တမတန်းတင် ပြဋ္ဌာန်းထားသော ဇာတကဝတ္ထုများ အနက်မှ နွားလိမ္မာ (နန္ဒိဝိသာလဇာတ်)၊ ပဥ္စာဝုဓမင်းသား (ပဥ္စာဝုဓဇာတ်)၊ ပညာရှိသော ပေါက်တူးသမား (ကုဒါလပဏ္ဍိတဇာတ်)၊ ဘီမသေန (ဘီမသေနဇာတ်)၊ ကျေးဇူးသိတတ်သော ခြင်္သေ့ (ဂုဏဇာတ်) နှင့် နှမ်းခိုး၍စားသော မင်းသား (တိလမုဋ္ဌိဇာတ်) တို့ကိုရွေးချယ်ခဲ့ပါသည်။

(၂) <u>ရည်ရွယ်ချက်ချမှတ်ခြင်း</u>–ရွေးချယ်ထားသော သင်ခန်းစာများပေါ်မူတည်၍

(က) ကျောင်းသားများသည် ဖြစ်စဉ်ပြရေးနည်းကို အသုံးပြု၍ ပုံပြင်၊ ကိုယ်တွေ့အဖြစ်အပျက်၊ လေ့လာရေးခရီးနှင့်အတ္ထုပ္ပတ္တိတို့ကို ရေးသားနိုင်စေရန်။

(ခ) အတိအကျသရုပ်ဖော် ရေးသားတတ်စေရန်နှင့် ရသစာပေဆန်ဆန် သရုပ်ဖော်ရေးသား တတ်စေရန်။

(ဂ) ဖြစ်စဉ်ပြရေးနည်းနှင့် သရုပ်ဖော်ရေးနည်းတို့ကို အသုံးပြု၍ ဇာတကဝတ္ထုများကို မိမိ နားလည်သလို ပြန်လည်ရေးသားတတ်စေရန် စသည့်ရည်ရွယ်ချက်များချမှတ်ပါသည်။

(၃) <u>သင်ကြားရန်အဆင့်ဆင့်ကြိုတင်ပြင်ဆင်ခြင်း</u>– ရည်ရွယ်ချက်များချမှတ်ပြီးလျှင် သင်နည်း မှတ်စုရေး၍ သင်ကြားရန်အဆင့်ဆင့်ကို ကြိုတင်ပြင်ဆင်ပါသည်။ စာသင်ကြားရာတွင် မည်ကဲ့သို့ နိဒါန်းပျိုးမည်။ သင်ခန်းစာကိုမည်ကဲ့သို့သင်ကြားမည်။ အုပ်စုများ မည်ကဲ့သို့ခွဲ၍ ဆွေးနွေးစေမည်နှင့် တတ်မြောက်မှုကို မည်ကဲ့သို့စစ်ဆေးမည်ကို ကြိုတင် ပြင်ဆင်ထားပါမည်။

(၄) <u>ကျောင်းသားများ၏ရှိပြီးသားအသိပညာဗဟုသုတများကိုနှိုးဆွပေးခြင်း</u>– စကားပြေကောင်း၏ အင်္ဂါရပ်များ၊ ဖြစ်စဉ်ပြရေးနည်းနှင့် သရုပ်ဖော်ရေးနည်းအကြောင်းကို ဆရာက ရှင်းပြပါမည်။ စာရေးနည်းများနှင့်ပတ်သက်၍ ကျောင်းသားများ၏ရှိပြီးသား အသိပညာ ဗဟုသုတများကို နှိုးဆွ ပေးပါမည်။ လိုအပ်သည်များကိုဆရာက ဖြည့်စွက်ရှင်းလင်းပေးပါမည်။

(၅) <u>ကျောင်းသားများအား အုပ်စုလိုက်ရည်ရွယ်ချက်များချမှတ်စေခြင်း</u>– ဖြစ်စဉ်ပြရေးနည်း၊ သရုပ်ဖော် ရေးနည်းနှင့် ရွေးချယ်ထားသော သင်ခန်းစာများအပေါ်အခြေခံ၍ ကျောင်းသား များအား အုပ်စုလိုက်ရေး လိုသော ခေါင်းစဉ်ကိုရွေးချယ်စေပြီး ရည်ရွယ်ချက်များ ချမှတ်စေ ပါမည်။ ဥပမာ – ပုံပြင်ရေးမည်ဆိုလျှင် မိမိတို့အုပ်စုလိုက် ရေးလိုသော ပုံပြင်ခေါင်းစဉ်ကို ရွေးချယ်စေပြီး အဘယ့်ကြောင့် ထိုပုံပြင်ကို ရေးသားရကြောင်း အုပ်စုလိုက်ရည်ရွယ်ချက်များ ချမှတ်စေပါမည်။

(၆) <u>ရေးသားရန်လှုံ့ဆော်ခြင်း</u>– ရေးသားရန်လှုံ့ဆော်ခြင်းကဏ္ဍတွင် စာရေးသားရန် အုပ်စုဝင် အချင်းချင်း တွန်းအားပေး၍ လှုံ့ဆော်ခြင်းနှင့် စာရေးသားရန် အုပ်စုဝင်အချင်းချင်းကူညီပေး၍ လှုံ့ဆော်ခြင်းဟူ၍ ပါဝင်ပါသည်။ နောက်ကဏ္ဍတစ်ခုမှာ အုပ်စုတွင်ရှိသော သက်တူရွယ်တူ အချင်းချင်း နမူနာပြခြင်း

ဖြစ်ပါသည်။ ထိုကဏ္ဍတွင် ကျောင်းသားကျောင်းသူများသည် မိမိတို့ သိရှိထားသည်များကို ဖော်ထုတ်ရှင်းလင်းရပါမည်။

(၇) <u>အုပ်စုတွင်ရှိသောသက်တူရွယ်တူအချင်းချင်းနမူနာပြခြင်း</u>– ထို့နောက်အုပ်စုဝင် အချင်းချင်းနမူနာပြရပါမည်။ ဖြစ်စဉ်ပြရေးနည်းနှင့် သရုပ်ဖော်ရေးနည်းဆိုင်ရာ သိနားလည်မှုများကို ဖော်ထုတ်စေပါမည်။ အုပ်စုဝင်အချင်းချင်း စာရေးနည်းများကို လေ့ကျင့်စေ၍ အုပ်စုဝင် အချင်းချင်းပင် အကဲဖြတ်၍ လိုအပ်သည်များကို ပြင်ဆင်စေပါမည်။ ဆရာကလေ့လာ ကြည့်ရှု၍ လိုအပ်ပါက လမ်းညွှန်ကူညီပေးပါမည်။ ကျောင်းသားကျောင်းသူများသည် ဖြစ်စဉ်ပြရေးနည်းနှင့် သရုပ်ဖော်ရေးနည်း သဘောတရားများကို သိနားလည်ပြီဆိုပါက ၎င်းတို့ရွေးချယ်ထားသော ခေါင်းစဉ်များကို စာရေးနည်းအဆင့်ဆင့်အတိုင်း ရေးသားရပါမည်။

(၈) <u>စာရေးနည်းအဆင့်ဆင့်အတိုင်းရေးသားခြင်း</u>– ကြိုတင်စီစဉ်ခြင်းအဆင့်တွင် ကျောင်းသားများသည်မိမိရေးလိုသော အကြောင်းအရာများကို စတင်တွေးတောရမည်။ မိမိရေးသားလိုသော အကြောင်းအရာနှင့်ပတ်သက၍ အတွေးအခေါ်နှင့်အချက်အလက်များကို ဖော်ထုတ်ရမည်။ ထိုသို့ စဉ်စားတွေးတောဖော်ထုတ်ရာတွင် ဉာဏ်ဖွင့်စဉ်းစားနည်း၊ တူရာစု၍ အုပ်စုဖွဲ့နည်းနှင့် မေးခွန်း မေးနည်း စသည်တို့ကို အသုံးပြုနိုင်ပါသည်။ မေးခွန်းမေးနည်းကိုသုံးရာတွင် မိမိ ရေးလိုသော ခေါင်းစဉ်ပေါ်မူတည်၍ မည်သူနည်း၊ မည်သည့်နေရာကနည်း၊ မည်သည့် အကြောင်းကြောင့် နည်း၊ မည်သည့်အချိန်မှာနည်း၊ မည်ကဲ့သို့ဖြစ်သနည်း စသည့် မေးခွန်းများ မေးရပါမည်။ ကြိုတင်စီစဉ်ခြင်းအဆင့်တွင် အတွေးအခေါ် အချက်အလက်များ လုံလုံလောက်လောက် ရရှိပြီး ပါက အကြမ်းကို လျင်မြန်စွာရေးသားရပါမည်။ ကျောင်းသားများ၏ အကြမ်းရေးသားထားသည် များကို ဆရာကစစ်ဆေး၍ လိုအပ်သည်များကို ဖြည့်စွက် ပြင်ဆင်စေပါမည်။ ဆရာ၏ ဖြည့်စွက်ချက်များပေါ်မူတည်၍ ကျောင်းသားတို့သည် မိမိတို့ ရေးသားထားသည်များကို ပြန်လည်ပြင်ဆင်ရပါမည်။ အုပ်စုလိုက် သဒ္ဒါအနေအထား၊ စာလုံးပေါင်းသတ်ပုံ၊ စာပိုဒ်ဖွဲ့စည်းပုံ စသည်တို့က တည်းဖြတ်ရပါမည်။ ပြင်ဆင်တည်းဖြတ် ပြီးလျှင် ဆရာ့ထံပြသရမည်။

(၉) <u>လုပ်ဆောင်ချက်များကိုစစ်ဆေးခြင်း</u>– စာရေးသားနည်းအဆင့်ဆင့်အတိုင်း ရေးသားစေ ခြင်းဖြင့် ကျောင်းသားများသည် စာရေးသားနည်းများနှင့်ပတ်သက်ပြီး ရင်းနှီးကျွမ်းဝင်ကာ စာရေးခြင်း အတွေ့အကြုံများ ရရှိလာပါသည်။ ထိုအခါကျောင်းသားများအား အခြားသော ခေါင်းစဉ်များပေး၍ ၎င်းတို့သည် စာရေးနည်းများကို အမှန်တကယ်နားလည်ပြီး ရေးသား နိုင်စွမ်းရှိမရှိနှင့် တတ်မြောက်မှု ရှိမရှိကို စစ်ဆေးပါမည်။

(၁၀) <u>လိုအပ်ချက်များကိုခွဲခြမ်းစိတ်ဖြာခြင်း</u>– တတ်မြောက်မှုစစ်ဆေးခြင်းတွင် ချမှတ်ထားသော သင်ကြားခြင်း ဆိုင်ရာရည်ရွယ်ချက်များ ပေါက်မြောက်မှုရှိမရှိကို စောင့်ကြည့်လေ့လာခြင်းနှင့် စစ်ဆေးခြင်းများ ပါဝင်ပါသည်။ အကယ်၍ တတ်မြောက်မှုစစ်ဆေးခြင်းသည် ရည်ရွယ်ချက်ကို ပေါက်မြောက်စေပါက အခြားသင်ခန်းစာအသစ်ကို ဆက်လက်လေ့လာစေပါမည်။ တတ်မြောက်မှု စစ်ဆေးခြင်းသည် ရည်ရွယချက်ပေါက်မြောက်မှု မရပါက သင်ပြီးသား သင်ခန်းစာကိုပင် ဆက်လက်လေ့လာစေပြီး လိုအပ်သောတုံ့ပြန်ကုစားမှုများပေးပါမည်။

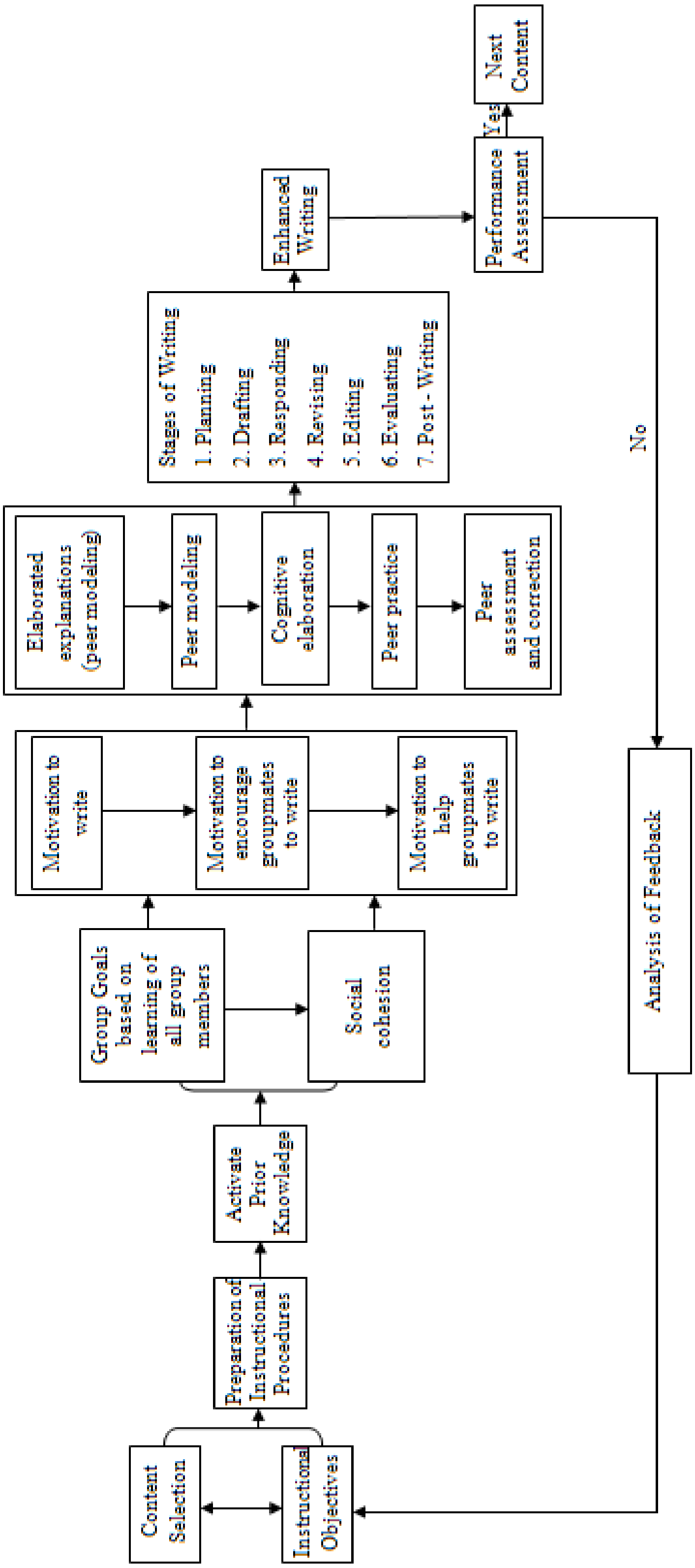

Figure 1 Proposed Model of Cooperative Learning for Teaching Writing

THE INFLUENCE OF MATHEMATICAL TERMINOLOGY ON STUDENTS' ACHIEVEMENT AT THE HIGH SCHOOL LEVEL

Cin Sian Huai[1] and Wai Wai Oo[2]

Abstract

The main purpose of this study is to investigate the influence of mathematical terminology on students' achievement at the high school level. Descriptive research study was used for this research. Twelve high schools were randomly selected from four selected townships of four districts from Yangon Region. The target population was (600) Grade Ten students. As instruments, a mathematical terminology test and a mathematics achievement test were used. The mathematical terminology test was used to investigate Grade Ten students' understanding of mathematical terminology concerned with mathematical terms, mathematical symbols, and mathematical structures. It included (15) items for each dimension. The mathematics achievement test was used to explore Grade Ten students' mathematics achievement. It involved three sections: (11) multiple choice items, (3) short questions and (6) long questions. For obtaining reliability, the pilot test was administered. The internal consistency of the instruments were (.780) and (.805) by using Cronbach's Alpha. In order to know the correlation between students' understanding of mathematical terminology and their mathematics achievement, Pearson product-moment correlation was used. The correlation coefficient between students' understanding of mathematical terminology and their mathematics achievement was (.682). This result shows that students' understanding of mathematical terminology is positively related with their mathematics achievement. It means that if students' understanding of mathematical terminology is low, their mathematics achievement will be low. On the other hand, if students' understanding of mathematical terminology is high, their mathematics achievement will be high. To sum up, mathematical terminology influence on students' mathematics achievement at the high school level.

Keywords: mathematics, terminology, mathematical terminology, mathematical term, mathematical symbol, mathematical structure.

Introduction

Education is as a basic human need, integral part of the quality of life, a support for moral and social values, and an instrument for economic productivity. Human beings create their society by using education as a tool. Education can only enhance the status of an era, a country, a nation, and a life. It is more noticeable in 21st century because a person needs to be educated to handle with the demands of the century including science and technology. It is hard to imagine today without using some form of technology. The origin of this interesting technology comes from mathematics. Mathematics is the necessity of technology and science. So it can be said that mathematics is at the heart of many successful careers and successful lives for societal development, particularly in the extraordinary and accelerating change circumstances. Human cannot live far away from mathematics. Since mathematics is finding the solution or solving problems, it trains a student to be successful in 21st century that demands critical thinking and problem solving.

Mathematics is a language itself. It has its own terminology. Mbugua (2012) stated that mathematical terminology is a system of communication with its own set of symbols,

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convections or special words. Mathematics concepts are present by mathematical structures. The language of mathematics consists not only of words and texts but also of symbols and diagrams; explicit instruction can help build the connections between the elements of mathematical language (Walle, 2001, cited in Lee, 2006). Bloom (1956, cited in Owens, 2008) asserted that the most type of knowledge in any particular field is its terminology. The understanding of terminology is the foundation of the whole mathematical knowledge and process.

If education is said as a hero, mathematics will be his gun and then the mathematical terminology might be the bullet. The hero counts on his gun and the gun can be nothing without having any bullets. Mathematical terminology is influent upon the power of mathematics. It plays a vital role in teaching and learning of mathematics and even the whole process of education. So, it is necessary to study the influence of mathematical terminology on students ' achievements at the high school level.

Purposes

The main purpose of the study is to study the influence of mathematical terminology on students' achievements at high school level. The specific objectives are as follows:

1. To investigate Grade Ten students' understanding of mathematical terminology including terms, symbols, and structures
2. To explore Grade Ten students' mathematics achievement
3. To find the relationship between students' understanding of mathematical terminology and their mathematics achievement
4. To give suggestions for improving the understanding of terminologies in students' learning mathematics.

Research Questions

Q1: To what extent do Grade Ten students understand mathematical terminology?

Q2: To what extent can mathematics be achieved by Grade Ten students?

Q3: Is there any relationship between students' understanding of mathematical terminology and their mathematics achievement?

Scope of the Study

The following points indicate the scope of the study.

1. This study was geographically restricted to Yangon Region.
2. Participants in this study were Grade Ten students from selected schools within 2018-2019 academic year.
3. This study was limited to mathematical terminology concerned with terms, symbols, and structures including in Grade Ten mathematics textbook.

Definition of Key Terms

Mathematics: Mathematics is the study of numbers, quantities, shapes, and space using mathematical processes, rules, and symbols (Barker, 1964).

Terminology: A structured set of concepts and their designations (graphical symbols, terms, phraseological units, etc.) in a specific subject field (University of Surrey, 2018).

Mathematical terminology: Mathematical terminology is a system of communication with its own set of terms, symbols and or structures (Mbugua, 2012).

Mathematical term: Mathematical term refers to a word that labels mathematical concepts e.g. quotient, chord, power, area among others (Wanjiru, 2015).

Mathematical symbol: Mathematical symbol is a concise way of giving lengthy instructions related to numbers and logic **(** Cobb, 2009).

Mathematical structure: A mathematical structure is a set or sometimes several sets with various associated mathematical objects such as subsets, operations and relations, all of which must satisfy various requirements. The collection of associated mathematical objects is called the mathematical structure (Wells, 2017).

Review of Related Literature

Mathematics as a Language

Mathematics is the essential tool to empower people with the knowledge, competencies and attitudes which are precursors for the dynamic world. Learning mathematics is like learning a new language. All languages have their own terminology, and mathematics is no exception. Unlike common English, which students hear, see, and use daily in reading, watching television, and conversing, the language of mathematics is limited largely to school (Thompson & Rubenstein 2000, cited Lee, 2006). It is the study of abstract system built of abstracts. It is a systematized, organized and exact branch of science. Mathematics is the language of physical science. It has its own terminology - terms, symbols, structures. Mathematics ideas can be understood by making connections between terms, symbols, structures and real - life situations (Lee, 2006). Terminology is a pivotal component of mathematics success (Seethaler, Fuchs, Star, & Bryant, 2011, cited in Wanjiru, 2015), and a student's general knowledge of mathematical terminology can predict mathematical performance (Walt, 2009, cited in Wanjiru, 2015).

Mathematical Terminology

Phyllis and Whitin (2000, cited in Lee, 2006) reminded that mathematics is language too. Since each language has its own terminology, mathematics has its unique mathematical terminology. Undoubtedly, the many difficulties that students face when learning the terminology of mathematics are complex and can negatively impact their language development. Students have to learn and use the terminology of mathematics to understand the many difficulties that it presents students. Mathematical terminology is a system of communication with its own set of terms, symbols and or structures (Mbugua, 2012).

Mathematical Terms

Mathematics learning can generally be divided into three periods. In the first period, mathematics can be taught without knowing the mathematical terms. It just needs to read and write the numbers, for example: 1, 2, 3, …. In the second period, mathematics learning depends on the term of mathematics. In this period, there are two kinds of mathematics. The initial one needs to understand the mathematical language and another one does not. After this period, most of mathematics learning depends on the terms of mathematics. Definition of mathematical terms may be regarded as the most importance of mathematics learning. Mathematical terms refers to words that label mathematical concepts :quotient, chord, power, are a among others(Wanjiru, 2015).

According to the research of Rubenstein and Thompson (2002, cited in Owens, 2008), there are at least (11) categories of difficulties associated with meaning of mathematical terms. The categories are defined in the following manner: (a) meanings are context dependent, for example: foot as in (12) inches vs. the foot of the bed, (b) mathematical meanings are more precise, for example: product as the solution to a multiplication problem vs. the product of a company, (c) terms specific to mathematical contexts, for example: polygon, parallelogram, imaginary number, (d) multiple meanings, for example: side of a triangle vs. side of a cube, (e) discipline-specific technical meanings, for example: cone as in the shape vs. cone as in what one eats, (f) homonyms with everyday words, for example: pi vs. pie, (g) related but different words, for example: circumference vs. perimeter, (h) specific challenges with translated words, for example: mesa vs.table, (i) irregularities in spelling, for example: obelus vs. obeli, (j) concepts may be verbalized in more than one way, for example: (15) minutes past vs. quarter after, and (k) students and teachers adopt informal terms instead of mathematical terms , for example diamond vs. rhombus. These categories of difficulties associated with meaning of mathematical terms are leading to misunderstanding in learning mathematics. In other words, mastery in mathematical term may lead success in learning mathematics.

Mathematical Symbols

The terminology of mathematics consists not only of words or terms but also of symbols and diagrams; explicit instruction can help build the connections between these elements of mathematical terminology (Walle, 2001, cited in Owens, 2008). Symbols are a communication tool. Mathematical symbols can put the lengthy statements, accurately and in exact form, in a brief description. For example if someone wish to say that the sum of the squares of two sides of a right triangle is equal to the square of the hypotenuse, then it can be written in symbolic form as $c^2 = a^2 + b^2$. For the ancient Greeks, a symbol was a “token, sign, mark” or anything that would be comparable to the real thing whose place it took. In mathematics a symbol is a sign that stands for a quantity, an operation, or a relation. Symbols are used to eliminate the need to write long, plain language instructions to describe calculations and other processes. The literature on the symbols of mathematics, such as constants and variables is enormous. Symbols in mathematics are generally used in two forms. The first is the process of what can be called alphabetization in mathematical discourse. The second is the process of meaning that accrues to symbols through the processes of `pattern recognition' and the privileging of formal similarity in symbolic, graphic forms.

Mathematical Structures

Mathematics can be described as the art of creating and exploring mathematical structures. A structure in the everyday sense might think of buildings, houses, and bridges. It may also be said as a more abstract object involving some form of complex organization. The plot of a movie, a musical composition, and government bureaucracies all are structures in some sense. All of these are instances in which small sub – structures are organized in ways to create larger, more complicated patterns. A building is nothing but the complicated organization of smaller sub – structures such as bricks, cement, wood, and iron. Mathematics is no different as the construction of a building. A mathematical structure is nothing but a (more or less) complicated organization of smaller, more fundamental mathematical substructures. Numbers are one kind of structure, and they can be used to build bigger structures like vectors, matrices and calculus. A structure consists of a set together with one or more binary operations, which are required to satisfy certain axioms. The binary operation in this definition may be any operation at all, such as addition, multiplication, or composition of functions.

The mathematical structures of a lesson differ from one lesson to the next. Studying mathematics is like building a castle in one's head. When building a castle, it needs first to learn to build a brick, and once that is mastered, then it can be used to build a wall. Stronger bricks allow for higher walls and bigger towers. The beauty of a mathematical structure comes from its ability to have larger structures built from it. Certain mathematical concepts allow for faster building than others. Mathematical structure means the identification of general properties which are instantiated in particular situations as relationships between elements. These elements can be mathematical objects like numbers and triangles, sets with functions between them, relations on sets, even relations between relations in an ongoing hierarchy.

Research Method

Research Design and Sample Size

The research design for this study is a descriptive survey research design which seeks to determine whether, and to what extent, a relationship exists between mathematical terminology such as mathematical terms, mathematical symbols, and mathematical structures and students' achievement at the high school level. In this study, data were collected through a quantitative method. All participants were Grade Ten students from Yangon Region. The sample schools were selected by using stratified random sampling method. Three high schools were selected from a township in each district. Therefore, twelve high schools were included and (600) Grade Ten students participated in this study.

Instruments

A mathematical terminology test for students' understanding of mathematical terminology and a mathematics achievement test were used as the instruments. The mathematical terminology test consisted of (15) mathematical terms, (15) mathematical symbols, and (15) mathematical structures. To investigate Grade Ten students' achievement, a mathematics achievement test was constructed. The instruments were based on the content area of Grade Ten mathematics textbooks prescribed by the Department of Basic Education Curriculum, Syllabus and Textbook Committee.

Research Findings

Based on the scores in mathematical terminology test, understanding of mathematical terminology was divided into three levels: low, moderate, and high.

Table 1 Level of Students' Understanding of Mathematical Terminology

Level	Score (x)	Number of Students	Percentage (%)
Low	$x \leq 19.27$	108	18
Moderate	$19.27 < x < 35.23$	396	66
High	$x \geq 35.23$	96	16
Total		**600**	**100**

Table 1 showed that students whose scores were below and inclusive (19.27) were included in low level of understanding mathematical terminology, students whose scores were between (19.27) and (35.23) were in moderate level, and students whose scores were above and inclusive (35.23) were included in high level. Then, 18% of students (108) were low in understanding of mathematical terminology, 66% of students (396) were moderate in understanding of mathematical terminology, and 16% of students (96) were high in understanding of mathematical terminology.

Based on the results of the mathematics achievement test, students' achievement of mathematics was divided into three levels: low, moderate, and high.

Table 2 Level of Students' Achievement in Mathematics

Level	Score (x)	Number of Students	Percentage (%)
Low	$x \leq 8.59$	93	15.5
Moderate	$8.59 < x < 31.95$	399	66.5
High	$x \geq 31.95$	108	18
Total		**600**	**100**

Table 2 showed that students whose scores were below and inclusive (8.59) were included in low level of achievement in mathematics, students whose scores were between (8.59) and (31.95) were in moderate level, and students whose scores were above and inclusive (31.95) were included in high level. Then, 15.5% of students (93 students) were low in mathematics achievement, 66.5% of students (399 students) were moderate in mathematics achievement, and 18% of students (108 students) were high in mathematics achievement.

For the relationship between students' understanding of mathematical terminology and their mathematics achievement, the results are summarized in Figure 1.

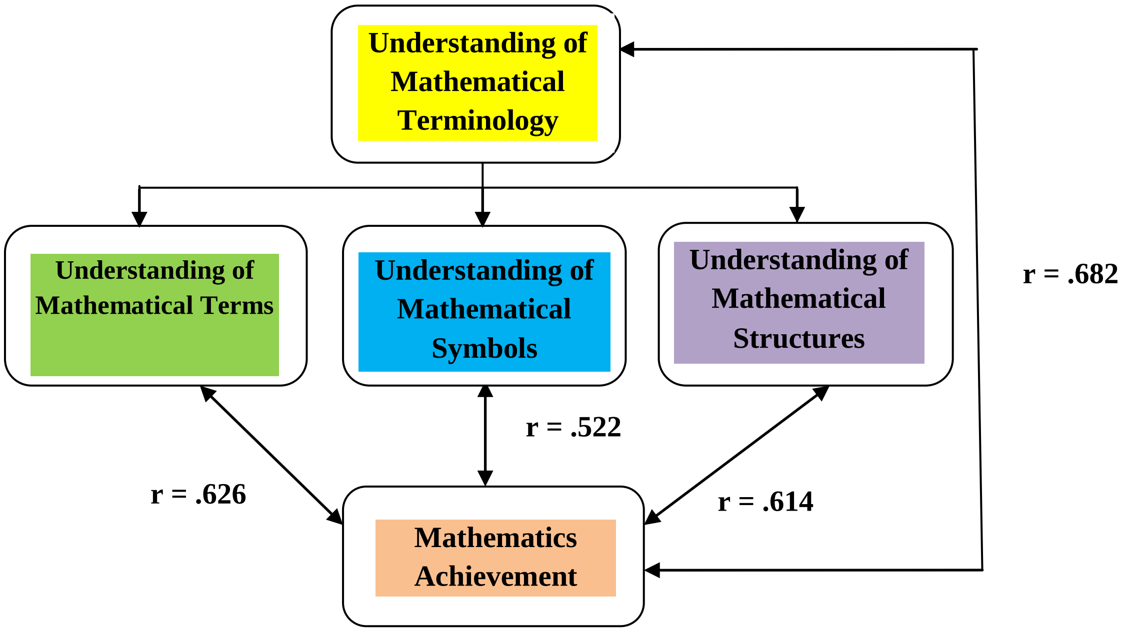

Figure 1 Correlation between Students' Understanding of Mathematical Terminology and their Mathematics Achievement

According to Figure 1, students' understanding of mathematical terms is positively correlated with their mathematics achievement (r = .626, p<.01). Students' understanding of mathematical symbols is positively correlated with mathematics achievement (r = .522, p<.01). Students' understanding of mathematical structures is positively correlated with mathematics achievement (r = .614, p<.01). Students' understanding of mathematical terminology is positively correlated with mathematics achievement (r = .682, p<.01).

Conclusion

Discussion

In the information age, science and technology make a huge revolution to the earth. The earth is like a village with a rapid transfer of information from pole to pole. Mathematics is a tool of information age. Mathematics is the origin of science and technology.

As knowledge of mathematics is essential for any vocation, mathematical terminology is vital in the process of understanding mathematical knowledge. Mathematical terminology is divided into three portions: mathematical terms, mathematical symbols, and mathematical structures in the study. Like anyone who wants to be top must trace the first step, students must learn first terms, symbols, and structures concerned with the topics of mathematics learning such as algebra, geometry and trigonometry to be proficient in mathematics.

Table 1 showed that the result responses the research question (Q1): To what extent do Grade Ten students understand mathematical terminology? By the response, 18% of students (108) were low in understanding of mathematical terminology, 66% of students (396) were moderate in understanding of mathematical terminology, and 16% of students (96) were high in understanding of mathematical terminology. It can be said that most students are in moderate level of understanding the mathematical terminology.

Table 2 replied the research question (Q2): To what extent can mathematics achievement test be performed by Grade Ten students? From the response, 15.5% of students (93) were low in mathematics achievement, 66.5% of students (399) were moderate in mathematics achievement, and 18% of students (108) were high in mathematics achievement. It can be said that most students are in moderate level of achievement in mathematics.

Based on the obtained data, the correlation between students' understanding of mathematical terminology and their mathematics achievement was found that $r = .682$, $p < .01$. It is strongly correlated as the size of the correlation coefficient is between 0.65 and 1 (Mills & Gay, 2016). Therefore, students' understanding of mathematical terminology is strongly correlated with their achievement in mathematics. This result showed that the direction of the correlation was positive and it pointed out that students' understanding of mathematical terminology is high, and then their mathematics achievement will be high. But if students' understanding of mathematical terminology is low, their mathematics achievement will be low. So, this finding answered to the research question (Q3): Is there any relationship between students' mathematics achievement and their understanding of mathematical terminology? This result supports the finding of Mbugua (2012): the understanding in mathematical terminology is also poor as achievement in the subject. The result also supports that knowledge of terminology influences achievement in mathematics (Sepeng & Madzoreras, 2014).

To sum up, mathematical terminology plays a critical role in mathematics achievement in High School level of mathematics education. To be high in understanding of mathematical terminology, some suggestions are presented as follows.

Suggestions

Mathematics is a compulsory component for human life. Mathematical knowledge is helpful in character and personality development. Mathematical instruction in basic education is the most fundamental process to be sound in mathematical knowledge . Mathematics instruction that encourages appropriate teacher and student communication provides contexts for learning the terminology of mathematics (NCTM, 1990). Pimm (1981, cited in Sepang & Madzorera, 2014) also expressed that mathematical terminology poses numerous challenges to learners' comprehension in solving related tasks, especially those involving word problems. Mathematical terminology used in mathematics problems appears to be an academic obstacle to learner' success in problem solving.

Therefore, students should be taught mathematical terminology concerned with mathematical terms, mathematical symbols, and mathematical structures in detail before problem solving. Developing and then using a systematic plan for teaching terminology will maximize and facilitate improved students' performance in mathematics. It is important that teachers to apply general language instructional techniques to mathematical language on a regular basis.

According to Moore and Readence (1984), the graphic organizer may be one of general language instructional techniques. A graphic organizer represents concepts and their relationships visually. It helps students to understand a concept and recognize similarities and differences between that concept and other concepts. So, teachers should teach with graphic organizer, representing the concept word, its definition, characteristics word, the examples and non-examples of concept word. As an example, in teaching the word "rectangle", the teacher should explain its concept with its definition as well as examples of rectangle such as blackboard, textbooks, and non-examples of rectangle such as chalk, ball.

To maximize students' learning of terminology in achieving positive academic outcomes across content areas, teachers should begin terminology instruction by providing students with an informal description, explanation, or example of the new terminology either directly or through indirect means. This will help students begin the process of connecting the new meaning to their prior knowledge. It is important to provide students with opportunities to restate the teacher-provided descriptions, explanation, or examples in their own words. This opportunity reinforces the connections to their prior knowledge. Teachers should also help to strengthen the linkage to prior knowledge, students are asked to construct a picture, symbol, or graphic representation of the term or phrase, and provide students with periodic opportunities to reengage in a variety of activities to help them further develop and enrich their knowledge. Students often only develop surface-level understanding of the material, and educators should give opportunities for further engagement students will gain the desired deep understanding necessary for mathematical reasoning and communication.

Moreover, students should be involved in small-group and or peer-to-peer discussions on specific terminology further develop a deeper understanding. Teachers should reduce misconceptions that may have formed in students when some mathematical terms have double meanings such as the word "square" that means double multiplication and a rectangle with all sides are equal. Moreover, some mathematical symbols do not like their abbreviation such as the symbol of slope is " m" while the symbol of mean is "μ". At that time, students used to be ambiguous between the term and symbol and then it leaded to choose uncertain structures for a problem. So teachers should give the clear instruction between mathematical terminologies to lessen students' hazy memories concerned with them.

Furthermore, medium of instruction starts with English, second language, from Grade Ten of Basic Education in Myanmar. Students face several difficulties in learning subjects due to changing the medium of instruction. According to Gueudet (2016), any change or transition process can be either continuous or discontinuous, with identified ruptures or gaps. This change could become apparent as an epistemological obstacle, as a cognitive discontinuity or as a didactical gap. A transition would be identified as a necessity for entering into a different type of discourse (in terms of the language, symbols, tools and representations involved). So, mathematics teachers should help students to transmit this transition period well. If students do not understand what the meanings of mathematical terminology, they will not be interested to solve problem. If they cannot solve the problem, they will have mathematics phobia. To sum up, the mathematics teachers should teach students the mathematical terminology before problem solving in mathematics, and schools should also support additional textbooks, workbooks, and real objects if it can be such as coins, dice, and charts to facilitate in understanding of mathematical terminology. Hence, high understanding of mathematical terminology may lead to high achievement in mathematics.

In addition, this study dealt with the influence of mathematical terminology concerned with mathematical terms, mathematical symbols, and mathematical structures, on students' achievement at the high school level. Since mathematics is a compulsory subject for all levels of basic education, further studies should be conducted for other levels such as primary level and middle level concerned with notations, representations, sign and so on. Sound foundation of mathematical terminology from primary level would mold perfect performance in mathematics towards middle level and high level of mathematics education.

Conclusion

Mathematics is an integral part of daily life. A day begins with mathematics and ends with mathematics. Everything on the world can be expressed as mathematics such as the earth is round like a circle, a day has 24 hours, and a rectangular playground has an area of 50 square-meters. Mathematics is concerned with physics, chemistry, biology, history, geography, and so on. If English is an international language, Mathematics will be a universal language. Each language has its own terminology: terms, symbols, structures, notations, representations and so on. Mathematics has its own terminology. Mathematical terminology was defined a system of language with mathematical terms, mathematical symbols, and mathematical structures in the study.

Many educators admitted that understanding of mathematical terminology is essential in the whole process of mathematics teaching and learning. It communicates the concepts of mathematics and problem solving. It leads factual understanding to the conceptual understanding of mathematics. So, it is necessary to understand the importance of mathematical terminology in mathematics.

According to the above results, generalization can be drawn that if students' understanding of mathematical terminology is high, achievement in mathematics will be high. It can also be summarized that if students' understanding of mathematical terminology is low, their mathematics achievement will be low. So, the role of mathematical terminology is critical in mathematics achievement. Therefore, mathematics teachers should focus on students' understanding of mathematical terminology in mathematics education. The study will help mathematics teachers to understand the importance of mathematical terminology in teaching mathematics. Moreover, this study will offer a teaching aid for mathematics teachers in teaching mathematics. It will also support in constructing curriculum of mathematics for high school level.

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THE EFFECT OF PARTICIPATORY TEACHING METHODS ON STUDENTS' ACHIEVEMENT IN MATHEMATICS AT THE MIDDLE SCHOOL LEVEL

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Abstract

The main purpose of the present research is to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level. This study was conducted with both quantitative and qualitative research methods. For quantitative research, an experimental study was used to study the effect of participatory teaching methods. The experimental design adopted in this study was a true experimental design, namely, posttest only control group design. For this study, (120) Grade Six students were selected from schools such as BEHS (4), Pazundaung and BEHS (1), Latha by simple random sampling method. These students were divided into two groups: control and experimental. Experimental group was treated with participatory teaching methods and control group was taught with formal instruction. After that, a posttest was administered to two groups. Independent samples *t*-test was used to test whether there was significant difference between these two groups. Examination of the means and *t*-test at BEHS (4), Pazundaung (t = 9.036, p < .001) and BEHS (1), Latha (t = 17.428, p < .001) indicated that students who were taught by using participatory teaching methods demonstrated significantly better than those who were taught with formal instruction. For qualitative research, students from the experimental group from two selected schools were given a questionnaire. It consists of (15) items five-point Likert-scale. The results showed that students expressed their willingness to learn in participatory teaching methods and they had positive attitude towards participatory teaching methods. Research findings proved that participatory teaching methods have positive contribution to the mathematics teaching at the middle school level.

Keywords: participatory teaching methods, achievement, mathematics

Introduction

Today, the whole world is changing fast and on the way of progress. One of the basics of a country's development depends on the education system. With education, individuals are able to increase their knowledge and skills, accept new manners and be able to survive in the society. A person cannot contribute to one's society without education, especially the knowledge of mathematics. The general aim of teaching mathematics is to enable students to develop in fundamental skills and solve mathematical problems in their daily lives.

As a mathematics teacher in this modern age, it is important to provide more opportunities for students to participate in teaching/learning process. Hence, students need more time to think, work independently, participate or exchange ideas with others. Also, there is a need for more engaging methods of instruction to boost students' participation and achievement in mathematics. Therefore, this paper aims to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level.

Statement of the Problem

According to Khin Zaw (2001), the aims of education can be summarized into three aspects. The first aim is to help the child to develop his personality. Secondly, it is to help the

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child to relate himself to the society in which he lives. Thirdly, it is to help those who are growing up to be active and creative forces in society. However, in current situation in Myanmar, the focus of standardized testing is grounded on achieving high scores. Teachers directly explain the facts and things in the textbook and only use formal instruction. Lack of students' participation in learning process actively is one of the problems of current mathematics classroom in Myanmar.

Purposes of the Study

The main purpose of this paper is to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level. The specific purposes are as follows:

- To compare mathematics achievement between students who are taught by using participatory teaching methods and those who are not taught,
- To study students' attitude towards participatory teaching methods, and
- To make suggestions for the improvement of mathematics teaching and learning at the middle school level.

Research Hypotheses

The hypotheses of this study are as follows:

- There is a significant difference in mathematics achievement between Grade Six students who receive participatory teaching methods and who do not receive.
- There is a significant difference in mathematics achievement between experimental group and control group in performing knowledge level questions.
- There is a significant difference in mathematics achievement between experimental group and control group in performing comprehension level questions.
- There is a significant difference in mathematics achievement between experimental group and control group in performing application level questions.
- Students who are taught with participatory teaching methods will have positive attitude towards participatory teaching methods.

Scope of the Study

The following points indicate the scope of the study.

- This study is geographically restricted to Yangon Region.
- Participants in this study are (120) Grade Six students from the selected schools of the two Districts: No. (4), Basic Education High School, Pazundaung and No. (1), Basic Education High School, Latha within academic year (2018-2019).
- This study is limited content areas from Grade Six mathematics textbook volume I and II prescribed by Basic Education Curriculum, Syllabus and Textbook Committee (2018-2019).
- There are many methods in participatory teaching methods. This study is limited to three methods: group discussion, project method and discovery learning.

Definition of Key Terms

Participatory Teaching Methods

Participatory teaching methods are those which draw the students into the classroom learning process (Jones, 1987).

Achievement

Accomplishment of proficiency of performance in a given skills or body of knowledge (Good, 1959).

Mathematics

The gateway and key to all sciences (Bacon, n. d., cited in Zubair, 2012).

Significance of the Study

People have to know about the 21st century skills and need to improve them in today's children. Without these skills, children will not be able to successfully participate in the global economy. Teaching styles need to shift from teacher-centered teaching approach to child-centered approach. The roles of students who receive teacher-directed instruction are to listen, wait, take tests and do seatwork. The needs of students will not be filled. Unlike this, children are needed to be active and interested in learning process which allows them to participate freely.

To meet the challenges of the 21st century, teachers should provide the classrooms which welcome students to participate more than the past in the education process. Similarly, mathematics is essential for the development of education system because it relies on logic. Certain qualities are nurtured by mathematical thinking skills such as reasoning and critical thinking skills. Thus, mathematics, a valuable and essential subject, should not be taught with formal teaching styles. It should be taught with effective teaching methods which can promote students' attitude towards mathematics and mathematical skills. Hence, the paper will seek to reveal the effect of participatory teaching methods on students' achievement in mathematics at the middle school level.

Review of Related Literature

Participatory Teaching Methods

The essence of participatory teaching methods is to let students participate in classroom tasks instead of acting as a passive bystander role and to allow students to truly experience. Due to Suffolk (2004), effective teaching can be achieved only when participatory teaching methods are applied in the classroom. Participatory teaching methods compel teachers to create learning environments which give a room for students to discover by themselves instead of being spoon fed. The assumption behind these methods is that students are given an opportunity to actively construct meaning and understanding during the learning process. These methods discourage passive assimilation of knowledge and support acquisition of knowledge, skills and attitudes by solving problems in life.

There are many methods in participatory teaching methods or learner-centered methods. Among them, group discussion, project method and discovery learning are used as a treatment for experimental group in this paper.

Group Discussion

Group discussion is a primary teaching method which allows students to stimulate critical thinking. When using group discussion, the teacher can challenge them to think more deeply and to articulate their ideas more clearly. Learning within groups is more effective in terms of academic success comparison to competitive and individualized learning systems.

Steps in Group Discussion

(1) Assign small groups
(2) Assign a leader
(3) Write problem
(4) Attack problem
(5) Record all solutions and draw conclusions (Dhand, 2010)

Project Method

Project method provides a practical approach to learning. This method leads to understanding and develops the ability to apply knowledge. The teacher has to work as a careful guide during the execution of the project. Students can perform constructivist activities in natural condition. Students are provided with various opportunities that can satisfy their interest and desires towards mathematics. Project method helps in promoting social interaction among students because they have to work in a group and have to interact with others to get information. As students gain knowledge directly through their own effort, they acquire permanent kind of information.

Steps in Project Method

(1) Provide a situation
(2) Choose and purpose
(3) Plan the project
(4) Execute the project
(5) Judge the project
(6) Record (Mishra, 2009)

Discovery Learning

Discovery learning is an active style of learning, originated by Jerome Bruner in the 1960s. Bruner emphasized "learning by doing." With this, students actively participate instead of passively receiving knowledge and interact with their environment by exploring objects and thinking about questions. They are encouraged to think, ask questions, hypothesize, speculate, cooperate and collaborate with others. Discovery learning takes into consideration that all students have some background knowledge that they may be able to apply to mathematics at hand.

Steps in Discovery Learning

(1) Select generalization
(2) Set up a problem situation

(3) Set up experiences that will bring out the essential elements
(4) Set up experiences that will bring out contrasting elements
(5) Draw generalization
(6) Apply generalization (Callahan & Clark, 1988)

Research Method

Research Design and Procedure

The design adopted in this study was one of the true experimental designs, via, the posttest only control group design. At the start of the research experiment, students were randomly divided into two groups as experimental group and control group according to the scores of October test. In each school, the experimental group was given a treatment by using participatory teaching methods such as group discussion, project method and discovery learning. In each school, the control group was given a treatment by using formal instruction. At the end of the treatment period, all selected students had to sit for posttest and a questionnaire for students' attitude towards participatory teaching methods.

Instruments

A posttest was constructed to measure the mathematics achievement of the students. It consisted of two sections. Section (A) contained (10) multiple choice items and section (B) contained (8) five-mark items. Test items were constructed based on the content areas of Chapters (7) and (8) from mathematics textbook volume I and Chapters (7) and (8) from mathematics textbook volume II. This test was also constructed based on Bloom's taxonomy of educational objectives (knowledge, comprehension, application). The students had to answer all questions.

Table1 Table of Specifications for Posttest

Section	Question Level	Mathematics Textbook Volume I		Mathematics Textbook Volume II		Total
		Chapter		Chapter		
		(7)	(8)	(7)	(8)	
(A) 1 mark	Knowledge	-	1	3	1	10 1 mark × 10 (10 marks)
	Comprehension	1	-	-	3	
	Application	1	-	-	-	
(B) 5 marks	Knowledge	-	-	-	-	8 5 marks × 8 (40 marks)
	Comprehension	-	2	-	2	
	Application	2	-	2	-	

Questionnaire for students' attitude towards participatory teaching methods was developed based on the literature by Muhangwa, G. M. (2011), advantages of participatory teaching methods. This questionnaire consisted of (15) items on a five-point Likert scale of (1) to (5). It contained five dimensions. Each dimension contained three items.

Research Findings

Quantitative and qualitative studies are made in this research.

Quantitative Research Findings

Table 2 *t*-Values for Posttest Mathematics Achievement Scores

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (4), Pazundaung	Experimental	30	27.27	5.05	11.04	9.036	58	.000***
	Control	30	16.23	4.38				
BEHS (1), Latha	Experimental	30	32.17	4.89	18.70	17.428	58	.000***
	Control	30	13.47	3.27				

Note: ***$p < .001$

The result showed that there was a significant difference between the students who were taught by using participatory teaching methods and those who were taught with formal instruction on the overall scores of mathematics achievement in the selected.

Table 3 *t*-Values for Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (4), Pazundaung	Experimental	30	3.47	0.90	0.87	3.591	58	.001**
	Control	30	2.60	0.97				
BEHS (1), Latha	Experimental	30	3.30	1.06	1.10	4.151	58	.000***
	Control	30	2.20	0.99				

Note: **$p < .01$, ***$p < 0.001$

Table 3 shows that there was a significant difference between the students who were taught by using participatory teaching methods and those who were taught with formal instruction in performing on knowledge level questions in the selected schools.

The comparison of means for knowledge level questions revealed that experimental groups who received participatory teaching methods did better in their knowledge level questions of mathematics achievement than control groups who did not receive them. Thus, teaching with participatory teaching methods could bring about the improvement of the students' ability to remember previously learned materials and recall ideas and specific facts schools (see Figure 1 & 2).

Table 4 *t*-Values for Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (4), Pazundaung	Experimental	30	19.03	3.68	8.10	8.628	58	.000***
	Control	30	10.93	3.59				
BEHS (1), Latha	Experimental	30	21.53	2.80	12.06	18.236	58	.000***
	Control	30	9.47	2.30				

Note: ***$p < .001$

The result showed that there was a significant difference between the students who were taught by using participatory teaching methods and those who were taught with formal instruction in performing on comprehension level questions in the selected schools.

It revealed that experimental groups who received participatory teaching methods did better in their comprehension level questions of mathematics achievement than control groups who did not receive them. Thus, teaching with participatory teaching methods could bring about the improvement of the students' ability to understand the meanings of learned materials, concepts and facts schools (see Figure 1& 2).

Table 5 *t*-Values for Scores on Application Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (4), Pazundaung	Experimental	30	4.77	2.19	2.10	4.358	58	.000***
	Control	30	2.67	1.47				
BEHS (1), Latha	Experimental	30	7.33	2.59	5.53	10.211	58	.000***
	Control	30	1.80	1.44				

Note: ***$p < .001$

The result showed that there was a significant difference between the students who were taught by using participatory teaching methods and those who were taught with formal instruction in performing on application level questions in the selected schools.

The comparison of means for application level questions revealed that experimental groups who received participatory teaching methods did better in their application level questions of mathematics achievement than control groups who did not receive them. Thus, teaching with participatory teaching methods could bring about the improvement of the students' ability to apply knowledge and facts that they have learned in the new situations, use general ideas and generalize methods schools (see Figure 1& 2).

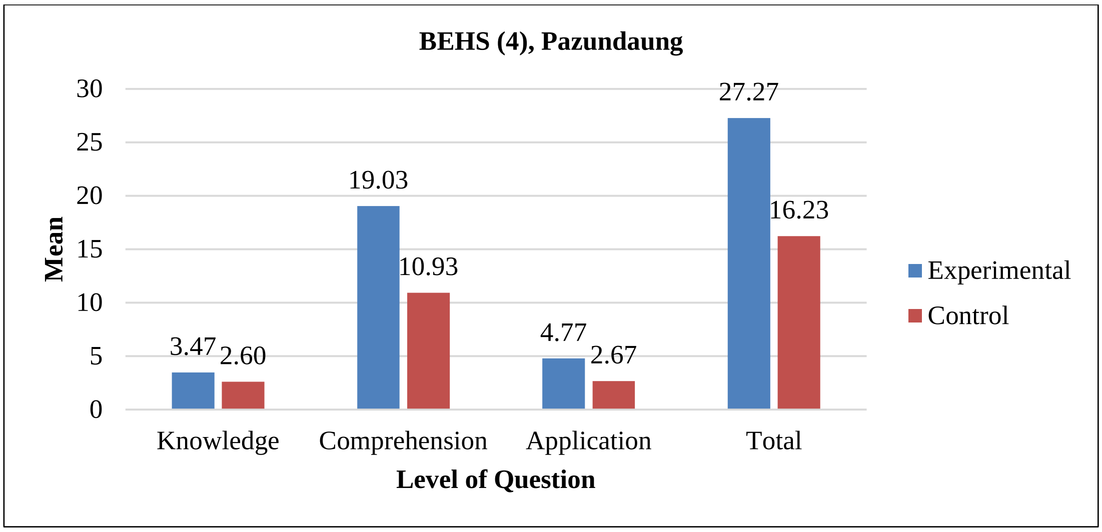

Figure 1 Comparison of Posttest Means of BEHS (4), Pazundaung

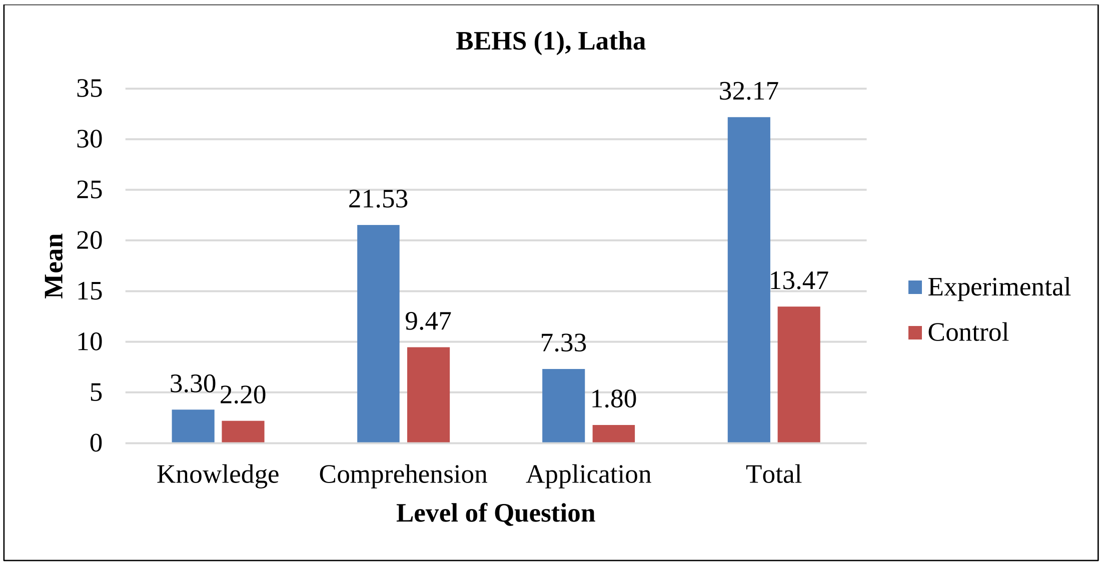

Figure 2 Comparison of Posttest Means of BEHS (1), Latha

Qualitative Research Findings

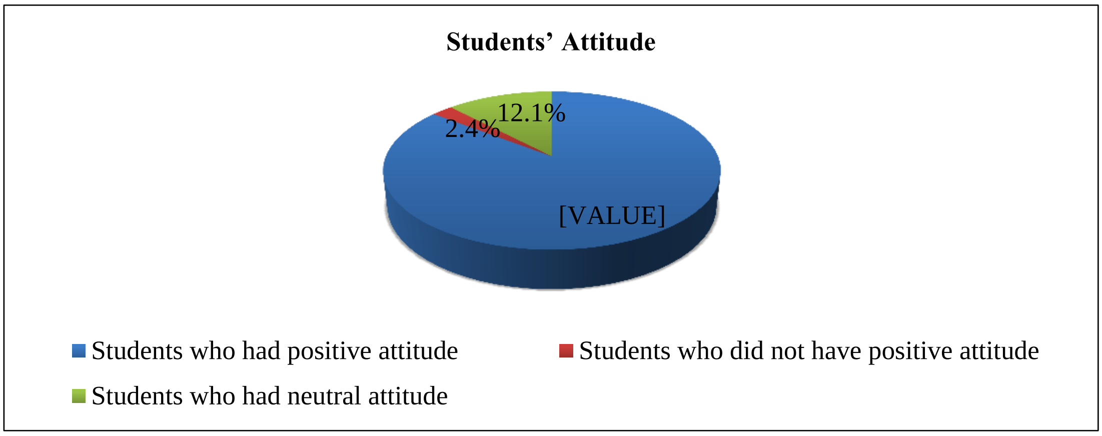

Figure 3 Percentage of Students' Attitude towards Participatory Teaching Methods

In this research, 85.5% of students of experimental groups have positive attitude towards participatory teaching methods. It can be interpreted that participatory teaching methods increase the students' interest, self-confidence, thinking, communication skill and problem solving skill. Thus, it can be summarized that the students' attitude towards participatory teaching methods is positive in both selected schools.

Conclusion

Discussion

According to the findings, the means of experimental groups were significantly higher than that of control groups in the selected sample schools. It showed that the use of participatory teaching methods had significant effect on mathematics achievement of the students. Thus, this finding supports the first hypothesis: There is a significant difference in mathematics achievement between Grade Six students who receive participatory teaching methods and who do not receive. It can be inferred that participatory teaching methods can achieve success in mathematics teaching and learning at the middle school level.

According to the comparison of means on each level questions for both selected schools, the findings showed the achievement of experimental groups was significantly higher than that of control groups. This finding supports the second, third, fourth hypotheses. There is a significant difference in mathematics achievement between experimental group and control group in performing knowledge, comprehension and application level questions. It can be interpreted that the students of experimental groups are more able to recognize the learned materials or information, to improve the ability to grasp the meaning of learned materials and to be more skillful in the use of ideas in particular situations than those of control groups.

One of the specific purposes of this research is to study students' attitude towards participatory teaching methods. According to the findings, 85.5% of students who had positive attitude on overall items of attitude questionnaire, 12.1% of those who had neutral attitude and 2.4% of those who did not have positive attitude on them. Thus, it can be summarized that students' attitude towards participatory teaching methods is positive in both selected schools. The finding supports the fifth hypothesis: The students who are taught with participatory teaching methods will have positive attitude towards participatory teaching methods. It can also be interpreted that participatory teaching methods increase the students' interest, self-confidence, thinking, communication skill and problem solving skill.

In this study, most of the students of experimental groups were alive, interested in their learning process and solved problems by themselves. Thus, this finding is consistent with Muhangwa (2011) who stated that participatory teaching methods make the students become more actively engaged in the learning process, solve problems, think critically, pose challenges and collaboratively construct knowledge. The situations in the class are contrary for teachers who were using traditional teaching.

Next, the students with group discussion were more active than those who received formal instruction. Group discussion increased the students' understanding of a lesson, supported in generating more ideas about a topic and helped the students to build confidence. Group discussion could lead to cognitive benefits by engaging the students in thinking of their ideas. By exchanging ideas and considering others' perspectives, the students were prompted to remember their existing ideas more as well as to integrate new ideas into their existing knowledge.

Then, although project method took time, it helped in growing knowledge and increased social participation. It encouraged the students' investigation and creativity. The students were motivated for further study. In this study, the students could make self-study activities, developed cooperation and showed their competence.

In discovery learning, the students participated more actively in learning process than the students who received formal instruction and fostered an attitude of inquiry. The result of this study revealed that discovery learning had an influence on the mastery of the students' mathematical concepts. The students involved actively in the learning process such as thinking by themselves, finding out contrasting elements and generalization of concepts.

In this study, the students of control groups were taught learning materials with formal instruction. The teacher directly explained the problems and the students listened passively at the same time. As the teacher rarely used group work in this classroom, the students were not able to discuss with their peers, work together and discover the solution by themselves. On the other hand, the students of experimental groups were actively involved in their learning process by discussing among groups, working out projects and discovering the solutions in hand-on activities.

To sum up, the findings mentioned above pointed out that participatory teaching methods have positive contribution to the achievement of students in mathematics. The students were interested in teaching with them and they participated willingly in the teaching/learning process in this study. Through participatory teaching methods, the students can receive opportunities to learn mathematics through various activities under the facilitation of the teacher. Participatory teaching methods can be applied for teaching mathematics at all levels of basic education to help the students for attaining academic achievement. Thus, participatory teaching methods if employed in mathematics classroom would bring about higher achievement of the students.

Suggestions

Although group discussion has a few disadvantages such as difficulties in group position, teacher can overcome this problem with careful preparation. In the ways of accepting students' ideas, reinforcing their discussions and providing feedback at the necessary time, teacher can use group discussion without getting any constraints. Therefore, mathematics teaching and learning will be effective by utilizing group discussion.

One of the disadvantages of using project method is time-consuming. However, it depends on teacher's work and management. If teacher observes simultaneously and gives guidance at the specific time, using project method can make students active and successful in academic achievement. It cannot be denied that students participate actively in learning process, develop social communication and improve the skill of cooperation by using group project.

Every method has both advantages and disadvantages. So, discovery learning has a small number of disadvantages. But, it can make students develop feeling of autonomy, critical thinking skills and habit of searching information. Moreover, discovery learning can be used not only for groups but also for individuals. To sum up, participatory teaching methods such as group discussion, project method and discovery learning should be used for promoting communication skill among the students, participation in teaching/learning process, thinking skills and cooperation between teacher and students or among students.

Based on the research findings and interpretations, participatory teaching methods should be used in classroom teaching but this study is not perfect because there are some limitations in this study such as time duration and content areas. With respect to the research findings, the following points are suggested.

- The teacher should explain clearly to the students about the steps in the method used and allow them to participate in the teaching/learning process and the teacher should give the students guidance and help what they need.
- The teacher should manage carefully classroom conditions to reduce time constraints.
- The teacher should encourage and pay attention for their students to learn and participate enthusiastically in learning activities.
- The teacher should provide opportunities for the students to be able to apply their knowledge in real life.

- The teacher needs to relate the learned materials with real situation so that the students will be more interested in their learning.
- The teacher should allow the students to think critically, make hand-on activities and solve problems by themselves instead of memorizing facts and repetition of solving problems without reasoning skills.
- The teacher should make valuable opportunities to provide the students with a clear understanding of concepts by using teaching aids.
- The teacher should impart information by using questions or hints so that the students can get high retention in applying these methods.
- This study is specifically contributed to mathematics teaching at the middle school level. Although this research was concerned with mathematics teaching, it can also be applied in other subjects and various school levels including primary school level and high school level.
- There are many methods in participatory teaching methods. However, group discussion, project method and discovery learning were used. Thus, other methods involved in participatory teaching methods can be applied in further studies.
- This study was done in the Yangon Region. Therefore, further researches should be carried out in other States and Regions.

Conclusion

There are many sectors for the development of a country such as economics, politics and education. Thus, educated people are important resources to develop a country. At the basic education level, education is mostly dependent on the students' achievement in their academic subjects. Among many academic subjects, mathematics is one which dominates people's lives. Thus, in teaching mathematics, the teachers should not only teach facts, information and how to calculate problems, but also allow the students to think critically, participate in the learning process and study themselves to be more clear. That is why, the implications of participatory teaching methods may lead the students to be good in learning process and using mathematics in their daily life.

The main purpose of the present study is to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level. The students of experimental groups who received participatory teaching methods had higher achievement in mathematics than those of the control groups who received formal instruction. Statistical results verified that participatory teaching methods were superior in improving the students' mathematics achievement.

This may be because the exposure to participatory teaching methods allows the students to think critically and actively participate in the learning process. Another result was that the students of experimental groups could perform better in answering posttest at knowledge, comprehension and application levels than those of control groups. Therefore, it can concluded that participatory teaching methods improve the students' ability to recall learned materials, remember information, comprehend learning materials and apply knowledge in new situation or problems.

Secondly, a qualitative study was done to study the students' attitude towards participatory teaching methods. According to this research, it can be interpreted that the attitude of the students towards participatory teaching methods was positive. Therefore, participatory teaching methods are useful methods in the classroom environment.

This study is conducted to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level. No study is perfect in one's effort. This study had to be carried out in four weeks duration for each group because of their December test, the time was short for conducting research in schools.

National Research Council (2009) illustrated that students who acquired hands-on, authentic activities may develop curiosity, interest and desire to learn more. Social skills can also develop as the students share perceptions and knowledge with other in discussion among groups. Mathematics teachers should make the students to participate in numerous activities and help them to understand more. The students should participate in learning that brings in real life situations.

Even though there are advantages and disadvantages in using participatory teaching methods, many researchers advocated the use of participatory teaching methods in classroom. It is known that one of the goals of education is to nurture students to participate actively in learning process and become lifelong learners. Participatory teaching methods encourage interaction between teachers, students, the content and environment in which learning occurs (Wolhuter, 2014). Participatory teaching methods are important teaching methods to achieve the aims of education and also contribute to teaching and learning mathematics.

To review, the study of the effect of participatory teaching methods is consistent with purposes and cover hypotheses of the research. Moreover, this study showed that the students' learning with active participation was more effective than learning with formal instruction. It improves not only the students' learning rate but also promotes their thinking ability. Besides, this result recommends many mathematics teachers to achieve their teaching/learning situation. The effective use of the participatory teaching methods has significant effect on the overall mathematics achievement of the students. Therefore, participatory teaching methods surely have positive contribution to the improvement of mathematics teaching at the middle school level and lead students to be keen on participating and learning and have a positive effect on students' academic achievement.

Acknowledgements

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TEACHERS' UNDERSTANDING OF TEACHING-LEARNING SITUATION AND INSTRUCTIONAL PRACTICES IN CHEMISTRY TEACHING

Khin Mar Aung[1] and Khin Mu Mu Han[2]

Abstract

The main aim of this study is to investigate understanding of high school chemistry teachers and their instructional practices in chemistry teaching. In this paper, questionnaire survey method, one of the descriptive methods, was used. Forty-eight high schools were selected with the adoption of stratified random sampling technique from Yangon Region. The participants of the sample were high school chemistry teachers. In order to get the required data, the questionnaire having sixty items with five point Likert-type scales and demographic data were developed. The questionnaire was based on five dimensions for teachers' understanding: teaching profession, curricular context, instructional strategies, students' learning needs and assessment. The questionnaire for instructional practices was based on three dimensions: structured practices, student-oriented practices and enhanced activities. The internal consistency of the pilot test was 0.837 and 0.8. The collected data of this study were systematically analyzed by Statistical Package for the Social Science (SPSS) software version as it is widely used in quantitative research. The descriptive analysis techniques were used to tabulate percentages, means and standard deviations. The results showed that the percentages of moderate level of chemistry teachers' understanding were more than high and low level of understanding teaching and learning aspects. According to Pearson product moment correlation result, it was found that there was a positive, moderate relationship between chemistry teachers' understanding of teaching-learning situation and instructional practices, (r=.391).It can be interpreted that teachers' understanding conveyed the associated ideas in chemistry teaching.

Keywords: understanding, instructional practices, teaching, learning

Introduction

Education is one of the essential tools for national development. The level of socio-economic development in the country is strongly connected to education. It is generally accepted that the quality education leads to economic growth hence reduced poverty, improve health and generate creative citizens. Myanmar is striving for quality education by advocating for quality teaching method that can make positive impact on learners through pre-service and in-service teacher education at all levels, to reach the ultimate goal of creating scientifically literate citizens. And thus, teachers' understanding in the meaning, functions and objectives of education are very crucial as a role in implementing the goals of education. Sullivan (1996, cited in Loughran et al, 2012) said that one of the pre-requisite to be good teacher is to understand the teaching and learning process in more depth. And this will facilitate better appreciation of the teaching profession as well as the process of imparting education.

Teaching is an art depending on the individual teacher' skills in using various teaching methods to suit the subject, topic and the students. The most changes that are impinging in education are science and its application. Chemistry education is also necessary because of its value in the students' individual life as well as in society. And thus, there is a need for a shift of emphasis in the teaching of chemistry.

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Purposes of the Study

The main purposes of the study are

(1) to inquire teachers' understanding of teaching-learning situation in chemistry teaching

(2) to investigate the relationship between chemistry teachers' understanding of teaching-learning situations and their instructional practices

(3) to give suggestions for improving chemistry teaching and professional development of chemistry teachers

Research Questions

According to the above research purpose, the following research questions were posed;

(RQ 1) To what extent do chemistry teachers understand teaching and learning ideas?

(RQ 2) To what extent are teachers' understanding conveyed during chemistry teachers' instructional practices?

(RQ 3) What is the relationship between science teachers' understanding of teaching learning situations and their instructional practices?

These questions explore what and how explicit teaching and learning ideas are conveyed during regular chemistry instruction, and what relationship exists betweenteachers' understanding and teaching of chemistry.

Scope of the Study

(1) This study is geographically restricted to Yangon Region.

(2) Participants in this study are chemistry teachers from the selected schools within the school year (2018-2019).

(3) Forty-eight high schools are selected for this study.

(4) Grade ten and grade eleven chemistry teachers are chosen for this study.

(5) Among Stephen Marble, Sandy Finley, and Chris Ferguson, 2000, five components of teacher's understanding on teaching and learning (curriculum context, instructional strategies, assessments and student's data use and vision of teaching) are used. Three dimensions (structured practices, student-oriented practices, enhanced activities) developed by OECD (Organization for Economic Cooperation and Development, 2009) are used for instructional practices.

Definition of the Key Terms

Understanding: Understanding involves obtaining a mental grasp of events, that is, a framework of knowledge that spins off into practical suggestions, theoretical considerations, estimates of worth (Scriven, 1976, cited in Loughran, 2012).

Instructional practice: Those actions exhibited by teachers in class intended to bring about a change in behavior in the students (Beccles, 2012, cited in Alam, 2014).

Teaching: Teaching is best described as guiding and directing the learning process such that learners acquire new knowledge, skills, or attitudes, increase their enthusiasm for learning, and develop further their skill as learners (Newcomb et al, 1986, cited in Alam, 2014).

Learning: Learning is the process of acquiring, altering, and abandoning conceptions or understandings (Murphy & Mason, 2000).

Background of the Study

Chemistry in school is part of the total education provision and the chemistry content is gained so as to enhance learning in the cognitive, personal and social domains. The teaching of a sequence of chemistry lessons begins from a relevant socio-scientific context. The teaching progresses from the societal (the familiar) to the chemistry concepts (the unknown) which are needed to better appreciate the issues, or concerns, and then proceeds to the socio-scientific decision making needed (the purposeful learning involving all educational domains). Teaching geared to the goals of education covers a wide range of intended targets in the intellectual, personal and social domains. Conceptual learning within the subject needs to be approached in a relevant manner, but also the teaching must not lose sight of the fact that the attitudes, communication abilities and personal attributes (such as creativity, initiative, safe working) need to be developed. Teachers need to recognize that curricula promoting chemistry fundamentals, grouping chemistry concepts for scientific convenience.

Chemistry is a difficult subject to teach and to learn at both secondary and tertiary levels. Major learning difficulties are due to the particular views of chemistry phenomena that in many ways contradict intuitive and everyday views of the learners. As a result, major misunderstandings occur when students try to comprehend chemical explanations within the framework of their pre-instructional conceptions in the domain of chemistry and on attempts to guide students from their conceptions to the core ideas of chemistry. Understanding and learning core science concepts and principles, including those in chemistry, are difficult.

Teachers need in the continuous development of understanding about the current trends of chemistry teaching and learning to include both the content and pedagogy of chemistry learning and teaching. Effective teachers exhibit a breadth of knowledge, bring information together from a variety of sources, analyze concepts effectively, and stay up to date in their specialty. The predispositions and understandings that teachers hold are both consciously and unconsciously replicated in their own classrooms during teaching.

Teachers' conceptions of teaching and learning, and of how these are related to students' approaches to learning, seem to be paramount in enhancing the quality of learning. Effective pedagogy requires learning to be scaffolded. A major contribution to such scaffolding derives from teachers' understanding of both curricular knowledge and of how children and young people learn. The teacher must know when learning is correct or incorrect, learn when to experiment and learn from the experience, learn to monitor, seek and give feedback, and know to try alternative learning strategies when others do not work. In a framework of continuous learning, it is necessary for a teacher to be well conversant with the latest pedagogical know-how. New pedagogical approaches such as cooperative learning, reciprocal learning, inquiry based learning, project based learning on learner-centered should be adopted by 21st century teachers.

The 21st century world has become increasingly complex. For example, the way people communicate with one another has been unequivocally altered by communication technologies that connect individuals in multiple networks. In education, the approach to reforming school systems requires appreciating the complexity of teaching and learning that exist among and between students, schools, and larger communities.

Significance of the Study

Chemistry students are unable to perceive relationships among components of chemistry subjects. The aim of any school chemistry curriculum is not only to educate in chemistry but also to educate through chemistry. The aim has to generate a population that is informed about chemistry and its importance in modern day society, a population who are positively disposed to chemistry and its impact in society. Teachers need awareness of students' limited understanding of complex ideas in chemistry and to be able to inspire good attitudes toward learning chemistry. The achievement of chemistry outcomes largely depends on teachers' interpretation and use of teaching strategies according to the students' needs.

Only if teachers understand teaching and learning situations, their efforts seem well in shaping the track of students' interests to chemistry subject. Active learning is promoted by learning outcomes related to chemistry process skills. At present times, it is found that students do not achieve chemistry process skills and they face difficulties in higher academic courses. Therefore, teachers must be well-versed with chemistry teaching and learning to fulfill the needs of the students. If not they understand the teaching and learning process well, they cannot interpret the components of chemistry effectively. Teachers must have understanding of learning needs and desire to fill these needs with the understanding of the connections of curriculum, instruction and assessment. As teachers develop a reliance on their understanding of and focus on student learning, they also begin to feel that they have a significant impact on the learning that goes on in their classroom. Collectively, these studies indicate that teachers' limited understanding of teaching and learning systems remains an educational problem.

Review of Related Literature

Theoretical Framework of Pedagogy

Teachers' use of communicative strategies encourages pedagogic practices that are interactive in nature, and is more likely to impact on student learning outcomes and hence be effective. Pedagogic practice is developed through interaction between teachers' thinking or attitudes, what they do in the classroom and what they see as the outcome of their practice. These attitudes were teachers' positive attitudes towards their training and their students, which positioned them in the best frame of mind to construct the teaching and learning process as an interactive, communicative process in which teaching involved provoking a visible response in their students that indicated that learning was taking place. Six specific strategies that promoted this interactive pedagogy were identified in the Education Rigorous Literature Review (2013, cited in Westbrook et al, 2013) include the following factors;

- feedback, sustained attention and inclusion;
- creating a safe environment in which students are supported in their learning;
- drawing on students' backgrounds and experiences.
- flexible use of whole-class, group and pair work where students discuss a shared task;
- frequent and relevant use of learning materials beyond the textbook;
- open and closed questioning, expanding responses, encouraging student questioning;
- demonstration and explanation, drawing on sound pedagogical content knowledge;

- use of local languages and code switching;
- planning and varying lesson sequences.

Understanding Teaching and Learning

Today, teaching is often viewed as a routine function, tacked on, something almost anyone can do. Great teachers create a common ground of intellectual commitment. They stimulate active, not passive, learning and encourage students to be critical, creative thinkers, with the capacity to go on learning. Indeed, as Aristotle said teaching is the highest form of understanding. Marton and Booth (1997) said that teaching as a scholarship enterprise involving the development of a knowledge of practice through building of bridges between teacher's understandings and students' learning. And also Entwistle (1998) said that it includes teachers' understanding research on student learning and deploying this knowledge in their approaches to teaching. (Marton & Booth, 1997, Entwistle, 1998, cited in Fry et al, 1999)

Teachers' perspectives on curriculum, assessment, instruction and their profession are important for the students in receiving a coherent message about what is important to learn and are assessed in a manner consistent with instruction. Ball and Cohen (1999) discussed teachers' learning, saying

"The knowledge of the subject matter, learning, learners, and pedagogy is essential territory of teacher's work if they are to work as reformers imagine, but such knowledge does not offer clear guidance, for teaching of the sort that reformers advocate requires that teachers respond to students' effort is to make of material. To do so, teachers additionally need to learn how to investigate what students are doing and thinking, and how instruction has been understood, the best way to improve both teaching and teacher learning would be to create the capacity for much better learning about teaching as a part of teaching" (Ball and Cohen, 1999, cited in Stephen et al, 2000).

Understanding on Students' Learning

A typical classroom activity focuses on a segment of a curriculum topic such as a significant concept, understanding, principle or skill (Wells, 2002b, cited in Kaur, 2012). Several different patterns of classroom organization might be involved. The parts of an activity (such as a whole-class discussion, completing a worksheet, conducting an experiment) are themselves activities that have their own expected components and make a specific contribution to the larger activity. Further, students tend to interweave elements of the smaller activities so that it is impossible to identify when one ends and the next one begins.

The processes of understanding, knowledge acquisition, internalization and memory are closely linked and related to individual differences in what is learned and remembered. If the concept of an activity is to provide a useful unit of analysis for understanding the conditions under which higher mental processes are acquired, then its theoretical basis needs to be expanded to incorporate the cognitive representations of activities (scripts and schemas) that have proved useful in explaining memory processes. Sheull (1993) said that it is important to remember that what the student does is actually more important in determining what is learned than what the teacher does. This statement is congruent with a constructivist view and reminds teachers that students in higher education must engage with and take some responsibility for their learning.

According to Vygotsky (1978), and other sociocultural theorists (Arievitch & Van Der Veer, 1995), the higher mental processes (involved in learning from experience) are generated through the internalization of culturally structured social activities (Sheull, 1993, cited in Kaur, 2012). Children acquire cognitive processes as part of acquiring the culture of the society in which they live, progressively, through constant guided participation in the activities and rituals that make up daily life. Through participation, they internalize the goals and purposes, the behaviors, and the knowledge and thinking processes involved in the activities.

The basis of a series of cross-cultural studies of children's development, that school, unlike other social institutions, requires the systematic and managed use of cognitive activities. What is unknown is how participation in school activities shape the way the child interprets, thinks about and uses experience (Nuthall, 2000, cited in Kaur, 2012). The process by which social activities become mental processes is referred to as internalization (Lawrence & Valsiner, 1998, cited in Kaur, 2012).

Chemistry in Science Education

Chemistry is the science of matter and its transformations. Investigation should be prominent in any science curriculum. Most of the big ideas in chemistry and other sciences were developed over many years of investigation. Experiments should be performed in the high school chemistry teaching.

Students should be exposed to the wonderful nature of science in general, and how chemistry relates to other sciences and other subjects in the high school curriculum. Frazer, 1975, claimed the general aim of chemistry should be like

- to prepare students for professional career in science especially in chemistry
- to contribute to general education using chemistry as an instrument and
- to inform future citizens of the country of the nature and the role which chemistry plays in everyday life (Frazer, 1975, cited in Matthews, n.d.)

High school chemistry teachers should strive to model and emphasize the inquiry, scrutiny, and information-sharing that is fundamental to the practice of science. Scientifically literate chemistry students should be able to describe the concepts and how the value could be investigated, verified, or applied. Students should be able to carry out such an investigation. Advance planning is crucial for active student engagement in learning. Chemistry teachers should first decide on the conceptual leaning goals for their students, focusing on broad concepts within the big ideas in chemistry. Spiraling the curriculum, building on and making connections to what students already know, will encourage student participation and understanding.

Method and Procedure

Research Design

The research design for this study was a descriptive research design, in which it is used to determine whether, and to what degree, a relationship exists between two quantifiable variables. In this study, data were collected through a quantitative method. Quantitative method is research technique that is used to gather quantitative data-information dealing with numbers and anything that is measurable (Gay & Airasian, 2003).

Instruments

In this study, two instruments were used for data collection. Both instruments, teachers' understanding inventory and instructional practices index. Teachers' understanding was developed by Stephen Marble, Sandy Finley, and Chris Ferguson, 2000 and instructional practices was developed by OECD (Organization for Economic Cooperation and development), 2009. To investigate the teachers' understanding and instructional practices both instruments were modified into Myanmar version and used.

Teachers' understanding inventory was constructed with total 40 items consisting five dimensions of curricular context (8 items), assessment (8 items), students' learning needs (8 items), instructional strategies (8 items) and teaching profession (8 items). It is a five point Likert scale ranging from (1), 'strongly disagree', (2) 'moderately agree', (3) 'undecided' (4), 'agree', and (5) 'strongly agree'.

Instructional practices inventory included 20 items that represented three dimensions structured practices (10 items), student-oriented practices (6 items), and enhanced activities (4 items). The response type for each item is a five point Likert scale: 'never' (1), 'seldom' (2), 'sometimes' (3), 'often' (4) and 'always' (5).

Table 4.1 Level of Chemistry Teachers' Understanding Teaching and Learning Aspects

Understanding Teaching and Learning Aspects	Level of Understanding	Frequency	Percent
Understanding Teaching Profession	High	17	11.8
	Moderate	100	69.4
	Low	27	18.8
	Total	144	100
Understanding Curricular Context	High	26	18.1
	Moderate	93	64.6
	Low	25	17.4
	Total	144	100
Understanding Instructional Strategies	High	20	13.9
	Moderate	101	70.1
	Low	23	15.9
	Total	144	100
Understanding Students' Learning Needs	High	33	22.9
	Moderate	101	70.1
	Low	10	6.5
	Total	144	100
Understanding Assessment	High	23	15.9
	Moderate	108	75
	Low	13	9.0
	Total	144	100

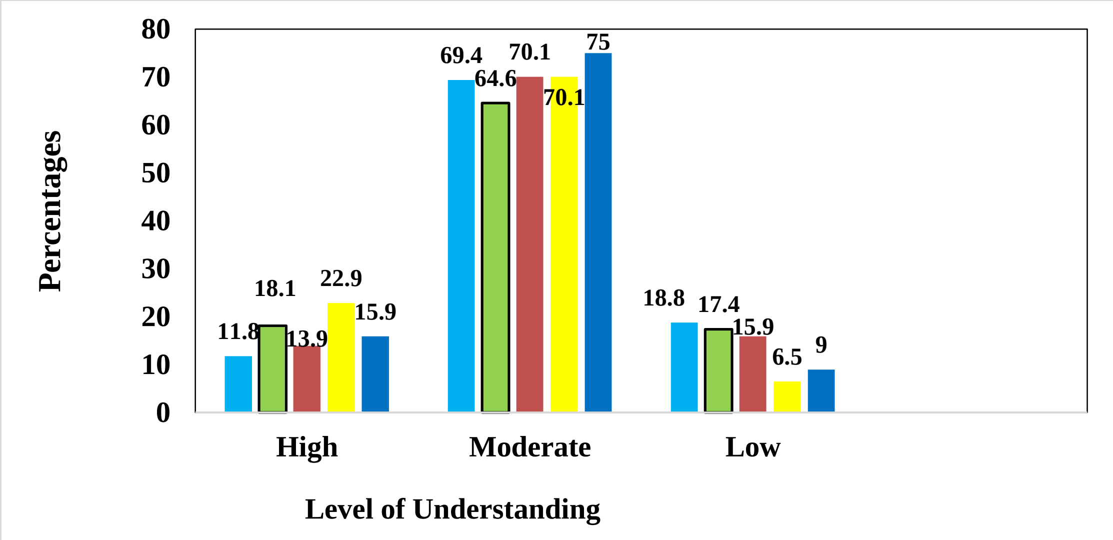

Figure 4.1 Level of Chemistry Teachers' Understanding of Teaching-Learning Aspects

Table 4.1 and figure 4.1 showed the percentages of chemistry teachers categorized into five dimensions of understanding teaching and learning aspects. According to the tale and figure, 11.8% of the chemistry teachers were identified as high-level group in understanding teaching profession, 18.1% of the teachers in understanding the curricular context, 13.9% of the teachers in understanding instructional strategies, 22.9% of the teachers in understanding students' learning needs and 15.9% of the teachers in understanding the assessment. 69% of the chemistry teachers were moderate in understanding teaching profession, nearly 65% of the teachers in understanding curricular context, 70% of the teachers in understanding instructional strategies, 70% of the teachers in understanding the learning needs and 75% of the teachers in understanding the assessment. Then, nearly 19% of the teachers were low in understanding teaching profession, 17.4% of the teachers in understanding the curricular context, 15.9% of the teachers in understanding instructional strategies, 6.5% of the teachers in understanding learning needs and 9% of the teachers in understanding the assessment. There was little difference in percentages of high and low level of understanding teaching and learning aspects. In all dimensions, the percentages of moderate level of understanding are more than high and low level of understanding teaching and learning aspects.

Table4.2 Means and Standard Deviations for Ten Items of Structured Practices

No	Items	N	Means	Std. Deviation
1.	Item 1	144	3.89	0.86
2.	Item 2	144	3.67	1.05
3.	Item 3	144	3.94	0.99
4.	Item 4	144	4.01	0.99
5.	Item 5	144	4.26	0.76
6.	Item 6	144	4.03	0.85
7.	Item 7	144	3.90	0.89
8.	Item 8	144	3.65	1.05
9.	Item 9	144	4.20	0.73
10.	Item 10	144	2.60	0.72
	Overall	144	3.82	0.54

Scoring Direction: 1.00-1.49=never, 1.50-2.49=seldom, 2.50-3.49=sometimes, 3.5-4.49=often, 4.50-5.00=always

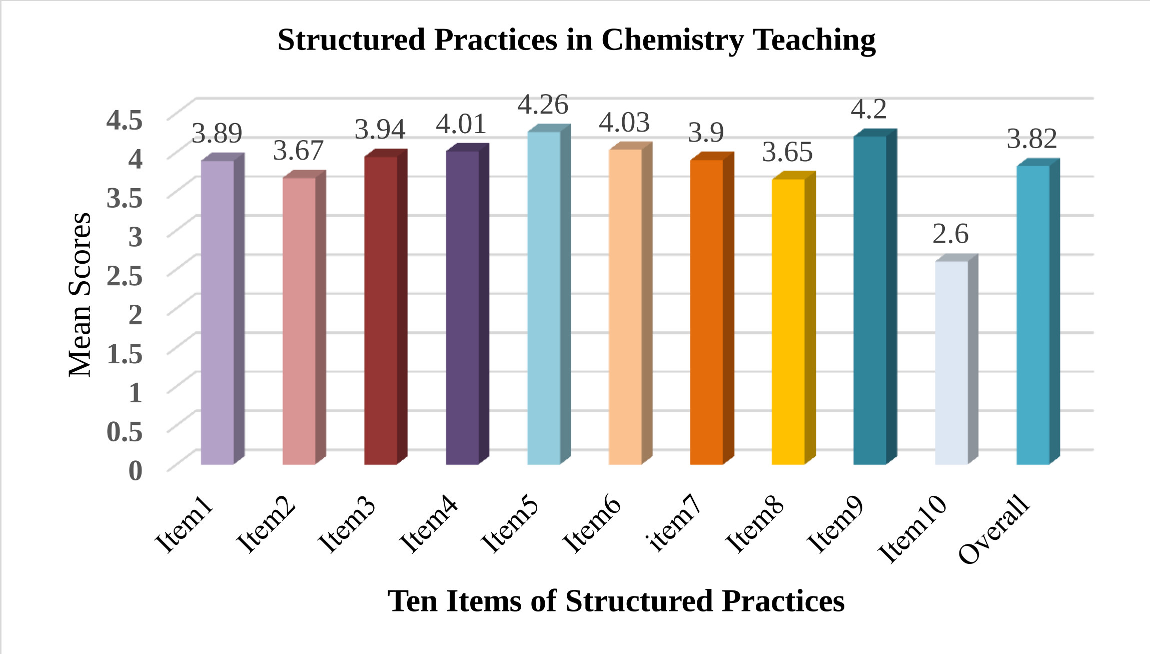

Figure 4.2 Mean Comparison for Ten Items of Structured Practices in Chemistry Teaching

According to table 4.8 and figure 4.3, it could be noted that the item (Check students' exercise books regularly) had the highest mean score (M=4.20). And, the item (questions are made to the application level and higher performance level of the students in checking students' understanding of subject matter) had the lowest mean score (M=2.60). Based on this result, it can be noted that teachers used to check the knowledge and comprehension level of students in questioning.

Table 4.3 Means and Standard Deviation for Chemistry Teachers' Student-Oriented Practices

No.	Items	N	Means	Std. Deviations
1.	Item 1	144	3.4	0.97
2.	Item 2	144	3.1	1.07
3.	Item 3	144	3.2	1.05
4.	Item 4	144	3.27	0.87
5.	Item 5	144	3.22	0.84
6.	Item 6	144	3.03	1.02
	Overall	144	3.21	0.74

Scoring Direction; 1.00-1.49=never, 1.50-2.49=seldom, 2.50-3.49=sometimes, 3.50-4.49=often, 4.50-5.00=always

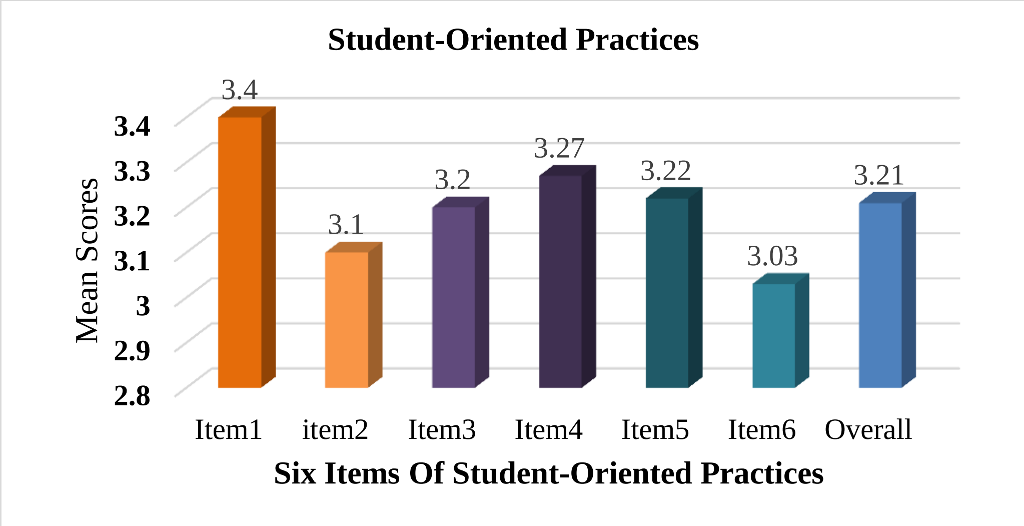

Figure 4.3 Mean Comparison for Six Items of Student-Oriented Practices

In the table 4.3 and figure 4.3, the item (Have students work with concrete materials or manipulative) had the highest mean score (M=3.4) which was equivalent to "sometimes" mark on scale. So, it is found that chemistry teachers sometimes use the concrete materials in teaching chemistry lessons. And, the item (Give enough time for reflective evaluation) had the lowest mean score (M=3.03) finding that chemistry teachers sometimes give enough time for students to reflect evaluation. Moreover, Others items which the mean scores are above 3.0, equivalent to "sometimes" mark mon scale.

Table 4.4 Means and Standard Deviations for Enhanced Activities in Chemistry Teaching

No.	Items	N	Means	Std. Deviation
1.	Item 1	144	1.76	0.92
2.	Item 2	144	1.94	0.99
3.	Item 3	144	2.7	0.89
4.	Item 4	144	2.7	0.87
	Overall	144	2.27	0.72

Scoring Direction: 1.00-1.49=never, 1.50-2.49=seldom, 2.50-3.49=sometimes, 3.50-4.49=often, 4.50-5.00=always

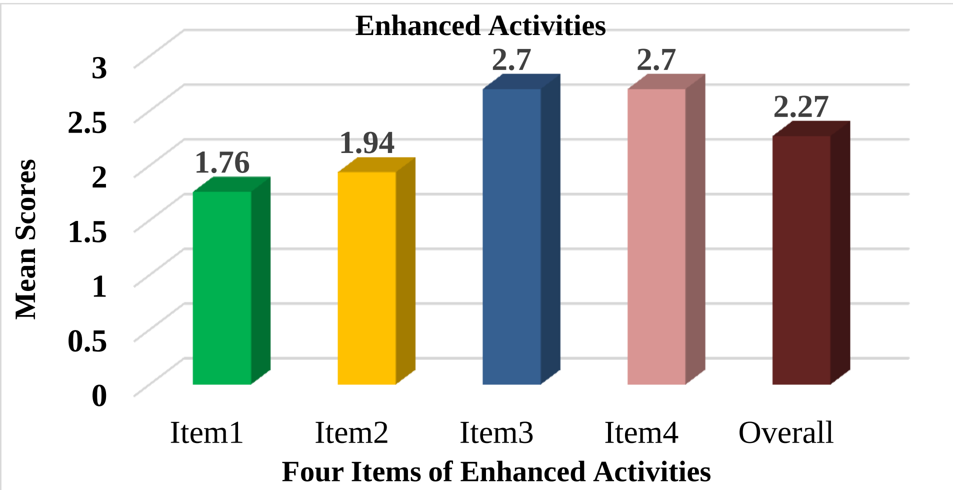

Figure 4.4 Mean Comparison for four items of enhanced activities

According to the table 4.4 and figure 4.4, the item (Writing essay to assess students' thinking and reasoning skills) and the item (Have students debate and evaluate upon an opinion) had the highest mean score (M=2.7). Thus, it could be noted that chemistry teachers have more strength upon making students writing essay and debate on an opinion in the practices of enhanced activities. And, the item (working a project at least one week to complete) had the lowest mean score (M=1.76). Thus, it could be noted that chemistry teachers have more strength upon making students writing essay and debate on an opinion in the practices of enhanced activities than practicing students doing investigation.

Table 4.5 Correlations between Chemistry Teachers' Understanding of Teaching and Learning Aspects and Instructional Practices

		Chemistry Teachers' Understanding of Teaching and Learning Aspects	Chemistry Teachers' Instructional Practices
Chemistry Teachers' Understanding of Teaching and Learning Aspects	Pearson Correlation	1	.391**
	Sig. (2-tailed)		.000
	N	144	144
Chemistry Teachers' Instructional Practices	Pearson Correlation	.391**	1
	Sig. (2-tailed)	.000	
	N	144	144

**. Correlation is significant at the 0.01 level (2-tailed).

To examine the relationship between teachers' understanding and instructional practices, Pearson product-moment correlation was used. A correlation indicates that the size and direction of a relationship. A correlation coefficient is a decimal number ranging from (+1.00) to (0.00) to (-1.00). A coefficient near (+1.00) has a high size and a positive relationship. If the coefficient near (0.00), the variables are not related. A coefficient near (-1.00) has a high size and negative or inverse direction. A coefficient below plus or minus (0.35), low or not related; coefficient between plus or minus (0.35) and (6.5), moderately related; and coefficient higher than plus or minus (.65), highly related (Gay &Airadian, 2003).

According to the Table 4.5, there is significant relationship between chemistry teachers' understanding of teaching and learning aspects and their instructional practices. And, it is found that there is moderate relationship between chemistry teachers' understanding and instructional practices.

Discussions, Suggestions and Conclusion

Discussions

The main purpose of this study was to investigate teachers' understanding of teaching and learning aspects in chemistry teaching. Therefore, an investigation is conducted by using the quantitative method. As a sample, a total of 144 senior assistant chemistry teachers were selected. A survey questionnaire was used to elicit the responses from chemistry teachers to know their understanding on teaching and learning aspects and the extent their understanding conveyed during their instructional practices.

For the first dimension, it was found that chemistry teachers have positive professional vision of teaching resulting the total mean score “3.99”. They expressed positive perceptions on the items (teaching profession is important in society, professional development activities are not conflict with their work, teaching is the application of skills in real situations, the capacities of a teacher must improve continuously, teaching is a collegial act best done in collaboration with others, classroom teaching makes the teacher more creative) which have the mean scores above “4.0” and “3.5”.

And they expressed “undecided” in the items (Professional development activities are too expensive and unaffordable for teachers and students’ success and instructional decisions depend on external factors) which have the mean scores above “3.10” and “3.33”.

For the second dimension, chemistry teachers claimed that they have understanding on curricular context resulting the total mean score “4.04”. They have positive perceptions on all the items resulting the mean scores above “4.0” and “3.5”.

For the third dimension, chemistry teachers claimed that they have understanding on the aspects of instructional strategies resulting the total mean score “4.1”. They expressed positive perceptions on the items (my role as a teacher is to facilitate students’ own inquiry, I rely on the teacher’s guide-book as the source of authority for instructional strategies, chemistry teachers should strive to model the effective teaching methods, some chemistry lessons can be taught by observation method and student-centered teaching method, some chemistry lessons can be taught by the demonstration method to facilitate students’ leaning, I understand the teaching procedures involved in student-oriented instruction) resulting the mean scores above “4.0” and “3.5”.

And they claimed “undecided” in the items (I need knowledge of chemistry teaching strategies and a laboratory lesson consists of three steps) which have the mean scores “2.5” and “2.57”.

For the fourth dimension, chemistry teachers claimed that they have understanding on the students’ learning needs showing the total mean score “4.11”. They expressed positive perceptions on the items (the higher mental processes of students are generated through the internalization of culturally structured social activities, teachers must consider what each task or activity will require of students, students differ learning styles according to their individual differences, linking the prior knowledge with the new information causes meaningful learning, the teacher must know the points in which students get misconceptions and learning the scientific terms and formulas is more important before teaching scientific concepts and principles) all showing the mean score above “4.0”.

For the fifth dimension, assessment is an integral component of teaching and learning system. A large number of assessment methods are available for use in education. Assessment of student learning requires the use of a number of techniques for measuring student achievement. Chemistry teachers claimed that they have understanding the assessment aspects resulting the total mean score “4.16”. They expressed positive perceptions on all the items showing the mean scores above “4.0” and “3.5”.

According to findings from this study, high, moderate and low level of understanding teaching and learning aspects are found. For the first dimension, it is found that 11.8% of chemistry teachers were at high level, 69.4% of teachers were at moderate level and 18.8% of teachers were at low level of understanding teaching profession. For the second dimension, it is found that 18.1% of chemistry teachers were at high level, 64.6% of teachers were at moderate level and 17.4% of teachers were at low level of understanding curricular context. For the third dimension, it is found that 13.9% of chemistry teachers were at high level, 70.1% of teachers were at moderate level and 15.9% of teachers were at low level of understanding instructional strategies. For the fourth dimension, it is found that 22.9% of chemistry teachers were at high level, 70.1% of teachers were at moderate level and 6.5% of teachers were at low level of understanding students' learning needs. For the fifth dimension, it is found that 15.9% of chemistry teachers were at high level, 75% of teachers were at moderate level and 9% of teachers were at low level of understanding assessment. Therefore, based on the results finding, it can be interpreted that most teachers do not have complete understanding about the teaching and learning aspects.

This may have been a result of a lack of professional development or a lack of effort in promoting professional development to enhance teachers' subject matter knowledge and PCK (i.e, how to teach and apply the tools and resources of teaching). The idea of PCK was enticing because it seemed to be such a clever way of imagining what the specialist knowledge of teaching might involve. PCK conjured up an image of cutting-edge knowledge of practice, something special and important, something that could define expertise, something that could illustrate in a meaningful way why teaching needed to be better understood and more highly valued.

The findings of instructional practices showed that structured practices are emphasized more than student-oriented practices and there was totally absent the practices of enhanced activities. There are ten items of structured practices corresponding to the teacher-centered teaching included state learning goals, review students' homework they have prepared, present a short summary of the previous lesson, check students' exercise book and lecture and check by asking questions. Based on the results, 44.5% of chemistry teachers expressed "often do" and 26.3% of the teachers expressed "always do".

According to the findings of student-oriented practices, 34.2% of the teachers expressed "often do" and 7.9% of the teachers expressed "always do". The mean scores of student-oriented practices for the whole sample is found all above "3.0." Therefore, it can be interpreted that chemistry teachers do not still emphasize student-oriented practices. The findings of enhanced activities show that 10.3% of the teachers is found "often" and 1.4% of the teachers is found "always." The mean scores of the enhanced activities show that "1.76" and "1.94" in the items (work on project at least one week to complete and students make product that others can use). This finding described that higher performance of students' capacities were not totally absent in chemistry teaching. Teachers need to change the pattern of questioning from the traditional way of checking students' knowledge. In order to increase interaction, science teachers need to set hands-on activities, group or peer work, subsequent student presentations and discussions. Thus, students need to be encouraged to liberally participate in such activities and willingly express their thought.

PCK had a dramatic impact on teachers' understanding of practice. The items (writing essay to evaluate students' thinking and reasoning skills and hold a debate upon an opinion) had the mean scores "2.7" and "2.2." This finding shows that chemistry teachers are weak in their teaching practices of chemistry teaching. As a consequence, it was reminded of how limited understandings of a specific topic inhibit the ability to create the amalgam of content and pedagogy that is PCK. In addition, the essence of PCK is not captured by mere representations of teachers just “knowing what to do” or “how to do it”. Teaching is complex work and many teachers come to find that their initial simplistic views of teaching are confronted when the intricacies of their work become clearer over time. Through this process, whereby a growing understanding of teaching begins to emerge largely as a result of learning through experience, a new appreciation of one’s skills and abilities compels some to move beyond the simple delivery of information.

The present findings, however, show that regular science classrooms have not yet to benefit from these commendable efforts. It is perhaps time for the science education research community to re-examine and focus on the translation and scaling up of these pieces of promising reform to science classrooms. The development of instructional resources, curricula and strategies aimed at facilitating the teaching of science required for the professional development of chemistry teachers. Results from survey responses and detailed analysis suggest that there is a relationship between science teachers’ understanding of teaching and learning systems and their instructional practices of chemistry teaching. From the surveys, a positive, moderate and significant association between chemistry teachers’ understanding and their indications of incorporating teaching and learning ideas in their instructional practices was obtained. This finding pointed out that there is a moderate relationship between teachers’ understanding of teaching and learning ideas and their instructional practices conveying the associated ideas. In this study, it is found that chemistry teachers have understanding on their teaching profession, curricular context, instructional strategies, students' learning needs and assessment. It will get better expectations on quality teachers if chemistry teachers have more thorough understanding of teaching profession, the connection between curriculum, assessment and instruction.

Suggestions

This study was restricted to the sample of population from the selected schools in Yangon region. The participants were only 144 chemistry teachers from forty-eight high schools. It can be conducted future research based on the findings of this study by using larger sample size of participants in different high schools, primary and middle schools, colleges and university. Video-observation method should be applied in further research to find out teacher-student interaction more definitely. Besides, interview method should be undertaken in order to build rapport between the researcher and the subjects.

Stephan Marble, Sandly Finley and Chris Ferguson (2000), made a framework for over a year with groups of teachers in five sites to examine their perspectives, experiences, and understanding about teaching. They created opportunities for teachers and their colleagues to carefully reexamine how children learn. In the safety of these collegial communities, teachers developed their confidence and refocused their practices. Most importantly, they moved from a habit of thinking mostly about the instructional problem to a habit of thinking first about the learner. This turn to learning opened doors to an extensive rethinking of teachers’ understanding and approaches to teaching. Huberman (1995) said that collegial learning in school networks has emerged as a way to promote professional development. This suggests that helping teachers build new connections and relationships requires intense and honest engagement.

Teachers need a wide array of information, materials, and requirements to develop the deep understanding necessary to make instructional decisions that promote students' learning. Teachers should be better able to understand and consider the importance of making the connections between curriculum, assessment and instruction for the learner. Therefore, further research should focus on what teachers do in the classrooms since content coverage and instructional strategies are the predominant theme of most curricular and professional development reforms. For teachers, designing a classroom assessment required to understand establishing clear targets in conjunctions with selecting important content for students to learn and appropriate instructional strategies to support their learning. Understanding of the connections help teachers see the need to focus on student learning. Therefore, it is important to build on teachers an understanding of how it is related to the other parts of the system. Chemistry teachers need to engage in many professional development activities such as attending courses and workshops, self-study, practicing, collaboration and observation. Professional development of chemistry teachers is necessary to enhance their capacity in teaching practices and to improve the current situation.

At the current trend of reform education, chemistry teachers face the challenges such as teaching methods, their teaching proficiency, and ways to motivate their students. For facing challenges to gain real traction in school science instruction, it requires reform efforts over extended time and at several levels, students and teachers, curriculum and learning and teaching resources, and school and district organizational support. This is in itself a complex endeavor, an endeavor the science education community should strive to continue working on. This will require the provision of time when teachers can meet to discuss new information with colleges and to test, reflect on and evaluate its effectiveness in the classroom.

Short-term intensive workshops are needed in upgrading teachers' content knowledge, and in their acceptance of the ideas behind an innovation. Current efforts in addressing the educational problem of quality education have largely focused on promoting quality teachers. Therefore, the science education and research community should place equal emphasis on the teachers and the teaching of science, and not simply on the learners and the learning of this domain. It is also necessary to bear in mind that the professional development efforts should not only help promote teachers' understanding of teaching and learning but also provides strategies and approaches they can use to facilitate their students' conceptions. Other professional trainings should address all the aspects of modern teaching-learning in a packaged programme so that the teachers can have a complete idea about modern approach of teaching.

The educational stakeholders should fairly consider vulnerable condition of science education depicts also the shortage of laboratory, availability of the laboratory equipment, shortage of science teachers and trained science teachers in Myanmar. The challenges for improving the quality of the education system, however, are significant, including low learning levels, inadequate acquisition of non-cognitive skills, inequitable learning among students, a high degree of variation between schools, low teacher motivation, low time on task, weak examinations and teacher development systems.

It is found that the understanding of facilitation, dialogue, and reflection is not widespread among those who currently work with preservice and in-service teachers. This way of working represents a paradigm shift for many of those who would assist teachers, including school district and university faculty. Therefore, the educational reformers need to learn more about what these educators require to be better able to facilitate groups of teachers in ways that promote the construction of more coherent practices.

Conclusions

The results regarding teachers' understanding of teaching and learning have revealed that in Myanmar high school chemistry teachers' understanding regarding teaching and learning did not partition within a particular dimension. Less than half of the chemistry teachers of the researched schools have low level of understanding regarding teaching-learning and more than half of the chemistry teachers hold moderate level of understanding. Only 20% of the teachers hold high level of understanding teaching and learning aspects.

The 21st century is one of complexity and complex systems science has garnered tremendous attention from scientists and policymakers. This field has influenced several science education reform documents over the past decade and science educators and researchers have advocated complex systems instruction in school science for better science understanding.

The empirical finding of the reasons hindering teachers' understanding also hints that a coordination of efforts – within and beyond professional development – will be required to carefully address the educational problem. From providing more learning opportunities and exposure to science teaching for teachers and students, designing teaching and learning aids to visualize the obscure nature of underlying mechanisms of science subjects, to putting more prominence to teaching in existing science syllabi and assessments, these efforts can help alleviate some of the challenges science teachers face in understanding and teaching science, especially, in chemistry teaching.

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A STUDY OF THE EFFECTS OF DIRECT INSTRUCTION AND INDIRECT INSTRUCTION ON STUDENTS' ACHIEVEMENT IN GEOMETRY

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Abstract

The main purpose of this study is to investigate the achievement differences in geometry between Grade Six students those who are taught by using indirect instruction and those who are taught by using direct instruction. It is an experimental research and the design adopted in this study was posttest only control group design. Yankin and South Okkalapa townships were randomly selected from four strata in Yangon City Development Area. One high school from each township was also randomly selected. The participants in this study were (120) Grade Six students and they were randomly selected from each school. Sixteen lesson plans and posttest were developed based on Chapter (7), Area and Volume, from Grade Six Mathematics Textbook Volume (II). Level of posttest items were based on the four levels of Bloom Taxonomy: knowledge, comprehension, application and analysis. During the study period, the experimental groups were provided instruction with indirect instruction and control groups were provided instruction with direct instruction. The duration of the study period was two weeks. The posttest scores were analyzed by using independent samples *t*-test to examine the differences in achievement result between experimental and control groups. The result of the study showed that there was a significant difference in the achievement in geometry between the experimental and control groups in each selected school. This finding pointed out that using indirect instruction is significantly better on students' achievement in geometry than using direct instruction. It can be suggested that teachers who teach geometry should use indirect instruction to improve in students' achievement result.

Keywords: Direct Instruction, Indirect Instruction, Achievement in Geometry

Introduction

Education is the basic part of everyone's life and it is required for holistic development of individual. The main objective of education is to bring behavioral change in terms of cognitive, skill and attitude and the purpose of teaching is to facilitate learning. All students do not learn the same way and they learn in various ways. Therefore, teachers should vary their use of instructional strategies in order to relate students' learning style and needs (Flender & Brent, 2005, cited in Kipper, 2011).

Students need to know how to turn formal instruction into solving real life problems. Geometry is a branch of mathematics and it has had a great importance in people's lives. Geometry helps students to acquire abilities such as making new discoveries, analyzing problems and making connections between mathematics and real life situations. To be effective in teaching geometry, the two most widely accepted instructional methods are direct instruction and indirect instruction.

Direct instruction is primarily teacher-centered. It is typically large-group, teacher-directed, highly structured expository teaching focus on academic content. The teacher is the major provider of information and the procedures of direct instruction are closely fit on the behaviorism (Borich, 2007). Indirect or experiential teaching is mainly student-centered and it includes approaches in which students dig out their own learning. It seeks a high level of students

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involvement in observing, investigating, drawing inferences from data and forming hypotheses. Borich (1990) stated that learning at the lower level of cognitive domain (knowledge, comprehension, application) relies heavily on direct instruction and the teaching functions associated with indirect instruction are applied in the context of higher level of cognitive domain (analysis, synthesis, evaluation). Although both methods can be used effectively in teaching geometry, there could be some differences in students' achievement result. Therefore, this study is mainly aimed to investigate the achievement differences in geometry between students who are taught by using indirect instruction and those who are taught by using direct instruction.

Aims

1. To investigate the achievement differences in geometry between Grade Six students who are taught by using indirect instruction and those who are taught by using direct instruction.
2. To give suggestions to improve teaching geometry based on the data obtained from the study.

Hypotheses

1. There is a significant difference in the achievement in geometry between students who are taught by using indirect instruction and those who are taught by using direct instruction.
2. There are significant differences in performing knowledge, comprehension, application and analysis level questions between students who are taught by using indirect instruction and those who are taught by using direct instruction.

Scope of the Study

- This study is geographically limited to Yankin and South Okkalapa Townships in Yangon City Development Area.
- No (1) Basic Education High School, Yankin and No (2) Basic Education High School, South Okkalapa are selected for this study.
- Participants in this study are Grade Six students from the selected schools in (2017 - 2018) Academic Year.
- This study is limited to the content area of Chapter (7), Area and Volume from Grade Six Mathematics Textbook Volume (II) prescribed by the Ministry of Education, Curriculum and Textbook Committee.

Definition of Key Terms

Direct Instruction: An instructional approach to teaching basic skills and sequential materials in which lessons are highly goal-directed and learning environments are tightly structured by the teacher (Arends, 2007).

Indirect Instruction: An instructional approach where a teacher plays a facilitator role with helping students to find out solutions by posing questions, guiding, indicating sources of information, sharing ideas and problems (Demoze, 2002).

Achievement in Geometry: The measure (scores) obtained on the geometry unit test constructed based on Bloom Taxonomy of Cognitive Domain.

Review of Related Literature

Theoretical Perspective of Learning

Behaviorism is a learning theory that only focuses on objectively observable behaviors and discounts any independent activities of the mind. Behavior theorists define learning as nothing more than acquisition of new behavior based on environmental conditions. They believe Learning is accomplished when a proper response is demonstrated following the presentation of a specific environmental stimulus.

Specific assumptions and principles of behaviorism in the teaching learning process are an emphasis on producing observable and measurable outcomes in students, pre-assessment of students to determine where instruction should begin, emphasis on mastering early steps before progressing to more complex level of performance and use of reinforcement to impact performance.

Constructivism is a theory of learning that equates learning with creating meaning from experience. Two permanent versions of constructivism are cognitive constructivism and social constructivism. Cognitive constructivist considered learning is the product of an internal cognitive activity and learners actively construct knowledge. Social constructivist viewed knowledge as the product of learning whereby individuals engage socially through conversations or shared problem-solving tasks and activities (Merriam, Caffarella & Baungartner, 2007, cited in Churchill, 2013).Constructivism puts the learner at the center of the educational stage. Constructivism asserts that knowledge cannot be handed from one person to another but must be constructed by each learner through interpreting and reinterpreting a constant flow of information. The learning environment encourages social networks and experiential opportunities where individuals are encouraged to make sense of information for themselves. In a constructivist classroom, the teachers build knowledge on students' prior knowledge and understanding, then carefully manage cues, penetrating questions, and instructional activities that challenge and extend the students' insight.

Bloom Taxonomy of Cognitive Domain

The taxonomy of educational objectives is a framework for classifying statements of what expect and intend students to learn as a result of instruction. Bloom Taxonomy of educational objectives has three domains: Cognitive domain (Knowledge), Effective domain (Attitude) and Psychomotor domain (Skill). Six major categories in the cognitive domain are knowledge, comprehension, application, analysis, synthesis and evaluation. The categories are ordered from simple to complex and lower to higher order types of thinking.

Knowledge is the ability to recognize and recall information. Comprehension includes the ability to translate or explain knowledge or information, to interpret it and to extrapolate it to new situations. Application is the ability to use the information. Once student can understand the information presumably they should be able to apply it. Analysis is the ability to divide the knowledge into component parts and see their relationships. According to Bloom, this skill includes analysis of elements, analysis of relationships and analysis of organizational principles. Synthesis is the ability to put the parts together to form new ideas. This level includes such skills as producing a unique communication, producing a plan or a proposed set of operations or deriving a set of abstract relations. The highest cognitive level of taxonomy, according to Bloom is Evaluation. This includes the ability to make judgment according to internal criteria and external criteria.

Importance of Mathematics

The American Heritage Dictionary of the English Language (2000) defines mathematics as the study of the measurement, properties, and relationships of quantities and sets, using numbers and symbols. Mathematics is a leading logical science upon other sciences like Chemistry, Physics, Biology and Geography and it encompasses number sense, estimation skills, ability to analyze data intelligently, knowledge of two and three dimensional geometry and knowledge of probability.

Geometry is the part of mathematics and the study of the relationships among points, lines, angle, surfaces and solids. Geometry can provide a more complete appreciation of the world and it plays a key role in the study of other areas of mathematics. Problem solving skill is one of the major reason for studying mathematics and geometry can develop that skill. The function of the teaching geometry is to systematize the information received by the pupils from the nature and practical works. The emphasis will be on the understanding of fundamental concepts and techniques. Therefore, the objective of teaching geometry is not to teach the students to know geometry but rather to lead them to think geometry.

Teaching Strategies for Direct Instruction

Direct instruction is basically teacher-centered that usually serves to address large group of students. In this model, facts, rules and action sequences are presented to students in the most direct way possible. Direct instruction usually takes place presentation and recitation format with explanations, examples and opportunities for practice and feedback are provided by the teacher.

According to Borich (2007), direct instruction has the following six teaching strategies.

- Daily Review and Checking the Previous Day’s Work
- Presenting and Structuring
- Guided Student Practice
- Feedback and Correctives
- Independent Practice
- Weekly and Monthly Review

Review and checking at the beginning of the lesson emphasizes the relationship between lessons, so the students remember previous knowledge and see new knowledge as a logical extension of content already mastered. Daily review and checking at the beginning of a lesson can be easily accomplished by instructing to correct each other’s homework at the beginning of class, by identifying especially difficult homework problems in a question and answer format, by sampling the understanding of a few students who are good indicators of the range of knowledge and by reviewing the task- relevant information necessary for the day’s lesson.

In Presenting and structuring, lesson must be served in small portions that are consistent with the previous knowledge, ability level and experience of the students. The key is to focus the material on one idea at a time and to present it so learners master one point before the teacher introduces the next point. Techniques for presenting and structuring new content include establishing part-whole relationship, identifying sequential relationship, finding combinations of relationship and drawing comparative relationship (Borich, 2014).

Guided students practice includes recalling from the structure of a lesson plan. The presentation of stimulus materials is followed by eliciting practice with the desired behavior. Prompting is an important part of eliciting the desirer behavior because it strengthens and builds learners' confidence by encouraging them to use some aspects of the answer that have already been given in formulating the correct response (Gagne et al., 1997, cited in Borich, 2014). Three kinds of prompting are verbal prompts, gestural prompts, physical prompts. Another guided students' practice is modeling. Modeling allows students to imitate from demonstration or infer from observation the behavior to be learned. Four processes need to occur for the learners to benefit from modeling are attention, retention, production and motivation (Borich, 2014).

Providing appropriate feedback and correctives involves knowing how to respond to answers. Rosenshine & Stevens (1986) advised some points to respond to answers: For a correct, quick and firm response, acknowledge the correct response and either ask another question of the same student or move on to another student. For correct but hesitate response, provide a reinforcing statement and restate the facts, rules or steps needed for the right answer. For an incorrect response due to careless, indicate that the response is incorrect and quickly move on to the next students without further comment. For incorrect response, that is due to lack of knowledge, engage the students in finding the correct response with hints, probes or related but similar questions (cited in Borich, 2007).

After the students have given the correct answers, the teacher continues the independence practice. The purpose of providing independence practice is to develop automatic responses in students. Teacher should circulate around the classroom while students are engaged in independence practice to provide feedback, ask questions and give brief explanations (Emmer et al., 2006, cited in Borich, 2007)

Weekly and monthly review is the sixth and final direct instruction strategy. Periodic review ensures that all task relevant information needed for future lessons and identified areas that require re-teaching of key facts, rules and sequences. Weekly and monthly reviews determine whether the pace is right or should be adjusted before covering too much content.

Teaching Strategies for Indirect Instruction

Indirect instruction is an instructional strategy that allows and encourages students to analyze their experience actively in the classroom to become self-directed and self- responsible for their own learning (Withall, 1987, cited in Demoze, 2002). Indirect instruction is more complex than direct instruction and classroom activities are less teacher-centered. This brings students' ideas and experiences into the lesson and lets students to evaluate their own responses.

According to Borich (2007), indirect instruction has the following seven teaching strategies.

- Content Organization
- Conceptual Movement: Induction and Deduction
- Using Examples and Nonexamples
- Using Questions
- Learners Experience and Use of Students Ideas
- Student Self-Evaluation
- Use of Group Discussion

According to indirect instruction, the lesson must be introduced with a framework or structure that organizes the content into meaningful parts. One way of providing this framework is to use advance organizers and these set the groundwork for focusing the lesson topics. Advanced organizers can be presented orally, charts and diagrams. An advance organizer gives learners a conceptual preview of what is to come and helps them store the content for retention and later use.

The next teaching strategy for indirect instructions is conceptual movement: induction and deduction. Induction is a form of reasoning used to draw a conclusion or make a generalization from specific instants (Stadler, 2011, cited in Borich, 2014). It is a process in which students observe specific facts and then generalize them to other circumstances. Deduction is reasoning that proceeds from principles or generalizations to their application in specific instances. The teaching of concepts with the indirect instructional models uses inductive and deductive thinking to develop initially crude and overtly restrictive concepts into more expansive and accurate understandings.

Providing examples and nonexamples helps to define the essential and nonessential attributes needed for making accurate generalizations. Examples represent the concept being taught by including the attribute essential for recognizing that concept. Nonexamples fail to represent the concept being taught by purposely. Borich (2014) stated that examples and nonexamples can be used by providing more than a single example and nonexample, by using examples that vary in ways that are important to the concept being defined, by including nonexamples that do not represent the important dimensions of concept and by explaining why nonexamples have some of the same characteristics as examples.

The fourth indirect instruction strategy is using questions. In indirect instruction, the role of questions is to guide students into discovering new dimensions of a problem or new ways of resolving a dilemma and not to get the correct answer quickly. Some uses of questions during indirect instruction include refocusing, presenting contradictions to be resolved, probing for deeper thought and responses, extending the discussion to new areas and passing responsibility to the class.

The use of students' ideas was considered the centerpiece of indirect instruction. Using students' ideas mean incorporating student experiences, points of view, feelings and problems into the lesson by making the student the primary point of reference. This approach is intended to heighten students' interest, organize content around student problems, tailor feedback to individual students and encourage positive attitudes and feelings toward the subject.

The sixth strategy for indirect instruction is to engage students in evaluating their own responses and thereby take responsibility for their own learning. One way to accomplish this is by allowing students to provide reasons for their answers so teacher and other students can suggest needed changes. The teacher's role is to maintain the momentum by offering hints or focusing statements that students can use to evaluate their previous responses.

A group discussion involves student exchanges with successive interactions among a large number of students. During these exchanges, teachers may intervene only occasionally to review, summarize and evaluate each group's progress and redirect the discussion when necessary. Teacher tasks are orienting students to the objective of the discussion, providing new or more accurate information when needed, reviewing, summarizing and relating opinions and facts, redirecting the flow of information and ideas back to the objective of the discussion and combining ideas and promote compromise to reach a conscious.

Method

Procedure

The design adopted in this study was one of the true experimental designs namely, the posttest only control group design. The sample students were selected randomly. The students were grouped randomly for experimental group and control group. In both schools, the experimental groups were taught by using indirect instruction and control groups were taught by using direct instruction. Learning materials were selected from chapter (7), Area and Volume, Grade Six Mathematics Textbook Volume (II). Lesson plans and posttest were validated by (5) expert teachers. To establish the reliability of the instruments, a pilot study was conducted for one week at No (4), Basic Education High School, Kamaryut. Pilot data were analyzed by using Cronbach's Coefficient Alpha and got the reliability level of (0.702).

The allocated time for posttest was (45) minutes and total score was (25) marks. Posttest data were analyzed by using independent samples *t*- test.

Subject

All participants in this study were Grade Six students. Two Basic Education High Schools were randomly selected from Yangon City Development Area. In each school, (60) students were also selected by using simple random sampling method from the population. The selected students were grouped randomly such as experimental group and control group.

Table 1 Population and Sample Size

No	Township	School	Population	Number of Students		
				Experimental Group	Control Group	Total
1	Yankin	BEHS(1)	165	30	30	60
2	South Okkalapa	BEHS (2)	277	30	30	60

Note: BEHS= Basic Education High Schoool

Instrumentation

In order to study the achievement differences in geometry, a posttest was developed. There were two sections in posttest and total score was (25) marks and time allocation was (45) minutes. Level of items was based on the four levels of Bloom Taxonomy: knowledge, comprehension, application and analysis. Lesson plans for direct instruction and indirect instruction were developed by using the seven stages: Gaining attention, informing the objectives, stimulating the recall of perquisite learning, presenting the stimulus material, eliciting the desired behavior, providing the feedback and assessing the behavior (Borich, 2014) (see Appendix A & B).

Data Analysis

The data obtained from posttest were analyzed by using the independent samples *t*-test to compare the mean differences between the experimental and control groups.

Findings

The findings of experimental groups and control groups are as follows.

Table 2 *t*-Values for Posttest Score on Students' Achievement in Geometry

School	Group	N	M	SD	MD	*T*	*df*	Sig.
S1	Experimental	30	19.90	2.74	3.63	4.567	58	.000***
	Control	30	16.27	3.39				
S2	Experimental	30	20.03	3.49	4.20	5.067	58	.000***
	Control	30	15.83	2.82				

Note: ****p* < .001 S1 = BEHS (1) Yankin S2 = BEHS (2) South Okkalapa

The results showed that the mean scores of experimental groups were significantly higher than the mean scores of control groups in two selected schools. It indicated that there was a significant difference between the experimental and control groups on students' achievement in geometry in both schools.

Table 3 *t* -Values for Posttest Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig.
S1	Experimental	30	2.80	0.40	0.17	1.433	58	.157 (ns)
	Control	30	2.63	0.49				
S2	Experimental	30	2.67	0.47	0.07	0.528	58	.599 (ns)
	Control	30	2.60	0.49				

Note: ns = no significant S1 = BEHS (1) Yankin S2 = BEHS (2) South Okkalapa

The mean scores of experimental groups were slightly higher than the control groups. It indicated that there was no significant difference between the experimental groups and control groups in performing knowledge level questions in both selected schools.

Table 4 *t* -Values for Posttest Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig.
S1	Experimental	30	2.97	0.61	0.24	1.381	58	.173 (ns)
	Control	30	2.73	0.69				
S2	Experimental	30	3.10	0.75	0.33	1.637	58	.107 (ns)
	Control	30	2.77	0.81				

Note: ns = no significant S1 = BEHS (1) Yankin S2 = BEHS (2) South Okkalapa

The mean scores of experimental groups were not much higher than the control groups. It showed that there was no significant difference between the experimental groups and control groups in performing comprehension level questions in each selected schools.

Table 5 *t* -Values for Posttest Scores on Application Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig.
S1	Experimental	30	7.93	1.17	1.03	2.799	58	.007**
	Control	30	6.90	1.64				
S2	Experimental	30	7.53	1.40	1.19	3.045	58	.004**
	Control	30	6.34	1.58				

Note: ***p* < .01 S1 = BEHS (1) Yankin S2 = BEHS (2) South Okkalapa

The mean scores of experimental groups were higher than the control groups. It showed that there was a significant difference between the experimental groups and control groups in performing application level questions in both schools.

Table 6 *t* -Values for Posttest Scores on Analysis Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig.
S1	Experimental	30	6.20	1.69	2.20	5.024	58	.000***
	Control	30	4.00	1.70				
S2	Experimental	30	6.73	2.01	2.50	5.668	58	.000***
	Control	30	4.23	1.33				

Note: ***$p < .001$ S1 = BEHS (1) Yankin S2 = BEHS (2) South Okkalapa

At the analysis level, the mean scores of experimental groups were quite higher than the control group. It was found that there was a significant difference between the experimental group and control group in performing analysis level questions in both schools.

Summary of Quantitative Findings

- There was a significant difference in the achievement in geometry between students who were taught by using indirect instruction and those who were taught by using direct instruction.
- There was no significant difference in performing knowledge and comprehension level questions between students who were taught by using indirect instruction and those who were taught by using direct instruction.
- There was a significant difference in performing application level questions between students who were taught by using indirect instruction and those who were taught by using direct instruction.
- There was a significant difference in performing analysis level questions between students who were taught by using indirect instruction and those who were taught by using direct instruction.

According to the summary of the quantitative findings from this study, the application and analysis level questions can be used to perform for the different achievement.

Discussion

Different teaching methods draw attention to different learning outcomes (Vygotsky, 2002, cited in Mawlese, 2014). This study provided support for this view. According to the results, there was a significant difference on the overall mean scores between the experimental groups and control groups in each selected school. This finding pointed out that using indirect instruction is significantly better on students' achievement in geometry than using direct instruction. This finding is consistent with Jahr (2011) who found that the indirect instruction stresses the importance of student involvement and student centered learning and can promote more achievement result than the direct instruction.

At the comparison of mean scores on knowledge level and comprehension levels, there were no significant differences between the experimental groups and control groups in both schools. The result showed that not only indirect instruction but also direct instruction could bring the same achievement result in performing knowledge and comprehension level questions. This result supports the findings of Rosenshine (1997) who found that direct instruction strategies are among those that correlate highest with student achievement as measured by tests, which tend to emphasize facts, rules and sequences (cited in Borich, 2014).

Concerning the application level, the comparison of mean scores between experimental groups and control groups in both schools pointed out that there was a significant difference between two groups in performing application level questions. This finding is not consistent with Borich (2007) who found that learning at the lower level of cognitive domain (knowledge, comprehension, application) relies heavily on direct instruction.

For the comparison of analysis level, the finding showed that the mean sores of experimental group was significantly higher than the control group in both schools. This result indicated that the use of indirect instruction could encourage more achievement result and higher order thinking ability than the direct instruction. This finding is consistent with Borich (2007) who pointed out that direct instruction is applied in the context of lower level skills (knowledge, comprehension, application) and the teaching functions associated with indirect instruction are best suited in the context of higher level skills (analysis, synthesis, evaluation) objectives.

Geometry is a network of concepts, ways of reasoning and representation systems used to explore and analyze shape and spaces (Battista, 2007, cited in Walle, 2013). Therefore, geometry teaching should focus on how to think and investigate the geometric concepts. According to the result of the research, it can be concluded that indirect instruction can provide more achievement result in geometry than direct instruction. Therefore, teacher should use indirect instruction in teaching geometry to promote students' higher order thinking skills.

In indirect instruction, teacher should consider specific time allocation for each stage of the lesson since lesson planning. In group discussion, teacher should be ensured that students have solid background of information before conducting discussion. Before giving group work, teacher should explain the activity by using short and clear instruction. After giving instruction, teacher should use instruction check questions (ICQ) to check students' understanding what they are going to do. By doing this, teacher could save the time and group work could be done within the time limit. In addition, teacher should not allocate resources before giving instruction what students are going to do. While students are doing group work, teacher should monitor the group works and take the role of facilitator. Sometimes, students are difficult to get the generalization in group discussion within the time limit. At that time teacher should change the role of moderator and orient students to the objective of the discussion, provide more accurate information where needed. In addition, teacher should review, summarize the opinions and facts into meaningful relationship and adjust the flow of information and ideas.

Sometimes, students need to be familiar with basic skills to be able to find concepts, pattern and abstraction. Direct instruction is useful to give the basic knowledge of the lesson within the limited period. Thus, teacher should not exclude the direct instruction. While using direct instruction, teacher should begin the lesson with a short review of previous prerequisite learning. Scaffolding lesson should be presented with detail instruction and explanations. Moreover, teacher should control the pace of the lesson, should provide systematic feedback and corrective.

Direct and indirect instructions have proven to be the most commonly accepted and best approaches to teaching geometry. Both methods have their respective advantages. Therefore, in teaching geometry, teacher should adjust using these two methods according to the time, space and circumstances.

Conclusion

The main purpose of this study is to investigate the achievement differences in geometry between Grade Six students who are taught by using indirect instruction and those who are taught by using direct instruction. Quantitative study was conducted to obtain the required data. The design adopted in this study was one of the true experimental designs, namely the posttest only control group design. After the experimental period, the independent samples *t*-test was used to compare the students' achievement result in geometry between experimental and control groups. The result showed that that there was a significant difference between the experimental and control groups on students' achievement in geometry in both schools. According to the result, teachers should use indirect instruction in teaching geometry to promote students' achievement result.

In the 21st century, an important goal of education is to develop individuals with high level of mathematical proficiency to support future participation in employment and citizenship (Battista, 2007, cited in Walle, 2013). Geometry teaching should focus on how to think and investigate the geometric concepts. Teaching of geometry should be dynamic and should be approached through meaningful explorations. Learning becomes more meaningful and challenging when each student explore, estimate, experiment, question and hypothesize through learner centered activities. Through direct instruction alone, students can learn how to perform tasks in a way that their instructor asks them to. If the education system truly wants all students to succeed, the students need to be taught how to solve problems with their own thoughts .Therefore, to be able to adapt in 21st century technology, mathematics teachers should give more emphasis on indirect instruction in teaching geometry.

Due to time limitation, this study was conducted about two weeks in two sample schools from Yangon City Development Area and based on only one content area of geometry in Grade Six Mathematics Textbook Volume (II). Therefore, further studies should be carried out in different areas by taking longer duration and using wider content areas to recommend the result of this study.

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Appendix A

Sample Lesson Plan for Indirect Instruction

Sample Lesson Plan (1)

၁။ ဘာသာ – သင်္ချာ

၂။ အတန်း – ဆဋ္ဌမတန်း

၃။ သင်ခန်းစာခေါင်းစဉ် – အနားပြိုင်စတုဂံ၏ဧရိယာရှာခြင်း

၄။ အချိန် – ၄၅ မိနစ်

၅။ သင်ယူမှုဦးတည်ချက်များ

(က) အနားပြိုင်စတုဂံ၏အခြေနှင့်အမြင့်ကိုခွဲခြားတတ်ရန်။

(ခ) အနားပြိုင်စတုဂံ၏ဧရိယာပုံသေနည်းကိုဖော်ထုတ်တတ်ရန်။

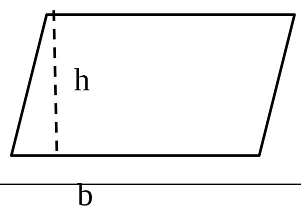
(ဂ) ပုံသေနည်းကိုအသုံးပြု၍အနားပြိုင်စတုဂံ၏ဧရိယာကိုတွက်ထုတ်တတ်ရန်။

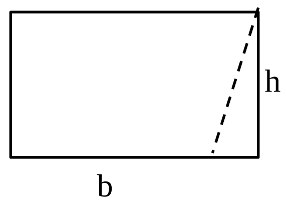
၆။ သင်ထောက်ကူပစ္စည်းများ

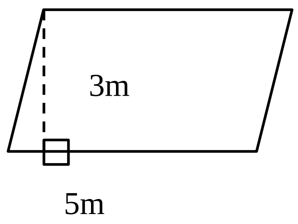
ရောင်စုံစာရွက်၊ ပေတံ၊ ကော်၊ ခဲတံ၊ကတ်ကြေး၊ သင်ပုန်း၊လုပ်ငန်းပေးစာရွက်၊ ရောင်စုံဆော့ပင်၊ ပြဋ္ဌာန်းစာအုပ်။

၇။ သင်ကြားသင်ယူမှုလုပ်ငန်းအဆင့်ဆင့်

လုပ်ငန်းစဉ်	**ဆရာ၏လုပ်ငန်း**	**ကျောင်းသား၏လုပ်ငန်း**	**အချိန်**
နိဒါန်းပျိုးခြင်း (Gaining Attention)	–အောက်ပါမေးခွန်းများကိုမေးမြန်းခြင်းဖြင့်သင်ခန်းစာကိုနိဒါန်းပျိုးပါမည်။ –ဧရိယာကိုမည်သို့နားလည်ပါသနည်း။ –သင်ပုန်း၏ဧရိယာကိုမည်သို့ရှာမည်နည်း။ (တစ်ဦးချင်းစဉ်းစားစေမည်၊ နှစ်ယောက်တွဲဆွေးနွေးစေမည်။အတန်းကိုပြန်လည်ဝေမျှစေမည်)	–တစ်ဦးချင်းစဉ်းစားသည် နှစ်ယောက်တွဲဆွေးနွေးသည်။ –အတန်းကိုပြန်လည်ဝေမျှသည်။ –ဧရိယာသည်မျက်နှာပြင်အကျယ်ဖြစ်သည်။ –သင်ပုန်းဧရိယာကိုအလျား× အနံဖြင့်ရှာနိုင်သည်။	၃ မိနစ်
သင်ယူမှုဦးတည်ချက်ကိုအသိပေးခြင်း (Informing the Objectives)	–သင်ကြားမည့်သင်ခန်းစာခေါင်းစဉ်ကိုပြောကြား၍သင်ပုန်းပေါ်တွင်ရေးသားပါမည်။ –သင်ယူမှုဦးတည်ချက်ရေးသားထားသောစာရွက်ကိုသင်ပုန်းထောင့်တွင်ကပ်ပါမည်။	–ကျောင်းသားများကြည့်ရှုလေ့လာပါမည်။	၂ မိနစ်
အခြေခံအသိသညာကို	–သင်ပုန်းပေါ်တွင်တြိဂံပုံနှင့်အနားပြိုင်စတုဂံပုံကိုဆွဲသားပါမည်။		၅ မိနစ်

လုပ်ငန်းစဉ်	**ဆရာ၏လုပ်ငန်း**	**ကျောင်းသား၏လုပ်ငန်း**	**အချိန်**
စစ်ဆေးခြင်း (Stimulating the Recall of Prerequisite Learning	–တြိဂံ၏အခြေနှင့်အမြင့်သတ်မှတ်ပုံ –အနားပြိုင်စတုဂံ၏ဂုဏ်သတ္တိများကို မေးမြန်းပါမည်။	–ကျောင်းသားများအဖြေ များကို ပြောကြား ပါသည်။	
သင်ကြား သင်ယူမှု လုပ်ငန်းစဉ် (Presenting the Stimulus Material)	(တစ်ဖွဲ့လျှင်၅ယောက်ဖြင့်အုပ်စုဖွဲ့ပါမည်) – အနားပြိုင်စတုဂံများပါသောလုပ်ငန်းပေး စာရွက်ကိုအုပ်စုအသီးသီးကိုဝေမျှပါမည်။ – အုပ်စုတွင်းဆွေးနွေးတိုင်ပင်စေမည်။ ပုံများကိုလေ့လာစေ၍အနားပြိုင်စတုဂံ၏ အခြေနှင့်အမြင့်သတ်မှတ်ပုံကိုဖော်ထုတ် စေမည်။ (ကျောင်းသားများဆွေးနွေးနေစဉ် အဖွဲ့တွင်း လှည့်လည်ကြည့်ရှု၍လိုအပ်ချက်များကို ပံ့ပိုးကူညီမည်) –တွေ့ရှိချက်ကိုတင်ပြစေမည်။ –လက်တွေ့လုပ်ငန်းဆောင်ရွက်ရန် အောက်ပါပစ္စည်းများကိုဝေပေးသည်။ (ရောင်စုံစာရွက်၊ပေတံ၊ကော်၊ခဲတံ၊ ကတ်ကြေး) –အောက်ပါလုပ်ငန်းများကိုလွယ်ကူချော မွေ့စွာဆောင်ရွက်နိုင်ရန်လိုအပ်သည် များကိုကူညီပံ့ပိုးမှုများပြုလုပ်မည်။	–အုပ်စုဖွဲ့သည်။ –လုပ်ငန်းပေးစာရွက် များကိုလက်ခံသည်။ –အုပ်စုတွင်းဆွေးနွေးသည်။ ပုံများကိုလေ့လာသည်။ (အောက်ပါအချက်များကို ဖော်ထုတ်သည်) –အနားပြိုင်စတုဂံတွင် အနားလေးနားရသည်။ –အနားအားလုံးအခြေ ဖြစ် နိုင်သည်။ –အနားတစ်ဖက်မှ မျက်နှာချင်းဆိုင် အနားပေါ်သို့ထောင့်မတ ကျဆွဲသောမျဉ်းသည် အမြင့်မျဉ်း၊ –တွေ့ရှိချက်ကိုတင်ပြသည်။ –ကျောင်းသားများ လက်တွေ့လုပ်ငန်း လုပ်ဆောင်ပါ သည်။ 	၁၀ မိနစ်

လုပ်ငန်းစဉ်	ဆရာ၏လုပ်ငန်း	ကျောင်းသား၏လုပ်ငန်း	အချိန်
	(စာရွက်ပေါ်တွင်အနားပြိုင်စတုဂံဆွဲရန်၊ အမြင့်မျဉ်းကိုဆွဲရန်၊အမြင့်မျဉ်း တစ်လျှောက်ကတ်ကြေးဖြင့်ညှပ်ရန်၊ ဖြတ်ထားသောအပိုင်းကိုအနားပြိုင် စတုဂံ၏တစ်ဖက်တွင်ကပ်ရန်) – အနားပြိုင်စတုဂံ၏ပုံစံမည်သို့ပြောင်းလဲ သည်ကိုလေ့လာစေ၍ထိုပုံမှတဆင့် ဧရိယာရှာသောပုံသေနည်းကိုဖော်ထုတ် စေမည်။ (ကျောင်းသားများဆွေးနွေးနေစဉ်အဖွဲ့တွင်း လှည့်လည်ကြည့်ရှု၍လိုအပ်ချက်များကို ပံ့ပိုးကူညီမည်) –အုပ်စုလုပ်ငန်းကိုတင်ပြစေမည်။ –အောက်ပါဥပမာပုစ္ဆာကိုကျောင်းသား များအားမည်သို့တွက်မည်ကိုစဉ်းစား စေမည်။	 –အနားပြိုင်စတုဂံနှင့် ထောင့်မှန်စတုဂံကို နှိုင်းယှဉ်၍ အနားပြိုင် စတုဂံ၏ဧရိယာ ပုံသေ နည်းကိုဖော်ထုတ်မည်။ အနားပြိုင်စတုဂံဧရိယာ= ထောင့်မှန်စတုဂံ ဧရိယာ ထောင့်မှန်စတုဂံအလျား= အနားပြိုင်စတုဂံအခြေ ထောင့်မှန်စတုဂံအနံ= အနားပြိုင်စတုဂံအမြင့် ထောင့်မှန်စတုဂံဧရိယာ= အလျား × အနံ အနားပြိုင်စတုဂံဧရိယာ A = အခြေ × အမြင့် A = b x h –အုပ်စုလုပ်ငန်းကိုတင်ပြ ကြသည်။	၁၀ မိနစ်

လုပ်ငန်းစဉ်	**ဆရာ၏လုပ်ငန်း**	**ကျောင်းသား၏လုပ်ငန်း**	**အချိန်**
	–ပုံပါပေးထားချက်များအရအနားပြိုင်စတုဂံ၏ဧရိယာကိုရှာပါ။  –အဖြေကိုတင်ပြစေမည်။လိုအပ်ချက်ရှိပါက ဖြည့်စွက်ဆွေးနွေးပေးမည်။	–ကျောင်းသားများမည်သို့တွက်မည်ကိုဆွေးနွေး၍အဖြေရှာသည်။ b = 5m, h=3m A= b x h = 5x3 = 15 m^2 –အဖြေကိုတင်ပြသည်။	
အသိသညာရရှိမှုအခြေအနေကိုဖော်ထုတ်ခြင်း (Eliciting the Desired Behavior)	–လုပ်ငန်းပေးစာရွက်ကိုအုပ်စုများကိုဝေမည်။ –စာရွက်တွင်ရှိသောပုစ္ဆာများကိုအုပ်စုတွင်းတိုင်ပင်၍တွက်စေမည်။ (ကျောင်းသားများပုစ္ဆာများကိုတွက်နေစဉ်အဖွဲ့တွင်းလှည့်လည်ကြည့်ရှု၍လိုအပ်ချက်များကိုပံ့ပိုးကူညီမည်)	–ကျောင်းသားများတိုင်ပင်ဆွေးနွေး၍ပုစ္ဆာများတွက်ကြသည်။	၅ မိနစ်
ကျောင်းသား၏လုပ်ဆောင်မှုကိုမှတ်ချက်ပေးခြင်း (Providing the Feedback)	–လုပ်ငန်းပေးစာရွက်များကိုအုပ်စုအချင်း ချင်းဖလှယ်စေမည်။ –သင်ပုန်းပေါ်တွင်ရေးသားထားသောအဖြေများနှင့်တိုက်ဆိုင်၍စစ်ဆေးစေမည်။ –ထူးခြားချက်များ၊မတူညီမှုများရှိပါကတင်ပြစေမည်။ (အပြုသဘောဆောင်သောမှတ်ချက်များပေးမည်)	–လုပ်ငန်းပေးစာရွက်များကိုအုပ်စုအချင်းချင်းဖလှယ်သည်။ –အဖြေများကိုစစ်ဆေး သည်။ –ရှင်းလင်းမှုမရှိသောအချက်များကိုတင်ပြသည်။	၅ မိနစ်
တတ်မြောက်မှုစစ်ဆေးခြင်း (Assessing the Behavior)	–အောက်ပါမေးခွန်းများကိုမေးပါမည်။ –အနားပြိုင်စတုဂံတွင်အခြေနှင့်အမြင့်ကိုမည်သို့ခွဲခြားသနည်း။ –အနားပြိုင်စတုဂံ၏ဧရိယာပုံသေနည်းမှာအဘယ်နည်း။ (ကျွမ်းကျင်မှုအတွက်လေ့ကျင့်ရန်ပြဋ္ဌာန်းစာအုပ်မှပုစ္ဆာအချို့ကိုတွက်စေမည်)	–ကျောင်းသားများအဖြေများကိုပေးကြသည်။	၅ မိနစ်

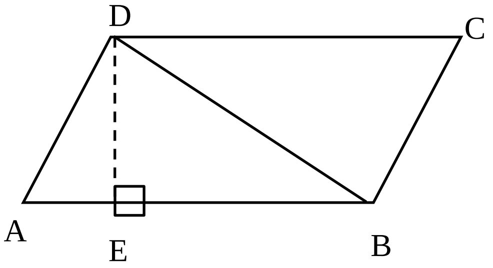
Appendix B

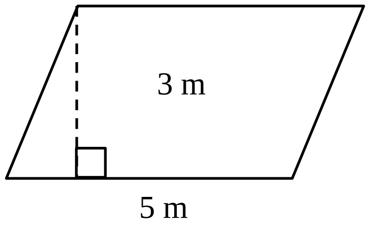
Sample Lesson Plan for Direct Instruction

Sample Lesson Plan (1)

၁။ ဘာသာ – သင်္ချာ
၂။ အတန်း – ဆဌမတန်း
၃။ သင်ခန်းစာခေါင်းစဉ် – အနားပြိုင်စတုဂံ၏ဧရိယာရှာခြင်း
၄။ အချိန် – ၄၅ မိနစ်
၅။ သင်ယူမှုဦးတည်ချက်များ
(က) အနားပြိုင်စတုဂံ၏အခြေနှင့်အမြင့်ကိုခွဲခြားတတ်ရန်။
(ခ) အနားပြိုင်စတုဂံ၏ဧရိယာပုံသေနည်းကိုဖော်ထုတ်တတ်ရန်။
(ဂ) ပုံသေနည်းကိုအသုံးပြု၍အနားပြိုင်စတုဂံ၏ဧရိယာကိုတွက်ထုတ်တတ်ရန်။
၆။ သင်ထောက်ကူပစ္စည်းများ
ကားချပ်၊ သင်ပုန်း၊ ပြဌာန်းစာအုပ်။
၇။ သင်ကြားသင်ယူမှုလုပ်ငန်းအဆင့်ဆင့်

လုပ်ငန်းစဉ်	ဆရာ၏လုပ်ငန်း	ကျောင်းသား၏လုပ်ငန်း	အချိန်
နိဒါန်းပျိုးခြင်း (Gaining Attention)	–သင်ပုန်းပေါ်တွင်အနားပြိုင်စတုဂံပုံကိုဆွဲ၍ ၎င်း၏ဂုဏ်သတ္တိများကိုမေးမြန်းခြင်း ဖြင့်နိဒါန်းပျိုးပါမည်။ (တင်ပြချက်များကိုသင်ပုန်းမှတ်ချက် ရေးသားသည်)	–ကျောင်းသားများ အဖြေများပေးသည်။ (မျက်နှာချင်းဆိုင်အနား တစ်စုံပြိုင်သည်၊ ထောင့်ဖြတ်မျဉ်းများ ထောင့်မတ်ကျသည်။ ပြိုင်နေသော မျဉ်းနှစ်ခု ကြားအကွာအဝေး တူသည်)	၃ မိနစ်
သင်ယူမှု ဦးတည်ချက်ကို အသိပေးခြင်း (Informing the Objectives)	–သင်ကြားမည့်သင်ခန်းစာခေါင်းစဉ်ကို ပြောကြား၍သင်ပုန်းပေါ်တွင် ရေးသားပါမည်။ –သင်ယူမှုဦးတည်ချက်ရေးသားထားသော စာရွက်ကိုသင်ပုန်းထောင့်တွင် ကပ်ပါမည်။	–ကျောင်းသားများမှတ်စု စာအုပ်ထဲတွင်ခေါင်းစဉ် ကိုရေးသားကြမည်။	၂ မိနစ်
အခြေခံအသိ သညာကို စစ်ဆေးခြင်း	–တြိဂံ၏ဧရိယာရှာသောပုံသေနည်းကို မေးမည်။	–ကျောင်းသားများ အဖြေပေးမည်။	၅ မိနစ်

လုပ်ငန်းစဉ်	ဆရာ၏လုပ်ငန်း	ကျောင်းသား၏လုပ်ငန်း	အချိန်
(Stimulating the Recall of Prerequisite Learning)	(ပုံသေနည်းကိုသင်ပုန်းမှတ်ချက်ထား ရှိမည်)	A= ½ x အခြေ x အမြင့်	
သင်ကြား သင်ယူမှု လုပ်ငန်းစဉ် (Presenting the Stimulus Material)	–အနားပြိုင်စတုဂံပုံ လေးခု ပါဝင်သော ကားချပ်ကိုသင်ပုန်းတွင်ကပ်မည်။ –အနားပြိုင်စတုဂံ၏အခြေနှင့်အမြင့် သဘောကိုဆရာကရှင်းလင်းမည်။ (အနားပြိုင်စတုဂံ၏ အနားအားလုံးသည် အခြေဖြစ်နိုင်သည်။အနားတစ်ဖက်မှ မျက်နှာချင်းဆိုင်အနားပေါ်သို့ ထောင့်မတ်ကျဆွဲသောမျဉ်းသည် အမြင့်မျဉ်းဖြစ်မည်) –သင်ပုန်းပေါ်တွင်အနားပြိုင်စတုဂံ ဆွဲသား၍ဧရိယာပုံသေနည်းဖော်ထုတ် ပုံကိုအဆင့်ဆင့်ရှင်းလင်းသင်ကြားမည။  အနားပြိုင်စတုဂံ ABCD ၏ဧရိယာ = ΔABD ဧရိယာ + ΔBCD ဧရိယာ = $2\Delta ABD$ ဧရိယာ = $2x \frac{1}{2} bh$ စတုရန်းယူနစ် $\boxed{A = b \times h}$ – မှတ်စုစာအုပ်တွင်ရေးသားရန် ညွှန်ကြားသည်။ –သင်ပုန်းပေါ်တွင်ပုစ္ဆာတစ်ပုဒ်ကိုရေး၍ ဧရိယာ တန်ဖိုးရရန်တွက်ပုံအဆင့်ဆင့်ကို ရှင်းမည်။	–ဆရာ၏ရှင်းလင်းမှုကို နားထောင်မှတ်သားသည်။ –ကျောင်းသားများရှင်းပြ ချက်ကိုသေချာစွာ နားထောင်သည်။ –အနားပြိုင်စတုဂံပုံ ဆွဲသည်။ ပုံသေနည်းတွက်ပုံ အဆင့်ဆင့်ကို ရေးမှတ်သည်။	၁၀ မိနစ် ၁၀ မိနစ်

လုပ်ငန်းစဉ်	ဆရာ၏လုပ်ငန်း	ကျောင်းသား၏လုပ်ငန်း	အချိန်
	 b = 5m, h=3m $A= b \times h = 5 \times 3 = 15\ m^2$	–ပုစ္ဆာကိုလေ့လာသည်။ –ရှင်းလင်းချက်ကို နားထောင်သည်။ –မှတ်စုစာအုပ်ထဲတွင် ရေးသားသည်။	
အသိသညာ ရရှိမှု အခြေအနေကို ဖော်ထုတ် ခြင်း (Eliciting the Desired Behavior	– အောက်ပါပုစ္ဆာကိုဖြေရှင်းစေမည်။ (အနားပြိုင်စတုဂံ ABCDတွင် CD= 5m ဖြစ်၍ ABနှင့် CDတို့ကြားအကွာအဝေး သည် 3mဖြစ်လျှင်အနားပြိုင်စတုဂံ၏ ဧရိယာကိုရှာပါ) – ပုစ္ဆာကိုဖတ်စေမည်။ – ပုစ္ဆာ၏ပေးချက်၊ မေးချက်များကိုမေးမည်။ မည်ကဲ့သို့ပုံဆွဲရမည်ကိုမေးမည်။ (ကျောင်းသားများပုစ္ဆာများကိုတွက်နေစဉ် အတန်းတွင်းတွင်လှည့်လည်ကြည့်ရှု၍ လိုအပ်ချက်များကိုလမ်းညွှန်မည်)	–ကျောင်းသားများပုစ္ဆာကို ဖတ်သည်။ –ပေးချက်၊မေးချက်များကို ပြောကြားသည်။ –ပုံဆွဲ၍အဖြေကိုရရန် တွက်သည်။	၅ မိနစ်
ကျောင်းသား၏ လုပ်ဆောင်မှုကို မှတ်ချက်ပေး ခြင်း (Providing the Feedback)	–ပုစ္ဆာ၏အဖြေကိုမေးမည်။ –ထူးခြားချက်များ၊မတူညီမှုများရှိပါက ဆရာမှရှင်းပြမည်။ (အပြုသဘောဆောင်သောမှတ်ချက်များ ပေးမည်)	–ကျောင်းသားများအဖြေကို တင်ပြသည်။ –မရှင်းလင်းသောအချက် များကိုမေးသည်။	၅ မိနစ်
တတ်မြောက်မှု စစ်ဆေးခြင်း (Assessing the Behavior)	–အောက်ပါမေးခွန်းများကိုမေးပါမည်။ –အနားပြိုင်စတုဂံတွင်အခြေနှင့်အမြင့်ကို မည်သို့ခွဲခြားသနည်း။ –အနားပြိုင်စတုဂံ၏ဧရိယာပုံသေနည်းမှာ အဘယ်နည်း။ (ကျွမ်းကျင်မှုအတွက်လေ့ကျင့်ရန် ပြဋ္ဌာန်း စာအုပ်မှပုစ္ဆာအချို့ကိုတွက်စေမည်)	–ကျောင်းသားများအဖြေ များကိုပေးကြသည်။	၅ မိနစ်

A STUDY OF SCIENCE PROCESS SKILLS AND ACHIEVEMENT OF STUDENTS IN SCIENCE AT THE MIDDLE SCHOOL LEVEL

Thin Thin Htike[1], Khin Mu Mu Han[2]

Abstract

The main purpose of this study was to investigate the science achievement of students who are taught with science process skills at the middle school level. This study was conducted with quantitative research method. The experimental design adopted in this study was a true experimental design, namely, posttest only control group design. This study was conducted in Yangon Region. The sample schools for this study were selected by using a random sampling method. Two high schools were selected from two different districts, Yangon Region. The subjects were Grade Seven students selected from No. (1) BEHS Latha and No. (4) BEHS Pazundaung. The reliability of instruments was calculated through a pilot testing with (30) Grade Seven students. The internal consistency (Cronbach's Alpha) of the students' achievement test was (.743). For this study, (120) Grade Seven students were selected from both schools by random sampling method. These students were divided into two groups: control and experimental. The experimental group was treated with science process skills and the control group was taught with formal instruction. After that, a posttest was administered to two groups. Independent samples t-test was used to test whether there was significant difference between these two groups. Examination of the means and t-test at No. (1) BEHS Latha (t=10.51, df = 58, MD=9.10, p=.000) and No. (4) BEHS Pazundaung (t=14.95, df=58, MD=10.70, p=.000) indicated that students who were taught by science process skills demonstrated significantly better than those who were taught with formal instruction. Research findings proved that science process skills has positive contribution to the science teaching at the middle school level.

Keywords: Science Process Skills, Achievement

Introduction

Science is simultaneously a kind of knowledge and a way of gaining and using that knowledge. Indeed science is both product and process, inseparably joined. Science has made a tremendous impact on the life of the present day society which is a product of science. The thinking, feeling and actions of a modern man are practically guided by the effects of science. There is an involvement of science, direct or indirect, in all works as well as leisure of a modern man. The habits and attitudes have also been affected by science. Science affects the behavior of the learner and enriches his character and personality. It also offers the opportunities for creative thinking and constructive imagination.

Science is the system of knowing about the universe. The impact of science is evident in agriculture, industry, health, modern civilization, democracy etc. Science looks for different kinds of pattern and relationship in our universe. Nowadays children undergo the explosion of information and they need to learn more to adapt the complex changing world. They also need to learn by themselves and the role of teachers and parents is to facilitate in the learning process of the children and to train them to become self-directed learners. To develop such habits, students must possess science process skills. According to Johnston (2009, cited in Maranan, 2017), science process skills are significant in improving students' cognitive development and facilitating students' active participation during the teaching and learning process.

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Statement of the Problem

The science process skills constitute a general definition of the logical and rational thought that are used throughout lifetime (Aydogdu & Kesercioglu, 2005, cited in Feyzioglu, 2009). Studies aiming to equip students with science process skills have concluded that students acquire each science process skills through certain stages (Saat, 2004, cited in Feyzioglu, 2009). These stages have been identified as recognition of scientific process, making habits, and automation.

These skills can be gained by students through certain science education activities (Harlen, 1999). Students equipped with science process skills tend to achieve higher than students with low process skills. This is because such students tend to reason intelligently and tackle problem situations more efficiently leading to higher achievement. Students who are able to make use of formal thought are also able to solve problems beyond the capabilities of those who did not possess modes of reasoning.

Purposes of the Study

The general purpose of this study is to investigate the science achievement of students who are taught with science process skills at the middle school level. The specific objectives are as follows.

- To compare science achievement of the students who are taught with science process skills and those who are not taught with science process skills.
- To provide suggestions for improving science teaching learning situation.

Research Hypotheses

(1) There is a significant difference in the achievement of science between students who receive science process skills and those who do not receive.

(2) There is a significant difference between the achievement of students who receive science process skills and those who do not receive in performing the knowledge level questions.

(3) There is a significant difference between the achievement of students who receive science process skills and those who do not receive in performing the comprehension level questions.

(4) There is a significant difference between the achievement of students who receive science process skills and those who do not receive in performing the application level questions.

Scope of the Study

This research has its own particular limitations. The first limitation is related to the fact that the participants of the study are from only two selected schools from Yangon Region. Participants in this study are Grade Seven students from the selected schools within the school year (2018-2019). The second limitation is that this study is only concerned with the science process skills of the Grade Seven students. The third limitation is the content area of chapter (5) from Grade Seven General Science Textbook prescribed by the Basic Education Curriculum, Syllabus and Textbook Committee, 2018-2019.

Definition of Key Terms

Science Process Skills

Science process skills are the tools that students use to investigate the world around them and to construct science concepts (Oxford Encylopaedia Science Dictionary).

Achievement

Achievement is a thing that somebody has done successfully, especially using their own effort and skill (Oxford Encylopaedia Science Dictionary).

Significance of the Study

In line with the development of new science curricula in Myanmar, it is necessary for all science teachers to have a firm understanding of the nature of science and be abreast of the current educational advances affecting the society every day. The purpose of science education is to provide experiences through which young children can acquire the knowledge, skills, and attitudes that lead to patterns of behavior acceptable to the society. Science teachers need to be willing to help their students develop science process skills as well as provide scientific technological knowledge.

Teaching science only through note taking and memorization cannot get students achieve science concepts. Teaching with science process skills is an appropriate approach for elementary and middle school teachers. Science process skills approach not only allows students to be an active participants in the learning process but also forces them to take an active role by engaging them in a meaningful thought provoking way. Science process skills are based on real life situations and such skills lead students develop self-confidence to solve problems that they might face in everyday activities.

Teaching science through science process skills provide students with experiences that help them attain positive attitudes toward science. If teachers are knowledgeable about the science process skills, their students will gain appropriate and effective skill instruction. These science process skills are vital for science learning and concept formation at the primary and middle school levels. The National Science Teacher Association (NSTA, 2002) states that teachers should create learning situations that focus on inquiry and the process skills to enhance students' learning.

Therefore, a research for studying the science process skills and the science achievement of students at the middle school level is necessary.

Theoretical Framework

Importance of Science Process Skills

Skills refer to specific activities or tasks that a student can proficiently do. Skills can be clustered together to form specific competencies. To be competent in the scientific knowledge, learners must use science process skills because they are ways of the acquisition of such knowledge. Ways of thinking in science are also called the process skills. Science process skills include the skills of each individual that are used in daily life which can improve the quality and standard of life by understanding the nature of science. Science process skills are process thinking skills using scientific processes and approaches (Rezba, Sprague & Fiel, 2002).

Learning science from cradle to adulthood begins with the development of science process skills. This is because science process skills serves as instrument that encourages the learner to perform the kinds of tasks that would lead him/her to reflective thinking and discovery knowledge. When science process skills are emphasized in the classroom, students' proficiency on individual skills increases, some skills are transferred to new situations, and the skills are retained over time (Padilla, 1990). Padilla suggests that basic science process skills provide a foundation for more complex science process skills. The development of science process skills in students provides essential components for the development of the general goals of education (Gbamanja, 2002, cited in Joseph, et., al., 2017).

The development of SPSs enables students to acquire the skills necessary to solve everyday problems (Aydogdu et al., 2014, cited in Rauf, et.,al., 2013). If these skills are not well developed, relevant evidence is not collected. According to karamustafaoglu (2011, cited in Maranan, 2017), understanding of science process usually refer to skills or abilities that must be owned by the scientists on the process of scientific discovery. The processes of science are basic components of thinking and are useful in problem solving and critical thinking, not only in science but also in day-to-day life situations.

Advantages of Science Process Skills

1. It develops skills in the learner which he or she could use in solving everyday problem.
2. It is activity-oriented, learner-centered and encourages maximum student participation in the learning activities.
3. It is motivating and increases students' interest in their activities.
4. Students tend to develop the scientific method of thinking in the learning process.
5. It facilitates concept formation emanating from primary experiences which the learner will encounter in the skills acquisition process.
6. It also encourages the development of skills which are the general attributes of scientists which students must emulate.

Disadvantages of Science Process Skills

1. Other non-science disciplines do not seem to benefit much from this approach since it is scientifically oriented.
2. The planning of the activities to facilitate skill developing among students could be time consuming and expensive in terms of material resources required.

Research Methodology

Research Design

The research design used for this study was a true experimental design.

Procedure for the Study

The researcher sought out the literature related to this study through books and Internet sources. After that, lesson plans and an achievement test were constructed for this study. Validation for instruments were determined by the expert judgments. According to their suggestions, test items were modified again and its marking scheme was also presented. After getting the validity of these instruments, pilot study was conducted. The pilot study was conducted in Basic Education High School, Kawhmu in November, 2018. After the pilot study, the experiment was conducted in No (1), Basic Education High School, Latha and No (4), Basic Education High School, Pazundaung.

The sample students were selected in random. The students were grouped randomly for control and experimental group. And then the experimental group learned through science process skills and the control group received the formal instruction. Finally, the achievements of experimental and control group were compared by using the independent samples '*t*' test.

Instruments

In this study, lesson plans and an achievement test for Grade Seven students were used as instruments.

(a) Lesson Plan

The format of lesson plan was based on the five basic science process skills described by Padilla, (1990). They are observing, communicating, classifying, inferring and predicting. The learning materials are the lessons from Chapter (5) "The Earth and Space". Extended materials were pictures, models and the things in the school compounds.

(b) Achievement Test

The posttest (achievement test) were developed based on the chapter (5) The Earth and Space in Grade Seven General Science Textbook prescribed by the basic education curriculum, syllabus and textbook committee. A table of specifications was drawn up for the posttest in order to facilitate the crafting of test questions. The items used for the posttest were composed of (5) true/false items, (5) completion items, (5) multiple choice items, (5) matching items and (5) short question items. The allocated time for the test was (45) minutes. The total marks for this test were (30).

Population and Sample Size

All the participants in the sample were Grade Seven students. This study was conducted in Yangon Region. There are four districts in Yangon Region. Two districts were selected in random. After that, one high school from each township was selected as sample schools. The participants in this study were selected by random sampling and they were assigned to experimental and control group. The total number of students participated in this study were (120).

Data Analysis

The data were analyzed by using descriptive statistics (mean score and standard deviation). The independent samples 't' test was used to compare the achievement of students who learned by science process skills and that of students who learned by formal instruction at knowledge, comprehension, and application level. In order to determine the significant differences, the independent samples 't' test was used with SPSS 22.

Research Findings

Finding of Students' Achievement at Knowledge Level on the Posttest Question

Table 1 *t*-Values for Experimental and Control Group on the Posttest Question at Knowledge Level

School	Group	N	M	SD	MD	*t*	*df*	Sig (2-tailed)
BEHS (1)	Experimental	30	5.03	0.72	1.06	4.98	58	.000***
	Control	30	3.97	0.93				
BEHS (4)	Experimental	30	5.60	0.67	1.50	6.53	58	.000***
	Control	30	4.10	1.06				

Note: ****p* < .001

BEHS (1) – No. (1) Basic High School Education, Latha

BEHS (4) – No. (4) Basic High School Education, Pazundaung

The mean scores of experimental and control groups were (5.03) and (3.97) in BEHS (1). They showed that there was a significant difference between the achievement of control and experimental group at the knowledge level in BEHS (1). This means that the students' achievement of experimental group at knowledge level is higher than that of control group. And the mean scores of experimental and control groups were (5.60) and (4.10) in BEHS (4). This also means that the students' achievement of experimental group at knowledge level is higher than that of control group in BEHS (4). This result is also illustrated by the Figure 1.

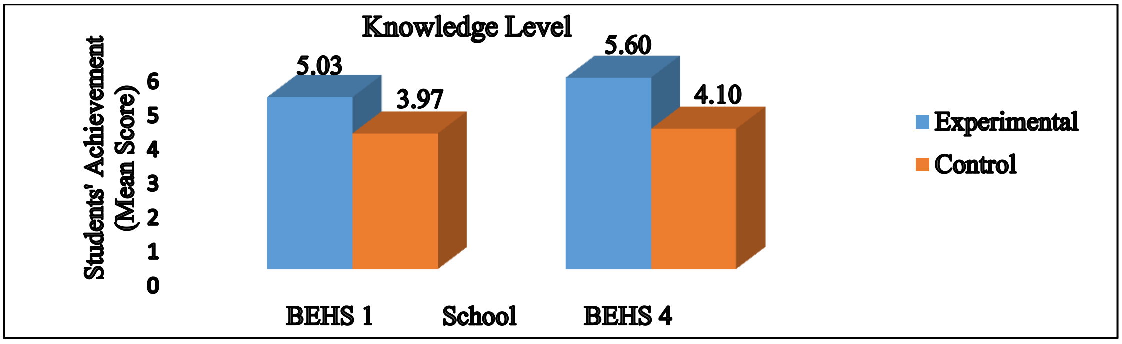

Figure 1 Mean Comparison of Students' Achievement on the Posttest Question at Knowledge Level by Schools

Finding of Students' Achievement at Comprehension Level on the Posttest Question

Table 2 *t*-Values for Experimental and Control Group on the Posttest Question at Comprehension Level

School	Group	N	M	SD	MD	*t*	*df*	Sig (2-tailed)
BEHS (1)	Experimental	30	10.30	0.79	4.07	12.26	58	.000***
	Control	30	6.23	1.63				
BEHS (4)	Experimental	30	10.77	0.77	2.54	6.69	58	.000***
	Control	30	8.23	1.92				

Note: ****p* < .001

BEHS (1) – No. (1) Basic High School Education, Latha

BEHS (4) – No. (4) Basic High School Education, Pazundaung

The mean scores of experimental and control groups were (10.30) and (6.23) in BEHS (1). It was found that the mean scores of experimental group was significantly different from the mean scores of control group in BEHS (1). In BEHS (4), the mean score (10.77) of experimental group is significantly different from the mean score (8.23) of control group. It can be interpreted that the achievement of experimental group is higher than that of control group at comprehension level. This result is also illustrated by the Figure 2.

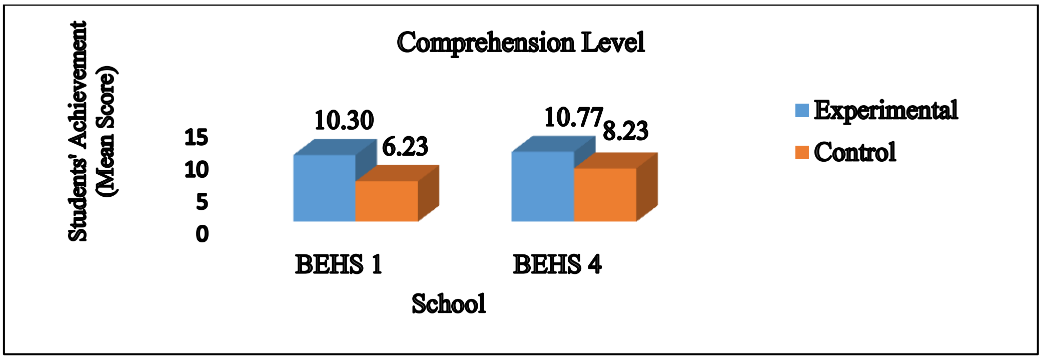

Figure 2 Mean Comparison of Students' Achievement on the Posttest Question at Comprehension Level by Schools

Finding of Students' Achievement at Application Level on the Posttest Question

Table 3 *t*-Values for Experimental and Control Group on the Posttest Question at Application Level

School	Group	N	M	SD	MD	*t*	*df*	Sig (2-tailed)
BEHS (1)	Experimental	30	9.93	2.12	3.63	6.34	58	.000***
	Control	30	6.30	2.32				
BEHS (4)	Experimental	30	10.60	2.81	6.33	10.09	58	.000***
	Control	30	4.27	1.98				

Note. ****p* <.001

BEHS (1) – No. (1) Basic High School Education, Latha

BEHS (4) – No. (4) Basic High School Education, Pazundaung

In comparison of the two groups' means of BEHS (1) indicated that the mean score of experimental group (9.93) was significantly higher than the mean score of control group (6.30) at application level. And also in BEHS (4), the mean score (10.60) of experimental group is significantly higher than the mean score (4.27) of control group. It can be interpreted the achievement of experimental group is significantly higher than that of the control group at application level in the posttest. This result is also illustrated by the Figure 3.

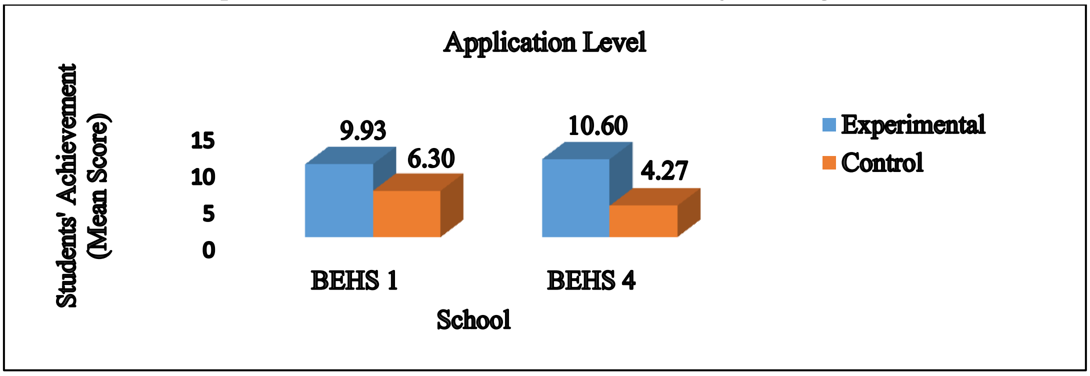

Figure 3 Mean Comparison of Students' Achievement on the Posttest Question at Application Level by Schools

Summary of Findings

The results of findings were as follows.

- At knowledge level, there was a significant difference between the achievement of students who learned by science process skills and those who learned by formal instruction. This means that the achievement of experimental group is higher than that of control group at knowledge level.
- At comprehension level, there was a significant difference between the achievement of students who learned by science process skills and those who learned by formal instruction. This means that the thinking skills of experimental group is higher than that of control group at comprehension level.
- At application level, there was a significant difference between the achievement of students who learned by science process skills and those who learned by formal instruction. This means that the problem solving skills of experimental group is higher than that of control group at application level.

Discussion, Suggestions, Conclusion

Discussion

According to the research findings of students' achievement in science, it was found that the mean scores of experimental and control groups were significantly different in each school. The mean scores for the total achievement at knowledge, comprehension and application levels of experimental and control groups were (25.27) and (16.17) in No. (1) Basic Education High School, Latha and (27.30) and (16.60) in No. (4) Basic Education High School, Pazundaung. This results showed that the achievement of the experimental groups who learned by science process skills was significantly higher than that of the control groups who did not.

By teaching with science process skills, active participation can be achieved. The construction of reality by verbal processes is frequently impossible because of the differences between the images which students visualize and the images which the writer or the speaker is attempting to convey. The more opportunities the students have for observing, the more they will improve observing skill and the more they will comprehend what they learn. According to the findings, the students from the experimental groups improved the level of comprehension and application. They were also able to construct their knowledge personally based on their experiences and develop a better understanding of scientific concepts.

Most students are not able to apply knowledge acquired in the class environment to other situations including other class environments. This is due to not having an appropriate cognitive level of comprehension and application. Students who acquired science process skills tend to think analytically and are more successful with new problems than those who do not possess science process skills (Oloyede, 2012).

It can be said that students in the experimental groups were active in the learning process because the students in the experimental groups applied their own process skills in learning the science lessons rather than listening to the teacher's lecture and reading the passage.

Suggestions

Rote learning and memorization do not support the creativity and critical thinking skills. These skills are essential elements in the 21st century that generates rapid development in information and technology and a constant explosion of knowledge. Science process skills are the foundation of such skills. They can be achieved by emphasizing student-centered approach that stresses the background situation of the students on which effective learning is made with the help of the teachers. Therefore, in order to meet the needs of nowadays, educators have to move from the teacher-centered approach to learner-centered approach. In today's classroom in Myanmar, students are asked to listen to the teacher's lecture, take down notes, memorize facts and information that they do not understand or the materials that was unknown. It is the responsibility for all educators to create better learning situation and provide students with the skills and confidence to go forth to solve the world's problem. By developing science process skills, students can become competent problem solvers and face the challenges head on according to this study.

Students who are taught with process skill approach are able to apply their skills and realize the importance of these skills in everyday activities. Learning with science process skills places students in realistic, contextualized environments. Both teachers and students should use materials or equipment during teaching and learning process. This will help students understand science concepts, in the event where the materials are not available, teachers or students must improvise. In school where large classes exist, teachers should endeavor to sub-divide the students into smaller groups and teach each group using extended materials at different times. This will help students in full participation during the lesson. Developing science process skills in learning science, students will recognize and accept the ways in which each individual is unique, understand that their lives influence their environment and are influenced by it, use information and values to make rational decisions and evaluate the personal consequences. They can also be aware of the constant changes in themselves. Applying science process skills, students become more autonomous, self-directed and responsible for their own learning.

One of the objectives of teaching Middle School General Science in Myanmar is to help pupils learn to think scientifically and creatively. Science education is crucial to enhance the ability of the leaders and citizens of tomorrow to create solutions and find new paths to a better, more sustainable future. It is through education that the next generation of citizens, workers, professions and leaders will be prepared for life-long learning about sustainability (UNESCO, 2012). Students should be given the responsibility to search for their own meaning through hands-on activities. It helps students to get them to think for themselves.

Therefore, educators should emphasize and be aware of the importance of teaching methods and styles of teaching on their teaching learning situation. And also, teachers should know the importance of selecting the most appropriate teaching methods. According to the results of this study, the mean scores of experimental group are higher than that of control group at all levels (knowledge, comprehension and application). The emphasis on student's self-study is important. The students should construct their own knowledge. Teachers should think from the angle of a learner, not to think how to give all the knowledge to students or to give all the content of the textbook to students in detail. The teacher should take more time in planning the lessons and engage students maximally with activities that should help them develop the spirit of enquiry through their exploration of nature from their local environment.

To equip students with science process skills in classroom environment, teachers themselves should possess these skills. A teacher who is not properly equipped with these skills may experience difficulties to deliver these skills to the students. Teachers should select the appropriate teaching aids that can stimulate students' interest to use their science process skills in the learning process. Science process skills are essential for encouraging critical thinking, cooperative learning and enhancing problem solving skills by solving real world problems. And, the teacher should design several good problems covering the knowledge of the course.

Teachers should manage a class where student teams are working independently and at a different pace and choose a problem that allows students to successfully reach the assigned outcomes. Teachers should provide a good learning community in the classroom with positive teacher-student and student-student relationships and give opportunities for students to do the activities. Teachers should encourage students to think more deeply and critically, to participate in problem solving activities and discussions, and to stimulate students to seek information on their own. Most of the students are not capable of thinking on their own. Therefore, teachers should help students become self-directed learners and create a classroom environment in which students study with freedom and think critically. Teachers as facilitators should help to keep the students focused on the essential problem, through the problem might change over time, and even become more complex.

In this research, there were some limitations such as content area (only Chapter-5, "the Earth and Space" from Grade Seven Science Textbook) and the sample is only Yangon Region. Therefore, the results were not representative for the whole content area of Grade Seven General Science. Science process skills should be used at various school levels: primary, middle and high school level. As the size of the sample is small, this result may not be generalized to a larger population. Thus, carrying out a larger research in a nationally representative area in a longer duration is highly recommended to validate results of the present research.

Conclusion

Scientific knowledge includes theory, principles and laws forming content part of sciences. To be competent in the scientific knowledge, learners must use science process skills because they are ways of the acquisition of such knowledge. Ways of thinking in science are also called the process skills. Science process skills include the skills of each individual that are used in daily life which can improve the quality and standard of life by understanding the nature of science. Science process skills are process thinking skills using scientific processes and approaches (Rezba, Sprague & Fiel, 2002). These skills help the learner build up competence in searching for knowledge and information in the field of sciences through scientific method and arousal of interest in future science-based pursuits.

When science process skills are emphasized in the classroom, students' proficiency on individual skills increases, some skills are transferred to new situations, and the skills are retained over time (Padilla, 1990). Padilla suggests that basic science process skills provide a foundation for more complex science process skills. He also affirms that teachers cannot expect students to develop the more complex skills and higher order thinking skills if students are not provided the opportunity to practice the basic skills.

The main purpose of this study is to study science process skills and achievement of students in science at the middle school level. Quantitative research methodology was used to study science process skills and achievement of students in science at the middle school level. The design adopted in this study was true experimental design (posttest only control group design).

There are four districts in Yangon Region: East, West, South and North. Two districts were selected in random and then one township was chosen in random from each selected district.

According to this study, the achievement of students in experimental group was significantly higher than that of control group in the combination of all levels in the posttest (knowledge, comprehension and application level).

Finally, the teacher should use suitable teaching methods or the styles of teaching for the students to have a sound understanding of the material. And the teacher cannot expect to teach all the material in a textbook to students. The teacher should tell the students that they are responsible for their study and emphasize on their self-study. Therefore, the teacher should focus on new teaching strategies and methods. Science process skills will encourage the students to become active participants in their learning. So, the teachers should consider to use science process skills in their instruction in science according to the time and circumstance of a classroom situation.

In addition more research is needed to find the ways how to improve students' problem solving skills, teamwork skills and critical thinking in their learning process. This research is only concerned with the quantitative measure of students' achievement by using science process skills and formal instruction in teaching general science. It is better to find the solutions for the students' problems facing in their learning process both in quantitative and qualitative research. And then, this research is concerned with the quantitative measure of students' achievement at knowledge level, comprehension level and application level. And also, a study should be made about the effects of science process skills on students' achievement at all levels (six levels of Bloom's Taxonomy). As a result of this study, it is recommended that in this study, the sample schools were randomly selected from Yangon Division. Further research should be carried out for the other states and divisions.

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Appendix A

Achievement Test

အခန်း (၅)၊ကမ္ဘာမြေကြီးနှင့် အာကာသ

တတ်မြောက်မှုစစ်ဆေးရန်မေးခွန်း

Posttest (30 marks)

အထွေထွေသိပ္ပံ

ဆဋ္ဌမတန်း **ခွင့်ပြုချိန် (၄၅) မိနစ်**

၁။ အောက်ပါဖော်ပြချက်များကို မှန်လျှင်(မှန်)၊ မှားလျှင် (မှား)ဟုရေးပါ။ (၅ မှတ်)

(က) မိုးလေဝသအခြေအနေများသည် စိုက်ပျိုးရေးအတွက် များစွာအရေးပါသည်။

(ခ) လေသည် ဖိအားနည်းသောဒေသမှဖိအားများသောဒေသများသို့ ရွေ့လျားလေ့ရှိသည်။

(ဂ) သတ္တဝါများအတွက် စိမ်းစိုသာယာသောပတ်ဝန်းကျင်သည် အရေးကြီးသည်။

(ဃ) ရေကြီး၊ ရေလျှံခြင်းသည် သီးနှံများကို ကောင်းစွာဖြစ်ထွန်းစေသည်။

(င) မြေဆီ၊ မြေဩဇာပျက်စီးမှုသည် စိုက်ပျိုးရေးကို ထိခိုက်စေသည်။

၂။ အောက်ပါဖော်ပြချက်များကို ပြည့်စုံမှန်ကန်စေရန် လိုအပ်သောစကားလုံးများကို ဖြည့်စွက်ပါ။ (၅ မှတ်)

(က) လေထုအတွင်းရေငွေ့ပါဝင်မှုသည် ------- ဖြစ်စဉ်များအတွက် အလွန်အရေးပါသည်။

(ခ) ရေသည် အငွေ့၊အရည်၊ ---------အသွင်ဖြင့်တည်ရှိနိုင်သည်။

(ဂ) အပင်များစိုက်ပျိုးခြင်းဖြင့်--------ပျက်စီးမှုကို ကာကွယ်နိုင်သည်။

(ဃ) ကျွန်ုပ်တို့ပတ်ဝန်းကျင်ရှိ အနံ့အသက်နှင့် စူးရှမှုများကို ------မှုဖြင့် အဝေးသို့ လွင့်သွား စေနိုင်ပါသည်။

(င) အိုဇုန်းလွှာသည်------- များကို တားဆီးပေးနိုင်သည်။

၃။ အောက်ပါကွင်းထဲရှိ အဖြေများအနက်မှ အဖြေမှန်ကို ရွေးပါ။ (၅ မှတ်)

(က) လေဖိအားသည် (အောက်မှ၊ အထက်မှ၊ အဘက်ဘက်မှ) သက်ရောက်နိုင်သည်။

(ခ) ငွေ့ရည်ဖွဲ့ခြင်းဆိုသည်မှာ (ရေခိုးရေငွေ့များအရည်အဖြစ်၊ အရည်များ ရေခိုးရေငွေ့အဖြစ်၊ ရေခိုးရေငွေ့များ ရေခဲအဖြစ်) သို့ပြောင်းလဲသွားခြင်းကို ခေါ်ပါသည်။

(ဂ) မြန်မာနိုင်ငံ အလယ်ပိုင်းရှိ မိုးနည်းရပ်ဝန်းဒေသသည် (ရေငွေ့များသော၊ ရေငွေ့နည်းသော၊ စိုစွတ်သော)ဒေသဖြစ်သည်။

(ဃ) မိုးနည်းရေရှားရပ်ဝန်း ဒေသများတွင် သစ်တောများအကုန်အစင်ခုတ်လှဲမှုသည် (အက်စစ်မိုးများ၊ ကန္တာရများ၊ မြေဆီလွှာ ပျက်စီးမှုများ) ကိုဖြစ်စေသည်။

(င) လေထုညစ်ညမ်းမှုကို (မီးသွေး၊ ဖွဲ၊ လျှပ်စစ်မီးဖို)များ သုံးစွဲခြင်းဖြင့် လျော့ချနိုင်သည်။

၄။ အောက်ပါပေးထားသော ကော်လံနှစ်ခုမှ သင့်လျော်ရာ ယှဉ်တွဲပါ။ (၅ မှတ်)

ကော်လံ (၁)

(၁) စက်မှုလုပ်ငန်းများနှင့် မော်တော်ယဉ်တို့ မှထွက်သော ဓာတ်ငွေ့များကြောင့်

(၂) တောပြုန်းမှုနှင့်ရွှေ့ပြောင်းတောင်ယာ လုပ်ကိုင်မှုကြောင့်

(၃) ပိုးသတ်ဆေးများအသုံးများလာမှုကြောင့်

(၄) အိမ်သုံးပစ္စည်းများတွင် ထည့်သုံးထား သောအအေးပြု ဓာတ်ငွေ့များကြောင့်

(၅) ရေဆိုးနှင့် အိမ်သာများလာမှုကြောင့်

ကော်လံ (၂)

(က) ရေချိုသယံဇာတများ ညစ်ညမ်း သွားရသည်။

(ခ) အိုဇုန်းလွှာ ပျက်စီးရသည်။

(ဂ) မြေသား၊မြေဆီလွှာ တိုက်စားခံရသည်။

(ဃ) မြေဆီလွှာ ပျက်စီးရသည်။

(င) လေထုညစ်ညမ်းမှုနှင့် ကမ္ဘာကြီးပူနွေး လာမှုများဖြစ်လာရသည်။

၅။ အောက်ပါမေးခွန်းများကို ရှင်းလင်းဖြေဆိုပါ။ (၁၀ မှတ်)

(က) လူသားများကြောင့်ဖြစ်ပေါ်လာသော ပင်လယ်သမုဒ္ဒရာများကို ညစ်ညမ်းစေသည့်အကြောင်း အရင်းများကို ရှင်းပြပါ။

(ခ) မိုးရေမလုံလောက်သော အရပ်ဒေသများတွင် မည်သို့စိုက်ပျိုးသင့်သည်ကို တင်ပြဆွေးနွေးပါ။

(ဂ) စိုက်ပျိုးရေးသည် မိုးလေဝသနှင့် ဆက်နွယ်မှုရှိပါသလား။ အဘယ်ကြောင့်နည်း။

(ဃ) လေထုဖိအား၏ သဘောသဘာဝကို မည်သည့်ကိရိယာများတွင် အသုံးပြုထားသနည်း။

(င) ရေငွေ့များအထက်သို့တက်ပြီး ငွေ့ရည်ဖွဲ့ခြင်းကြောင့် မည့်သည့် သဘာဝဖြစ်စဉ်များဖြစ်စေ နိုင်သည်ကို ရှင်းပြပါ။

Appendix D

Marking Scheme for Posttest

၁။ (က) မှန် (၁ မှတ်)
(ခ) မှား (၁ မှတ်)
(ဂ) မှန် (၁ မှတ်)
(ဃ) မှား (၁ မှတ်)
(င) မှန် (၁ မှတ်)

၂။ (က) မိုးလေဝသ (၁ မှတ်)
(ခ) အစိုင်အခဲ (၁ မှတ်)
(ဂ) အိုဇုန်းလွှာ (၁ မှတ်)
(ဃ) လေတိုက်ခတ်မှု (၁ မှတ်)
(င) ခရမ်းလွန်ရောင်ခြည် (၁ မှတ်)

၃။ (က) အဘက်ဘက်မှ (၁ မှတ်)
(ခ) ရေခိုးရေငွေ့များ အရည်အဖြစ် (၁ မှတ်)
(ဂ) ရေငွေ့နည်းသော (၁ မှတ်)
(ဃ) ကန္တာရများ (၁ မှတ်)
(င) လျှပ်စစ်မီးဖို (၁ မှတ်)

၄။

ကော်လံ (၁)	ကော်လံ (၂)	
(၁) စက်မှုလုပ်ငန်းများနှင့် မော်တော်ယဉ်တို့မှထွက်သော ဓာတ်ငွေ့များကြောင့်	(င) လေထုညစ်ညမ်းမှုနှင့် ကမ္ဘာကြီးပူနွေးလာမှုများ ဖြစ်လာရသည်။	(၁ မှတ်)
(၂) တောပြုန်းမှုနှင့် ရွှေ့ပြောင်း တောင်ယာလုပ်ကိုင်မှုကြောင့်	(ဂ) မြေသား၊မြေဆီလွှာ တိုက်စားခံရသည်။	(၁ မှတ်)
(၃) ပိုးသတ်ဆေးများအသုံးများ လာမှုကြောင့်	(ဃ) မြေဆီလွှာ ပျက်စီးရသည်။	(၁ မှတ်)
(၄) အိမ်သုံးပစ္စည်းများတွင်ထည့် သုံးထားသော အအေးပြုဓာတ်ငွေ့ များကြောင့်	(ခ) အိုဇုန်းလွှာ ပျက်စီးရသည်။	(၁ မှတ်)
(၅) ရေဆိုးနှင့် အိမ်သာများ လာမှုကြောင့်	(က) ရေချိုသယံဇာတများ ညစ်ညမ်းသွားရသည်။	(၁ မှတ်)

၅။ (က) ကုန်းပေါ်မှ အမှိုက်သရိုက်၊ အညစ်အကြေးနှင့် စွန့်ပစ်ပစ္စည်းများကို ပင်လယ်သမုဒ္ဒရာ များထဲသို့ အစုလိုက် အပုံလိုက် သွန်ချစွန့်ပစ်မှု၊ ရေနံတင်သင်္ဘောကြီးများ ပျက်စီးနစ်မြုပ် ရာမှ ရေနံဂါလံသန်းနှင့်ချီကာ ယိုဖိတ်မှုများကြောင့် ပင်လယ်သမုဒ္ဒရာများ ညစ်ညမ်း ရသည်။ (၂ မှတ်)

(ခ) မိုးရေမလုံလောက်သောဒေသများတွင် အနီးမှစီးဆင်းသည့် မြစ်ရေ၊ ချောင်းရေတို့မှရေကို နည်းအမျိုးမျိုးဖြင့် သွယ်ယူပြီး စိုက်ခင်းများအတွင်းသို့ပို့ခြင်း၊ ခြောက်သွေ့သောရာသီ တွင်လုံလောက်သောရေရရှိရန်အတွက် မိုးရာသီအတွင်း ရရှိသမျှရေကိုဆည်များ၊ ကန်များ ဖြင့်ခံယူစုဆောင်းကာ လိုအပ်သောစိုက်ခင်းများအတွင်းသို့ပို့ပေးရသည်။ (၂ မှတ်)

(ဂ) စိုက်ပျိုးရေးနှင့် မိုးလေဝသသည် ဆက်နွယ်မှုရှိပါသည်။ သီးနှံများဖြစ်ထွန်းတတ်သည့် မြေ၊ ရာသီဥတုနှင့် အချိန်အခါကို မှတ်သားလေ့လာပြီး လိုအပ်သောသီးနှံတို့ကို စိုက်ပျိုးရ သောကြောင့်၊ မိုးများသောဒေသများတွင် ရေကြိုက်သော သီးနှံတို့ကို ရွေးချယ်စိုက်ပျိုးရပြီး၊ အနည်းငယ်ခြောက်သွေ့သောဒေသများတွင် မိုးမကြိုက်သောအပင်များကို ရွေးချယ်စိုက်ပျိုးရသည်။ (၂ မှတ်)

(ဃ) သကြိန်အခါ ကလေးများကစားသည့်ပွဲတော်၊ ဆရာဝန်သုံးဆေးထိုးပြွတ် (၂ မှတ်)

(င) ရေငွေ့များအထက်သို့တက်ပြီး ငွေ့ရည်ဖွဲ့ခြင်းကြောင့် တိမ်ဖြစ်ထွန်းခြင်း၊ မုန်တိုင်း ဖြစ်ပေါ်ခြင်း၊ မိုးရွာခြင်း၊ မိုးသီးကြွေကျခြင်း၊ ဆီးနှင်းကျခြင်း၊ မြူထူဆိုင်းခြင်းများဖြစ်ပေါ် စေနိုင်ပါသည်။ (၂ မှတ်)

FACTORS AFFECTING THE STUDENT'S INTEREST IN MATHEMATICS AT THE MIDDLE SCHOOL LEVEL

Phyu Phyu Win[1] and Htay Win[2]

Abstract

The main purpose of this study is to investigate the factors affecting the student's interest in mathematics at the middle school level. Especially, this study aims to investigate the teacher factors and student factors that affect students' interest in mathematics. Quantitative method was used to gather required data. The research method for this study was descriptive research method. Four townships were randomly selected from four districts in Yangon Region. Two high schools and one middle school from each township were selected by using stratified random sampling technique. The subjects in this study consisted of (68) middle school mathematics teachers and (600) Grade Eight students. As instruments, teacher questionnaire, student questionnaire and students' interest questionnaire were used. For obtaining questionnaire reliability of the pilot test was administered. The internal consistency (Cronbach's Alpha) of five-point Likert-type of teacher questionnaire was (.721), student questionnaire was (.745) and students' interest questionnaire was (.834). In order to know the correlation between the factors mentioned above and students' interest in mathematics, Pearson product-moment correlation was used. According to the results, the correlation between teacher factors and students' interest in mathematics was ($r = .778$, $p< .01$) and the correlation between student factors and their interest in mathematics was ($r = .565$, $p < .01$). These results showed that teacher factors and student factors were positively correlated with students' interest in mathematics.

Keywords: Factor, Interest, Mathematics.

Introduction

Education plays a tremendous role in economics and social development of country. Education is very important to everyone to lead a successful life. Also, competency in mathematics learning is vital to any individual and nation in domestic and business deals, scientific discoveries, technological breakthrough, problem-solving and decision making in different situations in life.

Mathematics is a subject that determines individuals' functionality in any given society. It is essential requirement in every field of intellectual endeavor and human development to cope with the challenges of life. To be skillfull, a genuine interest in school subjects is important as well. Students with an interest in a subject like mathematics is likely to be more motivated to manage their own learning and develop the requisite skills to become effective learners of that subject.

Hence, interest in mathematics is relevant when considering the development of effective learning strategies for mathematics. According to Voss and Schauble (1992, cited in Arthur, 2014), higher levels of interest would result in higher levels of cognitive activation leading to higher achievement. So, the researcher thought that it is important to investigate the factors that affecting students' interest in mathematics.

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Background of the Study

In several education systems all over the world, mathematics is one of the important subjects within the list of foundation subjects that constitute the core curriculum for basic education. The basic knowledge acquired in mathematics at the lower level is vital for a student to progress to upper classes in secondary schools. Mathematics is a core subject in schools all over the world and occupies a privileged position in the school curriculum.

Napoleon remarked that "The progress and improvement of mathematics is linked to the prosperity of the state. The competence gain in the study of mathematics is widely used in all spheres of human life. Mathematics plays a key role in shaping how individuals deal with the various sphere of private, social and civil life (Anthony & Walshow, 2009, cited in Ogunkola, 2012). It is a backbone of students to achieve and develop the skill in reasoning and thinking level.

Moreover, mathematics is at the heart of many successful careers and successful lives (National Council of Teachers, 2000, cited in Ogunkola, 2012). Mathematics is a precursor of scientific discoveries and inventions. It is the foundation of any meaningful scientific endeavor and any nation that must develop in science and technology and must have a strong mathematical foundation for its youths (Hersh, 1986, cited in Ogunkola, 2012). It is also the foundation on which the whole essence of living revolves and the platform for scientific and technological innovation.

In the field of education, mathematics has become a burning problem and the numbers of low achiever students in mathematics in the school level are constantly increased. In spite of the pedagogic progress and efforts of teachers of mathematics, results in general are unsatisfactory.

This may be due to the lack of 'interest' of the students in the subject of mathematics. Whatever one learns, 'interest' plays a dominant role in making him learn that things. When a student attributes high value to a particular subject area, then it is said that the student has interest in that area. According to Gardener and Tamir, (1999, cited in Arthur, 2014) the term 'interest' refers to engage in some types of activities rather than others. 'Interest' may be regulated as a highly specific types of attitude. When we are interested in a particular phenomenon or activity, we are favorably inclined to it and give time to it. The term 'interest' is used also to indicate a permanent mental disposition. According to Mc Dougal, (2000), cited in Arthur, (2014), 'taking interest' means the bearing of a condition or subject. If a person takes 'interest' in a subject, then he would centralize himself in it despite being tired.

It is utmost needed to create interest of students in mathematics, so that different intellectual traits like power of thinking, reasoning, analysis, synthesis, discovery etc develop in the students and there by lead the society towards a positive and constructive direction that teachers know the interest of pupils towards different subjects. Mathematics is an essential not only for education but also very useful in day to day life. Various factors are involved in shaping the understanding and learning of mathematics. However, one of the prerequisites for understanding mathematics is interest in learning mathematics and the desire to learn it.

Despite mathematics' great importance, it is the only subject that is most dreaded to learners among all subjects offered in schools (Ashcraft & Faust, 1994; &Akinoso, 2011, cited in Chinaedum, 2015). Now a day's student's interest is going down and down. If the students keep interest in mathematics then automating they have high level of reasoning and achievement. Poor achievement in mathematics may be traceable to students' lack of interest in studying the subject. So, the researcher wanted to investigate the factors affecting students' interest in mathematics at the middle school level.

Purposes of the Study

The main purpose of the study is to investigate the factors affecting students' interest in mathematics at the middle school level.

- To investigate the teacher factors that affect students' interest in mathematics.
- To investigate the student factors that affect students' interest in mathematics.
- To investigate students' interest in mathematics at the middle school level.
- To investigate the relationship between teacher factors and students' interest in mathematics.
- To investigate the relationship between student factors and their interest in mathematics.

Research Questions

The research questions of this study are as follows:

- To what extent do teacher factors affect students' interest in mathematics?
- To what extent do student factors affect students' interest in mathematics?
- To what extent do students have interest in mathematics?
- Is there a relationship between teacher factors and students' interest in mathematics?
- Is there a relationship between student factors and their' interest in mathematics?

Scope of the Study

This research has its own particular limitations. The first limitation is related to the fact that the participants of the study came from only Yangon Region. Participants in this study are (68) middle school mathematics teachers and (600) Grade eight students from the twelve selected schools of the four Districts (East, West, South, and North) within the academic year (2018-2019). Eight Basic Education High Schools and Four Basic Education Middle Schools are included in this study. The second limitation is that this study is only concerned with the factors (teacher factors, student factors) that affecting students' interest in mathematics. Particularly, this study is concerned with teacher factors (teachers' knowledge, instructional strategy, attitudes towards mathematics and class size) and student factors (attitudes towards mathematics, attitudes towards their mathematics teachers and mathematics anxiety).

Definition of the Key Terms

Factor: A factor is defined as one of the elements contributing to a particular result or situation (Costello, 1992, cited in Payan, 2014).

Interest: Interest is defined as the feeling of intentness, concern and curiosity about an object (Obodo, 1991, cited in Arthur, 2014).

Mathematics: Mathematics is the gateway and key to all sciences (Bacon, n.d., cited in Zubair, 2012).

Significance of the Study

Mathematics is a highly structured subject it's also abstract in some ideas and it requires some special attention in learning. Hence, students see mathematics as difficult in nature. According to Sidhu (1995), "To arouse and maintain the student's interest in mathematics, is a major problem for the teacher. He knows that loss of interest is one of the principal causes of student failure". Lack of interest by pupils should not be allowed to prevail in a class, as effective learning might not take place. (Gagne, 176), For example, a student who has a positive attitudes towards mathematics, studies it effectively because he like it .This is supported by Aremu (1998, cited in Arthur, 2014) who explain that when pupils express lack of interest in the subject it affects the way they react or listen to the teacher. Students work most effectively at tasks in which they are genuinely interested.

Moreover, this study is vital in mathematics education for the following reasons. First, it could provide information to mathematics teachers on why pupils lose interest and development negative attitudes in learning mathematics so that they can take steps to instill interest and positive attitudes toward learning mathematics. Secondly, it could provide information to teacher education institutions on how to arouse interest and maintain positive attitudes of which can in turn be shared with trainee teachers. Thirdly, the Curriculum Development Centre (CDC) might formulate and implement a syllabus and learning materials that arouse interest toward learning mathematics in the light of the results of this study. Lastly, the finding of this study will contribute to the existing mathematics education literature and provide information for further studies.

Review of Related Literature

Teacher Factors Affecting Students' Interest in Mathematics

If teacher is interested in mathematics, his students will also show interest in it. If, on the other hand, he dislike mathematics his students will also dislikes it. A teacher who is interested in mathematics will regularly practice it. As a result of this he will be strong in it and teach it with enthusiasms. For examples, when a teacher is confident, supportive and enthusiastic, those characteristics are communicated to the students with the result that the learning experience and the outcomes are generally positive. Thus, teachers play a pivotal role in the teaching-learning process because they manage themselves and others involved in the learning environment. In this study, teacher factors such as teachers' knowledge, instructional strategy, teacher attitudes towards mathematics and class size were studied.

Teachers' Knowledge

Excellent teachers of mathematics have a sound, coherent knowledge of mathematics appropriate to the student level they teach, and understanding of the broader mathematics curriculum. They understand how mathematics is represented and communicated, and why mathematics is taught. Fennema and Franke (1992, cited in Turnuklu & Yesildere, 2007) determined the components of mathematics teachers' knowledge as;

1) Knowledge of mathematics
   - Content knowledge
   - The nature of mathematics
   - The mental organization of teacher knowledge

2) Knowledge of mathematical representations
3) Knowledge of students
    - Knowledge of students' cognitions
4) Knowledge of teaching and decision making

Instructional Strategy

A qualified mathematics teacher can easily use different approaches/ methods, styles, illustrations, examples, and improvise materials in teaching students mathematics concepts, principles or ideas which counterpart (unqualified mathematics teacher) cannot do. This suggests student mathematics interest is depended on qualification of mathematics teacher. A qualified mathematics teacher can arouse students' interest in mathematics learning and ensure success in the learning of the subject through the use of appropriate instructional strategies in teaching the student. There are effective instructional strategies as follow.

Teachers' Attitudes towards Mathematics

Neal (1969, cited in Jacobs, 2010) defied attitude towards mathematics as a tendency to engage in or avoid mathematics activities, a belief that one is good or bad in mathematics is useful or useless. An understanding of how attitudes are learned should establish a connection between teachers and students' attitudes and performance. Schofield (1981, cited in Jacobs, 2010) reports that positive teacher attitudes towards mathematics were significantly related to high achievement in pupils. Teachers are the key to improving mathematics education. The preparation, certification, ongoing professional and attitude of teachers define the outcome of their students.

Class Size

The number of students in a mathematics class otherwise referred to as class size is a factor of interest to learn mathematics. According to Ifamuyiwa (2005), uncooperative attitude of the students and large class size contribute to student' poor performance in mathematics. More so, probably because of the negative effect of large class size that Claiber Associates (2005, cited in Vandenberg, 2012), reported that class size of not more than 18 students per teacher is required to produce the greatest benefits. Large class size therefore affects preparatory training such as students' interest to further learning of mathematics.

Student Factors Affecting their Interest in Mathematics

Chung (1998, cited in Mensah et al., 2013), in his study of 11-13 years old, also discovered positive correlation between attitude and mathematics achievement. The correlation showed that the more positive the attitude, the higher the level of achievement as well as interest in the student. In this study, student factors such as (attitude towards mathematics, attitude towards their teacher and mathematics anxiety) were studied.

Students' Attitudes towards Mathematics

Attitude towards mathematics is an important variable, which steers the behavior of students about mathematics lessons as how they should be and which have contribution for their motivation, in other words, it can be considered as the determinant of personal emotions (Bayturan, 2004). It is important for the success in mathematics (Enemark & Wise, 1981, cited in

Akkaya, 2012), has an important role for explaining mathematics success of students. Moreover, students' success and interest in mathematics depend on their attitudes towards mathematics.

Students' Attitudes towards their Mathematics Teachers

Students' attitudes towards their teachers play a crucial role in the teaching and learning process of mathematics. Teachers are, invariably, role models whose behaviors are copied by students. So, students follow like their teacher behavior. If the teacher is interested in mathematics, his students will show interest in it. Thus, all mathematics teachers should support and encourage their students to develop positive attitude towards mathematics.

Mathematics Anxiety

According to Burns (1998, cited in Wigfield, 1998), many students have fears and loathsome experiences about mathematics. Such negative experiences are caused by mathematics anxiety which knows no boundaries irrespective of age or gender. Mathematics anxiety is the feeling of tension, helplessness, mental disorganization and dread one when required to manipulate numbers and shapes and the solving of mathematics anxiety is poor mathematics achievement and competence (Asheraft, 2002). Students who are infested with mathematics anxiety will lack interest to learn mathematics and consequently may tend to achieve poverty in the subject.

Research Method

This study is concerned with the factors that affect students' interest in mathematics from the selected schools. The factors such as teacher factors and student factors were investigated to be able to determine whether these factors affect students' interest in mathematics or not. Research design and procedure, instruments, population and sample size, and data analysis are presented in this chapter to address the research questions.

Research Design and Procedure

The research design for this study was a descriptive research design, in which the researcher seeks to determine whether, and to what degree, a relationship exists between two or more quantifiable variables (teacher factors, student factors and students' interest in mathematics). In this study, data were collected through a quantitative method. Quantitative method is research technique that is used to gather quantitative data-information dealing with numbers and anything that is measurable (Gay & Airasian, 2003).

First of all, the researcher sought out the relevant literature concerning with the research through reading books. Moreover, the researcher studied the literature from the Internet sources. Secondly, in order to get the required data, the researcher constructed the instruments. Content validity was determined by experienced teachers' judgment. After getting the validity of these instruments, a pilot testing was conducted. The pilot testing for the instrument was conducted in November, 2018. The modified instruments were distributed to all participants of the twelve sample schools with the help of the headmaster/ headmistress of those schools in December 2018. After all instruments were returned, and then the data were entered the computer data file and were analyzed using the Statistical Package for the Social Science (SPSS 22).

Instrumentation

In this study, two types of questionnaire (questionnaire for teacher and questionnaire for student) for Grade Eight students were used as the instruments. Questionnaire for teachers' knowledge was mainly based on "The Components of Mathematics Teachers' Knowledge" (Fennema and Franke, 1992). Questionnaire for instructional strategy was mainly based on "Effective Instructional Strategies" (Sinay, E., & Nahornick, A., 2016). Questionnaire developed by Meece (1981) was adapted to investigate mathematics anxiety of students. Questionnaire for class size was mainly based on Kristy Chandler Vandenberg (2012).Questionnaire developed by Tapia and Marsh (2004) was adapted to investigate teachers' attitudes towards mathematics, students' attitudes towards mathematics and students' attitudes towards their mathematics teacher. Questionnaire for students' interest in mathematics was developed by the researcher based on four dimensions by "The Four-Phase Model of Interest Development" (Hidi & Renninger, 2006).

Population and Sample size

All participants in the sample were Grade Eight students and middle school mathematics teachers. This study was conducted in Yangon Region in which there are four districts and thus one township was randomly selected from each district. Two high schools and one middle school were selected from each township as the sample schools by using stratified random sampling technique. Therefore, twelve schools (eight high schools and four middle schools) are included in this study. Middle school mathematics teachers and Grade Eight students from the selected schools were selected as the sample of the subjects by using equal size random sampling. So, the participants in this study were consisted of (600) students and (68) teachers respectively.

Data Analysis

In this study, the data were analyzed by using descriptive statistics such as mean, standard deviation, percentage and person product-moment correlation. In order to know teacher factors, student factors and students' interest in mathematics mean, standard deviation and percentage were used. Person product-moment correlation was used to assess whether there was relationship between teacher factors and students' interest in mathematics and student factors and their' interest in mathematics at the middle school level.

Findings

Findings of Teacher Factors in the Selected Schools

In order to find out teacher factors, a questionnaire for mathematics teachers was used. It is necessary to examine the percentage of the teachers who had low, moderate and high level of performance in teacher factors. There were involved 68 numbers of teachers in teacher factors. The full score for teacher factors was (200).The sample mean and standard deviation in teacher factors were (164.51) and (10.887) respectively. Based on the scores in respective areas of teacher factors, teachers with scores below (153.62) were identified as those who had low level of teachers' performance and teachers with scores above (175.40) were identified as those who had high level of teachers' performance. Then, teachers with scores between and equal (153.62) and (175.40) were considered as those who had moderate level of teachers' performance. The percentage of the teachers in low, moderate and high levels of performance were 16% (N=11), 66% (N=45) and 18% (N=12) respectively (see Table 1).

Table 1 Level of Teachers' Performance in Teacher Factors

Level of Teachers' Performance	**Score (x)**	**No. of Teacher**	**Percentage (%)**
Low	x < 153.62	11	16
Moderate	153.62≤ x ≤175.40	45	66
High	x > 175.40	12	18
Total		**68**	**100**

Figure 1 displays the percentage of the teachers' performance in each level based on the results of the percentage of Table 1.

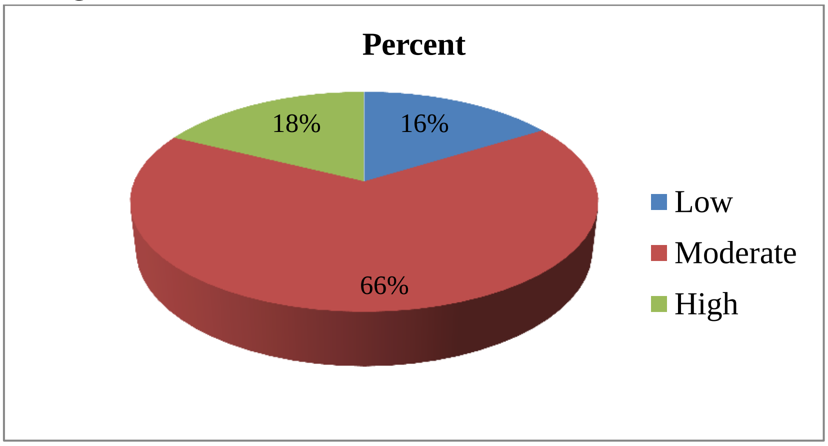

Figure 1 Level of Teachers' Performance in Teacher Factors

Findings of Student Factors in the Selected Schools

In order to find out student factors, a questionnaire for students was used. It is necessary to examine the percentage of the students who had low, moderate and high level of performance in student factors. There were involved 600 numbers of students in student factors. The full score for student factors was (120).The sample mean and standard deviation in student factors were (94.67) and (7.408) respectively. Based on the scores in respective areas of student factors, students with scores below (87.26) were identified as those who had low level of students' performance and students with scores above (102.08) were identified as those who had high level of students' performance. Then, students with scores between and equal (87.26) and (102.08) were considered as those who had moderate level of students' performance. The percentage of the students in low, moderate and high levels of performance were 4 % (N=25), 37 % (N=220) and 59 % (N=355) respectively (see Table 2).

Table 2 Level of Students' Performance in Student Factors

Level of Students' Performance	**Score (x)**	**No. of Student**	**Percentage (%)**
Low	x < 87.26	25	4
Moderate	87.26 ≤ x ≤102.08	220	37
High	x > 102.08	355	59
Total		**600**	**100**

Figure 2 displays the percentage of the students in each level based on the results of the percentage of Table 2.

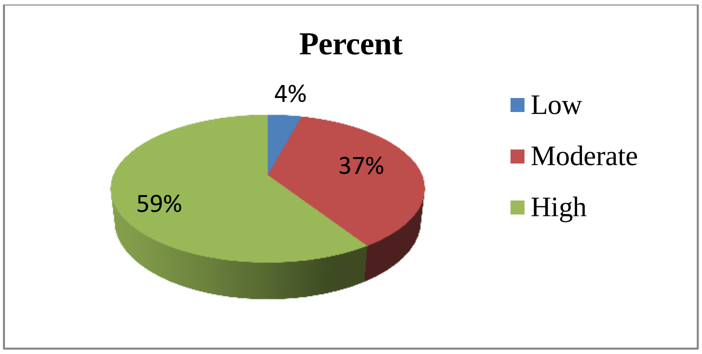

Figure 2 Level of Students' Performance in Student Factor

Finding of Students' Interest in Mathematics in the Selected Schools

In order to find out students' interest, a questionnaire for students' interest in mathematics was used. It is necessary to examine the percentage of the students who possessed low, moderate and high level of interest in mathematics. There were involved (600) numbers of students in this study. The full score for students' interest in mathematics was (140).The sample mean and standard deviation were (110.30) and (12.426) respectively. Based on the scores in respective interest items, students with scores below (97.87) were identified as those who possessed low level of interest and students with scores above (122.73) were identified as those who possessed high level of interest. Then, students with scores between and equal (97.87) and (122.73) were considered as those who possessed moderate level of interest. The percentage of the students in low, moderate and high levels of interest were 16 % (N=95), 66 % (N=398) and 18 % (N=107) respectively (see Table 3).

Table 3 Level of Students' Interest in Mathematics

Level of Interest	Score (x)	No. of Student	Percentage (%)
Low	$x < 97.87$	95	16
Moderate	$97.87 \leq x \leq 122.73$	398	66
High	$x > 122.73$	107	18
Total		**600**	**100**

Figure 3 displays the percentage of the students in each level of students' interest in mathematics based on the results of the percentage of Table 3.

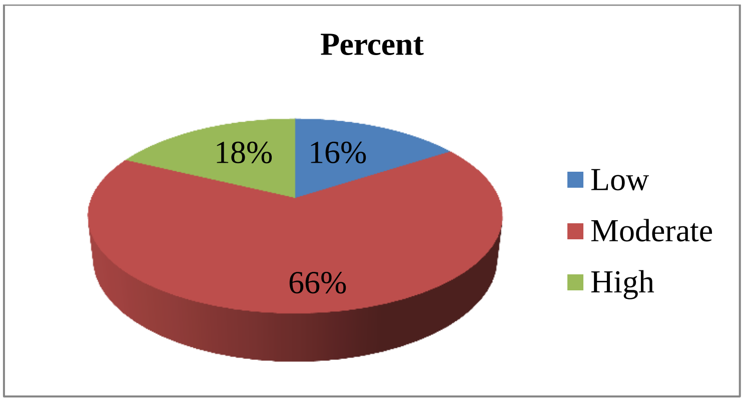

Figure 3 Level of Students' Interest in Mathematics

Relationships of Teacher Factors, Student Factors and Students' Interest in Mathematics

The relationship between teacher factors and students' interest in mathematics, and the relationship between student factors and their interest in mathematics are presented as follows:

Relationship between Teacher Factors and Students' Interest in Mathematics

To examine the relationship between teacher factors and students' interest in mathematics, Person product-moment correlation was used. It was found that there was a significant correlation r = .778, p<.01. This result shows that there was a significant correlation between teacher factors and students' interest in mathematics. The result shows that the direction of correlation was positive. This means that if the function of teacher factors is high, the interest of students in mathematics is likely to be high or if the function of teacher is low, the interest of students in mathematics is likely to be low. Table 4 shows the correlation between teacher factors and students' interest in mathematics.

Table 4 Correlation between Teacher Factors and Students' Interest in Mathematics

Correlation			
		Teacher Factors	**Students' Interest in Mathematics**
Teacher Factors	Pearson Correlation	1	.778**
	Sig. (2-tailed)		.003
	N	12	12
Students' Interest In Mathematics	Pearson Correlation	.778**	1
	Sig. (2-tailed)	.003	
	N	12	12

**. Correlation is significant at the 0.01 level (2-tailed).

After that, the correlation between the respective areas of teacher factors and students' interest in mathematics is presented in Table 5.

Table 5 Correlation between Respective Areas of Teacher Factors and Students' Interest in Mathematics

Correlation					
	SI	**TK**	**IS**	**TA**	**CS**
Students' Interest in Mathematics (SI)	1	.712**	.758**	.777**	-.591*
Teachers' Knowledge (TK)		1	.737**	.445	-.610*
Instructional Strategy (IS)			1	.534	-.567
Teachers' Attitudes towards Mathematics (TA)				1	-.460
Class Size (CS)					1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Relationship between Student Factors and their Interest in Mathematics

To examine the relationship between student factors and their interest in mathematics, Person product-moment correlation was used. It was found that there was a significant correlation r = .565, p<.01. This result shows that there was a significant correlation between student factors and their interest in mathematics. The result shows that the direction of correlation was positive. This means that if the function of student factors is high, their interest in mathematics is likely to be high or if the function of student is low, their interest in mathematics is likely to be low. Table 6 shows the correlation between student factors and their interest in mathematics.

Table 6 Correlation between Student Factors and their Interest in Mathematics

Correlation			
		Student Factors	**Students' Interest in Mathematics**
Student Factors	Pearson Correlation	1	.565**
	Sig. (2-tailed)		.000
	N	12	12
Students' Interest In Mathematics	Pearson Correlation	.565**	1
	Sig. (2-tailed)	.000	
	N	12	12

**. Correlation is significant at the 0.01 level (2-tailed).

After that, the correlation between the respective areas of teacher factors and students' interest in mathematics is presented in Table 7.

Table 7 Correlation between Respective Areas of Student Factors and their Interest in Mathematics

Correlation				
	SI	**SAM**	**SAT**	**MA**
Students' Interest in Mathematics (SI)	1	.614**	.481**	-.563**
Students' Attitudes towards Mathematics (SAM)		1	.360**	-.262
Students' Attitudes towards their teachers (SAT)			1	-.301
Mathematics Anxiety (MA)				1

**. Correlation is significant at the 0.01 level (2-tailed).

Summary of Findings

To sum up, the findings can be generalized as follows:

- The percentage of the teachers in low, moderate and high levels of performance were 16% (N=11), 66% (N=45) and 18% (N=12) respectively.
- The percentage of the students in low, moderate and high levels of performance were 4 % (N=25), 37 % (N=220) and 59 % (N=355) respectively.
- The percentage of the students in low, moderate and high levels of interest were 16 % (N=95), 66 % (N=398) and 18 % (N=107) respectively.
- Teacher factors have positively correlated with students' interest in mathematics (r= .778, p<.01).
- Student factors have positively correlated with their interest in mathematics (r= .565, p<.01).

Based on the research findings, discussion, suggestions and conclusion will be presented in the next chapter.

Conclusion

This chapter will present the discussion, suggestion and conclusion.

Discussion

From the research findings (Table 1), it was observed that there were involved 68 numbers of teachers in teacher factors. The sample mean and standard deviation in teacher factors were (164.51) and (10.887) respectively. It was observed that 16 % (N=11) of the teachers were low level teachers' performance, 66 % (N=45) of the teachers were moderate level teachers' performance and 18 % (N=12) of the teachers were high level teachers' performance in teacher factors. It can be interpreted that most teachers were moderate level of teachers' performance in teacher factors. So, this finding revealed that the answer of the first question: To what extent do teacher factors that affect students' interest in mathematics? Moreover, this finding shows that most teachers have average level of ability in teachers' knowledge, instructional strategy, teachers' attitudes towards mathematics and interaction with students in teaching mathematics.

From the research findings (Table 2), it was observed that there were involved 600 numbers of students in student factors. The sample mean and standard deviation in student factors were (94.67) and (7.408) respectively. It was observed that 4 % (N=25) of the students were low level, 37 % (N=220) of the students were moderate level and 59 % (N=355) of the students were high level in student factors. It can be interpreted that most students were high level in student factors. So, this finding revealed that the answer of the second question: To what extent do student factors that affect their interest in mathematics? Moreover, this finding shows that most students were good condition in their attitudes towards mathematics, attitudes towards their mathematics teachers and mathematics anxiety in learning mathematics.

From the research findings (Table 3), it was observed that there were involved 600 numbers of students in this study. The sample mean and standard deviation in students' interest in mathematics were (110.30) and (12.426) respectively. It was observed that 16 % (N=95) of the students possessed low level of interest, 66 % (N=398) of the students possessed moderate level of interest and 18 % (N=107) of the students possessed high level of interest in mathematics. It can be interpreted that most students had moderate level of interest in mathematics. So, this finding revealed that the answer of the third question: To what extent do students have interest in mathematics? Moreover, this finding shows that most students have average level of interest in learning mathematics. So, they need to improve their interest in learning mathematics.

According to the research findings (Table 4), the correlation between teacher factors and students' interest in mathematics was found that the correlation ($r = .778$, $p<.01$). This result shows that the direction of correlation was positive and it was pointed out that if the functions of mathematics teachers are high, students' interest in mathematics is also high. So, this finding revealed that the fourth question: Is there a relationship between teacher factors and students' interest in mathematics?

From the research findings (Table 6), the correlation between student factors and their interest in mathematics was found that the correlation ($r = .565$, $p<.01$). This result shows that the direction of correlation was positive and it was pointed out that if the functions of students are high, their interest in mathematics is also high. So, this finding revealed that the fifth question: Is there a relationship between student factors and their interest in mathematics?

According to research findings (Table 5), the correlation between respective area of teacher factors and students' interest in mathematics were found that the correlation between mathematics teachers' knowledge and students' interest in mathematics was .712, the correlation between instructional strategy and students' interest in mathematics was .758, the correlation between mathematics teachers' attitudes towards mathematics and students' interest in mathematics was .777 and the correlation between class size and students' interest in mathematics was - .591. These findings revealed that mathematics teachers' knowledge, instructional strategy and mathematics teacher attitudes towards mathematics were positively correlated with students' interest in mathematics. Among respective area of teacher factors, the fourth area, class size was negatively correlated with students' interest in mathematics. This result shows that the direction of correlation was negative and if the ratio of class size is large, students' interest in mathematics is low or if the ratio of class size is small, students' interest in mathematics is to be high.

Based on the result of research findings (Table 7), the correlation between respective area of student factors and their interest in mathematics were found that the correlation between students' attitudes towards mathematics and their interest in mathematics was .614, the correlation between students' attitudes towards their mathematics teachers and their interest in mathematics was .481 and the correlation between mathematics anxiety and their interest in mathematics was -.563. These findings revealed that students' attitudes towards mathematics and students' attitudes towards their mathematics teachers were positively correlated with their interest in mathematics. . Among respective area of student factors, the third area, mathematics anxiety was negatively correlated with students' interest in mathematics. This result shows that the direction of correlation was negative and if the mathematics anxiety is high, students' interest in mathematics is low or if the mathematics anxiety is low, students' interest in mathematics is to be high.

The research findings reveal that teacher factors and student factors affect students' interest in mathematics. These findings can support the finding of Leonard Chinaedum (2015): teacher factors, student factors, instructional strategy, mathematics anxiety and class size have significant relative effects on mathematics interest.

According to the above results, a generalization can be drawn that teacher factors and student factors are significantly influenced on students' interest in mathematics. Therefore, it can be realized that these factors are essential for improving students' interest in mathematics.

Suggestions

Based on the research findings, it was found that most students possess moderate level of interest in learning mathematics. In order to motivate student' interest, the mathematics teachers need to be creative in their teaching methods. To increase students' interest, the teacher should use a variety of visual aids, instead of the usual paper and pencil test and they should use continuous assessment. Moreover, mathematics lessons should be prepared to address a variety of learning styles. Students should be encouraged to learn mathematics. The mathematics teacher needs to know their pupils well, in general, so that the needs of the pupils are well catered for. This will enable the teacher to plan a lesson which will absorb all the pupils' interests.

Moreover, based on the findings of this study, it is suggested that mathematics teachers should develop positive attitude towards the subject and make mathematics interesting and appealing to students in order to help them a positive attitude towards it. Thus, mathematics teacher ought to create interesting and non-threating environments in their mathematics classroom and model enthusiasm for the teaching and learning of the subject. In this way, the students may develop positive attitude and more interest in learning mathematics.

Furthermore, interest is one of the most important ingredients in the learning process which builds a strong inner feeling or motion to have an appetite to learn concepts no matter how challenging the task may be. So, a mathematics teacher should well verse with means and techniques of arousing and maintaining interest in mathematics. To arouse and maintain interest in mathematics, the following points should be considered in depth.

The teacher should explain to the child the usefulness of learning mathematics in their daily life and for higher studies.

- The teacher should correlate the contents of mathematics with other school subject.
- The teacher should remove the fear from the mind of the child that is not a difficult subject rather very easy and interesting.
- The teacher should use different methods of teaching.
- The teacher should use Audio-visual aids in learning.
- The teacher should give interesting puzzles to the learner in teaching mathematics lessons.
- The teacher should give incentives to the learner.

In this study, sample schools were randomly selected from only Yangon Region. So, further research should be carried out for the rest States and Region for replication. Thus, carrying out a larger research in a nationally representative area in a longer duration is highly recommended to validate the present research results. Moreover, this research concerned with the middle school level students. That is so, other studies with the primary and high school level students should be conducted.

In addition, this study dealt with the factors that affect students' interest in mathematics such as teacher factors (teachers' knowledge, instructional strategy, teachers' attitudes towards mathematics, class size), and student factors (students' attitudes towards mathematics, students' attitudes towards their mathematics teachers, mathematics anxiety). Therefore, further studies should be conducted with many other factors.

Conclusion

One of the objectives of mathematics of secondary school stage is to develop interest in mathematics (Zubair, 2012). For pupils to learn mathematics, they need to have interest and a positive attitude. The challenges of mathematics learning for today's education are that it requires disciplined study, concentration and motivation. To meet these challenges learners must be focused and motivation to progress. This requires pupils having interest and positive attitude. All good teaching should arouse attention and interest. Interest is important in the teaching of a teacher and in the required absorption of the children in their learning. Firsov (2004) stated that interest leads to learning – if students are interested in a subject they will succeed.

So, there is a need to catch and hold students' interest in mathematics, to tap the full potential of talent within this domain -both male and female- and to encourage them to pursue related careers. When pupils lack interest towards learning mathematics might they may have low achievement or poor performance in the subject. Thus, the researcher wanted to know what factors that affect students' interest in learning mathematics. This is the main reason for conducting this research study.

According to the above results, it can be seen that there is a relationship between teacher factors and students' interest in mathematics and student factors and their interest in mathematics. Thus, teachers must revise formal teaching methods which often do not match the students' learning styles and skills needed to be productive in society.

Therefore, the researcher would like to put forward the following conclusive remarks.

- Students today have a need for practical mathematics. Mathematics needs to be relevant to their everyday life.
- Students must be engaged in exploring, conjecturing, and thinking rather than engaged in only role learning of rules and procedures.
- Teaching methods must be re-examined and there should be more emphasis placed on the specific methods which include less lecture, more student directed classes, and more discussion.
- Teachers not only need knowledge of a particular subject matter but also need to have pedagogical knowledge and knowledge of students.
- Teachers need to be creative in their teaching methods, so students do not lose interest.
- To engage students in mathematics, a teacher can focus on active involvement and student-centered activities, connect to everyday life, support conceptual competences, encourage active involvement, allow students to problematize the content, empower them to address the problems using their own authority and provide relevant resources.

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A STUDY OF MISCONCEPTIONS ABOUT GEOMETRY IN MIDDLE SCHOOL LEARNERS

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Abstract

The main purpose of this research is to study the misconceptions about geometry in middle school learners. Quantitative research methodology was mainly used to find out students' misconceptions in geometry. The design adopted in this study was a descriptive research design. This study was conducted in Yangon Region. There are four districts in Yangon Region: East, West, South and North. One township from each district was randomly selected. Two basic education high schools and one basic education middle school from each township were randomly selected. Thus, eight high schools and four middle schools were included in this study. To obtain the required data, (600) students and (68) mathematics teachers were participated in this study. Two instruments: a test for Grade Eight students' misconceptions in geometry and a questionnaire for mathematics teachers' perceptions were employed. The test included eight content areas: angles, triangles, congruence of triangles, quadrilaterals, parallel lines, circles, Pythagoras' theorem, and areas and volumes. The questionnaire consisted of (15) items on a five point Likert scale of (1) to (5) to explore attitude, attention, participation, doing exercises and conceptual understanding. The internal consistency (Cronbach's Alpha) for the test and the questionnaire were (.740) and (.866) respectively. The research findings revealed that most of the students had misconceptions in geometry, and least of the students had understanding the concept and less understanding the concept in geometry. For Grade Eight students, the highest level of misconceptions in geometry was in Pythagoras' theorem and the lowest level was in angles. For Grade Eight students, the highest level of the causes of misconceptions in geometry was in doing exercises (rote learning) and the lowest level was in attitude. To reduce misconceptions in geometry, it is necessary to ensure meaningful learning and quality education.

Keywords: geometry, misconception.

Introduction

Competency in mathematics is a necessity in the modern world because it not only plays a vital role in supporting the education system but also is a practical discipline reaching into a wide variety of fields such as science, technology, etc. Similarly, geometry, an area of mathematics, helps in developing good reasoning and it is applicable to solve human and natural problems like everyday life problems. Thus, it is necessary to be successful teaching and learning in geometry. According to National Council of Teachers of Mathematics (NCTM) (2000), students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge. In learning geometry, if learners have misconceptions before teaching, these can lead to confusion, frustration, errors and prevent learners to build up confidence and positive attitude towards mathematics learning, to value mathematics and to appreciate the beauty of mathematics. Therefore, in order to prevent misconceptions in geometry, there is necessary to understand why these misconceptions emerge and persist.

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Background of the Study

Learners' thinking about geometry is critical in learning geometry. Although geometric concepts have a visual aspect, learners consider them difficult to learn (NCTM, 1989, cited in Kembitzky, 2009). Clements and Battista (1992, cited in Pusey & Lousie, 2003) indicated the reasons for learners' misconceptions about geometric concepts as follows: learners do not understand subjects sufficiently, they overgeneralize specific rules about geometric expressions, they mostly learn by rote, and they cannot understand concepts exactly. Besides, according to National Education Strategic Plan (NESP) (2016), the current emphasizes on rote memorization of factual information in learning and assessment. This will make learners' misconceptions.

Some fundamental misconceptions often originate from earliest years of schooling, but may persist at higher levels. Besides, learners can enter into a classroom having misconceptions that have the potential to derail new learning. This can justify why it is important to carry out a research on the misconceptions held by learners in the teaching and learning of concepts.

If a learner has a misconception prior to learning a subject, this may prevent him/her from learning the new subject properly, thereby leading to new misconceptions. Thus, it is necessary to know learners' common misconceptions to reduce learners' conceptual difficulties and to become successful learning.

Statement of the Problem

In Myanmar, middle school level is the bridge between the primary school level and the high school level. Students' meaningful learning of geometry could help them solve and appreciate real-life problems. But, many students have some difficulties in geometry.

They thought themselves that "They cannot do geometry. Geometry and they are like oil and water." They mostly learn rote learning. They have accustomed to learning through memorization with hard work, but not independent thinking and creativity. Then, they gradually become math phobia, especially in geometry.

Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well (National Council of Teachers of Mathematics, NCTM, 2000, cited in Kembitzky, 2009). Identification of students' specific misconceptions is especially important for students with learning disabilities and low performing students (Salvia & Ysseldyke, 2004, cited in Zuya & Kwalat, 2015). By pinpointing students' misconceptions, teacher can provide instruction targeted to the student's area of need. Therefore, this study is aimed to study students' misconceptions in geometry.

Purposes of the Study

The main purpose of this research is to study the misconceptions about geometry in middle school learners.

The specific purposes are as follows:

1. To find out students' misconceptions in geometry
2. To investigate the mathematics teachers' perceptions on the causes of students' misconceptions in geometry
3. To give suggestions for reducing misconceptions in geometry at the middle school level

Research Questions

The research questions are as follows:

1. To what extent do Grade Eight students have misconceptions in geometry?
2. In which content area do Grade Eight students have the highest level of misconceptions in geometry?
3. In which content area do Grade Eight students have the lowest level of misconceptions in geometry?
4. In which cause do Grade Eight students have the highest level of misconceptions in geometry?
5. In which cause do Grade Eight students have the lowest level of misconceptions in geometry?

Scope of the Study

This research has its own particular limitations. The first limitation is related to the fact that the participants of the study came from only twelve selected schools from Yangon Region. Participants in this study are Grade Eight students from the twelve selected schools in four districts (East, West, South and North) in the academic year (2018-2019). The second limitation is the content areas of the subject. The content areas are limited to eight areas such as angles, triangles, congruence of triangles, quadrilaterals, parallel lines, circles, Pythagoras' theorem and areas and volumes, based on mathematics textbooks volume II (Grade Six, Grade Seven and Grade Eight).

The third limitation is that this study is only concerned with three levels of misconceptions (recognition/visualization, analysis, informal deduction) according to the van Hiele theory. Besides, in this study, other ways that foster learners' misconceptions in geometry at the middle school level were not tried to find out. The fourth limitation is that the questionnaire for mathematics teachers' perceptions was only used to investigate the mathematics teachers' perceptions on the causes of students' misconceptions in geometry.

Definition of Key Terms

Geometry: Geometry is a branch of mathematics concerned with point, straight line, plane figures, space, spatial figures, the relations between them and the measures of geometric figures including length, angle, area and volume, etc. (Biber, Tuna & Korkmaz, 2013, cited in Zuya & Kwalat, 2015).

Misconception: A misconception is a concept that is not in agreement or is different from the accepted understanding of in a field and that are presumed to interfere with the acquisition of new knowledge (Resnick, 1983, cited in Mestre, 1989).

Significance of the Study

Geometry is the study of shapes, their relationships and their properties (Bassarear, 2012, cited in Luneta, 2015). In teaching geometry, learning concepts with understanding is essential. When learners have conceptual knowledge, they know more than isolated facts and methods. They are able to represent mathematical situations in different ways and know how different representations can be useful for different purposes.

According to Hibert (1986), conceptual knowledge is achieved in two ways: by the construction of relationships between pieces of information and by the creation of relationships between existing knowledge and new information that is just entering the system. However, learners' rote (and frequently faulty) knowledge often interferes with their informal (and usually correct knowledge). This may lead to misconceptions. If learners have misconceptions, their learning becomes more challenging. If a learner holds a misconception, it distorts correct concepts.

An understanding of common students' misconceptions, and effective strategies to help students avoid them, is an important aspect of mathematical pedagogical content knowledge (Graeber, 1999). If teachers "un-teach" or "undo" students' misconceptions first, students cannot become successful learners with positive outcomes.

With a greater understanding of students' misconceptions of the skills that are prerequisites to the learning of new material in basic mathematics, teachers may be able to improve student learning. To do so, teachers must understand students' misconceptions. Therefore, to help teachers, this study is intended to find Grade Eight students' misconceptions in geometry.

Review of Related Literature

Mathematics Education

Mathematics plays a vital role in the day to day life. The knowledge of fundamental process of mathematics and the skill to use them are the preliminary requirements of human beings in any society of modern time. Thus, it is a very important subject.

Mathematics is necessary for the development of scientific, technical, monetary and commercial activities around the life of an individual and the community. Mathematics aids in understanding other subjects, especially science subjects, and in teaching mathematics. Therefore, it is necessary to enable the learner develop clear and logical thinking needed for analysis of both academic and everyday life situation.

The Reasons for Learners' Failing in Mathematics

According to Lieback (n.d.), some learners failed at mathematics because of rote learning, anxiety, understanding and attitude.

Rote Learning

Learning by heart is the memorization of information based on repetition. Some consider rote learning to be a necessary step in learning certain subjects. Although there are many advantages, rote learning can lead to many disadvantages. Rote work is widely considered an inaccurate representation of the learner's intelligence and comfort with the subject matter. Because it relies so heavily on memory, and does not necessarily reflect the student's core understanding of the subject, theory and memorization can portray a false sense of accomplishment.

Anxiety

Anxiety is possible to become over-motivated. Many psychologists have shown that high anxiety impedes learning. Learners with negative attitude towards geometry have performance problems simply because of anxiety.

Understanding

When concepts are explained, students have to rely on their understanding and imagination to figure out what is being taught. If not, learning will not be a continuing process.

Attitude

Attitude plays an important role on leaners' geometry achievement. Learners' interest in geometry is associated with their achievement in geometry. In addition, learners' attitude towards geometry had a direct effect on their achievement. In spite of the recognition given to geometry among mathematics topics, it is evident that learners still show negative attitude towards geometry thereby leading to poor performance.

The above causes can make learners fail in mathematics as well as geometry and also lead to some misconceptions. Therefore, teachers should try to reduce learners' anxiety and ensure meaningful learning, conceptual understanding and positive attitude.

The Teaching of Geometry

Geometry is the branch of mathematics that deals with space, figures in space and with properties of those figures such as size and shape. It involves the great importance place in people's lives to fulfill the need of human beings to specify quantities, to measure figures, land and earth, and make maps. Thus, it is a very important subject in daily life.

Geometric representations can be used to help students make sense of other areas of mathematics: fractions and multiplication in arithmetic, the relationships between the graphs of functions (of both two and three variables), and graphical representations of data in statistics. It is also an important branch of mathematics and it is well known to be the one of basic skills to be mastered. Therefore, it is an important area in the school mathematics curriculum and necessary to teach.

The Objectives of Teaching Geometry at the Middle School Level

According to Sidhu (1995), the objectives of teaching geometry at the middle school level are as follows:

1. To familiarize with the use of the straight edge, protractor, compass, an set-square and to draw the simple geometric figures with them
2. To help students learn the important facts, relations and principles of geometric figures by drawing, measuring, comparing, experimenting, discussing, explaining, questioning, conjecturing, verifying and testing
3. To help students learn the geometric vocabularies
4. To develop an understanding of the inductive method as a way of looking for geometric facts, relations and principles
5. To acquaint the students with the characteristics of good geometric notation

Different Stages of Teaching Geometry

According to Sidhu (1995), there are three stages of teaching geometry: the practical stage, the stage of reasoning and the systematizing stage.

1. The Practical Stage

The practical stage is the stage of the geometry of the classroom and environment. It is the period of experimentation, observation, recognition and construction. In the practical stage, students will be expected to acquaint themselves with the common geometrical concepts and figures. By examining and handling geometric models, straight lines, curved lines, angles, triangles, polygons, circles, cubes, cuboids, cylinders, sphere, etc., students will be mainly guided to experience the symmetry, variety, regularity and beauty of forms in the nature and practical arts. Besides, students will be taught how to keep and handle the instruments. The work will center round the observing and drawing of common geometric figures. But it should not be taken to mean that practical geometry ends with this stage. It is the beginning of the entire geometrical work.

2. The Stage of Reasoning

The stage of reasoning is the stage to learn to prove theorems and exercises. The proofs will have to be presented in both the practical and theoretical forms to provide flawless understanding. In this stage, students will be expected to get used to reasoning without dependence on real and concrete instances. The reasoning will more and more incline to the side of argument than stick to the obvious nature of observation. Informal reasoning will be encouraged and made interesting and attractive at this stage. Students will be enabled to know the interesting theorems of plane geometry and to solve easy riders. Students will be prepared for the more formal reasoning to come in the next stage.

3. The Systematizing Stage

The systematizing stage is the stage of acquisition of mastery in reasoning. The reasoning will be more rigorous but properly suited to the mental age of the students. Practice in logical reasoning will be more important than convincing them that the facts are true. Dependence on axioms will also be reduced.

Importance of Conceptual Understanding in Geometry

Geometry is a way of thinking. Geometric understanding builds its foundation on geometric meaning. When a student understands the meaning underlying principles of geometric concepts, he or she has conceptual knowledge in geometry. Conceptual understanding refers to an integrated and functional grasp of geometric ideas. Conceptual understanding knows more than isolated facts and methods.

In the 21^{st} century, students need to develop conceptual understanding in order to flourish and solve problems as adults in the present changing environment. The successful student understands the ideas and has the ability to transfer their knowledge in new situations and apply it to new contexts. Therefore, conceptual understanding is an important component and teachers should help learners ensure conceptual understanding.

Before learning the new concept, if learners have some misconceptions, it may disturb to understand the concept and use the concept appropriately. Hence, learners will also encounter conceptual difficulties and many challenges. That is why, to ensure conceptual understanding, it is necessary to find out and understand learners' misconceptions.

Nature of Misconception

Students' thinking consists of many things. Formulae, relevance, tedium and enjoyment are part of their attitudes and thinking about mathematics. Many students do not come to the classroom as "blank slates". Rather they come with informal theories constructed from everyday experiences. These theories have been actively constructed. They provide an everyday functionality to make sense of the world but are often incomplete half-truths (Mestre, 1989). So, they become misconceptions.

Students learn concepts, and sometimes they can also learn misconceptions – in spite of whatever teachers try to teach them. Some errors or mistakes are persistent because of misconceptions. However, although misconceptions are consciously made, mistakes are usually due to carelessness. They cannot do the same for misconceptions. Misconceptions are committed because students think they are correct.

Students often approach learning situations with misconceptions or with prior knowledge that actually impedes learning. During experiences with a concept or a process (or a procedure), a student focuses on whatever the experiences appear to have in common and connects that information to information already known. Students have done the right beginning to solve the problems but they couldn't reach correct answer because of some mathematical misconception.

Some students will make some generalizations that are not correct and many of these misconceptions will remain hidden unless the teacher makes specific efforts to uncover them. Misconceptions are a problem for two reasons. First, students tend to be emotionally and intellectually attached to their misconceptions, partly because they have actively constructed them and partly because they give ready methods for solving various problems. Second, they definitely interfere with learning when students use them to interpret new experiences.

Another problem that leads to very serious learning difficulties in mathematics is those misconceptions that student may get from previous inadequate teaching, informal thinking, or poor remembrance. Therefore, it is very important to recognize student misconceptions and to re-educate students to correct mathematical thinking.

Students' Misconceptions in Geometry

Knowledge is not transferred from person to person. The individual does not passively receive knowledge from the environment, but is an active participant in the construction of his/her own knowledge. The construction activity involves the reception of new ideas and the interaction of these with the students' existing ideas. Student errors are the result or the product of previous experience in the mathematics classroom.

Confusions or misconceptions that occur during the fundamental learning of underlying concepts, may lead to greater difficulties throughout school and beyond. It is important that students develop correct concepts. Misconceptions are conceptual or reasoning difficulties that hinder students' mastery of any discipline.

Geometric misconceptions are the students' unacceptable explanations and responses about geometric concepts as a result of passing through inaccurate, incorrect and confused life, and learning experiences which contradict with the approved geometric concepts by mathematics teaching professionals partially or wholly. This is based on the fact that students' awareness of such concepts is in contrast with those who are specialized in these concepts.

Many students have problem in comprehending geometric concepts, which is an important aspect of learning mathematics. Reasons for students' misconceptions in geometry include students' reliance on the physical appearances of the figures, inability to associate geometric properties with one another, overgeneralization and rote learning (Ozerem, 2012).

Some common misconceptions in geometry among students are as follows. Clements and Battista (1992, cited in Pusey & Lousie, 2003) said geometric shapes presented in non-standard forms are hardly recognized by many students, as they perceive a square as not a square if it is not on a horizontal base. Furthermore, many students have problems in perceiving class inclusions of shapes, for example, they do not think that a square is a rectangle, or a square is a rhombus, and a rectangle is a parallelogram.

Other common misconceptions include, using the bottom line as the base of the triangle in calculating the area of a triangle; larger space means larger angle; inability to understand the angles in parallel lines – alternate and corresponding angles; inability to recognize and perceive the properties of quadrilaterals; learning formulas and definitions inadequately.

Many teachers have observed that many students have numerous misconceptions about geometry when a teacher discusses a geometry proof problem in class, it generally involves oral presentation of a formal proof and body movements pointing at different parts of the figure of the problem. Students must watch, listen, jot notes, and think as a lecture proceeds. They have to refer to many elements of the instruction and incorporate them into their memory (Sweller, 1988, cited in Ozerem, 2012). This often causes cognitive overload and poses a negative effect on students' learning.

Addressing the difficulties and misconceptions in learning geometry, Duval, Healy and Hoyles (1998, cited in Ozerem, 2012) explained that geometry instruction is often more complex than that of numerical operations or elementary algebra. It is therefore more important that geometry instructions must incorporate new and tested approaches such as using visual and multimedia tools in the classroom. Furthermore, to be effective teaching learning in geometry, teachers should try to apply appropriate theories, approaches and methods according to their students' previous knowledge.

The van Hiele Theory

According to Senk (1989, cited in Makhubele, 2014), the van Hiele theory of levels of thought in geometry is the most famous and prominent model used in the teaching of geometry. The two Dutch mathematics educators, Pierre van Hiele and his wife Dina van Hiele investigated the role of instruction in assisting learners to acquire geometric knowledge and raise their thought levels.

According to van Hiele (1986, cited in Makhubele, 2014), there are five levels in students' geometric understanding. They are:

1. **Level 0 (recognition/visualization):** Learners identify, name, compare and operate on geometric figures on the basis of their appearance in a holistic manner at this level they are able to recognize and name figures based on the characteristics of the figure. The emphasis at this level is on the shapes that students can observe, feel, build, take part, or work with in some manner.

2. **Level 1 (analysis):** Learners analyze figures in terms of their components and discover the relationships among those components as well as derive the properties/rules of a class of shapes empirically. They are able to consider all shapes within a class rather than a single shape. Learners begin to appreciate that a collection of shapes goes together because of properties.
3. **Level 2 (informal deduction):** Learners are able to interrelate logically previously discovered properties/rules by giving or following informal arguments. They begin to be able to think about properties of geometric objects.
4. **Level 3 (deduction):** Learners are able to prove theorems deductively and establish interrelationships among networks of theorems. Learners begin to appreciate the need for a system of logic. They are able to work with abstract statements about geometric properties and make conclusions based on logic than intuition. They also prove theorems using clearly articulated logical reasoning.
5. **Level 4 (rigor):** Learners establish theorems in different postulation systems and analyze/compare these systems. At this level, there is an appreciation of the distinctions and relationships between different axiomatic systems. Learners can understand the necessity of precision and the interrelationships between mathematical systems or structures. This means learners can reason abstractly without any reference to a concrete model.

Among them, the first three levels (recognition/visualization, analysis and informal deduction) will be examined in this study.

Research Method

This study is concerned with the misconceptions about geometry in middle school learners. The purpose of this study is to find out the students' misconceptions in geometry at the middle school level. Research design and procedure, instruments, population and sample, and data analysis are presented to address the research questions.

Research Design and Procedure

Research design and procedure are presented as follows:

Research Design

The research design for this study was a descriptive research design. In this study, data were mainly collected through a quantitative method. The researcher used descriptive research design to collect data about the Grade Eight students' misconceptions in geometry. Quantitative descriptive research data were mainly collected from the test and the questionnaire.

Procedure

To obtain the required data, the researcher had done the following steps in this study.

Step 1: Formulating the Problem

The students' misconceptions in learning geometry are still in the unsatisfied condition. So, to study the misconceptions about geometry in middle school learners is necessary.

Step 2: Compiling Related Literature

The researcher sought out the literature related to this study through reading books. Moreover, the researcher studied the literature from the Internet sources.

Step 3: Constructing Instruments and Validation

A questionnaire for mathematics teachers' perceptions and a test for Grade Eight students' misconceptions in geometry were constructed under the guidance of the supervisor. After preparing the instruments, in order to get validation, expert review was conducted by three experts in the field of mathematics from Mathematics Department, four experts in the field of mathematics from the Department of Methodology and two experts who had experience in teaching mathematics from the basic education middle schools and high schools. Since ambiguities were found in the responses, a little change was made in the original questionnaire after consulting experts.

Step 4: Pilot Testing

The questionnaire for mathematics teachers' perceptions and the test for Grade Eight students' misconceptions in geometry were validated through pilot testing with four middle school mathematics teachers and fifty Grade Eight students. The pilot testing for the instruments was conducted in B.E.H.S 2 (Hmawbi). The internal consistency of the questionnaire for mathematics teachers' perceptions was (.866) and the test for Grade Eight students' misconceptions in geometry was (.740) by using Cronbach's Alpha.

Step 5: Sampling

After the pilot test, the sample schools for this study were selected by using stratified random sampling method. Two high schools and one middle school were selected from each district. Therefore, eight high schools and four middle schools were included in this study. There were (68) middle school mathematics teachers and (600) Grade Eight students participated in this study.

Step 6: Data Collection

The modified instruments were distributed to all participants of the twelve sample schools with the help of the headmaster/headmistress of those schools in December 2018. After that, students' answer sheets were scored manually based on the marking scheme.

Step 7: Analysis of the Data

All the data were organized into the computer data file and were analyzed using the Statistical Package for the Social Science (SPSS 22).

Instruments

In this study, a questionnaire for mathematics teachers' perceptions and a test for Grade Eight students' misconceptions in geometry were used as the instruments. The questionnaire for mathematics teachers' perceptions was mainly based on questionnaire developed by Wong et al. (2001) and questionnaire developed by Kakai (2012). It included causes of students' misconceptions in geometry. It consisted of (15) items on a five point Likert scale of (1) to (5) to explore attitude, attention, participation, doing exercises and conceptual understanding. A test for Grade Eight students' misconceptions in geometry was mainly based on three-tier diagnostic test developed by Ningrum et al. (2018) and three-tier diagnostic test developed by Jauhariyah et al. (2018). It consisted of three levels of questions: the first level contained the usual multiple-choice questions, the second level contained the choice of reason, and the third level contained questions relating to the belief in the answer chosen in two the previous level. Using this test, it can be known the students who understand the concept, students who have experience misconception, and students who do not understand the concept (see Appendix).

Population and Sample

All participants in the sample were Grade Eight students and middle school mathematics teachers. This study was conducted in Yangon Region. There are four districts in Yangon Region. One township from each district was randomly selected for this study. The sample schools for the study were selected by using a stratified random sampling technique. Two high schools and one middle school from each township were selected as the sample schools. Therefore, eight high schools and four middle schools are included in this study. Grade Eight students and middle school mathematics teachers from selected schools were selected as the sample. The number of students was (600) and the number of teachers was (68).The participants in this study were selected by using a random sampling method and a stratified random sampling technique respectively.

Data Analysis

The data were analyzed by using descriptive statistics (mean, standard deviation and percentage). In order to know the students' misconceptions in geometry, their achievement and their confidence in performing geometric problems, mean, standard deviation and percentage were used. In addition, the responses to the questionnaire for mathematics teachers' perceptions were analyzed to investigate the mathematics teachers' perceptions on the causes of students' misconceptions in geometry.

Findings

Findings of Students' Misconceptions in Geometry

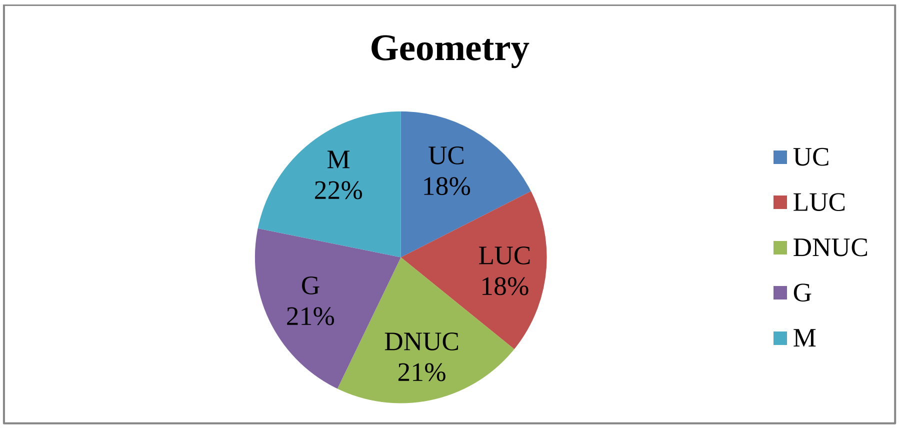

Figure 1: Percentage of Students' Responses in Geometry

Note: UC = Understand the Concept; LUC = Less Understand the Concept; DNUC = Do Not Understand the Concept; G = Guessing; M = Misconception

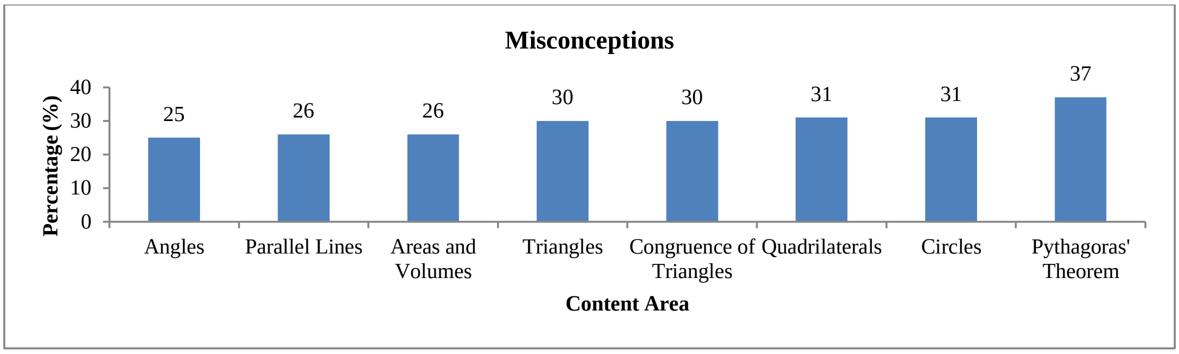

Figure 2 Comparison of Percentage of Students' Misconceptions in Content Areas of Geometry

Findings of Mathematics Teachers' Perceptions on the Causes of Students' Misconceptions in Geometry

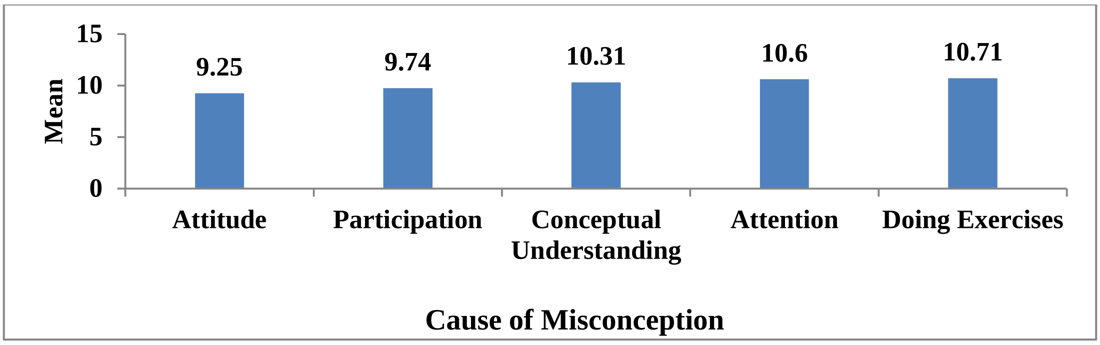

Figure 3 Comparison of Mean for Causes of Students' Misconceptions in Geometry Summary of Findings

To sum up, the findings can be generalized as follows:

- According to a test for Grade Eight students' misconceptions in geometry, Grade Eight students have 22% misconceptions in geometry.
- Grade Eight students have 25% misconceptions in angles.
- Grade Eight students have 30% misconceptions in triangles and congruence of triangles respectively.
- Grade Eight students have 31% misconceptions in quadrilaterals and circles respectively.
- Grade Eight students have 26% misconceptions in parallel lines and areas and volumes respectively.
- Grade Eight students have 37% misconceptions in Pythagoras' theorem.
- Therefore, for Grade Eight students, the highest level of misconceptions in geometry is in Pythagoras' theorem and the lowest level is in angles.
- According to questionnaire for mathematics teachers' perceptions, the mean of doing exercises (10.71) was the highest among five causes of students' misconceptions in geometry and that of attitude (9.25) was the lowest.
- Thus, for Grade Eight students, the highest level of the causes of misconceptions in geometry is in doing exercises and the lowest level in attitude.

Conclusion

Discussion, suggestions and conclusion will be presented.

Discussion

The main purpose of this study is to study the misconceptions about geometry in middle school learners. The specific purposes are to find out students' misconceptions in geometry, to investigate the mathematics teachers' perceptions on the causes of students' misconceptions in geometry and to give suggestions for reducing misconceptions in geometry at the middle school level. To implement these three purposes, this study was conducted by five research questions. In this part, the findings of the research study will be discussed according to the research questions.

Research Question 1: To what extent do Grade Eight students have misconceptions in geometry?

According to the research findings, concerning the students' responses in geometry (see Figure 1), the researcher found that eighteen percent of students' responses in geometry were Understand the Concept (UC) and Less Understand the Concept (LUC) respectively. Twenty one percent of students' responses in geometry were Do Not Understand the Concept (DNUC) and Guessing (G) respectively. Twenty two percent of students' responses in geometry were Misconception (M). Therefore, most of the students have misconceptions in geometry and least of the students have understanding the concept and less understanding the concept in geometry.

Research Question 2: In which content area do Grade Eight students have the highest level of misconceptions in geometry?

Research Question 3: In which content area do Grade Eight students have the lowest level of misconceptions in geometry?

Then, the research questions 2 and 3 will be discussed. Figure 2 was illustrated by arranging the percentages of misconception in content areas of geometry in ascending order. According to Figure 2, the first is the percentage of misconception in angles. The second is the percentage of misconception in parallel lines and areas and volumes. The fourth is the percentage of misconception in triangles and congruence of triangles. The sixth is the percentage of misconception in quadrilaterals and circles. The last is the percentage of misconception in Pythagoras' theorem. Therefore, for Grade Eight students, the highest level of misconceptions in geometry is in Pythagoras' theorem and the lowest level is in angles.

Research Question 4: In which cause do Grade Eight students have the highest level of misconceptions in geometry?

Research Question 5: In which cause do Grade Eight students have the lowest level of misconceptions in geometry?

Besides, the research questions 4 and 5 will be discussed. Figure 3 was illustrated by arranging the means for the causes of students' misconceptions in geometry in ascending order. According to Figure 3, the first is the mean of attitude. The second is the mean of participation. The third is the mean of conceptual understanding. The fourth is the mean of attention and the fifth is the mean of doing exercises. Therefore, for Grade Eight students, the highest level of the causes of misconceptions in geometry is in doing exercises and the lowest level is in attitude.

According to the results of the above presentation, the highest level of the causes of misconceptions in geometry was in doing exercises (rote learning). This result implies that most of the students are learning by rote. Rote learning can make students to be inadequate thinking and reasoning abilities. Thus, it is necessary to reduce rote learning.

According to National Education Strategic Plan (NESP) (2016), the current emphasizes on rote memorization of factual information in learning and assessment. Although there are many advantages of rote learning, rote learning can lead to many disadvantages. Clements and Battista (1992, cited in Pusey & Lousie, 2003) indicated the reasons for learners' misconceptions about geometric concepts as follows: learners do not understand subjects sufficiently, they overgeneralize specific rules about geometric expressions, they mostly learn by rote, and they cannot understand concepts exactly.

According to the research findings, most of the students have misconceptions in geometry, least of the students have understanding the concept and less understanding the concept in geometry, and the highest level of the causes of misconceptions in geometry is in doing exercises (rote learning). These results are consistent with the facts indicated by Clements and Battista (1992, cited in Pusey & Lousie, 2003). Therefore, to reduce misconceptions, it is necessary to ensure meaningful learning and quality education.

Suggestions

To reduce learners' misconceptions in geometry and rote learning, it is necessary to ensure meaningful learning and quality education. To become meaningful learning and quality education, effective teaching and learning is essential. That is why; teachers should use appropriate methods according to the level of geometric thinking of students. Teachers should use three stages of teaching geometry: the practical stage, the stage of reasoning and the systematizing stage. If students do not have the underlying foundation of what actually means, students will struggle with learning geometry. Therefore, teachers should not be concentrated on facts. Learning by doing can make students raise the level of recall and retention of the content in long-term memory. Thus, teaching should be done in using visual aids, manipulatives, games and puzzles, etc.

Besides, students should learn geometry by small group cooperative learning. Small group provides a forum in which students ask questions, discuss ideas, demonstrate to others, learn to listen to others and offer constructive criticism and summarize their discoveries in writing. If so, students can reduce anxiety and misconceptions. Furthermore, to become effective teaching and learning, the nature of the classroom should be suitable for actively oriented pedagogy. This classroom should provide learners to interact with teacher without fear and move freely in it. It should also provide opportunity for variety of activity. Sufficient learning materials should available in this classroom. There should be freedom of expression and need of the learners should be taken into consideration. Areas like reference corner, reading corner, information corner, classroom library, etc. should set up in the classroom.

These are some suggestions to reduce misconceptions and ensure meaningful learning and quality education. Moreover, many factors to take into account before learning and after learning are also remaining in order to become meaningful learning. In the teaching and learning process, the teacher is essential. Thus, to become effective teaching and learning, teachers should continuously try to know the factors that support meaningful learning and to upgrade their pedagogical content knowledge.

Conclusion

In the 21st century, learning is an active process in which learners construct new ideas or concepts based upon their current and past knowledge. If learners have actively constructed misconceptions, they will think everything according to misconceptions and solve various problems by using them. They will definitely interfere with learning. Therefore, it is necessary to reduce misconceptions to become effective learning.

Besides, one of the challenges for mathematics educators is not only enabling their charges to know more and be able to do more with their mathematics, but to have a greater affinity for mathematics itself (Allen, 2011, cited in Foley, 2016). Therefore, teachers should try students to have positive attitudes towards mathematics.

Positive student perceptions of mathematics can link to higher student achievement. These can contribute to students in their daily lives. If students have misconceptions in geometry, these can lead to confusion, frustration, errors and prevent learners to build up confidence and positive attitude towards learning, to value mathematics and to appreciate the beauty of mathematics. Therefore, it is necessary to reduce students' misconceptions. To reduce misconceptions in geometry, it is also necessary to understand why these misconceptions emerge and persist.

According to the research findings, most of the students had misconceptions in geometry, least of the students had understanding the concept and less understanding the concept in geometry, and the highest level of the causes of students' misconceptions in geometry was in doing exercises (rote learning). Therefore, it is necessary to ensure meaningful learning and quality education.

To become meaningful learning and quality education, teaching and learning should be effective. To become effective teaching and learning, teachers should know the previous knowledge of their students and use appropriate methods according to the level of students' geometric thinking. Teachers should teach students by using visual aids, manipulatives, games and puzzles, etc. Furthermore, students should learn small group cooperative learning. To be convenience in learning geometry, a proper atmosphere should be created in the classroom.

Furthermore, teachers should use not only summative assessment but also formative assessment. Assessment should not emphasize on rote memorization of factual information. It should emphasize students' thinking and reasoning skills. If teachers find out students' misconceptions according to the result of assessment, teachers should not ignore these misconceptions. Teachers should provide remediation by using appropriate methods. Only when, teachers will reduce students' misconceptions.

Although this study cannot fulfill the all objectives of teaching mathematics at the middle school level in Myanmar, it can be a support for teachers and curriculum planners to understand the middle school learners' misconceptions and address conceptual difficulties.

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Appendix

အောက်ပါ မေးခွန်းများကို ဖတ်ရှု၍ ပေးထားသော ဖော်ပြချက်များမှ မှန်ကန်သော အဖြေကို စက်ဝိုင်းဝိုင်းပေးပါ။

ဥပမာ

1.	a.	အောက်ပါ ထောင့်တွဲများအနက် ထောင့်မှန်ဖြည့်ဖက် အတွဲမှာ A. 30°, 60° B. 40°, 140° C. 70°, 200° D. 90°, 270° ဖြစ်သည်။
	b.	ထောင့်နှစ်ထောင့်သည် ထောင့်မှန်ဖြည့်ဖက် ဖြစ်လျှင် ၎င်းထောင့်နှစ်ထောင့် ပေါင်းလဒ်သည် A. 90° B. 180° C. 270° D. 360° ရှိသည်။
	c.	သင်ဖြေဆိုထားသည့် အဖြေနှင့် ပတ်သက်၍ (i) သေချာပါသည်။ (ii) မသေချာပါ။

Marking Scheme

No. of Items = 22 items
Each question = 1 mark
သေချာပါသည် = 1 မသေချာပါ = 0

Each Item			Problem Level Analysis
a	**b**	**c**	**Category**
1	1	1	Understand the Concept
1	1	0	Less Understand the Concept
0	0	0	Do Not Understand the Concept
1	0	0	Guessing
0	1	0	
1	0	1	Misconception
0	0	1	
0	1	1	

AN INVESTIGATION INTO THE DIFFICULTIES OF STUDENTS IN LEARNING BIOLOGY

Hnin Oo Wai[1] and Su Su Khine[2]

Abstract

The main purpose of this study is to investigate the difficulties of students in learning biology. Especially, causes of difficulties in terms of subject matter, use of instructional materials, teachers' styles of teaching, students' attitudes, study habits and students' anxiety in subject were examined. Difficult biology topics were also investigated. Sixteen high schools from eight townships of four districts in Yangon Region were randomly selected. (32) biology teachers and (640) Grade Ten science students from the selected schools participated in this study. Three instruments: questionnaire for teacher, questionnaire for student and an achievement test were used. For obtaining questionnaire reliability, the pilot test was administered. According to the questionnaires' responses, causes of students' difficulties learning in biology were presented as percentage. According to the teachers' responses, the most serious causes of difficulties of students in learning biology were due to inadequate use of instructional materials and students' poor study habits in biology. Based on the students' responses, the most serious causes of difficulties were due to inadequate use of instructional materials and students' anxiety. Difficult topics such as plant and animal cells, plant and animal tissues, bacterial cell and protozoa were mostly responded. And then, students' achievement in biology was presented as mean score and standard deviation. Pearson product moment correlation was also used to study the relationship between students' learning difficulties and their achievement in biology. The correlation between students' learning difficulties and their achievement in biology was r=-.698, $p < .01$. These results showed that students who have difficulties in learning have lower achievement and vice versa.

Keywords: difficulty, biology, learning

Introduction

Education is the process through which an individual is developed into individuality and a person into a personality. It refers to the change in behavior, attitude and culture brought about in the individual as a result of his having undergone education during a particular period (Sharma & Vyas, 2017). In Myanmar society, education is traditionally valued as a key determinant for social mobility and it is widely recognized as a critical building block for nation building, national unity and sustainable development (National Education Strategic Plan [NESP], 2016). As children grow up in an increasingly technologically and scientifically advanced world, they all need to be scientifically literate to succeed. Science is the most ideal subject to help improve students' thinking ability, for it emphasizes inquiry, which in turn permits students to construct their own knowledge through active investigation of objects and events (Collette & Chiappetta, 1989). In accordance with Myanmar education curriculum, science is taught from Kindergarten (KG) to Grade Nine as a compulsory subject. At the upper secondary school level, science is optional and students who take science combination have to learn Physics, Chemistry and Biology. The knowledge of biology is the major potent source for social and economic changes in the contemporary history of mankind (Owiti, 2009). Unlike other science subjects, biology is expected to be performed much better because the subject matter touches on life and life processes that are expected to be interesting and motivating to the learners (Samikwo, 2013).Therefore, the teaching and learning of biology should be taken very seriously.

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Background of the Study

In our universe, plants and animals are depending on each other. Animals have to take food and water to survive. The food that the animals had taken are the products and by products of the plants. For this reason, the study of living things, biology, stands as the most fundamental and important of all the sciences (BEd Correspondence Course, 2018). Biology is a unique discipline where experiments with living organisms can take place both in the laboratory and in the field (Prokop, 2007, cited in Hasruddin & Putri, 2014). But, biological materials that exist today is loaded with biological terms, mostly taken from the Latin so that the loss of important concepts that are simply not understood by the students (Hasruddin & Putri, 2014). According to research done by Samikwo (2013) obtained that respondents named terminologies used in the content of biology, misspelling of biological terms and the strict making of biology examinations as the key challenges faced in the study of biology.

As a result, the improvement of biology learning for all students requires effective teaching in all classrooms. Effective teaching requires clarity in presentation and explanation. According to a study by Smith and Meux (1962, cited in Westwood, 1996), it appears that the greatest source of confusion in learners is lack of precision in teachers' explanations. Poor explanations usually get learners confused and therefore create learning problems. Added with the lack of teaching learning strategies that is used so that students unable to complete the study (Hasruddin & Putri, 2014).

Also, inadequate or lack of practical work during biology lessons could be a stumbling block to pupils insofar as understanding new biological concepts is concerned (Woodley, 2009). Because biology includes many abstract concepts and phenomena that require observation, students need to see what they are learning or to experiment with what is being taught. Moreover, the use of instructional materials in teaching biology is very important because it provides a concrete basis for conceptual thinking which motivates pupils to learn more. However, it is fail to use instructional materials and do practical work in teaching biology lessons today. Failure to use on the part of the teacher as Onyegegbu (2001) explained made it rather difficult for pupils to grasp difficult biological concepts.

In addition, Dillon (2008, cited in Salibio, 2014) stated that students' learning and studying habits were one of the reasons they had difficulties in learning biology. Success or failure of each student depends upon his own study habits. Many students of today memorize biology by rote without acquiring real understanding of principles. Besides, many of them did not study biology regularly, review previously taught materials or work on biology questions on a regular basis. As a result, in such a context, students cannot learn biology with understanding. This causes very rapid rate of forgetting.

Furthermore, if students are not happy with the way that biology is taught, they may show disinteret in and negative attitudes towards biology and its teaching. Without interest or motivation in the subject being studied, it is hard for the learner to keep learning. Thus, students should be given opportunities to develop positive attitudes in relation to their studies in biology. Promoting positive attitudes related to the pupil's understanding in biology is a key part of biology education (Johnstone & Reid, 1981, cited in Chu 2008).

Besides, students of all academic achievement levels suffer from academic anxiety (Dobson, 2012). Anxiety is a negative feeling to learning process. According to the research done by Ucak and Say (2018) indicate that anxiety and negative attitudes become obstacles to students' participation into the teaching and learning process and they reduce students' performance and achievement.

For these issues, it was aimed to investigate the causes of difficulties of students in learning biology and to give suggestions based on the data obtained from this study to improve biology learning.

Purposes of the Study

The main purpose of this study is to investigate the difficulties of students in learning biology. The specific objectives are as follows:

(1) To investigate the causes of difficulties students face in learning biology
(2) To investigate the difficult biology topics for Grade Ten students
(3) To investigate the relationship between students' learning difficulties and their achievement in biology
(4) To give suggestions based on the data obtained from the study to develop biology learning

Research Questions

(1) What are the most serious causes of difficulties of students in learning biology from teachers' views?
(2) Which biology topics do Grade Ten students have difficulties learning from teachers' views?
(3) What are the teachers' views of the reasons which students face difficulties in learning biology?
(4) What are the most serious causes of difficulties of students in learning biology from students' views?
(5) Which biology topics do Grade Ten students have difficulties learning from students' views?
(6) To what extent do students achieve in biology in the selected schools?
(7) Is there any significant relationship between students' learning difficulties and their achievement in biology?

Scope of the Study

(1) This study is geographically restricted to Yangon City Development Area (YCDA).
(2) Participants in this study were (32) biology teachers and (640) Grade Ten science students from (16) selected Basic Education High Schools within (2018-2019) Academic Year.
(3) Three instruments: questionnaire for teacher, questionnaire for student and an achievement test for students were used.
(4) Questionnaires in this study are limited to find out the causes of difficulties in learning biology in terms of subject matter, instructional materials, teachers' styles of teaching, students' attitudes, students' study habits and students' anxiety.

(5) The achievement test included true/false items, completion items, multiple-choice items and short-question items.

(6) The content area is limited to twelve topics from five chapters covered in biology textbook to measure students' achievement.

Definition of Key Terms

Difficulty: Something that inhibits the student in accomplishing correctly or in understanding quickly a given terms (Centeno, 1988)

Biology: The study of life and living organisms including their physical and chemical structure, function, development and evolution (Richards, 2002)

Learning: The acquisition of new behavior or strengthening or weakening of old behaviour as the result of experience (Henry P. Smith, 1962)

Significance of the Study

In accordance with Myanmar basic education curriculum, Grade Ten biology is the foundation course for the beginners to make them aware of the actual meaning of biology that deals with living things, organisms. A subject becomes interesting with systematic learning methods. It is thus greatly depend on the deliverers (teachers) who must prepare each lesson carefully in order to draw the interests of the receivers (students) (Ministry of Education [MOE], 2016). Therefore, teachers should make biology lessons interesting and attractive for students to learn more effectively.

Students are also more motivated to solve authentic problems and show the preference for the learning activities through a process of thinking and working rather than just learning by listening (Lombardi & Oblinger, 2007, cited in Suwono et al., 2017). Bilbao (2006, cited in Alngog & Aledon, 2014) pointed out that learning through hearing alone proves to be the least effective means of learning. One learns eleven percent by hearing as against eighty-three percent by seeing. As far as retention of hearing is concerned, learning through hearing again stands at the lowest ebb because after three days, we recall only ten percent of what we learn through hearing as against fifty percent of what we learn through both hearing and seeing and ninety percent of what we acquire by applying three of our senses i.e. seeing, hearing and doing. Thus, the need to emphasis on the use and importance of instructional materials in any learning and teaching environment cannot be underestimated. For any learning to take place, the teacher has to make use of these materials that would enable him to teach effectively (Effiong et al., 2015).

Not only do teachers need to know how to teach but students need to know how to study. The link between study habits and academic achievement has strong connection. By learning better study techniques, students may save time and effort and at the same time do their work better (Ellis, 1956). Thus, proper study habits and skills entail to proficiency as well as high quality of learning.

Additionally, the aim of teaching biology is in making educated students: people who can understand the importance of the role of biology in their society and can make judgments or decisions based on biological views, where appropriate. Success in learning is closely related to degree of concentration. Concentration is closely related to interest (Ellis, 1956). Students' like and dislike towards biology as well as their belief are influencing their learning. For these reasons, it is important to not only give biological knowledge but also to encourage the development of positive attitudes towards biology in biology classes (Suzuki, 2007).

Myanmar secondary education has numerous problems. It completely emphasizes upon rote learning and memorization and regurgitation inhibiting students' creative thinking and critical thinking skills (Wikipedia, 2011). Teachers of today need to know and see in which part their students have difficulties in learning and they also need to explore the ways to minimize the difficulties students face learning in biology.

Review of Related Literature

Importance of Biology

Johnson (1986, cited in Ozcan, 2003) pointed out the importance of biology which will have a profound impact on ones' lives through advances for the next few decades. Biological sciences stimulate human interest to find the truth with an intellectual rigor therefore have important cultural and educational functions (Liras, 1994, cited in Ozcan, 2003). It is a very important thing for all to have healthy life for everybody and biological knowledge can assist: understanding the routes of infection, the immune system, how people practice good domestic hygiene and use ordinary medicine such as antibiotics (Rowland, 2007, cited in Salibio, 2014).

According to Sharma (2009), the knowledge of body structures and its systems help ones to lead a healthy life. Similarly, knowledge about the balanced diet and hygienic principles helps ones to lead a healthy life. The study of botany has also helped ones to understand the germination process of different plants and thus to improve the quality of seeds of useful plants and improve the quality of their variety which will not only have resistance to diseases but also give more yield and production.

Likewise, Samikwo (2013) stated that the biology subject caters for the needs of a learner who may pursue his or her studies in the subject and its related disciplines. In many areas, biological knowledge can be applied in general improvement of man's well-being as evidenced in medicine, agriculture and industry. In brief, it can be seen that knowledge derived from biology has a major significance for the lives of all students and for the way societies may develop.

Causes of Difficulties Learning in Biology

Learning difficulties have probably existed since the beginning of the human race, but have received concerted attention only since the 1950s and 1960s. Since the mid-1960s, efforts on behalf of students with learning difficulties have grown rapidly, with support a very active parent/advocacy group, and state and federal legislative mandates (Bill & Carol, 1989). Learning difficulties may have not only in education but also in other professions (Orton, 1925, cited in Bill & Carol, 1989).

Learning difficulties in biology stem from many causes. The main reasons why students have difficulties learning in biology are the nature of biology (subject matter), teachers' styles of teaching biology, lack of resources, students' learning and studying habits and students' feelings and attitudes towards the subject (Cimer, 2011).

1. Nature of Biology

Biology is a vast subject containing many subdivisions and disciplines. In biology area, students have to learn structure and classification of animals and plants, observation of organisms, structure of cells of organism, reproduction and investigation of environment (Suzuki, 2007). Some topics covered in the biology course are difficult for students to connect with their lives directly because their effects are complex and indirect. For instance, the cell division is a microscopic subject. Unless the expressions seen in this subject (chromosome, chromatid, protoplasm) are related to daily life, the subject is learnt more difficulty (Tasci & Soran, 2008, cited in Ozcan et al., 2013).

Diagrams are critically important in biology teaching. To develop scientific meanings, diagrams and illustrations are universally accepted as being beneficial learning tools in many disciplines (Stieff, Bateman & Uttal, 2005, cited in Liu, 2012). However, research suggests that a large number of students have difficulty understanding and illustrating diagrams (Hartley et al., 2011, cited in Liu, 2012).

In addition, biology is especially prone to terminology overload. There are many terms and many synonyms; most terms are long, polysyllabic words of Greek or Latin origin, which makes them more difficult to read or say. Learners who learn biology not in their first language face the problem of understanding both the scientific terminologies (technical terms) and regular explanation of the knowledge itself. Language development and concept development are linked so that if the language is not learner-friendly, they will experience difficulties in understanding concepts.

2. Teachers' Styles of Teaching Biology

The teacher is one of the key factors in the actualization of the goals of teaching science in the secondary schools as stipulated by the National Policy on Education (2004). The teacher not only needs the knowledge of subject matter but an in-depth knowledge of the organization of the contents of the subject matter (Arubayi, 2010). Genome (2012, cited in Arubayi, 2010) defined the place of the teacher in biology as "making the biology come alive by illustrating how classroom biology applies to the professional laboratory and make the students aware of the relevance of biology to their lives". The transmission of subject matter from the teacher to the student is done through method. By means of method, the child is guided as to what parts subject matter to appreciate and what attitudes to develop.

In addition, effective teaching requires teachers to check continuously the development of students' understanding and give detailed positive feedback in order to make sure that students correctly integrate new knowledge into the existing knowledge structure (Svinicki, 1999; Cimer, 2004; cited in Cimer, 2007). Cimer (2004, cited in Salibio, 2014) said that teacher styles of biology teaching and teaching methods and techniques may be factors that affect students' learning in biology. As a result, it is of paramount importance for a teacher to adopt the appropriate teaching methods and techniques according to the teaching environment and the curriculum provided. For, according to Kempa (1991), a learning difficulty may be said to exist in such situation as mismatch between instructional approaches used by the teacher and the student's preferred learning mode (learning style).

3. Importance of Instructional Materials in Biology

The use of instructional materials would make discovered facts glued firmly to the memory of students. Trowbridge and Bybee (1990) said that more of the students' senses are stimulated by instructional materials. Similarly, Nwike and Catherine (2013) stated that students learn more and perform better when they are taught with instructional materials because using instructional materials give students the chance to feel, view, listen and touch the material during teaching which help to arouse students' attention and interest in the process of teaching and learning.

Similarly, practical activities in biology lessons have an important place among instructional methods for a meaningful learning. Practical work can provide a good opportunity for students to apply their newly acquired knowledge or skills and gain first-hand experience of phenomena talked about in theory (Millar, 2002, cited in Cimer, 2007). Teaching through practical work enhances students' understanding of the abstract terms. Cross (1987, cited in Ozcan, 2003) concluded that "when students are actively involved in the learning task, they learn more than when they are more passive recipients of instruction". By actively participating, the students with learning advantages in the learning process it is possible to create real meaning (Frankenstein, 1981, cited in Ozcan, 2003). For these reasons, there must be science laboratories in schools and laboratory practice is compulsory for all students in biology classes.

4. Concept of Study Habits

Of all educational objectives, few are more important and none is more difficult to achieve than the development of efficient, independent, permanent study habits and skills. With this in mind one of the continuous objectives of teaching should be the improvement of the study habits and techniques of the students (Trexlar, n.d., cited in Ellis, 1956). Study habit refers to the student ways of carrying out the task of studying by using various techniques and ways in the field of study to keep him afloat along with the wise use of his or her time in studying. Good study habits can be defined as to have a clean, organized area for studying, keeping good notes, reading textbooks as well as studying at the same time each day. According to M.T.V Nagaraju (2004, cited in Ellis, 1956), study habit serves as the vehicle of learning and poor study habits creates anxiety in the students.

Gbore (2006, cited in Odiri, 2015) argue that study habits have strong relationship with the academic performance of students. A student who cultivates certain study habit will perform differently from a student who has another set of study habit. It is believed that student who lacks effective and efficient means of studying would be building on shaking foundation and consequently have weak foundation. It is worthwhile to note and understand that one of the reasons of underachievement by students is lack of proper methods of study.

5. Concept of Attitudes

Attitudes provide a frame of reference for the individual. The attitude towards biology is an important component that is needed to support teaching and learning of the subject. In order to be effective in leaning biology, students need to develop attitudes not only towards the learning of biology such as understanding about the nature of knowledge, about approaches to successful study, about the nature of learning as a lifelong process but also towards the process of biology. Zacharia and Barton (2004, cited in Mavrikaki et al., 2012) suggested that attitudes are affected by students' interest levels in biology, the curriculum and the learning climate. So, students' attitudes towards biology can be considered as a necessary one to predict biology-related behaviors such as having interest or lack of it, whether or not a student will have the subject further and even in taking it for a career.

6. Concept of Anxiety

Many foreign language learners experience foreign language anxiety which is a situation-specific and unique type of anxiety closely related to the acquisition of a foreign language. Some conditions of foreign language learning that provoke anxiety in learners like confusion and embarrassment may result from the inability of the learners to comprehend or articulate written input. Test anxiety is one of the major problems among students and it is also thought to be one of the biggest hurdles in achieving good grades. Whenever students take some test, they encounter some level of anxiety, which decreases their performance. Researchers found that anxious individuals find it harder to avoid distractions and take more time to turn their attention from one task to the next than their less anxious peers. This makes learning, reading, remembering and writing difficult affecting academic performance.

Method and Procedure

Research Design

The research design used for this study was a descriptive research design, in which the researcher seeks to determine whether, and to what degree, students' have difficulties in learning biology and the relationship exists between students' learning difficulties and their achievement in biology. In this study, data were mainly collected through a quantitative method.

Instruments

In this study, the relevant data and information were collected by teachers' questionnaire, students' questionnaire and an achievement test. Six dimensions: subject matter, teachers' styles of teaching, use of instructional materials, students' attitudes towards biology, students' study habits and students' anxiety in biology were included in both questionnaires: teachers and students. The item for questionnaire of subject matter was adapted by Zisanhi (2013) and Liu (2012). The items for questionnaire of use of instructional materials and teachers' styles of teaching were adapted by Salibio (2014). Study habit's questionnaire was constructed based on "Educational Psychology" (Ellis, 1956). The item for questionnaire of students' attitudes was based on Chu (2008) and students' anxiety was based on Zeidner (1998). In addition to these questionnaires, an open-ended question for teachers which is adapted by Cimer (2011) was used as an instrument.

Research Findings

Findings of the Difficulties of Students in Learning Biology from Teachers' Views

In order to find out the difficulties of students in learning biology from teachers' views, a questionnaire on difficulties into six factors was examined. Percentage of teachers' responses to each difficulty was presented (see Table 1 and Figure 1).

1. Percentage of Teachers' Responses to Each Difficulty

Types of Difficulties	Number of Teachers' Responses to Each Difficulty	Percentage
Subject Matter	15	47%
Teachers' Styles of Teaching	19	59%
Instructional Materials	28	88%
Attitudes	28	88%
Study Habits	29	91%
Anxiety	20	63%

Note: Total number of teachers = 32

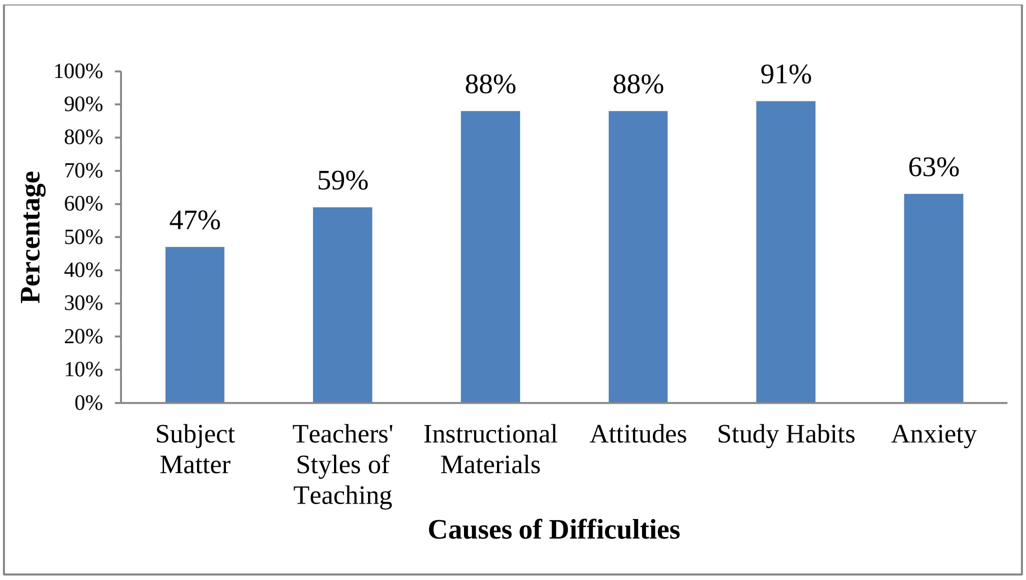

Figure 1 Percentage of Teachers' Responses to Each Difficulty

From analyzing the data result, it was found that inadequate use of instructional materials, students' attitudes towards biology and students' poor study habits are the most serious causes of difficulties of students in learning biology.

Findings of Teachers' Responses to Difficult Biology Topics for Grade Ten Students

In order to find out the difficult biology topics for Grade Ten students from teachers' views, a question as "Read the list of biological topics stated below and tick the difficult topics for students to learn" was examined. Number of teachers' responses to difficult biology topics for Grade Ten students was presented in Table 2.

2. Number of Teachers' Responses to Difficult Biology Topics for Grade Ten Students

No	Difficult Biology Topics	Number of Teachers' Responses
1	Plant and animal cells	5
2	Plant and animal tissues	28
3	Bacterial cell	6
4	Protozoa	15

According to the results described in Table 2, it can be seen that "plant and animal tissues" is the most difficult biology topic for Grade Ten students in biology.

Findings of Teachers' Responses to Open-ended Question

The reasons for why Grade Ten students face difficulties in learning the topics as stated above are as follows:

- Terminology (biological terms are less familiar for most students)
- Confusion (similar words, different meanings are included)
- Students' poor study habits (rote memorization without understanding, lack of writing down the spelling of biological terms)
- Inadequacy of use of instructional materials
- Time for teaching is insufficient
- In plant and animal tissues, tables and meanings are complex unlike the other topics.
- In protozoa, it is broad and includes many topics which are abstract and complex.

Findings of the Difficulties of Students in Learning Biology from Students' Views

In order to find out the difficulties of students in learning biology from students' views, a questionnaire on difficulties into six factors was examined. Percentage of students' responses to each difficulty was presented in Table 3 and Figure 2.

3. Percentage of Students' Responses to Each Difficulty

Types of Difficulties	Number of Students' Responses to Each Difficulty	Percentage
Subject Matter	448	70%
Teachers' Styles of Teaching	434	68%
Instructional Materials	552	86%
Attitudes	334	52%
Study Habits	468	73%
Anxiety	541	85%

Note: Total number of students = 640

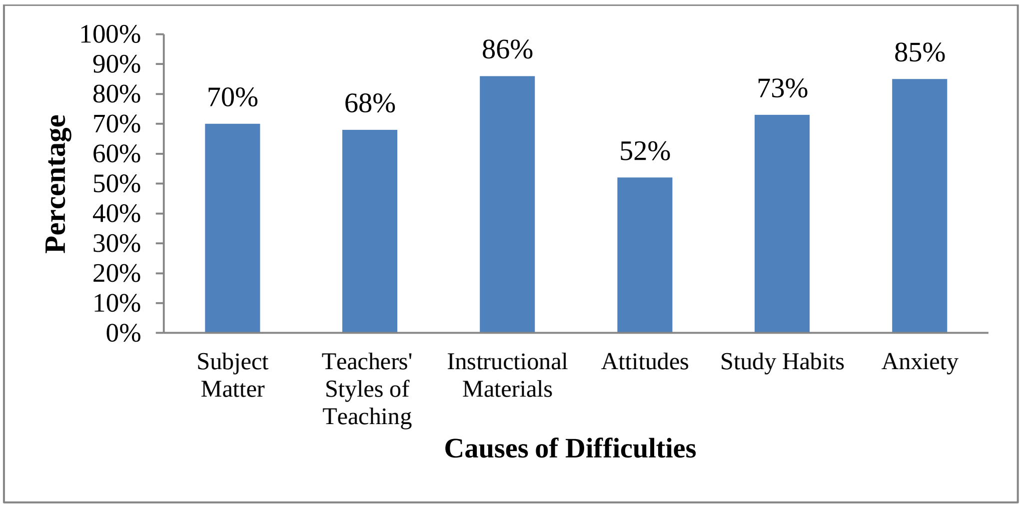

Figure 2 Percentages of Students' Responses to Each Difficulty

From analyzing the data result, it can be interpreted that inadequate use of instructional materials and students' anxiety are the most serious causes of difficulties in learning biology.

Findings of Students' Responses to Difficult Biology Topics

In order to find out the difficult biology topics from students' views, a question as "Read the list of biological topics stated below and tick the difficult topics for students to learn" was used. Number of students' responses to difficult topics was presented in Table 4.

4. Number of Students' Responses to Difficult Biology Topics

No	Difficult Biology Topics	Number of Students' Responses
1	Life and its characteristics	68
2	Plant and animal cells	76
3	Classification of plant and animal	144
4	Plant and animal tissues	149
5	Bacterial cell	135
6	Protozoa	232
7	Liverworts, mosses and ferns	87

According to the results described in Table 4, it can be observed that "protozoa" and "plant and animal tissues" are the most difficult biology topics for Grade Ten students.

Findings of Relationship between Students' Learning Difficulties and their Achievement in Biology

To examine the relationship between students' learning difficulties and their achievement in biology, Pearson product-moment correlation was used. It was found that there is a significant correlation between students' learning difficulties and their achievement in biology and it also shows that the direction of correlation is negative (r = -.698**, p < .01). This means that if students' difficulty is high, their achievement is likely to be low or if students' difficulty is low, their achievement is likely to be high (see in Table 5).

5. Correlation between Students' Learning Difficulties and their Achievement in Biology

Correlation			
		Students' Difficulties	**Students' Achievement**
Students' Difficulties	Pearson Correlation	1	-.698**
	Sig. (2-tailed)		.000
	N	640	640
Students' Achievement	Pearson Correlation	-.698**	1
	Sig. (2-tailed)	.000	
	N	640	640

** Correlation is significant at the 0.01 level (2-tailed).

Discussion, Suggestion and Conclusion

Discussion

This study is aimed to investigate the difficulties of students in learning biology. In this research study, students' learning difficulties in biology had been examined under six factors:

subject matter, teachers' styles of teaching, instructional materials, students' attitudes towards biology, students' study habits and students' anxiety. According to the teachers' responses, it can be seen that inadequate use of instructional materials and students' poor study habits cause learning difficulties in biology mostly. Also, it was found that (5) teachers responded that plant and animal cells is difficult, (28) teachers responded that plant and animal tissues is difficult, (6) teachers responded that bacterial cell is difficult and (15) teachers responded that protozoa is difficult for students among (32) biology teachers.

The reasons for why Grade Ten students face difficulties in learning these topics were due to terminology, confusion, students' poor study habits, inadequacy of use of instructional materials and time for teaching is insufficient. Besides, in plant and animal tissues, tables and meanings are complex unlike the other topics and in protozoa, it is broad and includes many topics which are abstract and complex.

According to the students' responses, it was found that inadequate use of instructional materials and students' anxiety cause learning difficulties in biology mostly. Plant and animal cells, plant and animal tissues, bacterial cell and protozoa are found as difficult topics for most students. It was also found that there was a significant correlation r = -.698**, $p < .01$. Based on this result, it can be interpreted that students' learning difficulties and their achievement is negatively correlated.

This study is consistent with the study of Cimer (2011) who investigated what makes biology learning difficult and effective: students' views? In his study, the participants identified the nature of the subject matter as the main reason for their difficulties in learning. The main reasons for this were that biology includes there are a lot of concepts, various biological events that cannot be seen by the naked eye, some concepts are too abstract and that there are a lot of foreign / Latin words. Another reason in his study for why students had difficulties learning in biology was teacher qualities. A few of students indicated that teachers' lack of mastery in biology and teaching negatively affected their learning.

Students' study habits were one of the reasons they had difficulties learning in biology. Many students do not study biology lessons regularly, review previously taught materials or work on biology questions on a regular basis. According to Cimer (2011), the final reason students have difficulties learning in biology was the paucity of facilities, materials and lesson time.

Suggestions

A foundation in biology is considered to be critical for the 21st century students since many of decisions require an understanding of biology. According to Ozcan (2003), the students through biology education should be able to comprehend basic structure of living organisms, recognize and protect the environment, comprehend the importance of environment for human life, gain conscious of health care, think critically and approach the resolutions to the problems that he or she met through the life with scientific method and relate the gained knowledge to everyday life. Consequently, teaching and learning of biology should be taken very seriously.

Every subject has its difficulty. In biology area, it includes many abstract concepts and also saturates with many scientific terms, Latin words which are less familiar with many secondary school students in Myanmar. This makes students specifically low achievers hard to learn and understand very well. According to the questionnaire responded, it was observed that many students experience difficulties in understanding technical vocabularies (biological terms) very well and difficult to pronounce these terms, too". So, teachers should explain the scientific terminologies precisely in order for students to understand these terms well and to apply these terms in further studies. In addition, students should be well practised to pronounce these terms correctly.

Inadequate use of instructional materials while teaching and learning biology is one of the reasons which makes students' learning difficult. To minimize it, teachers should use various visual teaching and learning materials and tools as figures, models, computer simulations, videos and real specimen in teaching biology, a practical subject. Moreover, practical work should be done regularly for students to comprehend new ideas or concepts and construct their own knowledge because as stated above biology includes many abstract concepts and phenomena that require observation and experiment with what is being taught. In addition, microscope is such an essential instrument for biology teaching that all schools should have at least one and teachers should let students make contact with it.

The role of teacher in education is very important as well. Teachers' qualities influence students' achievement. Teachers should explain the objectives of the lesson before it starts. Knowing the objectives of the lessons make students more interested and more meaningful. This helps students learn in a more meaningful way. Besides, teachers should employ appropriate teaching methods and techniques depending on the nature of subject matter. Subsequently, teachers should provide examples from the real world or students' daily lives to recognize easily what is being taught and should establish links between topics. Teachers should also be confident enough to handle with the subject matter and should be ready to explain and answer to the questions probed by the learners. Likewise, as there are students having mixed ability in a single classroom, teachers should try to understand his students with regard to their abilities, capacities, needs, aims, weakness and their level of aspirations and beliefs. In addition, teachers should also give regular feedback to his students on their performance without any personal bias. In so doing, the gap between the teacher and his students should be minimized.

If students are not happy with the ways that is learnt or dislike the subject they learn, negative attitudes will develop. Developing negative attitudes causes learning problems. As a result, they may fail to achieve highly in classes or exams. Accordingly, teachers should help their students to develop the right kind of attitudes towards subjects in classrooms through the use of teaching methods that arouse and sustain students' interest in the subject. In other words, teachers should make biology lessons interesting, fun, attractive and challenging. In addition, motivation is needed to create positive learning environment as it pushes the students to gain interest and develop positive attitudes towards the subject being taught. So, teachers should not miss to motivate their students.

It is noted that biology is a subject which includes many technical terms and non-technical terms that require to be memorized. But, learning by heart it is needed to know the meaning of the scientific terms because learning by rote is easily forgotten. Therefore, students should be forced to learn the biology lessons with understanding. In this study, many students agreed the fact that they do not study the biology lessons regularly. How a student takes his or her studies greatly determines his or her level of academic achievement. Without good study habits, a student cannot succeed. So, students should be nurtured to enhance good studying habits as writing down the important notes, studying the lessons regularly, and learning by linking the real life's happenings, etc.

Students of all academic achievement levels suffer from academic anxiety. According to this study, it was observed that many students agreed the statement that lack of understanding the biology questions, lack of understanding the vocabulary, lack of understanding the biological concepts cause students' academic and test anxiety. Anxiety can negatively affect academic performance. Therefore, reducing anxiety levels in students is essential for helping to improve academic achievement. Hence, teachers should practice students to have good study skills and good test taking skills. Similarly, students should be taught to use methods such as mindfulness meditation whenever anxieties increase.

To conclude up, a teacher should be aware in which parts his or her students experience difficulties in learning and also let students overcome it with his act of teaching. For further study, the following points are suggested.

- As this study was carried out in Yangon Region, the generalizability of this result may be uncertain to be representative nationally.
- It would be better to conduct if sufficient time is allowed.
- Interviews and observations should be conducted in addition to questionnaire to acquire the complete figures of students' learning difficulties in biology.

Conclusion

Education is a necessity of life. Without education, no new ideas will be explored. Without new ideas, there will be no creativity. Without creativity, there will be no development. Therefore, "plants are developed by cultivation and men by education" stated Rousseau. The standard of livings can be raised through education. Human beings do learning and teaching to be educated since learning and teaching are the foundation of education and training. Learning is a never ending process. Teaching is a process that facilitates learning. As a result, teacher plays an important role in the teaching-learning process as a facilitator of learning.

The function of a teacher in a creating positive classroom environment is very important. A teacher should identify and meet the educational needs of the learners. A teacher must try to know the motivational level, abilities, attitudes, emotional conditions, interests and intelligence of the learners. As students are unique individuals, teaching methodologies must be varied by teachers to accommodate the different individual learning styles of student. Several important questions are come out concerned with learning as "How do individuals learn? What are the factors that influence learning? What makes students learning difficult? How do overcome learning difficulties?" It is essential to investigate the factors influencing learning or the causes which makes learning difficult.

Based on the results shown in above, a generalization can be drawn that inadequate use of instructional materials in teaching biology mostly causes learning difficulty in most students. It is believed that this research will be beneficial for teachers and students in order to minimize difficulties in learning. It is hoped that it will give some assistance for further study concerned with biology.

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FACTORS INFLUENCING ON STUDENTS' ACADEMIC ACHIEVEMENT IN LEARNING BIOLOGY

Thet Htar Swe[1] and Su Su Khine[2]

Abstract

The main purpose of this study is to investigate the factors that influence on students' academic achievement in learning biology. Specifically, this study aimed at investigating school based factors and student factors that influence on students' academic achievement in learning biology. Quantitative research methodology was mainly used to gather required data. The design adopted in this study was a descriptive research design. Sixteen high schools were selected from Yangon Region. A sample of (50) biology teachers and (640) Grade Ten science students was used. The school based factors considered in this study include: teaching methods, teaching and learning resources, and principal's instructional supervisory role. The student factors considered in this study include: teacher- student relationship, students' attitudes towards biology, students' motivation towards biology, students' study habits and parental involvement. A pilot study was conducted to test the reliability of the measuring instruments. Three sets of instruments were used to collect data. These included the students' questionnaire, the teachers' questionnaire and an achievement test. Descriptive Statistics such as mean, standard deviation and Pearson product – moment correlation coefficient were used to analyze data using Statistical Package for the Social Sciences Programme (SPSS) version 25. The finding indicated that the correlation between school based factors and students' biology achievement was $r = .819$, $p < .01$ and the correlation between student factors and students' biology achievement was $r = .889$, $p < .01$. The results of this study revealed that school based factors and student factors were positively correlated with students' biology achievement.

Keywords: learning, biology, academic achievement, factor.

Introduction

Education is the process of instructions aimed at the all-round development of the individual, facilitating realization of self-potential and latent talents of an individual (Anderman, Maehr & Midgley, 1999). Education starts with the birth of an individual and then it goes on till the last day of the individual. Education equips the individual with social, moral, cultural and spiritual aspects and thus makes life progressive, cultured and civilized. About education, P.O. Bannerji said, "It is the development of the power of adaptation to ever changing social environment" (Rather, 2004). In this modern era, science has become the backbone for the prosperity in each and every field of life. A broad science education for the entire population is therefore more vital today than ever. Biology is one of the cornerstones of science. In many areas, biological knowledge can be applied in general improvement of man's well-being as evidenced in Medicine, Agriculture and Industry. From this point of view, biology is fundamental and important of all the other subjects of science. So educators need to consider how to teach to develop students' biological literacy and how to promote students learning in biology and which factors are important for attaining students' academic achievement in learning biology.

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Background of the Study

All people are living in the age of knowledge explosion and knowledge economy. Knowledge is power. Those nation and their citizens who are successful in knowledge creation can really rule the world. Every citizen of this world must know and understand himself or herself in relation to the environment, various processes of life, plants, animals and their interaction and interdependence. Only after understanding these, one can preserve, enrich and endeavor to create a better environment to live in. Biology deals with plants, and animals, their biological processes, interactions, interdependence, and the role of biotic factors in the environment (Ahmad, 2011).

In the era of globalization, the world faces many social, economic, and environmental challenges as well as ethical problems. Biology is undoubtedly a key discipline in understanding and responding to some of these pressing issues of the day from the many challenges arising from population growth, human impacts on ecosystems and services to climate change and sustainability (Kim & Diong, 2012). Many biologists are working on problems that critically affect people’s lives such as the world’s rapidly expanding population, global warming and diseases. The knowledge that biologists are gaining is of fundamental importance to people's ability to manage the world’s resources in a suitable manner, to prevent or cure diseases, to control population growth rate and to improve the quality of humans’ lives and those of their children and grandchildren. All of these improvement meet human needs and so these times have been considered as “the Age of Biology”. Because the activities of biologist alter people’s lives in so many ways, an understanding of biology is becoming increasing necessary for any educated person (Raven & Johnson, 1988). Therefore, a foundation in biology is considered to be critical for the 21st century students since many of decisions require on understanding of biology (Keysar & PasQuale, 2006, cited in Samikwo, 2013). In addition, educating people in science especially Biology has been widely acknowledged as a way of promoting economic development, eliminating poverty and introducing social welfare. Thus, biology plays a role in everyone’s lives and touches almost every aspect of human existence in some ways. Because of the indispensability of biology, much emphasis must be placed on biology achievement at the upper secondary school level. Therefore, this study sought to investigate factors influencing students’ academic achievement in learning biology.

Purposes of the Study

The primary purpose of this study is to investigate the factors that influence on students’ achievement in learning biology.

Objectives of the Study

The study intended to achieve the following specific objectives:

- To investigate the school based factors that influence on students’ academic achievement in learning biology.
- To investigate the student factors that influence on students’ academic achievement in learning biology.
- To investigate the students’ academic achievement in biology.
- To give suggestions to improve the achievement of students in learning biology.

Research Questions

This study was guided by the following questions:

- Is there a relationship between school based factors and students' biology achievement?
- Is there a relationship between student factors and students' biology achievement?

Scope of the Study

This study has its own particular limitations. The first limitation is related to the fact that the participants of the study come from only Yangon Region. Sixteen Basic Education High Schools were included in this study. Participants in this study were (50) biology teachers and (640) Grade Ten Science Students from the sixteen selected schools within academic year (2018-2019). The second limitation is that this study specifically focused on the school based factors (teaching and learning resources, teaching methods, principal's instructional supervisory role) and student factors (teacher-student relationship, students' attitude towards biology, students' motivation towards biology, students' study habits, and parental involvement) that influence on students' biology achievement. Besides, there has been many other factors influencing students' biology achievement but this study did not try to find out other factors that influence on students' achievement in learning biology at the upper secondary school level. As a result the finding of this study may not exactly bring out the influence of such other factors.

Definition of Key Terms

Learning: Learning is the acquisition of new behavior or the strengthening or weakening of old behavior as the result of experience (Smith, 1962, cited in Mangal, 2007).

Biology: Biology is the study of living things and their vital processes (Sarojini, 2010).

Academic achievement: Academic achievement means the extent to which the learner is profiting from instruction in the given area of learning i.e. achievement is reflected by the extent to which skill and knowledge has been imparted to him (Crow & Crow, 1969).

Factor: A factor is defined as one of the elements contributing to a particular result or situation (Costello, 1992, cited in Mutinti, 2018).

Significance of the Study

There is no country that would develop without the use of science and technology because it is considered as the backbone of national development. Biology is one of the largest and most important branches of science. The 21^{st} century has been called a Biology century because of the many advances in humankind's understanding of the basic processes and component of life (Kim & Diong, 2012). The main goals of science education are to develop understandings of biological systems, the methods of scientific inquiry, prepare students to make responsible decisions concerning science-related social issues and inform students about possible science careers (Bybee, Carlson-Powell & Trowbridge, 2007, cited in Kim & Diong, 2012). To develop science education, it is also important to know factors that influence students' achievement in learning biology. Therefore, school based factors and students factors are important aspects to consider also in school biology education.

Review of Related Literature

School Based Factors Influencing on Students' Biology Achievement

According to Onyara (2013, cited in Mutindi), school based factors are those within school control that can influence students' academic achievement in schools. They include; teaching methods, teaching and learning resources and principal's instructional supervisory role**.**

Teaching Methods

Early educators such as Dewey (1964), Montessori (1968) and Froebel (1974) believed that, effectiveness of teaching and learning are determined by the type of teaching strategies applied in classroom. A teaching method is characterized by a set of principles, procedures or strategies to be implemented by teachers to achieve desired learning in students (Liu & Shi, 2007, cited in West Wood, 2008). These principles and procedures are determined partly by the nature of the subject matter to be taught, and partly by their beliefs or theories about how students learn. Anene (1999, cited in Caleb, 2015) stated that teaching methods are pedagogical strategies designed and adopted by the teacher to facilitate teaching on the teacher's part and learning on the learner. According to him, for effective teaching and learning to take place, the skillful teacher needs to use many different methods at his disposal.

Teaching and Learning Resources

According to Coombs (1970), education consists of two components. He classified these two components into inputs and outputs. According to him, input consists of human, physical facilities and material resources and output are the goals and outcomes of the educational process. Teaching and learning resources which are educational inputs are important to the teaching of any subject in the school curriculum. Teaching and learning resources comprises basically three components: material resources, physical facilities and human resources. Availability of teaching and learning resources enhances the effectiveness of schools as they are the basic resources that bring about good academic performance in the students (Atieno, 2014).

Principal's Instructional Supervisory Roles

Principals in schools are the people entrusted with the responsibility of ensuring that educational strategies are put in place that support effective teaching and learning for all students in their schools (Makau, Ronoh & Tanui, 2016). Principals are the chief instructional supervisors. Their key responsibility is to promote the learning and success of all students by ensuring that effective instruction is done (Alig-Mielcarek, 2003, cited in Makau, Ronoh & Tanui, 2016). Instructional supervision is a collegial, collaborative way of offering help to improve instruction (Olivia & Pawlas, 2004, cited in Makau, Ronoh & Tanui, 2016). Therefore, instructional supervision is primarily concerned with improving instructional practices for the benefit of students. According to Okumbe (1998), the instructional supervision aspect involves helping in the formulation and implementation of lesson plans, notes, and schemes of work, evaluating the instructional programmes and overseeing modification, delivery of instructional resources, helping in conducting and coordinating staff in- servicing, advising and assisting teachers involved in instructional programmes.

Student Factors Influencing on Students' Biology Achievement

Student factors have an effect on academic achievement of students. In this study, student factors such as teacher- student relationship, students' attitudes towards biology, students' motivation towards biology, students' study habits and parental involvement were studied.

Teacher- Student Relationship

On average, students spend six hours at school each day for 170 days throughout the year. Therefore, it comes as no surprise that teachers have an enormous amount of influence on their students. This influence, or power, can significantly impact the learning environment, which, in turn, affects a student's achievement in school. The most powerful weapon teachers have, when trying to foster a favorable learning climate, is a positive relationship with their students (Boynton & Boynton, 2005, cited in Varga, 2017).

Teachers who take time develop positive relationships with their students will see improvement in their students both academically, behaviorally, and emotionally. Students who have positive relationships with their teachers tend to put forth more effort in class and as a result improve their academic achievement. Teachers also see improvement in their student behavior when they take the time to develop positive relationships with their students. Positive relationships between students and teachers have positive academic affects (Pianta, 1999, cited in Varga, 2017).

Students' Attitudes towards Biology

Attitude is generally defined as an individual's tendency to react positively or negatively towards a stimulus (Fishbein and Ajzen 1977, cited in Karadag, 2017). Reid (2006) notes that attitudes translate people's evaluation of things to certain behaviors toward something or someone. Indeed, they shape people's ways of thinking and behavior and, therefore, assume great importance. Attitudes are highly complex and can affect learning extensively. A learner's attitude relates to all the facets of education. For example, the attitude of a learner towards biology will determine the measure of the learner's attractiveness or repulsiveness to biology. Attitudes associated with biology appear to affect students' participation in biology as a subject and impact performance in biology (Linn, 1992, cited in Jebson & Hena, 2015). It is generally believed that students' attitude towards a subject determines their success in that subject. In other words, favorable attitude result to good achievement in a subject.

Students' Motivation towards Biology

According to Ertem (2006, cited in Karadag, 2017), motivation is an inner state uncovering individuals' behavior and directing them to these behaviors. In an educational context, motivation may be described as a student's desire, intention and behaviors directed to learning and achieving their optimum educational outcome. It involves students' energy and drive to learn, work effectively and achieve to their potential at school, and the behavior that follow from this energy and drive (Martin, 2003, cited in Woolfolk & Margetts, 2013). Especially educational researchers and practitioners express that motivation is one of the most important factors in student achievement and in ensuring continuous achievement (Karadag, 2017).

Students' Study Habits

Study is a part of life for anyone who goes to school or college and every person studies in different ways to some degree or the other. According to Crow & Crow (1948) study can be interpreted as a planned program of subject matter mastery. It is essential to learning and fundamental to school life. Its chief purposes are (1) to acquire knowledge and habits which will be useful in meeting new situations, interpreting ideas, making judgments, and creating new ideas, and in the general enrichment of life; (2) to perfect skills: (3) to develop attitudes.

Habits help the individual to do something with less effort and thought. They are important and play a crucial role in shaping the personality of the individual. In the field of education habits of thinking regularly, proper reasoning, concentration on study, punctuality etc., help the students in their proper adjustment and learning. According to Percival and Ellington (1984, cited in Osa-Edoh & Alutu, 2012), study habit refers to the method or techniques of effective learning which in turn involve a set of study skills as organization of time, effective use of time, reading skills, essay writing, report writing skills, note-taking, examination techniques and even job-hunting skills.

Parental Involvement

Parents are essential in children's daily lives and they play a significant role in their children's education. In the more economically developed countries, parents are actively involved in their children's education at all ages. Parental involvement can be defined as any interaction between parents and children at home or with the school to ensure that the children's academic performance is going in a positive way. Most commonly, parental involvement is categorized in home-based and school based involvement (Hoover-Dempsey & Sandler, 1997, cited in Jaiswal & Choudhur, 2017).

Home based involvement includes strategies like communication between parents and children, creating a learning environment at home, monitoring and helping in homework, talking with them about school related activities and academic issues, monitoring their progress, encouraging school success. Parents school based involvement refers to parents' participation in school activity such as Parent Teacher Organisation (PTOs), volunteer work, attending school events and conference, visit to classroom and interaction with class teachers.

Research Method

This study is concerned with the factors that influence on students' academic achievement in learning biology. The factors such as school based factors (teaching methods, teaching and learning resources, and principal's instructional supervisory role), and student factors (teacher-student relationship, students' attitudes towards biology, students' motivation towards biology, students' study habits and parental involvement) are investigated to be able to determine whether these factors influence on students' biology achievement or not. Research design and procedure, instruments, population and sample, and data analysis are presented to address the research questions.

Research Design

The research design for this study was descriptive research design, in which this study seeks to determine whether, and to what degree, a relationship exists between two or more quantifiable variables (school based factors, student factors and students' biology achievement). Quantitative method was used to collect the required data for this study.

Procedure

Firstly, the problem concerning students' academic achievement in biology learning was formulated. Secondly, the related literature for the study through books, journals and internet sources was gathered. The third procedure for this study was the questionnaire and achievement test were developed under the careful guidance of the supervisor.

The instruments for the study were reviewed by six experienced teachers from Methodology Department, Yangon University of Education. After modifying these instruments, a pilot study was carried out with two biology teachers and fifty science students from No. (1) Basic Education High School, Hmawbi Township, Yangon Region. Necessary modifications were made again under the supervision of the supervisor. After pilot testing, the questionnaires were distributed to the total of (640) students from Grade Ten and (50) biology teachers and the achievement test was administered to the total of (640) students from Grade Ten, High School level on November, 2018.

Instruments

In this study, two types of questionnaire (questionnaire for teacher and questionnaire for student) and an achievement test for Grade Ten students were used as the instruments. Questionnaire for teaching methods used by biology teachers was mainly based on "Teaching of Life Science" (Sharma, 2009) and "The Act of Teaching" (Cruickshan, Jenkins & Metcalf, 2009). The questionnaire for teaching and learning resources was based on "The World Educational Crisis: A System Analysis" (Coombs, 1970). The questionnaires for principal's instructional supervisory role was based on "Educational management: Theory and practice" (Okumbe (1998). Questionnaire developed by Fisher, Fraser, & Cresswell (1996) was adapted to investigate teacher- student relationship. Questionnaire for students' attitudes towards biology was mainly based on "Slovakian Students Attitudes toward Biology" (Prokop, Tuncer, Chuda, 1970). Questionnaire developed by Glynn, Koballa, et al (2006) was adapted to investigate students' motivation towards biology. The questionnaire for students' study habits was mainly based on "Study Habits Inventory" (Patel, 1976) and the questionnaires for parental involvement was based on "A review of the relationship between parental involvement and students' academic performance" (Jaiswal & Choudhuri, 2017). The total items were (72) on a five point Likert-type scale of (1) to (5) to explore school based factors and student factors. The achievement test was based on the content area of Grade Ten Biology textbooks prescribed by the Curriculum and Textbook committee, Ministry of Education, Myanmar. True/false items, completion items, multiple choice items, short answer and long answer items were used for this study. There were totally items (39) were included in the test. The items in the test were constructed according to Bloom's Taxonomy.

Population and Sample

This study was conducted in Yangon Region. The research area was divided into four parts (East, North, West and South in Yangon Region). Two townships from each part were randomly selected for study. Selection of schools was based on simple random sampling technique. Two schools from each township were selected for this study. Sixteen high schools were selected as representative schools for this study. Participant students for this study were selected by using random sampling technique. The number of teachers and students were (50) and (640) respectively.

Data Analysis

The data was analyzed by using descriptive statistics (mean, standard deviation and correlation). The descriptive analysis: the mean, standard deviation, maximum and minimum scores were used to describe the mean scores of each factor by schools. Pearson Correlation Analysis was conducted to provide information about the relationship between the selected factors and students' biology achievement.

Findings

Findings of School Based Factors in the Selected Schools

In order to find out the school based factors, a questionnaire for biology teachers was used. The average mean score is (97.54) and standard deviation is (8.669). The scores for school based factors ranged from (72) to (113) (See Table 1).

Table 1 Mean Scores of School Based Factors in the Selected Schools

School	Number of Teacher	Mean	Std. Deviation	Minimum	Maximum
BEHS1 South Dagon	2	97.50	4.950	94	101
BEHS2 South Dagon	4	100.00	2.944	97	104
BEHS1 Thingangyun	4	91.50	4.726	85	95
BEHS Thuwana	4	102.00	4.761	99	109
BEHS1 Mayangone	2	95.00	14.142	85	105
BEHS2 Mayangone	4	106.50	4.509	103	**113**
BEHS2 Hlaing	4	92.50	13.435	83	102
BEHS4 Hlaing	2	**81.00**	12.728	**72**	90
BEHS1 Thanlyin	4	**109.00**	1.826	107	111
BEHS2 Thanlyin	4	101.50	2.887	98	105
BEHS1 Kyauntan	2	97.50	9.192	91	104
BEHS2 Kyauntan	2	94.50	2.121	93	96
BEHS2 Insein	4	101.00	2.828	99	105
BEHS1 Insein	4	87.25	4.924	81	93
BEHS1 Mingalardon	4	85.00	7.071	80	90
BEHS5 Mingalardon	4	99.00	3.651	95	103
Average/ Total	**50**	**97.54**	**8.669**	**91.38**	**101.63**

Findings of Student Factors in the Selected Schools

In order to find out the student factors, a questionnaire for students was used. average mean score is (168.01) and standard deviation is (20.355). The scores for student factors ranged from (95) to (221) (see Table 2).

Table 2 Mean Scores of Student Factors in the Selected Schools

School	Number of Student	Mean	Std. Deviation	Minimum	Maximum
BEHS1 South Dagon	40	164.78	23.958	**95**	202
BEHS2 South Dagon	40	170.35	19.453	125	219
BEHS1 Thingangyun	40	167.00	19.077	128	205
BEHS Thuwana	40	175.80	20.313	126	208
BEHS1 Mayangone	40	162.68	17.607	129	193
BEHS2 Mayangone	40	176.27	16.742	130	205
BEHS2 Hlaing	40	163.67	20.633	118	201
BEHS4 Hlaing	40	**153.33**	15.488	128	188
BEHS1 Thanlyin	40	**182.75**	11.584	159	216
BEHS2 Thanlyin	40	163.97	21.016	104	191
BEHS1 Kyauntan	40	170.72	17.161	137	210
BEHS2 Kyauntan	40	172.20	20.386	112	204
BEHS2 Insein	40	174.35	19.127	137	**221**
BEHS1 Insein	40	172.90	17.862	127	203
BEHS1 Mingalardon	40	154.30	22.008	114	197
BEHS5 Mingalardon	40	163.08	19.502	114	199
Average/ Total	**640**	**168.01**	**20.355**	**123.94**	**203.88**

Findings of Students' Biology Achievement in the Selected Schools

In order to measure the students' biology achievement in the selected schools, a test that is comprised of (39) items from five chapters of the Grade- 10 Biology textbook with the help of table of specifications was constructed. The average mean score is (33.95) and the standard deviation is (6.092) (See Table 3).

Table 3 Mean Scores of Students' Biology Achievement in the Selected School

School	Number of Student	Mean	Std. Deviation	Minimum	Maximum
BEHS1 South Dagon	40	34.37	6.815	20	45
BEHS2 South Dagon	40	37.70	6.509	23	48
BEHS1 Thingangyun	40	35.18	6.271	20	45
BEHS Thuwana	40	38.00	6.987	23	47
BEHS1 Mayangone	40	34.63	6.720	20	43
BEHS2 Mayangone	40	38.40	5.848	23	47
BEHS2 Hlaing	40	34.12	3.844	24	41
BEHS4 Hlaing	40	**31.13**	6.398	22	42
BEHS1 Thanlyin	40	**41.05**	4.728	24	47
BEHS2 Thanlyin	40	35.82	6.968	20	44
BEHS1 Kyauntan	40	37.75	5.952	25	47
BEHS2 Kyauntan	40	37.00	6.222	20	45
BEHS2 Insein	40	37.52	5.316	24	48
BEHS1 Insein	40	38.13	5.730	23	47
BEHS1 Mingalardon	40	31.83	7.150	20	43
BEHS5 Mingalardon	40	32.35	6.015	20	44
Average/Total	**640**	**33.95**	**6.092**	**21.93**	**45.19**

Relationship between School Based Factors and Students' Biology Achievement

To examine the relationship between school based factors and students' biology achievement, Pearson product-moment correlation was used. It was found that there was a significant correlation r = .819, $p < .01$. The result shows that there was a significant correlation between school based factors and students' biology achievement. The result shows that the direction of correlation was positive. Table 4 shows the correlation between school based factors and students' biology achievement.

Table 4 Correction between School Based Factors and Students' Biology Achievement

Correlation			
		School Based Factors	**Students' Biology Achievement**
School Based Factors	Pearson Correlation	1	**.819****
	Sig. (2-tailed)		.000
	N	16	16
Students' Biology Achievement	Pearson Correlation	**.819****	1
	Sig. (2-tailed)	.000	
	N	16	16

****. Correlation is significant at the 0.01 level (2-tailed).**

After that, the correlation between the respective areas of school based factors and students' biology achievement is presented in Table 5.

Table 5 Correlation between Respective Areas of School Based Factors and Students' Biology Achievement

Correlation				
	SBA	**TM**	**TLR**	**PISR**
Students' Biology Achievement (SBA)	1	.705**	.708**	.691**
Teaching Methods (TM)		1	.754**	.503*
Teaching and Learning Resources (TLR)			1	.546*
Principal's Supervisory Instructional Roles (PISR)				1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Relationship between Student Factors and Students' Biology Achievement

To examine the relationship between student factors and students' biology achievement, Pearson product-moment correlation was used. It was found that there was a significant correlation r = .898, $p < .01$. The result shows that there was a significant correlation between student factors and students' biology achievement. The result shows that the direction of correlation was positive. Table 6 shows the correlation between student factors and students' biology achievement.

Table 6 Correction between Student Factors and Students' Biology Achievement

Correlation			
		Student Factors	**Students' Biology Achievement**
Student Factors	Pearson Correlation	1	**.898****
	Sig. (2-tailed)		.000
	N	640	640
Students' Biology Achievement	Pearson Correlation	**.898****	1
	Sig. (2-tailed)	.000	
	N	640	640

**. Correlation is significant at the 0.01 level (2-tailed).

After that, the correlation between the respective areas of student factors and students' biology achievement is presented in Table 7.

Table 7 Correlation between Respective Areas of Student Factors and Students' Biology Achievement

Correlation						
	SBA	**TSR**	**SAB**	**SMB**	**SH**	**PI**
Students' Biology Achievement (SBA)	1	.611**	.621**	.704**	.771**	.700**
Teacher-Student Relationship (TSR)		1	.412**	.412**	.420**	.409**
Students' Attitudes towards Biology (SAB)			1	.593**	.462**	.377**
Students' Motivation towards Biology (SMB)				1	.624**	.481**
Students' Study Habits (SSH)					1	.563**
Parental Involvement (PI)						1

**. Correlation is significant at the 0.01 level (2-tailed).

Summary of the Research Findings

The summary of the research findings of this study are presented as the following.

- For school based factors, the average mean score is (97.54) and standard deviation is (8.669).
- For student factors, the average mean score is (168.01) and standard deviation is (20.355).
- For students' biology achievement, the average mean score is (33.95) and standard deviation is (6.092).
- According to the table (4), there was a significant correlation (r = .819, $p < .01$) between school based factors and students' biology achievement.
- According to the table (6), there was a significant correlation (r = .898, $p < .01$) between student factors and students' biology achievement.

Conclusion

Discussion

The purpose of this study is to investigate the factors that influence students' academic achievement in learning biology. According to the Table 4, the correlation between school based factors and students' biology achievement was found that the correlation r = .819, $p < .01$. This result shows that the direction of correlation was positive and it was pointed out if the function of school based factors are high, students' biology achievement is also high. So, this finding was revealed the research question: Is there relationship between school based factors and students' biology achievement?

From the research findings Table 6, the correlation between student factors and students' biology achievement was found that the correlation r = .898, $p < .01$. This result shows that the direction of correlation was positive and it was pointed out if the functions of student factors are high, students' biology achievement is also high. So, this finding was support the research question: Is there relationship between student factors and students' biology achievement?

Suggestions

The students' academic achievement plays an important role in producing the best quality students who will become great leader and manpower for the country thus responsible for the country's economic and social development. The social and economic development of the country is therefore, directly linked with students' achievement. Academic achievement gives students an opportunity to develop their talents, improve their grades and prepare for the future academic challenges. Mastery of academic content serves as the basis for higher order thinking skills as well as the impetus for improved interpersonal and intrapersonal competencies. In today's world having strong background in science subjects, especially in biology seems very crucial in getting into many careers and occupation such as medicine and economic areas. In the advancement of science in this rapidly changing world, the role of biology is highly pronounced. To insure this, students' achievement in science field particularly in biology should be high.

According to the Table 5, the use of teaching methods by teachers has a significant influence on students' biology achievement. The method in any teaching and learning situation is very important because it affects the responses of students and determines whether they are interested, motivated and involved in a lesson in such way as to engage in a good learning. The students face many difficulties in learning biology. Because biology subject involves many abstract concepts and terms such as metabolism, adaptability, cell, tissues. To overcome these barriers, teachers need to utilize various teaching methods. Therefore, teachers should also increase their knowledge of various instructional strategies in order to keep students engaged and motivated throughout the learning process. Since individual students differ in regard to their specific needs according to their personality patterns, the biology teacher should select appropriate teaching methods to the pupils in his class, and to the subject he is teaching. In addition, Ministry of education, curriculum developers should outline appropriate instructional methods for use by teachers to teach any topic highlighted in the biology curriculum. This will gear towards enhancing students' achievement potentials in schools.

According to the Table 5, teaching and learning resources significantly influence on students' biology achievement. Nowadays, student-centered approaches to learning are being officially encouraged by the Ministry of Education. However, the success of these approaches will be affected by the availability of teaching and learning resources. Biology as a branch of science has interconnected series of concepts. This has been necessary to demystify teaching of difficult concepts by intensifying the use of material resources in the teaching of biology. Besides, biology subject requires a lot of practical works, so inadequate teaching and learning materials and physical facilities may lead to passive learning with profound effects on learners' academic achievement. Even though how good a curriculum may be, absence of teaching and learning resources (teaching and learning materials, physical facilities and human resources) can jeopardize its effective implementation. Therefore, adequate teaching and learning resources should be provided by the Ministry of Education for effective teaching and learning of biology in schools. For the betterment and improvement of biology achievement, country should further invest in teaching and learning resources for the better achievement of the students.

According to the Table 5, there is an improvement in the students' achievement in the biology when principals monitor the teaching learning process. Therefore, principals should supervise, evaluate and coordinate the instruction process to ensure that it is in line with the set goals. This can be done by meeting with individual teachers to encourage them on the effective use of instruction time and new teaching skills and also with students to discuss their performance at given times. Principals should be available in the school to both teachers and students. They should visit teachers in classrooms and laboratory to encourage the teachers and ensure the provision of teaching and learning resources.

Besides, the school principals should ensure that they check on the teachers' lesson plans, teachers' records of work, and students' exercise books and carry out the conferences with the teachers regularly to ensure that the process of instructional supervision in schools is effective. Principals should monitor students' progress by discussing their academic achievement with teachers. Moreover, the principal should intensify classroom observations with the aim of ensuring efficiency as the teachers are able to provide the students with the necessary knowledge and no time is lost or wasted. By doing so, students' academic achievement will improve significantly. Therefore, principals should be setting time for instructional supervision in schools because it is one of the roles that influence students' academic achievement positively.

According to the Table 7, teacher- student relationship has a significant influence on students' biology achievement. In order to build a positive relationship between teacher and student, the teachers should care their students' needs and strengths, holds a supportive relationship with their students, and give them the same chances and opportunities to participate in the learning process. These opportunities make students feel comfortable and free to interact in the classroom and improve their academic achievement. Furthermore, the teacher should establish a supportive and warm classroom climate, and encourage students to behave well in classroom and to be motivated. To build caring and respectful teacher-student relationships, the teacher should praise students' academic progress, encourage low achievers, reinforce positive behaviors, convey respect and establish trust in students.

According to the Table 7, students' attitudes towards biology significantly influence on students' biology achievement. Attitudes influence performance in a subject because it provides students with the drive to participate in the learning process. Therefore, biology teacher should use modern methods of teaching including use of computers and audio visual aids in presenting biology lessons to facilitate students understanding and sustain their interest in the subject. These will help foster a more positive attitude of students towards biology. In addition, biology teachers should create interesting and non-threating environments in their classroom and model enthusiasm for the teaching and learning of the subject. This may go a long way to help students develop positive attitude towards the biology subject, learn it without any inhibition and hence improve their academic achievement. Furthermore, the curriculum planners, the teachers and parents should articulate well on the usefulness and applicability of biology in general so that students create positive minds towards the subject and subsequently strive to improve in the subject. According to the Table 7, student's achievement greatly relies on their motivation of learning. The teachers of biology should try as much as they could to motivate their students during the course of instructions. In order to motivate students, the teacher should use reward and incentive appropriately during his delivery of instruction and give praise to students for their effort and being active participants in classroom activities. Besides, active participation of learners increases motivation. Therefore, the teacher should utilize student-centered instructional strategies such as discovery learning, cooperative learning, discussion method, etc. in teaching biology. These strategies encourage students to collaborate and learn from each other. So, these strategies improve students' active and interactive learning. Moreover, teachers should also build good interpersonal relationships with students and this enhances achievement motivation as well as proper academic engagement for academic success. Furthermore, the desirable physical learning environment can motivate students' biology learning. Hence, the government and Ministry of Education should provide well equipped biology laboratory with numerous specimens, adequate microscopes and the necessary materials to do practical work and the classroom with adequate teaching aids.

According to the Table 7, it can be easily seen that how a student takes his or her studies, greatly determines his level of academic achievement. Therefore, teachers, schools and parents should pay attention to the study habits of learners. Teachers should guide students to understand and develop in them the desirable study habits, while parents should understand the significance of good study habits and monitor their children towards that.

According to the Table 7, parental involvement has a significant influence on students' biology achievement. Thus parents should play a leading role in supporting their children's education. Parents should set high and realistic expectations for their children's educational attainment. These high and realistic expectations will motivate their children to perform well academically. Parents should ensure home supervision by establishing and enforcing the rules and regulations regarding school and home activities as well as providing opportunities and environment conducive for learning. Parents should also assist students in doing homework, discuss with children about what they are doing in school, monitor progress and encourage school success. As school involvement, parents should attend in parent teacher conference, participate in school events and communicate with the teacher in order to know their children academic and learning progress, and teaching learning condition. Parents should also participate in their children's school by joining Parent Teacher Association. Parent Teacher Associations (PTAs) should be strengthened in all schools to support improved student learning.

Conclusion

In today's global economy a nation's success depends fundamentally on the knowledge, skills and competencies of its people. Countries which invest in education are likely to reap substantial long-term benefits, such as greater economic and social prosperity (MOE, 2016). Education at upper secondary school levels is supposed to be the bedrock and the foundation towards higher knowledge in tertiary institutions or university. It is an investment as well as an instrument that can be used to achieve a more rapid economic, social, political, technological and scientific development in a country. Science and technology is now widely considered as the pillar of any country's development. Science education is imperative for useful living in any society and it is at the centre of producing resources necessary for socio-economic, scientific and technological development needed for advancement of any nation.

In the current scenario, biology has a pivotal role to play in the economic and social development of any nation. According to Ajelayemi (1990, cited in Owiti, 2009) the knowledge of biology is the major potent source for social and economic changes in the contemporary history of mankind. It has contributed so much and still continues to contribute to make life comfortable for people, whether in urban or rural areas, both in developed and developing countries. Everyday, each person is called upon to make decisions concerning personal and societal issues involving biology. Such decisions are likely to be difficult to make. They may be the wrong decisions if there is little or no understanding of biological information or scientific awareness (Franyo, 2007, cited in Owiti, 2009). Therefore, it becomes very important that each member of the society should develop an understanding of biology. Biology education also modifies the habitual attitude of imagination, creativity, feelings of the learners and humans' thoughts of the purposes of life and how to improve it to a sufficient extent. Bearing in mind the importance of biology, it is the need of the hour to promote the biology achievement of students, who form the concrete foundation for the country's progress. There are numerous factors that contribute an important part in enhancing the academic achievement of students in learning biology.

According to the research findings, it can be concluded that there is a relationship between school based factors and student factors and students' biology achievement. According to this study, these factors are important and significantly influence on the students' biology achievement. On the basis of this research, students, teachers, parents and principal need to form joint efforts to promote students' academic achievement in learning biology.

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A STUDY OF THE EFFECTS OF COOPERATIVE LEARNING ON STUDENTS' ACHIEVEMENT IN GRADE NINE ECONOMICS

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Abstract

The major purpose of this study is to investigate the effects of cooperative learning on students' achievement in grade nine economics. This study was conducted using quantitative research method. Quantitatively, an experimental study was used to compare the students' economics achievement between the control group and the experimental group. The posttest only control group design was used in this study. In this experimental study, the subjects were Grade Nine students (economics combination) who were selected and tested from two schools; No. (1) Basic Education High School, Mayangone and No.(4) Basic Education High School, Insein from Yangon Region. The subjects, (64) Grade Nine student were chosen from each school. The students from each school were randomly divided into two groups: experimental group and control group. The subjects from the experimental group were taught by using cooperative learning method and those from the control group were taught by using formal instruction. After that, a posttest was administered to two groups. Independent samples *t*-test was used to analyze whether there were significant differences between two groups. The results showed that the students who received a treatment by using cooperative learning method were significantly higher than those who received formal instruction. Examination of the mean and *t*-test at No. (1) Basic Education High School, Mayangone was (t = 6.26, df = 62, MD = 3.00, $p < .001$) and No. (4) Basic Education High School, Insein was (t = 5.08, df = 62, MD = 2.56, $p < .001$). The result indicated that there was a significant difference between the two groups. Therefore, research findings proved that cooperative learning method has positive contribution to the economics teaching and learning at the high school level.

Keywords: Cooperative Learning, Economics, Achievement

Introduction

It is widely accepted that of all the subjects children study in school. Social studies is a very important and compulsory subject which has the most responsibility for preparing them to be good citizens. The social studies is an integration of experience and knowledge concerning human relations for the purpose of citizenship education. The basic purpose of the social studies is to develop reflective, competent, and concerned citizens (Martorella, 1985). Hugo believed that education is crucial to the improvement of the economic and social situation for all people (Skeel, 1979). Economics is a social science, which is the study of human beings as they exist, and make reasonable thinking in their ordinary business of life.

In cooperative learning, it encourages learners to work together for both the common and individual goal. Slavin (1995) considers the cooperative learning as a tool for promoting individual skills, improving relationship among students and preparing them to play roles in group activities. Each member will have an equal opportunity to learn, to converse with peers, present and defend ideas, exchange diverse believes, question other conceptual frameworks and are actively engaged. By working together in small groups, students may discuss and explore problem solving techniques. Students also develop problem solving skills, practice meaningful tasks, thinking skills and social skills.

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Purposes of the Study

The main purpose of the study is to study the effects of the cooperative learning on grade nine students' achievement in economics. The specific objectives are as follows:

- To compare the economic achievement between the students who receive instruction through cooperative learning and those who do not receive it,
- To give suggestions based on the data obtained from the study to improve in teaching economics.

Research Hypotheses

1. There is a significant difference in economics achievement between Grade Nine students who receive instruction through cooperative learning and those who do not receive it.
2. There is a significant difference in performing knowledge level questions between Grade Nine students who receive instruction through cooperative learning and those who do not receive it.
3. There is a significant difference in performing comprehension level questions between Grade Nine students who receive instruction through cooperative learning and those who do not receive it.
4. There is a significant difference in performing application level questions between Grade Nine students who receive instruction through cooperative learning and those who do not receive it.

Scope of the Study

The following points indicate the scope of the study.

- This study is geographically restricted to Yangon Region.
- Two Basic Education High Schools (No.1, BEHS Mayangone and No. 4, BEHS Insein) are selected for this study. Participants in this study are Grade Nine students (economics combination) from selected schools in (2017-2018) Academic Year. In each selected school, only 64 students are included in this study.
- This study is to find out the effects of cooperative learning on Grade Nine students' economics achievement.
- This study is limited to the content area of chapter (10) "Trade, Finance, Transport, and Communication Sectors of Myanmar" from Grade Nine Economics textbook prescribed by the Basic Education Curriculum and Syllabus and Textbook Committee, 2017-2018.

Definition of Key Terms

- **Cooperative Learning**: Cooperative learning is the instructional use of small groups so that the students work together to maximize their own and each other's learning (Zubair, 2012).
- **Economics**: Economics is the study of human efforts to satisfy what appear to be unlimited and competing wants through the careful use of relatively scarce resources (Clayton, 1995).
- **Achievement**: Achievement is the ability to demonstrate accomplishment of some outcome for which learning experiences were designed (Őzdemir, 2016).

Review of Related Literature

Vygotsky's Sociocultural Cognitive Theory

Cognitive development has its origins in interaction among people in a culture before the psychological process representing those ideas, events, attitudes, and strategies become possible within children. All personal psychological processes begin as social processes, shared among people, often among adults and children. According to Vygotsky, cognitive development should be enhanced when children work cooperatively or collaboratively with adults and other children.

Vygotsky (1978, cited in Gage & Berliner, 1992) stated cooperative learning enhances children's intellectual growth by working in within one another's proximal zones of development. Zone of proximal development is the zone between what a student can achieve independently and what a student can accomplish while working with an instructor or more capable peers (Johnson & Johnson, 2007). Cooperative learning provides modeling, coaching, and scaffolding for the students; therefore, students learn from each other (Slavin, 1995). Vygotsky (1978, cited in Gage & Berliner, 1992) declared that teachers should minimize the time for students to work alone.

Importance of Learning Economics

The use of learning economics can be seen from three dimensions: (i) personal satisfaction; (ii) social benefits and (iii) an intellectual exploration (Srinivasan, 2005).

Personal Satisfaction

Most of the activities carried out in a family are economics in nature. The advantage students of economics have is that they learn a lot about real life economic activities in a systematic way in schools. This enable them in understanding various economic activities taking place in their surroundings compared to those who do not study economics. It introduces students to the concept of satisfaction or benefit that a consumer derives when units of a commodity are consumed along with how much the consumer needs to pay for the good.

Social Benefits

The study of economics widens the understanding about and adds value to democracy and good citizenship. Students of economics get the opportunity to learn about various economic issues faced by the nation. A large variety of economics curricular activities help them to critically analyze economic issues and make suggestions based on economic principles that are studied over the years. Economic theories train students to think like a scientist- to put it rightly-as an economist-logically and rationally.

Intellectual Exploration

Learning economics is an exciting intellectual adventure. Economics students also get excited when they master many facets of the economic system. Peterson (n.d, cited in Srinivasan, 2005) stated that economics offers a pleasing blend of the purely intellectual and the artistic, for pure economics analysis has the rigour and symmetry of science and mathematics, whereas the policy partakes more the uncertain character of an art than a science.

Cooperative Learning

Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning (Johnson, Johnson, 2007). Cooperative learning occurs when students work in small groups to help each other learn. Cooperative learning groups vary in size, although four is a typical number of students. When students are assigned to work in a cooperative group, the group usually stays together for weeks or months, but cooperative groups usually occupy only a portion of the student's school day or year (Sherman, 2001, cited in Santrock, 2006). In a cooperative learning group, each student typically learns a part of a larger unit and then teaches that part to the group. When students teach something to others, they tend to learn it more deeply (Santrock, 2008).

The Purpose of Cooperative Learning

There are basically four main reasons why cooperative learning is to be recommended: (Santrock, 2006).

1. More children actively learning

Cooperative learning helps to actively engage more children in learning than do teacher-centered or lecture-oriented methodologies. By using more cooperative methodologies in which students work together in groups, all students are actively engaged on a learning task. Students become more active participants in their own learning, as opposed to passive recipients of knowledge who only listen, observe and take notes.

2. Children learn to help one another

Cooperative learning encourages students to support their classmates in a group rather than to compete against one another. In this way, students can combine their talents and help one another.

3. Children-to-child learning support

Cooperative learning provides the opportunity for higher-achieving students to help students who are slower learners. These higher-achieving students can probably communicate more easily with peers than can the teacher. The help of these students also increases the amount of explanation that occurs in the classroom overall.

4. Improved motivation through success

Cooperative learning helps to improve the motivation of many students by offering the opportunity to more students to experience the joy of winning and academic success. In classrooms where students are only allowed to complete individually, only the few high achieving students will likely have this experience.

In classrooms where the students are divided into cooperative teams, each with its high and low-achieving students, the opportunity to succeed is more evenly distributed.

Cooperative Learning Methods

In cooperative learning instructional methods, students work together in small groups to help each other learn. There are various forms of cooperative earning and each has a set of best procedures to follow (Chruickshank, Bainer & Metcalf, 1999).

Student Team Achievement Divisions (STAD): Student Teams Achievement Divisions (STAD) was developed by Robert Slavin and his colleagues at John Hopkins University and is perhaps the simplest and most straightforward of the cooperative learning approaches (Slavin, 1994, 1995 cited in Arends, 2007). According to Slavin (1995), the instructional technique, STAD typically involves five steps:

1. **Presentation.** New material is typically presented to class using conventional approaches like lectures, discussions.
2. **Teamwork.** Groups are given material to study and worksheets to complete. They can work on these individually, in pairs, or in larger groups. They are encouraged to help each other and to make sure that everybody understands and knows the material, the emphasis being on the performance of the team.
3. **Quizzes.** At the end of the study period, which typically lasts a week, students write quizzes based on that week's material- individually, and without helping each other.
4. **Individual improvement scores.** Team scores are then calculated. And although recognition is given to teams that obtain the highest total scores, winning teams are those whose individuals improved the most. In that way, lower-achieving students can contribute as much to the team's total score as more able students.
5. **Team recognition.** Teams are then rewarded, perhaps with certificates, tokens, prizes, and praise. Team scores may also be used as a factor in determining individual grades.

In STAD, when delivering a good presentation, the teacher should get students' attention, tell them what they will learn and what they should be able to do after learning; relate the new information to ideas learners already know; present information in a step-by-step manner; don't overwhelm or underwhelm; emphasize the most important points students need to remember or use; use examples and illustrations to increase clarity; use variety to maintain attention; and make sure learners understand by asking them questions.

Two Stay Two Stray: Two Stay Two Stray (TSTS)

The TSTS procedure is based on Spencer Kagan (1992, cited in Maonde et al., 2015):

1. The teacher introduces the lesson.
2. The teacher divides the students into groups of four.
3. The students work together in a group of four.
4. Two members from each group stray to two other groups.
5. Two members stayed have job to share their work and information to those who come to their group.
6. The two strayed members get back to their own group and the groups discuss in their own group.
7. Finally, the teacher asks what the students have learned.

The advantages of using Two Stay Two Stray technique are:

1. This technique can be applied to all of lesson materials.
2. Every group can share information with other students.
3. Students can train social relation to other student.
4. This technique can train students' respect in a problem.
5. That can improve good relation among the students.
6. That can increase students' critical thinking on a problem.

Among many cooperative learning methods, the researcher used two cooperative learning methods (STAD and TSTS) in this study.

Research Methodology

Research Design and Procedure

The design adopted in this study was one of the true experimental designs, viz., the posttest only control group design.

Table 1: Experimental Design

Group	Assignment	No. of Students		Treatment	Posttest
		BEHS(1) (Mayangone)	BEHS(4) (Insein)		
Experimental	Random	32	32	Cooperative Learning	EA
Control	Random	32	32	Formal Instruction	EA

Note: EA = Economics Achievement

According to Gay (2003), true experimental research allows researchers to make cause-effect statements about their research studies. True experimental researchers control the selection of participants for the study, divide the selected participants into two or more groups that have similar characteristics at the start of the research experiment, and then apply different treatments to the selected groups. The prerequisite test was administered to all selected students before the treatment was provided. According to the scores of the prerequisite test, the students were randomly divided into two groups: control group and experimental group.

Finally, the achievement of experimental group and control group were compared by using the independent sample *t*- test.

Instrumentation

The instruments used for this study were a prerequisite test and a posttest (Achievement test).

(i) Prerequisite Test

The researcher developed a prerequisite test to measure the basic economics knowledge of the selected samples. There are (25) true or false items in this test and the total score of the test was (25) marks.

(ii) Posttest

A posttest was constructed to measure the economics achievement of Grade Nine students. The students had to answer all questions and there was no choice. The test was constructed based on Grade Nine Economics Textbook with the advice and guidance of the supervisor. In the question used for posttest, 5 items were true or false items, 5 items were completion items, 5 items were multiple choices items, 5 items were short questions.

Population and Sample size

Two High Schools were selected from Yangon Region by using simple random sampling method. These sample schools were No. (1) BEHS, Mayangone and No. (4) BEHS, Insein. No. (1) BEHS, Mayangone was selected from Western area and No. (4) BEHS, Insein was selected from Northern area in Yangon Region. At No. (1) BEHS, Mayangone, only (64) students were selected by random sampling method from a total population of (437) Grade Nine students (economics combination) in the academic year 2017-2018. In the same way, only (64) students were selected from a total population of (317) Grade Nine students (economics combination) at No. (4), BEHS, Insein (see Table 2)

Table 2 Population and Sample Size

Name of School	No. of Total Population	No. of Selected Student
BEHS (1)	437	64
BEHS (2)	317	64

BEHS (1) = No. (1) Basic Education High School, Mayangone
BEHS (2) = No. (4) Basic Education High School, Insein

Data Analysis

The data were analyzed by using a descriptive statistics (means, standard deviation) and independent samples ***t***-test. The independent samples ***t***-test was used to compare the achievement of students who receive instruction through cooperative learning method and those who receive instruction through traditional method at knowledge, comprehension, and application level. In order to determine the significant differences, the independent samples ***t***-test was used with the Statistical Package for Social Science (SPSS) 22.0.

Findings

This chapter is concerned with the research findings from the quantitative study. Quantitative study deals with the analysis of the data, findings and interpretations of the experimental study. The independent samples ***t***-test was used to compare the differences between the control and experimental groups.

The data obtained from the posttest were recorded systematically. And then, these data were analyzed by using the independent samples ***t***-test to compare the differences between the experimental and control group. The ***t***-test for independent samples was used to compare whether the students in one group did better or worse than the students in other group.

Table 3 *t* Values for Posttest Economics Achievement Scores

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (1)	Experimental	32	16.75	2.048	3.00	6.258	62	.000***
	Control	32	13.75	1.778				
BEHS (2)	Experimental	32	16.19	2.250	2.56	5.080	62	.000***
	Control	32	13.63	1.755				

Note: ***$p < .001$
BEHS (1) = No. (1) Basic Education High School, Mayangone
BEHS (2) = No. (4) Basic Education High School, Insein

Table (3) shows for posttest economics achievement scores. Moreover, it describes standard deviation, mean difference, *t*-value, degree of freedom, and Sig (2 tailed). The mean scores of the experimental groups were significantly higher than that of the control groups in two sample schools (see Table 3). It showed that there was a significant difference between the experimental group and the control group for scores on the overall economics achievement in each school.

Table 4 *t* Values for Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (1)	Experimental	32	8.38	1.699	0.41	0.927	62	0.357(ns)
	Control	32	7.97	1.805				
BEHS (2)	Experimental	32	8.16	1.273	0.28	0.790	62	0.433(ns)
	Control	32	7.88	1.561				

Note: ns = not significant
BEHS (1) = No. (1) Basic Education High School, Mayangone
BEHS (2) = No. (4) Basic Education High School, Insein

Results of knowledge level questions showed that the mean scores of the experimental groups were not significantly higher than that of the control groups in each school (see Table 3). It showed that there was no significant difference between the experimental group and control group for the scores on knowledge level questions in each selected school.

Table 5 *t* Values for Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (1)	Experimental	32	6.25	1.320	1.53	4.860	62	.000***
	Control	32	4.72	1.198				
BEHS (2)	Experimental	32	5.81	1.091	1.41	5.428	62	.000***
	Control	32	4.41	0.979				

Note: ***p< .001
BEHS (1) = No. (1) Basic Education High School, Mayangone
BEHS (2) = No. (4) Basic Education High School, Insein

According to the scores on the comprehension level questions, the mean scores of the experimental groups were significantly higher than that of the control groups in each selected schools (see Table 5). It showed that there was a significance difference between the experimental group and control group for the scores on comprehension level questions in each selected schools.

Table 6 *t* Values for Scores on Application Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (1)	Experimental	32	2.13	0.907	1.06	4.581	62	.000***
	Control	32	1.06	0.948				
BEHS (2)	Experimental	32	2.22	0.941	0.88	3.950	62	.000***
	Control	32	1.34	0.827				

Note: ***p< .001
BEHS (1) = No. (1) Basic Education High School, Mayangone
BEHS (2) = No. (4) Basic Education High School, Insein

As regards the scores on the application level questions, the mean scores of the experimental groups were significantly higher than that of the control groups in both selected schools (see Table 6). It showed that there was a significant difference between the control group and experimental group for the scores on application level questions in each selected schools.

Summary of Quantitative Findings

The results of research findings from two selected schools were as follows:

(1) There was a significant difference between the control groups and experimental groups on the scores of economics achievement in two selected schools. It can be interpreted that the use of cooperative learning method has a significant effect on the overall economics achievement of the students.

(2) There was no significant difference between the control groups and experimental groups on the scores of knowledge level questions in each selected school. It can be interpreted that formal instruction can also bring about the improvement of students' ability to remember previously learned materials as cooperative learning method.

(3) There was a significant difference between the control groups and experimental groups on the scores of comprehension level questions in each selected school. It can be interpreted that cooperative learning method can encourage the improvement of students' conceptual understanding.

(4) There was a significant difference between the control groups and experimental groups on the scores of application level questions in each selected school. It can be interpreted that cooperative learning method can bring about the improvement of students' ability to apply economics concepts in new situation.

Discussion

The main purpose of this study is to find out the effects of cooperative learning on students' achievement in grade nine economics. The results show that the posttest mean score of the experimental group was significantly higher than that of the control group in each school. So, the first hypothesis is accepted.

The results also show that there was no significant difference between the economics achievement of two groups, experimental group and control group, in answering knowledge level questions in each school. So, the second hypothesis is rejected.

The results also show that there was a significant difference between the economics achievement of two groups, experimental group and control group, in answering comprehension level questions in each school. So, the third hypothesis is accepted.

The results also show that there was a significant difference between the economics achievement of two groups, experimental group and control group, in answering application level questions in each school. So, the fourth hypothesis is accepted by the results of the study.

Suggestion

This research will contribute to improvement of economics teaching at the high school level in Myanmar. Cooperative learning consists of five basic elements: positive interdependence, individual accountability, interpersonal and small group skills, face-to-face promotive interaction and group processing. Learning situations are not cooperative if students are arranged into groups without the prescribed five basic elements. Therefore, when implementing cooperative learning, teachers need to create learning environments which include the above five essential elements. Each teacher needs to know how to prepare and plan his/her lessons and create their tasks. Grouping of students can be a difficult process and must be decided with care. Groups should contain three to five members. If the group is too small, one member can dominate the others. If it is too large, the group will ignore the contributions of one or more members. The group should be heterogeneous. Therefore, teachers should organize students into heterogeneous groups with respect to sex, and ability/learning styles when implementing cooperative learning. The present study used two cooperative learning methods (Student Teams Achievement Divisions and Two Stay Two Stray). The effectiveness of other methods of cooperative learning can also be studied. Moreover, further research of this kind with respect to different subjects and at all levels should be carried out in education.

Conclusion

Cooperative learning comprises instructional methods in which teachers organize students into small groups, which then work together to help one another learn academic content (Slavin, 2011, cited in Tran, 2013). In this research, cooperative learning was found to be more effective than formal instruction with respect to students' achievement. In the cooperative learning environment, students learn to analyze, synthesize, and critically analyze others' ideas, which contribute much to the improvement of critical thinking.

The results indicated that STAD and TSTS cooperative learning methods compared to traditional method showed better achievements and motivated students to learn in economics. The effective use of cooperative learning method has significant effect on the overall economics achievement of the students. Therefore, cooperative learning method surely has positive contribution to the economics teaching at the high school level.

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A CASE STUDY OF USING SCIENCE LABORATORY IN TEACHING SCIENCE SUBJECTS AT THE HIGH SCHOOL LEVEL

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Abstract

The primary purpose of the study is to investigate the science teachers' perception of using science laboratory in teaching science subjects at the high school level. Science laboratory is a setting in which the students work cooperatively in small groups to investigate scientific phenomena, a unique mode of instruction and unique mode of learning. The design applied in this study was the descriptive case study design. The sample size for this study was six science teachers from No. (1), BEHS, Hlegu and No. (1), BEHS, Mingalardon in Yangon Region. Triangulation, content analysis and cross site analysis were used to analyze the qualitative data such as interview, and observation records. The semi-structured interview and observation checklists were applied to collect the data. According to the result of the study, science teachers perceived that science laboratory had the impact on science teaching. Finally, discussion, and suggestions were provided for improving science teaching and learning at the high school level.

Keywords: Science Laboratory, Science, Perception.

Introduction

Science education is the most crucial factor in building a well-developed and modern country because this age is knowledge-driven age. Science knowledge explosion is more rapidly increasing in this century and science education is the most essential component of today education. Science is a process as well as a product of that process. Moreover, science process skills are important in exploring truth science products and science teachers must teach students to be coped with the basic science process skills. In addition, basic education is the foundation of higher education in which students may study depthfully specialized subject according to their interest. So, teachers must help students to fulfill basic knowledge and skills.

Science is a practical oriented work discipline and the laboratory is accompanied with every science subject. No course in science can be considered as complete without including some practical work. The science laboratory is the potential place where theory and practice can converge for students.

According to Tobin (1990), laboratory activities allow students to learn with understanding and engage in a process of constructing knowledge by doing science. Science laboratory has the potential to develop students' abilities and skills. In addition, science laboratory is the place where teachers can train students to be skillful in science process and gained basic science knowledge. Basic science teachers are the most important in teaching science at the high school level. According to Collette and Chiappetta (1989), inspiring and encouraging students to do well in school can be achieved through science activities and laboratories. According to Hofstein and Lunetta (2003), experiences in a laboratory can also help students to gain ideas about the nature of the science that are crucial for their understanding of scientific knowledge. Laboratory activities permit students to participate in investigations in which they do their own thinking and draw conclusions. Laboratory activities give students concrete learning experiences in which they can explore new ideas and relate concepts and theories to data gathered by personal observations (Hurd, 1964, cited in Collette & Chiappetta, 1989).

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If a teacher believes that the laboratory work is important and has the competence and the scientific facilities, the students will frequently engage in laboratory activities that will reflect the philosophy of the teacher. If a teacher believes that the function of teaching science is to transmit information, the laboratories will be deductive in nature, occurring after textbook reading and classroom discussion. Thus, the laboratory will serve to verify existing knowledge. If the teacher believes that teaching science should be investigative in nature, then the laboratories will be inductive and will occur before textbook readings and teacher lectures and presentations (Pella, 1961, cited in Collette & Chiappetta, 1989). Nevertheless, promotion of science laboratory activity and practical work in school is increasingly a matter of concern. Science laboratory will have an impact on teaching science. Thus, the focus of this paper is to explore teachers' perception on the science laboratory in teaching science and the impact of science laboratory in students' learning at the high school level.

Purposes of the Study

The main purpose of the study is to explore the teachers' perception on science laboratory in teaching science at the high school level.

Specific purposes of the study are:

(1) To identify the impact of science laboratory on teaching science subjects.

(2) To find out the teachers' perception on teaching science in the science laboratory environment.

Research Questions

(1) How do teachers perceive on teaching science?

(2) Why do teachers use science laboratory in teaching science?

(3) How do science teachers deal with science laboratory?

(4) How do teachers perceive the impact of science laboratory in teaching science?

Scope of the Study

This study is geographically restricted to Yangon Region. Participants in the study are six science teachers who taught at Grade Nine and Grade Ten from No (1) B.E.H.S, Hlegu, Hlegu Township and No (1) B.E.H.S, Mingalardon, Mingalardon Township within the 2017 – 2018 academic year. Participants are selected by using purposive sampling method. Although there are many factors that impact on science teaching such as using teaching aids and electronic media, activity-based learning, concept map, and appliance of different science teaching methods, this study is restricted to the impact of science laboratory on teaching science.

Definition of Key Terms

Science laboratory: Science laboratory is a setting in which the students work cooperatively in small groups to investigate scientific phenomena, a unique mode of instruction and unique mode of learning (Hofstein and Lunetta, 1982).

Science: Science is a way of thinking in the pursuit of understanding nature, a way of investigating and a body of established knowledge (Collette & Chappetta, 1989).

Perception: Perceptions are the processes that determine how humans interpret their surroundings.

Review of Related Literature

According to the epistemology, the sources of knowledge gained are different. The empiricism stress that students gained knowledge from experiences, experimentation in pragmatism and learning by doing in constructivism. Science teaching is closely related to above philosophies. In this study, science knowledge has to be viewed as tentative human construction from the constructivist perspective.

Constructivism

Constructivism is a psychological and philosophical perspective contending that individuals form or construct much of what they learn and understand (Tonning 1990, cited in Leslie, 1995).

A basic assumption of constructivism is that people are active learners and must construct knowledge for themselves (Geary, 1995, cited in Leslie, 1995). To understand material well, learners must discover the basic principles for themselves. The teachers provide the appropriate materials and a social context within which the material is discussed but does not lecture or guide discussion in the traditional sense.

Another constructivist assumption is that teachers should not each in the traditional sense of delivering instruction to a group of students. Rather, teachers should structure situations such that learners become actively involved with content through manipulation of materials and social interaction. Activities include observing phenomena, collecting data, generating and testing hypotheses, and working collaboratively with others. Students are taught to be self-regulated and take an active role in their learning by setting goals, monitoring and evaluating progress, and going beyond basic requirements by exploring interests (Geary, 1995, cited in Leslie, 1995).

Constructivist Learning Environment

Constructivist environments should create rich experiences that encourage students to learn. According to Brooks (1990, cited in Lesie, 1995), there are some guiding principles of constructivist learning environments. One principle is that teachers should pose problems of emerging relevance to students, where relevance is preexisting or emerges through teacher mediation. Thus, a teacher might structure a lesson around questions that challenge students' preconceptions. A second principle is that learning should be structured around primary concepts. This means that teachers design activities around conceptual clusters of questions and problems. Third, it is important to seek and value students' points of view. Trying to understand students' perspectives is essential for learning activities that are challenging and interesting. This requires that teachers ask questions, stimulate discussions, and listen to what students say. Teachers who make little effort to understand what students think fail to capitalize on the role of their experiences in learning. Fourth, teachers should adapt curriculum to address students' suppositions. Some activities encouraged in constructivist classrooms are experimentation, research project, field trips, class discussion and so on.

Constructivism and Science Laboratory

Constructivism is an educational theory that emphasizes hands-on, activity based teaching and learning during which student develop their own frames of thought. Constructivist learning theory states that knowledge is constructed in the mind of the learner, and instructors cannot simply feed knowledge to willing recipients. Shiland (1999) applies five postulates of this learning theory to the laboratory environment. The first states that learning requires mental activity. This application involves modifying experiments to encourage students to design parts of the procedures, identify variables and construct subsequent data tables. The second states that naive theories affect learning, and Shiland (1999) suggests moving experiments to the beginning of the chapter, allowing students to make predictions and explain them before the experiment. The third states that learning occurs from dissatisfaction with present knowledge, and experiments should be designed as problems to challenge this knowledge. The fourth suggests that learning has a social component that needs to be addressed through opportunities to discuss results and predictions with other students and instructors. Finally, the fifth postulate states that meaningful learning needs to connect theoretical principles with practical applications. All of these elements are part of laboratory-based learning, establishing a constructivist model of learning.

School Science Laboratory

The goal and purposes

Lunetta (1998) explained the objectives of laboratory activities as follows.

- Providing students with theoretical and conceptual information while learning natural science.
- Enabling students to learn science by helping them understand methods and nature of science.
- Enabling students to do science using scientific research procedures.
- Supporting students in a way that will help them define and put scientific theories into practice.
- Improving students' analytical and critical skills and encouraging them to be creative in science field.

The Laboratory as a Learning Resource

Laboratory work can be used as a powerful learning resource of science. Laboratory work is based on the principle of learning by doing and it is an integral part of science education. It helps in better understanding of various concepts of science and construction of knowledge. The first-hand experience obtained through experiment of knowledge. It imprints a permanent impression on the mind of the learners and provides opportunity to the teacher to inculcate various process skills of science such as observation, classification, analysis of data, recording, inferring, generalizing and communicating. Process skills required help in developing interests, values, and spirit of inquiry that constitute scientific attitude. Students learn while handling, manipulating and innovating different types of equipment. It provides an environment to learners for exhibiting their qualities such as resourcefulness, initaitiveness, orderliness, cooperation, and team spirit. Students enjoy working together with their peers with some freedom of action, having a feel of excitement of the unknown and achieving a sense of discovery. Learners cannot discover all of science; however, encouraging them to observe, investigate and think critically on a laboratory activity can facilitate them to construct some abstract concepts and principles of science, to awaken curiosity about the world around them and to gain a feel and appreciation of science. Thus, laboratory work facilitates development of (i) cognitive abilities, i.e. principles and laws discussed in the classroom may precede or follow the laboratory work or it may be carried out during discussion; (ii) process skills of science; (iii) scientific attitude; and

(vi) understanding nature of science. Use of laboratory must be focused towards achieving these developments.

The kind of experience that is provided by the laboratory cannot be replaced by any other exercise. Well-planned laboratory experiences have great potential to attract students.

Common Characteristics of Science Laboratory

Laboratory guide book or manual is designed to identify problems requiring observations and solutions. Laboratory assistant helps science teacher to maintain and organize the equipment and supplies. The directions for laboratory exercises must be explicit. They can be given orally or in written form or discussed during the pre-laboratory session.

Auxiliary record book - Observation of the experiment performed should be recorded in it. Discussion in laboratory includes pre-discussion and post-discussion.

Effectiveness of the laboratory experiences is directly related to the amount of individual participation by students. Individual participation means active involvement in the experiment with definite responsibilities for its progress and success.

Approaches to Laboratory Work

Verification or Deductive Laboratory

The verification or deductive laboratory is the most common approach to laboratory work in science courses. The purpose of this type of laboratory work is to illustrate concepts, principles, and laws. Teachers generally present major ideas first, through lecture, discussion, and reading, followed by laboratory work to illustrate and verify ideas using concrete activities.

Inductive laboratory

The inductive laboratory provides students with the opportunities to form concepts, principles, and law through firsthand experiences before they are discussed and taught in the classroom.

Science Process Skill Laboratory

A major purpose for including laboratory work in science courses is to present science as a way of investigating and as a way of thinking. Science process skills include basic skills; observing, classifying, using space/time relations, using numbers, measuring, inferring, predicting, and integrated skills; defining operationally, formulating models, controlling variables, interpreting data, and experimenting.

Technical Skill Laboratory

Good laboratory techniques are essential to conduct successful laboratory activities and to collect accurate data. They require manipulative skills that involve the development of hand-eye coordination.

Exploratory Laboratory

Science teachers allow their students to explore an idea, concept, principle, or theory without structured procedures. In an exploratory laboratory students are given the freedom to explore and test ideas.

Laboratory Instructional Styles

	Descriptor		
Style	**Outcome**	**Approach**	**Procedure**
Expository	Predetermined	Deductive	Given
Inquiry	Undetermined	Inductive	Student generated
Discovery	Predetermined	Inductive	Given
Problem-based	Undetermined	Deductive	Student generated

Source: from J. J. Lagowski, (2002).

Science Teaching Methods.

Science teaching methods are lecture, demonstration, discussion, laboratory method, project and problem solving.

Method and Materials

The study is aimed to explore the high school science teachers' perception toward science laboratory in teaching science. Teaching science is not interesting without laboratory. Teaching science is always accompanied with science laboratory. In every science curriculum the laboratory work is included. This study was conducted by using interview and observation methods.

Research design and procedure

This study is a descriptive case study by using interview and observation techniques. Descriptive case study focuses on thick description of whatever is being studied. Thick description may be defined as the complete and literal description of the entity investigated. This study used the semi-structured interview to explore teacher's perception and naturalistic observation checklists to watch the teacher's performance during the laboratory instruction.

Firstly, the relevant literature is studied. In order to get the required data, the instruments were developed. Content validity was determined by expert judges. After preparing the required interview questions and checklists, pilot testing was done. During the interview procedure, audio-recorder and note taking were used to record the data. The interview takes an average of twenty minutes. During the observation procedure, checklists were used to observe teachers' performance during laboratory instruction and to detect the physical appearance of science laboratory. According to the pilot study, the interview questions were modified by repairing the wording and added the other facts needed to ask. After the pilot study, the main study was executed during the last two weeks of November in 2017 – 2018 academic year. The modified instruments were interviewed to the selected participants of the two sample schools and the data were analyzed.

Instruments

The interview was conducted by using semi-structured questions (see Appendix A). These questions were constructed based on Ayse, G. K. and Zengin, R. 2015. The interview consists of six components. Two types of observation checklists were created. One is aimed at investigating the teachers' performance during teaching science in science laboratory. This checklist was developed based on the procedure of laboratory method and demonstration method of Belen, 1962, cited in Garica, 1989, (see Appendix B2). Another was established to describe the physical appearance of science laboratory (See Appendix B1).

Population and Sample size

This study used the purposive sampling method and it was conducted in the North district of Yangon region. Participants were selected from one of the high schools in Mingaladon Township and from one of the high schools in Hlegu Township. This study was implemented during 2017 - 2018 Academic year. It takes about two weeks.

Data Analysis

The modified questions were interviewed to six participants from the selected schools. Qualitative data were collected from the teachers' response of interview and performance from checklist. The record of the interview was translated into a scripts as important reference for encoding. The observation was noted descriptively and reflectively. The data were analyzed by using triangulation method, content analysis and cross-site analysis method.

Findings

Demographic Factors of science Teachers

The science teachers are from thirty to fifty nine years old. They are bachelor and master degree holders. Their total teaching services are about eight years to thirty years. They teach science twenty four periods per week. The range of science teaching services is at least four years to at most twenty six years.

Science Teaching

Most science teachers apply explanation (lecture) and demonstration methods in science teaching. They employ direct instructional strategies. Teachers aim students to understand the lesson clearly and apply knowledge and formula in problem solving at examination. They only look forward students to pass examination outstandingly. They aim to increase pass percentage range of examination (See Appendix C). Teachers' difficulties are insufficient conditions of laboratory equipment, materials, chemicals and teaching aids. They cannot show real objects for every lesson. Teachers solve these difficulties by showing relevant photos and videos that are downloaded from internet and Facebook instead of real objects (See Appendix C). So, teachers apply technology in science teaching. Teachers' technology skills are important in today science teaching. Another difficulty is that some students are weak in Mathematics and Basic English skills.

Teachers are really interested in science teaching because science is related to the nature and environment and scientific knowledge can be applied in real life. Science teaching includes practical and discovery work. Teachers are satisfied with science teaching. They thought that science has no fictional character and it is pragmatic.

Appliance of Science Laboratory

There is only one science laboratory in No.1, B.E.H.S, Hlegu but No.1, B.E.H.S, Mingalardon has three science laboratories. Teachers apply science laboratory in science teaching. Because of appliance of science laboratory, students can execute practical work and observe demonstration. They can easily understand, memorize, retain and remember the lessons lastly. They are interested in experiment. Practical equipment can only be systematically stored in science laboratory. Teachers have known that science laboratory assists students to learn lessons easily. Performing experiments can identify that theory is true.

Doing Laboratory Work

Teachers aim that doing laboratory work can improve students' thoughts and comprehension about the lessons. Students will illuminate lessons explicitly. Because of practical experience, students can make reasoning for everything (See Appendix C). Teachers comprehend that science laboratory is a learning resource. Teachers think that science laboratory is absolutely necessary for science teaching because students learn effectively and remember the lesson. Explanation of lessons by showing real objects is necessary for students' understanding. Students' investigative and creative abilities can be developed. It can concluded that science teachers' purpose of doing laboratory work is to facilitate development of cognitive abilities and process skills of science. Teachers taught in science laboratory according to the practical course relating to the lesson. Teachers performed convenient laboratory work. Laboratory work is not performed for every lesson (See Appendix C). The laboratory work is not systematically recorded in books. Teachers are weak in doing laboratory work. In site one, laboratory assistant helps teachers to perform experiment by preparing required materials and equipment for demonstration. She stores the laboratory equipment and materials systematically. But in site two, laboratory assistant does not help teachers. Nevertheless, laboratory assistant should help science teachers to maintain and organize equipment and supply for the preparation of laboratory and demonstration.

Teaching Methods and Approaches Applied in Science Laboratory

Teachers use demonstration, laboratory, cooperative and discussion methods in science teaching at science laboratory. They apply question and answer techniques and observation techniques. Teachers apply direct and indirect instructional methods. They can use variety of teaching methods in science teaching at the science laboratory but classroom situation must be interactive.

The four science teachers apply science laboratory after lesson. Those teachers execute verification or deductive laboratory work. Teachers thought that without knowing theory and procedure, students do not understand how to perform experiment. After they have known them, they can verify that theory is true by performing laboratory work themselves (See Appendix C). But two science teachers apply science laboratory before lesson. Those science teachers execute inductive laboratory work. Before lesson, doing laboratory work by students improve their understanding (See Appendix C). Teachers employ inductive and deductive approach in science teaching.

Implementation of laboratory work

Teachers implement laboratory work by working together each other. They draw practical schedules and prepare experiment themselves. Teachers' cooperation is important to execute the laboratory work. Teachers determine the laboratory procedure by asking opinions from partners. Based on the method they applied, they also determine the laboratory procedure. Four science teachers employ teacher-led demonstration method. So, they use the laboratory procedure such as purposing, proper demonstration, executing and evaluation. Two science teachers employ laboratory method. So, they use laboratory procedure such as lesson introduction, predicting and overview of activity, performing experiments and closure. It can be interpreted that four science teachers mainly apply expository laboratory instruction style. Two science teachers employ discovery laboratory instruction style. Teachers assess students' laboratory work by giving A, B grade on practical book. They also check students' understanding by asking questions. The practical marks are not needed to count for final exam result. So, they only check the practical paper whether students get the right results (See Appendix C).

Teachers favour to implement group laboratory work because time is not enough to do individual laboratory work and the laboratory books are not sufficient. Because of group laboratory work, students can give their opinions to each other and they can work cooperatively together (See Appendix C). Teachers create science laboratory as a place in which students work cooperatively in small groups to investigate the phenomena. Although social interaction in laboratory is paramount, individual participation is also important in science laboratory work. Teachers approach students by using questioning and observation techniques in teaching laboratory work. They explore background knowledge of students by asking questions. Their approaches are formal. It should include discussion because science laboratory work includes pre and post discussion. Teachers' problems are that the required laboratory equipment and materials are not sufficient and enough to implement laboratory work. They are weak in knowledge to do practical experiment. The laboratory materials are old, faded and needed to be repaired. Teachers solve these problems by applying replaceable materials that are easily got from environment. Teachers' pedagogical knowledge and creative abilities are important to become successful teaching – learning process in science laboratory. Teachers have no laboratory manual but they have laboratory work book. They study the procedure in the work book and implement them. Teacher's manual for science laboratory is absolutely necessary because without knowing the procedure, effects of chemicals and limitations of experiments, and how to apply instruments, teaching science in the laboratory cannot be successful. The head of the school supports the laboratory equipment that are given by Ministry of Education. Four science teachers attended practical course at West Yangon University. This course takes only one day. The dean of subject has a chance to attend this course. They get a lot of new required knowledge from this course. The practical course is absolutely necessary for all science teachers.

Practical Experiment

Teachers thought that practical experiments make science teaching more interesting. Since students perform and observe experiments themselves, scientific knowledge, facts and concepts are firmly attached in their memory. Teachers said that science teaching without practical experiment is like story telling (See Appendix C). Practical experiments play a main role in science instruction. Four science teachers favour student-led experiments. Two science teachers prefer teacher-led experiments. But in reality, teacher-led experiments are performed because of incomplete situation of materials and apparatus. Teacher-led experiments are convenient if students have limited amount of scientific knowledge to do experiments well. Teachers thought that students can easily understand the lesson, remember the important facts and identify that theory is true by performing practical experiments. Practical experiments are suitable with students' learning. Science teaching with practical experiments help students to learn lessons easily. Teachers believe that the practical experiment is related to students' learning theoretical lesson because students can easily memorize the lessons and retain them lastly when they perform and observe the experiments (See Appendix C). Science includes facts, concepts, theory and law. Without practical science teaching may be unsuccessful. Nevertheless, teachers who have positive scientific attitude and creative spirit can create complete science laboratory environment in which students will actively learn by performing practical experiments. Teachers assume that there is a significant difference in students' learning between doing science experiment and conventional teaching. Students interest to perform practical experiment. But in conventional teaching, students may be lazy and not interested in lesson. Practical experiments have positive effect on students' learning and their interest.

Perception toward Science Laboratory

Teachers believe that science laboratory has impact on students' learning because students easily recognize and remember the lessons when they perform laboratory work (See Appendix C). Teachers suppose that practical experiments are much enough to concretize abstract knowledge for students. Students have difficulty to understand the theoretical lessons that are abstract. Practical experiments confirm that theory is true. So, students' abstract knowledge can be transformed into concrete. Teachers believe that students can apply knowledge gained through learning in science laboratory as a basis for next grade. The scientific skills and ways of problem solving can be applied in real life situation (See Appendix C). So, teachers have to teach students to develop scientific thoughts, attitudes and skills by the use of laboratory work. Teachers assume that science teaching in the laboratory progress students' learning and active participation because students work together to get the right result of experiment and they also ask investigative questions. Science laboratory should be a place which can progress students' learning by allowing them to perform practical experiments cooperatively with each other. Teachers like science teaching in science laboratory and interest to do experiments. Science practical work is related to the environment. Students' thoughts, affiliation and confidence can be improved by teaching science in laboratory. Teachers who have positive attitude toward science laboratory may design experiments even without complete situation of laboratory equipment.

Discussion and Conclusion

Discussion

This study is to investigate the teachers' perception towards the science laboratory in science teaching. In the research of Kozcu (2006), he described that laboratory based learning has a much greater effect on students' academic success, level of memory and their sensibility than the formal teaching. In this study the teachers perceive that science laboratory activities assist students to learn lesson easily. Science laboratory has positive influence on science teaching in which students can easily understand, lastly retain and remember the lessons. Trowbridge and Bybee (1990) suggested that in reality, the maximum learning may be achieved, for certain students, by working in pair or small group activity may be beneficial. This result is agreement with this study. Teachers thought that students can give opinions and work cooperatively because of group laboratory work. They asserted that the group work is time saving approach. In the research of Prachanent and Chaivisthungkura (2016), they asserted that problems of lacking basic science laboratory equipment result students have no chance to do experiments. To enable the complete contents, teachers used the video clips involving experiments. Comparatively, the research found that most science laboratory equipment are faded, old and are not enough for all students. Teachers apply replaceable materials that are easily got from environment. They also show the relevant pictures and videos that are downloaded from the internet.

The laboratory guides or manuals and instruction must develop students' conceptual understanding, creative thinking, problem solving activity, and scientific thinking (Pavelich and Abraham, 1979). In this study, teachers have no laboratory manuals. They have laboratory work books. They implement laboratory work by asking opinions from each other. Four science teachers applied verification or deductive laboratory approach and two science teachers used inductive laboratory approach. According to (Renner, 1986), in good laboratory, students discover concepts: they do not just verify them. Science teaching should include both approaches.

Laboratories are crucial making abstract concepts concrete (Pekmez, 2001, cited in Sample, 2011). In this study teachers perceive that students' abstract knowledge can be transformed into concrete because of performing practical experiment which can verify that theory is true. Learning can be more meaningful by the manipulation of objects such as in the laboratory and through the use of pupil experiences and interest. This statement supports with this study's results. Teachers perceived that laboratory activity broadens interest of students and science students can see and confirm things in the textbook. Moreover, when the students handle themselves in the experiments, experience is impressed more trimly on their minds than when they listen or see from distance. They prefer student-led demonstration. But, in reality, teacher-led demonstrations are performed.

According to Bybee (2000), the school laboratories have the potential to be an important medium for introducing students to central, conceptual and procedural knowledge and skills in science. The findings of this study confirm Bybee's statement. Teacher believed that knowledge gained though science laboratory can be applied in the next grade. The scientific and problem solving skills can be also applied in real life situation. According to Freedman (1997), laboratory work is an effective learning environment for enhancing attitudes, stimulating interests and enjoyment and motivating students to learn science. Teachers asserted that students' thoughts, affiliation, and confidence can be improved by teaching science in laboratory. Laboratory work has impact on students' learning and improve students' participation because they perform experiments. Their inquiry and investigative spirits are evoked.

Suggestions

Science teachers perceived that science laboratory has impact on science teaching. Science laboratory activities motivated students to learn by doing individually or in a small group. According to the results of the study, the suggestions are given as follows.

a. In order to make use of laboratory effectively which is essential for science instruction, the perceptions of science teachers and students need to be considered for necessary regulations and developments of laboratory work.
b. Teachers should systematically and regularly implement the laboratory work.
c. Teachers should provide the direct experiences in science where students are curious, energetic and resourceful.
d. Experimental activities should improve scientific thought and problem solving skills so that students can develop positive attitude in science learning.
e. Teachers should be provided on the job training on how to conduct practical experiment in classrooms.
f. A wealth of resources for experimentation should be provided.
g. The laboratory should be provided in every Myanmar high school.

Conclusion

In order to fulfill the goal of science education, the teachers must be well prepared in their respective science subjects. They must have a firm understanding of the nature of science and help their students to develop inquiry skills as well as provides scientific and technological knowledge. Students must learn factual information, but, more important, they must discover ideas for themselves through laboratory activities, field studies and library work (Gould, 1984, cited in Collette & Chappetta, 1989).

Science involves highly complex and abstract subject matter that some high school students fail to grasp science concepts without concrete objectives and opportunities for manipulations. The solution of solving above problem is appliance of science laboratory in teaching science because laboratory activities give students concrete experiences in which they can explore new ideas and theories by gathering data and observation. Science laboratory has an important role in learning science. Practical work is more important because of the fact that people learn by imitating and by doing scientific principles and applications. Practical classroom experiments help in boarding pupils experience and develop initiative and cooperation. Science is a laboratory oriented subject because it contains a lot of practical wok to do in teaching and learning process. Science laboratory is a crucial factor in learning and achievement in that subject.

The laboratory activities have had distinctive and central role for science curriculum. The science teachers asserted that many benefits mount up from engaging students in science laboratory activities. So, science laboratory play an important role in science teaching.

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Appendix A

Interview Questions for Science Teachers

စဉ်	မေးခွန်းများ
	Demographic Factor
1.	Gender: Male ▢ Female ▢
2.	How old are you?
	အသက်ကိုပြောပြပါ။
3.	Which certifications did you got?
	ရရှိခဲ့သောဘွဲ့ကို ဖော်ပြပါ။
4.	What is your teaching services?
	စုစုပေါင်း လုပ်သက်ကိုဖော်ပြပါ။
5.	Which subject do you teach at present?
	လက်ရှိသင်ကြားနေသော ဘာသာရပ်ကိုဖော်ပြပါ။
6.	Which grade do you teach at present?
	လက်ရှိသင်ကြားနေသောအတန်းကိုဖော်ပြပါ။
7.	Describe your total teaching periods at present?
	လက်ရှိသင်ကြားနေသော စုစုပေါင်းစာသင်ချိန်ကို ဖော်ပြပါ။
8.	How long is your teaching services as a science teacher?
	သိပ္ပံဘာသာသင်ကြားနေသော စုစုပေါင်း လုပ်သက်ကိုဖော်ပြပါ။
	Teaching Science
1.	Which teaching methods do you always use in teaching science? Explain one of them?
	သိပ္ပံဘာသာရပ် သင်ကြားရာတွင် မည်သည့်သင်နည်းများကို အမြဲတမ်း ထည့်သွင်းအသုံးပြု သင်ကြားသနည်း။ တစ်ခုအကြောင်း ရှင်းပြပါ။
2.	What is your aim of teaching science? Why do you set this aim?
	သိပ္ပံဘာသာရပ်သင်ကြားခြင်းနှင့် ပတ်သက်၍ သင၏ရည်မှန်းချက်ကိုပြောပြပါ။ အဘယ်ကြောင့် ဤရည်မှန်းချက်ကို ချမှတ်ပါသနည်း။
3.	Which difficulties do you always face in teaching science? How do you solve them?
	သိပ္ပံဘာသာရပ်သင်ကြားရာတွင် သင် တွေ့ကြုံရသော အခက်အခဲများကိုဖော်ပြပါ။ ထိုအခက်အခဲများကို သင်မည်ကဲ့သို့ ဖြေရှင်းပါသနည်း။
4.	How do you feel about science teaching?
	သိပ္ပံဘာသာရပ်သင်ကြားခြင်းနှင့် ပတ်သက်၍ သင်မည်ကဲ့သို့ တွေ့ကြုံခံစားရပါသနည်း။
5.	Are you interested in teaching science? Why?
	သိပ္ပံသင်ကြားမှု အပေါ်စိတ်ဝင်စားအမှုရှိပါသလား။အဘယ်ကြောင့် စိတ်ဝင်စားပါသနည်း။
6.	Do you apply science laboratory in teaching science? Why?
	သိပ္ပံဘာသာရပ်သင်ကြားရာတွင် လက်တွေ့ခန်းကို အသုံးချပါသလား။ အဘယ်ကြောင့်လက်တွေ့ခန်းကို အသုံးပြုပါသနည်း။

စဉ်	မေးခွန်းများ
	Teaching Science
	Using Science Laboratory
1.	What is your purpose of doing laboratory work in science laboratory? Why do you set this purpose?
	လက်တွေ့ခန်းအတွင်း လက်တွေ့လုပ်ငန်းများဆောင်ရွက်ရခြင်းနှင့် ပတ်သက်၍ သင်၏ရည်ရွယ်ချက်ကိုဖော်ပြပါ။ အဘယ်ကြောင့် ဤရည်ရွယ်ချက်ကို ချမှတ်ပါသနည်း။
2.	Do you think that science laboratory is necessary for teaching science? Why do you think like this?
	သိပ္ပံ သင်ကြားမှုအတွက် သိပ္ပံလက်တွေ့ခန်း လိုအပ်သည်ဟု သင်ထင်မြင်ယူဆပါသလား။ အဘယ်ကြောင့် ဤကဲ့သို့ထင်မြင်ယူဆပါသနည်း။
3.	How many periods per week do you teach in science laboratory? How long take a period?
	သိပ္ပံလက်တွေ့ခန်း အတွင်း တစ်ပတ်လျှင် အချိန်မည်မျှ သင် ဝင်ရောက်သင်ကြားပါသနည်း။ စာသင်ချိန်တစ်ချိန်၏ ကြာချိန်ကိုဖော်ပြပါ။
4.	Is there laboratory assistant to help you in the laboratory?
	သိပ္ပံလက်တွေ့ခန်း အကူရှိပါသလား။ သူ/သူမက သင်ကိုမည်သို့ ကူညီဆောင်ရွက်ပေးသနည်း။
5.	Before lesson or after lesson, when do you use science laboratory? Why do you use like this?
	သင်ခန်းစာ သင်ပြီးနောက် လက်တွေ့ခန်းကိုအသုံးပြုပါသလား။ သင်ခန်းစာမစတင်မီ လက်တွေ့ခန်းကိုအသုံးပြုပါသလား။ အဘယ်ကြောင့် ဤ ကဲ့သို့ အသုံးပြုပါသနည်း။
6.	Which methods do you use in teaching science in the laboratory? Why do you use them?
	သိပ္ပံလက်တွေ့ခန်းတွင် သိပ္ပံ သင်ကြားသောအခါ မည်သည့်သင်နည်းများကို ထည့်သွင်းအသုံးပြုသင်ကြားပါသနည်း။ အဘယ်ကြောင့်နည်း။
	Implementation of Laboratory Work
1.	How do you implement laboratory work?
	သိပ္ပံလက်တွေ့ခန်းလုပ်ငန်းများကို သင်မည်ကဲ့သို့ အကောင်အထည်ဖော်ဆောင်ရွက်ပါသနည်း။
2.	How do you determine the laboratory procedure?
	သိပ္ပံလက်တွေ့ခန်း လုပ်ငန်းအစီအစဉ်များကို သင်မည်ကဲ့သို့ ဆုံးဖြတ်ဆောင်ရွက်ပါသနည်း။
3.	How do you assess laboratory work?
	သိပ္ပံလက်တွေ့ခန်းလုပ်ငန်းများကို သင်မည်ကဲ့သို့ အကဲဖြတ်ပါသနည်း။
4.	Which one do you favour: individual laboratory work or group work? Why do you prefer this?
	တစ်ဦးချင်းဆောင်ရွက်ရသော သိပ္ပံလက်တွေ့ခန်းလုပ်ငန်းနှင့် အုပ်စုဖွဲ့လုပ်ဆောင်ရသော လုပ်ငန်းတွင် မည်သည့်ကိုအလေးပေးနှစ်သက် ဆောင်ရွက်ပါသနည်း။ အဘယ့်ကြောင့်နည်း။
5.	Which approaches do you use in teaching laboratory work? How do you apply laboratory manual?
	သိပ္ပံလက်တွေ့ခန်းလုပ်ငန်းများ သင်ကြားမှုဆောင်ရွက်ရာတွင် မည်သည့်ချဉ်းကပ်နည်းများကို အသုံးပြုပါသနည်း။ လက်တွေ့ခန်း အသုံးပြုမှုလက်စွဲ စာအုပ်ကို သင်မည်ကဲ့သို့ အသုံးချပါသနည်း။

စဉ	မေးခွန်းများ
6.	Which problem do you face during implementation of laboratory work?
	သိပ္ပံလက်တွေ့ခန်းလုပ်ငန်း အကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင် သင်တွေ့ကြုံရသော အခက်အခဲပြဿနာများကိုဖော်ပြပါ။
	Interest in Doing Practical Experiment
1.	Do you think that teaching science without practical experiment is not interesting? Why do you think like this?
	သိပ္ပံလက်တွေ့စမ်းသပ်ချက်များ မပါရှိပဲ သိပ္ပံသင်ကြားခြင်း သည် စိတ်ဝင်စားဖွယ်ကောင်းပါသလား။ သင်အဘယ်ကြောင့် ဤကဲ့သို့ တွေးထင်ပါသနည်း။
2.	While doing practical experiment, do you prefer teacher-led experiment or student-led experiment? Why?
	လက်တွေ့လုပ်ငန်းဆောင်ရွက် သောအခါ ဆရာဦးဆောင်သော လက်တွေ့စမ်းသပ်ချက် နှင့် တပည့်ဦးဆောင်သော လက်တွေ့စမ်းသပ်ချက် တို့တွင် မည်သည့်စမ်းသပ်ချက်ကို သင်နှစ်သက်ပါသနည်း။
3.	Do you think that practical experiment is suitable or not with students' learning? How and why do you perceive like this?
	လက်တွေ့စမ်းသပ်ချက်များသည် ကျောင်းသားများ၏ သင်ယူမှုနှင့် သင့်တော်မှုရှိသည်ဟု ထင်ပါသလား။ သင်သည် အဘယ်ကြောင့် ဤကဲ့သို့ထင်မြင်ယူဆပါသနည်း။ မည်ကဲ့သို့ သင့်တော်မှုရှိပါသနည်း။
4.	How do you think that there is any relationship between the practical experiment and students' learning theoretical lessons?
	လက်တွေ့စမ်းသပ်ချက်များ နှင့် ကျောင်းသားတို့၏သဘောတရားဆန်သော သင်ခန်းစာများနှင့်ပတ်သက်သည့် သင်ယူမှုကြား ဆက်စပ်မှုရှိခြင်းကို သင်မည်ကဲ့သို့ ထင်မြင်ယူဆပါသနည်း။
5.	Is the laboratory material and equipment suitable and enough for the students? If not, how do you implement practical experiment?
	လက်တွေ့ခန်းပစ္စည်းကိရိယာများ သည် ကျောင်းသားများအတွက် သင့်တော်လုံလောက်မှု ရှိပါသလား။ သင့်တော်လုံလောက်မှု မရှိခဲ့သော် လက်တွေ့စမ်းသပ်ချက်များကို သင်မည်ကဲ့သို့ အကောင်အထည်ဖော်ဆောင်ရွက်ပါမည်နည်း။
6.	What is the difference of students' learning between conventional teaching and doing science experiment? How do you think about this difference?
	လက်တွေ့စမ်းသပ်ချက် များဆောင်ရွက်ချိန်နှင့် သာမန်စာသင်ချိန်ကြား ကျောင်းသားများ၏ သင်ယူတွင် မည်သည့်ခြားနားချက်ရှိပါသနည်း။ ထိုခြားနားချက်ကိုသင်မည်ကဲ့သို့ ထင်မြင်ယူဆပါသနည်း။

စဉ်	မေးခွန်းများ
	Perception toward Teaching Science in the Laboratory
1.	How do you believe that science laboratory has the impact on students' learning?
	သိပ္ပံလက်တွေ့ခန်းသည် ကျောင်းသားများ၏ သင်ယူမှုအပေါ် သက်ရောက်မှုရှိသည်ကို သင်မည်ကဲ့သို့ ယုံကြည်လက်ခံပါသနည်း။
2.	Do you think that laboratory work are enough to concretise abstract knowledge for students? Why do you think that?
	လက်တွေ့လုပ်ငန်းများသည် ကျောင်းသားများအတွက် လက်ဆုပ်လက်ကိုင်မပြနိုင်သော အသိပညာများကို လက်ဆုပ်လက်ကိုင် ပြနိုင်သော အသိပညာအဖြစ်သို့ ပြောင်းလဲပြုလုပ်နိုင်ရန်အတွက် သင့်တော်မှုရှိပါသလား။ သင်မည်ကဲ့သို့ထင်မြင်ယူဆပါသနည်း။
3.	Do you believe that students could apply knowledge gained through learning in science laboratory in their daily life? How can they apply? Why?
	လက်တွေ့ခန်းမှရသောအသိပညာများကို ကျောင်းသားများ၏ လက်တွေ့ဘဝတွင် အသုံးချနိုင်မည်ဟု ယုံကြည်ပါသလား။ ကျောင်းသားများသည် ထိုအသိပညာများကို မည်ကဲ့သို့ အသုံးချနိုင်သနည်း။ အဘယ်ကြောင်နည်း။
4.	Do teaching science in the laboratory progress students' learning and active participation? How do they progress?
	လက်တွေ့ခန်းအတွင်း သိပ္ပံသင်ကြားခြင်းသည် ကျောင်းသားများ၏ သင်ယူမှု နှင့် တက်ကြွစွာပူးပေါင်းဆောင်ရွက်တတ်မှုကို တိုးတက်စေပါသလား။ ကျောင်းသားများသည်မည်ကဲ့သို့ တိုးတက်ပြောင်းလဲလာပါသနည်း။ အဘယ်ကြောင့်နည်း။
5.	How do you feel about teaching science in the science laboratory yourself?
	လက်တွေ့ခန်းအတွင်း သိပ္ပံသင်ကြားခြင်းအပေါ် သင်ကိုယ်တိုင် မည်ကဲ့သို့တွေးမြင်ခံစားပါသနည်း။
6.	How do your headmaster/headmistress support for your science laboratory? Do you attend laboratory course? How do this course support for your teaching?
	လက်တွေ့ခန်းအတွက် သင်၏ကျောင်းအုပ်ကြီးမှ မည်ကဲ့သို့ကူညီထောက်ပံ့မှုများ ပြုလုပ်ပေးပါသနည်း။ လက်တွေ့ခန်းသင်တန်းတက်ရောက်ဖူးပါသလား။ ထိုသင်တန်းက သင်ကြားမှုအတွက် မည်မျှအထောက်အကူပြုပါသနည်း။

Appendix B 1

Observation (I)

School ------------------

Checklists for the Physical Appearance of Science Laboratory

No	Indicator / Statement	Poor	Fair	Good
	Organization			
1.	Ventilation System			
2.	Waste Disposal			
3.	Clean			
4.	Lighting			
5.	Water Supply			
6.	Usage of Basin			
7.	Structures of Tables			
8.	Structures of Shelves			
	Appliance of Teaching Aids			
9.	Uses of Charts			
10.	Uses of Models			
11.	Periodic Table			
12.	Laboratory Safety Rules			
	Maintainance			
13.	Storage of Chemicals			
14.	Storage of Materials			
15.	First-aid box			
16.	Laboratory Manual			
17.	Stock Register			
18.	Instructional Card			
19.	Pupils' Practical Notebook			
20.	Record of Doing Practical Work			

Appendix B2

Observation (II)

Performance during Laboratory Work

1. Subject --
2. Topic --
3. Period --
4. No of students --
5. Experiment --
6. Apparatus --
7. Materials --
8. Aim --
9. Procedure --

----
10. Techniques used --
11. Methods applied --

If the teacher used Laboratory method or Student-led demonstration

	Teacher performance	**Yes**	**No**	**Students performance**	**Yes**	**No**
1.	Lesson introduction					
	Asking Questions			Answer questions		
	Discussion			Active discussion		
	Grouping students			Actively participation		
	Giving the required apparatus			Carefully and systematically use		
2.	**Predicting and overview of activity**					
	Arousing investigative questions			Describe investigative questions		
	Designing experiment			Carefully note taking		
	Laboratory safety instruction			Carefully pay attention to teacher		
	Explaining instructional procedure			Carefully listening and asking questions about unclear facts		
3.	**Performing experiment**					
	Teacher monitor group as they work on the laboratory			Systematically, actively and individually perform experiment		
	Helping students with difficulties in doing experiment			Know how to use apparatus & Asking teachers for their difficulties		
	Telling students to collect the data from experiment			Collecting data from careful observation		
	Discussion with students			Discussion with teacher or peers		
4.	**Closure**					
	Summarize, transfer and relate to real life			Reporting their observation and summarization		
	Evaluation of students' work			Answer questions		

If the teacher used teacher-led demonstration

	Teacher performance	Yes	No	Students performance	Yes	No
1.	**Purposing**					
	The class (or) and teacher decides an activity that involves demonstration			Decides an activity that involves demonstration		
	Asking questions			Answer questions		
	Discussion			Discussion		
2.	**Planning**					
	Grouping students			Actively participation		
	Designing experiment			Carefully pay attention		
	Laboratory safety instruction			Carefully note taking, and listening		
3.	**Proper demonstration**					
	Teach the theory of concepts before demonstration			Asking investigation questions and carefully pay attention		
4.	**Executing**					
	Self-preparation			Self-preparation		
	Right explanation			Right explanation		
	Starting experiments			Starting experiments		
	Handling instrument			Handling instrument		
	Explaining observations			Explaining observations		
				Writing report		
5.	**Evaluation**					
	Asking questions			Answering questions		

Appendix C

Teachers' Responses to Interviews

Q : What is your aim of teaching science?
P1: "To get knowledge and got distinctions with high marks."
P2: "To complete a course outstandingly."
P3: "To understand the lessons clearly."

Q : How do you solve difficulties facing in teaching science?
P1: "I searched the photos and videos relevant to the lessons and show them to students."
P2: "Sometimes, I showed the pictures that are downloaded from internet."
P3: "I download the pictures from the internet. When I show these photos, students understand lessons."

Q : What is your purpose of doing laboratory work?
P1: "I aims students to learn lesson by doing experiments rather than by heart."
P2: "Students will make reasoning for everything."
P3: "Students will clearly and easily study the lessons."

Q : How many periods per week or month do you always teach laboratory work?
P1: "Relating to the lesson." "Can't tell the periods explicitly."
P2: "I have to favour the normal teaching periods."
P3: "The laboratory work cannot be done for every lesson." "Can't tell the exact period."

Q : Why do you use science laboratory after lesson?
P1: "Because students have known terminology, they can guess what can happen."
P2: "Before the lesson, students do not know theory."
P3: "After the lesson, they can verify theory."

Q : Why do you use science laboratory before lesson?
P1: "Since students firstly get the concrete experience, they are more interested. Can get more knowledge in giving lecture.
P2: "To improve their understanding"

Q : How do you assess laboratory work?
P1: "I assess students' understanding by asking questions"
P2: "I give A, B grade on practical work book."
P3: "The practical marks are not needed for final results."

Q : Which one do you favour: individual lab work or group lab work?
P1: "Group works can emerge good social interaction among students."
P2: "Group work is better because students give their opinions to each other."
P3: "Time is not enough to do individual laboratory work."

Q : Do you think that practical experiment is suitable with students' learning?
P1: "Practical experiments are linked to the lessons." "Because of them, students can verify that theory is true."
P2: "Without practical experiment, teaching science is like story telling."
P3: "Students answer the questions without forgetting unimportant facts."

Q : How do you think that there is any relationship between the practical experiment and students' learning theoretical lessons?
P1: "Yes, they are related. If they see experiments, they understand the refraction of light and law of refraction."
P2: "Theory and practical experiments are related. So, experiment can identify that theory is true."
P3: "After explanation of theory, I taught how to apply it in practical. Students are more likely to understand the theory."

Q : How do you believe that science laboratory has the impact on students' learning?
P1: "It is the most believable fact. Science lab effects on students' learning."
P2: "Since students directly see the experiments, they are easy to recognize the lessons."
P3: "They remember the lessons. We should do laboratory work more than conventional teaching.

Q : Do you believe that students could apply knowledge gained through learning in science laboratory in their daily life? How they can apply? Why?
P1: "Some can be applied for the next level or grade."
P2: "If students can apply knowledge, they may create new things."
P3: "Through finding the result and solving problems in schools, students get process skills, and ways to solve their real life problems.

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THE EFFECTS OF INSTRUCTIONAL AIDS ON THE SCIENCE ACHIEVEMENT OF MIDDLE SCHOOL LEVEL STUDENTS

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Abstract

The major purpose of this research was to study the effects of Instructional aids on the science achievement of middle school level students. This study was conducted with both quantitative and descriptive research methods. For quantitative research, an experimental study was used to investigate the effects of instructional aids. In this experimental study, the subjects were Grade Seven students selected from BEHS-B Kyauk Chet and No (1) BEHS Pyinmana. The experimental designed adopted in this study was a true experimental design, namely, posttest only control group design. For this study, (120) Grade Seven students were selected from both schools by random sampling method. These students were divided into two groups: experimental and control group. The experimental group was taught by using instructional aids and the control group was taught as formal instruction. After that, a posttest was administered to two groups. Independent samples *t*-test was used to test whether there was significant difference between these two groups. Examination of the means and *t*-test at BEHS-B Kyauk Chet (t=13.85, df = 58, MD=16.84, $p < .001$) and No (1) BEHS Pyinmana (t=7.47, df=58, MD=11.37, $p < .001$) indicated that students who were taught by using instructional aids demonstrated significantly better than those who were taught as formal instruction. The descriptive data also supported the findings from the experimentation. For this research study, students from the experimental group from two selected schools were given a questionnaire. It consists of (16) items five-point Likert-scale. The results showed that the students expressed their willingness to learn science by using instructional aids and they had positive attitudes towards instruction by using instructional aids. Research findings proved that the use of instructional aids has positive contribution to the science teaching at the middle school level.

Keywords: instructional aids, achievement, science

Introduction

Education is a process which, changes, moves, is flexible and is infinitely varied. The most changes that are impinging in education are science and its application. So, everyone needs to understand the relationship between science and men. Science education is intended to prepare youth to assure future science-oriented carriers in business and industry. And also, science education is expected to contribute not only to the personal development of individual but also the national building. To give precedence to the teaching of science of strengthening and developing productive forces is one of the aims of Basic Education. The huge contribution of science teaching to the society leads to far higher. So, it is quite obvious that science education is highly important. Instructional aids make a lesson or a lecture more interesting and provide a memorable experience not only for students but for teachers as well. Moreover, instructional aids eliminate the abstract nature of science by concretizing the facts in the lesson content. Since instructional aids can help to bring a change in the atmosphere of the class, instructional aids can help students to develop scientific attitudes and get training in scientific methods. Thus, instructional aids play the vital role in teaching science.

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Purposes of the Study

The main purpose of this study is to investigate the effects of instructional aids on the science achievement of the middle school level students. The specific purposes are as follow:

(1) To compare the science achievement between students who are taught by using instructional aids and those who are not.
(2) To study the effects of instructional aids in teaching science.
(3) To investigate students' attitudes towards the instruction by using instructional aids.
(4) To give suggestions based on the data obtained from the study for the improvement of science teaching.

Research Hypotheses

The hypotheses of the study are as follows.

(1) There is a significant difference between the science achievement of the Grade Seven students who learn science through the use of instructional aids and those who learn science without using instructional aids.
(2) There is a significant difference between the science achievement of the Grade Seven students who learn science through the use of instructional aids and those who learn science without using instructional aids in answering knowledge level questions.
(3) There is a significant difference between the science achievement of the Grade Seven students who learn science through the use of instructional aids and those who learn science without using instructional aids in answering comprehension level questions.
(4) There is a significant difference between the science achievement of the Grade Seven students who learn science through the use of instructional aids and those who learn science without using instructional aids in answering application level questions.
(5) The students will have positive attitude towards the instruction by using instructional aids.

Definition of Key Terms

Instructional Aids: Instructional aid has defined as "activity or illustrative materials by means of which the learning process may be encouraged or carried on; includes audio-visual aids as well as other sensory aids" (Good, 1959).

Instructional Aids: Instructional aids were devices that can be employed to aid in teaching process. (Bruner, 1960)

Achievement : Accomplishments or proficiency of performance in a given skill or body of knowledge (Good, 1959).

Science : Knowledge as of facts, phenomena, law and proximate causes, gained and verified by exact observation, organized experiment and correct thinking, also the sum of the universal knowledge (Good, 1959).

Review of Related Literature

In the process of education, a teacher required to make decision about what should be taught, what methods should be used in the instruction, what learning activities should be included in each lesson, whether learning should be by group activity or individual project, and what techniques should be applied to evaluate this learning. Thus, education involves the investigation of the multitude of problems and questions, and the possible answers to all of these questions are based on the teacher's beliefs about people, about the world, about how students learn, about how students think, and about values. Discipline and classroom control practices are especially dependent on the teacher's belief system and philosophy of education. Teaching without a philosophy would be analogous to building a house on sand instead of on a firm foundation, or to taking a trip without a road map (Hessong & Weeks, 1991).

Cognitivism is a cognitivist theory that based on thought process behind the behavior. It means that the theory occurs inside the learners mind consciously. A key focus of cognitive psychology is looking at how to communicate or transfer knowledge to students in the most effective and efficient way by looking at mental processes, and how the structure of the brain is changed during the course of learning. The cognitive orientation to learning focuses on how students manipulate information during learning, and how students make meaning out of information and experience. . One cognitive function that plays a key role in learning is memory. Memory is the active mental mechanisms that enable people to retain and retrieve information about past experience (Baddeley, 1999; cited in Sternberg & Willians, 2010). The three major components of memory are the sensory register, short-term or working memory, and long-term memory. During the communicative process, the sensory register of the memory acts as a filter. As stimuli are received, the individual's sensory register works to sort out the important bits of information from the routine or less significant bits. Within seconds, what is perceived as the most important information is passed to the working or short-term memory where it is processed for possible storage in the long-term memory. This complex process is enhanced by the use of instructional aids that highlight and emphasize the main points or concepts.

Objectives of Using Instructional Aids

Instructional aids are used in the teaching-learning process as described the following objectives:

- To reinforce what one is saying
- To ensure that one's point is understood
- To signal what is important/essential
- To support the lesson plan and support the learning
- To enhance the interest of students
- To enable the students to visualize or experience something that is impractical to see or do in real life
- To engage students' other senses in learning process
- To facilitate different learning styles (Babaria Institute of Technology, 2011)

Charactierstics of Good Instructional Aids

A few characteristics of good instructional aids are enlisted as follows:

- They are large enough to be seen by the students for whom they are used.
- They are meaningful and they always stand to serve a useful purpose.

- They are upto the mark and uptodate in every respect.
- They are simple, cheap, and may be improvised. They are not very costly.
- They are handy and easily portable.
- They are accurate.
- They are realistic.
- They are according to the mental level of the learners.
- Their purpose may be informative but it is not just entertainment.
- They motivate the learners. They capture the attention of the pupils.
- They help in the realization stipulated learning objectives.
- They are useful for supplementing the teaching process but they cannot replace the teacher. (Rather, 2004)

Principles for the Selection of Instructional Aids

A science teacher has to take care of the following principles while making a judicious selection of the proper teaching aids for teaching a particular topic in his subject.

- Relevancy. The aid used should be quite relevant to the topic in hand.
- Suitability. It should suit the topic as best as possible by making its study quite comprehensive, interesting, permanent and effective.
- Educative. The aid should have specific educational value besides being interesting and motivating. In no case it should be confined to mere entertainment.
- Best substitute for the first hand experience. The aid should be so chosen as to prove a best possible substitute in terms of reality, accuracy and truthful representation of the object or first hand experiences.
- Simplicity. The aid should be quite simple in its construction and use. It must also be able to convey its sense as simply as possible.
- Learner centered. The aid material selected should be such that it suites the age level, grade level, basic instincts, urges, interest and other unique characteristics of the students of the class.
- Environment centered. The aid material should suit the requirement of the physical, social, and cultural environment of the students.
- Practicability. The aid material should be selected in view of the prevailing circumstances, available resources and purposes to be served. It should not be too costly in its purchase and collection or in terms of its use and demonstration in the class. It should meet the available circumstances in terms of weather conditions, climatic requirements, handling by the teacher and students and other resources readily available in the institution and classroom.
- Objectives attainment. The aid material should be so selected as to help in the proper realization of the stipulated learning or instructional objectives of the topic in hand. (Sharama, 2009)

Advantages of Instructional Aids

The instructional aids as have many advantages which are explained as follows:

- The use of teaching aids by the teacher while teaching make the teaching learning process more interesting.

- The use of instructional aids gives reality to the learning situation.
- It gives vividness to the learning situation.
- It gives clarity to the learning situation.
- The aids motivate the child and arouse his feeling of curiosity.
- They make the abstract ideas concrete and thus help in making learning more effective.
- The different types of aids when use successfully in the classroom provide variety in the classroom situations.
- The different types of aids, thus, serve in different ways for meeting out the varied requirements of the students.
- The aids are good substitutes for the real objects as they make learning equally meaningful.
- The use of instructional aids help in the development of various skills among the students.

Types of Instructional Aids

In modern trends in Educational Technology, Mohanty (2007) classified teaching aids:

1. According to the Sense-Stimulation
2. According to the Projection Facilities Available
3. According to Kinds of Experiences
4. According to the Learner Control and
5. According to Their Reach

1. According to the sense stimulation

The teaching aids or instructional aids may be divided into three categories:

- Visual
- Audio, and
- Audio-visual

2. According to Projection Facilities Available

Audio-visual aids are divided into:

- Projected
- Non-projected and
- Activity aids

3. According to the Kinds of Experiences

- Real-Objects, Specimens
- Field Visits, Observations, Excursions
- Case Studies
- Demonstrations
- T.V., Films, Closed Circuit TV
- Slide, Film Strips
- Picture, Maps, Photographs
- Display Board, Radio, Audio Cassettes
- Chalkboard
- Abstract Word

4. According to the Learner's Control

(i)	(ii)	(iii)	(iv)
No control Radio TV	Projected Aids	Non-Projected Aids	High-Control Computer, Program Learning, Tape Recorder

5. According to Their Reach

- Computer-Assisted Instructional (CAI) Programme
- Non-Projected Aids
- Projected Aids and
- Mass Media

Method and Procedure

Sampling and procedure

The main purpose of this study is to investigate the effects of instructional aids on the science achievement of middle school level students. The research design for the study was an experimental research design. Quantitative research methodology was used to compare students' achievement between two groups: Experimental group and Control group. For descriptive study, a questionnaire was used to interpret the students' attitudes, feelings, satisfactions, experiences and opinions about instruction by using instructional aids. This study was geographically restricted to Naypyidaw Union Territory. The townships in Naypyidaw Union Territory are stratified into two districts: Ottara and Dekkhina. Two townships from those districts were randomly selected for this study; one township was from Ottara district and the other from Dekkhina. The required schools were selected by using simple random sampling method. The sample schools are Basic Education High School-Branch, Kyauk Chet and No. (3), Basic Education High School, Pyinmana. There were totally (86) students who were learning Science in Grade-Seven at BEHS-B, Kyauk Chet and (73) students who were learning Science in Grade-Seven at No. (3), BEHS, Pyinmana. Among them, (30) students for the experimental group and (30) students for the control group from each school were selected by using the simple random sampling method.

Results

After the treatment is given, posttest was administered to measure the science achievement of the students. The data were analyzed by using the independent samples *t*-test to compare the differences between the experimental and the control groups (See Table 1).

Table 1 *t*-Value for Posttest Science Achievement Scores

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
S1	Experimental	30	35.57	4.79	16.84	13.85	58	.000***
	Control	30	18.73	4.95				
S2	Experimental	30	30.47	6.85	11.37	7.47	58	.000***
	Control	30	19.10	4.74				

Note: ***p<.001

S1=Basic Education High School- Branch, Kyauk Chet

S2=No. (3), Basic Education High School, Pyinmana

The mean scores of experimental groups were significantly higher than that of the control groups in each school. As shown in the table, there was a significant difference between the experimental and control group for the scores on the science achievement in each school.

Table 2 *t*-Value for Mean Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
S1	Experimental	30	6.60	1.16	1.47	3.81	58	.001**
	Control	30	5.13	1.75				
S2	Experimental	30	5.50	1.73	1.40	3.61	58	.001**
	Control	30	4.10	1.21				

Note: **p< .01
S1=Basic Education High School- Branch, Kyauk Chet
S2=No. (3), Basic Education High School, Pyinmana

According to the scores on the knowledge level questions, the mean scores of the experimental groups were higher than the mean scores of the control groups in both selected schools. It showed that there was a significant difference between the experimental and control group for the scores on knowledge level questions in each school.

Table 3 *t*-Value for Mean Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig (2-tailed)
S1	Experimental	30	17.90	1.76	7.57	12.37	58	.000***
	Control	30	10.33	2.84				
S2	Experimental	30	14.03	3.46	2.83	3.34	58	.001**
	Control	30	11.20	3.07				

Note: ***p<.001, **p<.01
S1=Basic Education High School- Branch, Kyauk Chet
S2=No. (3), Basic Education High School, Pyinmana

According to the scores on the comprehension level questions, the mean scores of the experimental groups were higher than the mean scores of the control groups in both selected schools. It showed that there was a significant difference between the experimental and control group for the scores on comprehension level questions in each school.

Table 4 *t*-Value for Mean Scores on Application Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
S1	Experimental	30	11.07	2.99	8.37	11.50	58	.000***
	Control	30	2.70	2.62				
S2	Experimental	30	10.93	3.74	7.00	9.18	58	.000***
	Control	30	3.93	1.85				

Note: ***p <.001
S1=Basic Education High School- Branch, Kyauk Chet
S2=No. (3), Basic Education High School, Pyinmana

As shown in table (4), the mean scores of the experimental groups were significantly higher than that of the control groups in both schools. It showed that there were significant differences between the two groups for the selected schools on the scores of the application level questions.

Descriptive Research Findings

In order to find out the attitude of students who learned by using instructional aids, the questions concerned with their attitude on science learning through instructional aids were asked (See Figure 1).

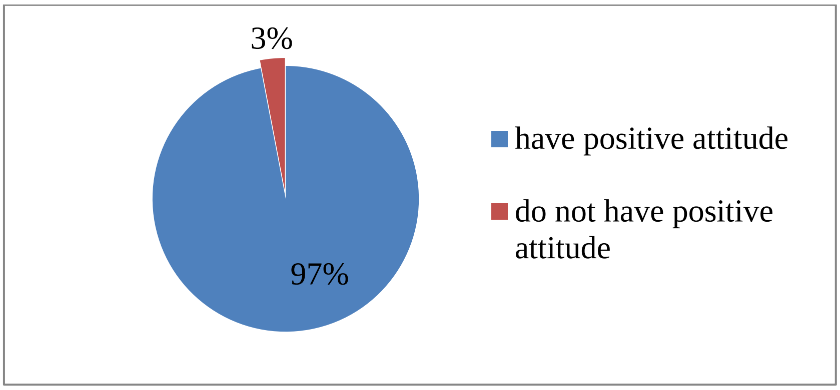

Figure 1 Overall Percentages of Students' Attitudes towards Instruction by Using

Instructional Aids

According to figure 1, (97%) of the students have positive attitudes and (3%) do not have positive attitudes towards instruction by using instructional aids. Some students do not have positive attitudes because they have had no experience in expressing that kind of questionnaire and in learning by using instructional aids.

Discussion

The main purpose of this study was to investigate the effects of instructional aids on the science achievement of middle school level students. Results from the study showed that the posttest mean scores of experimental groups were significantly higher than the mean scores of control groups in two selected schools. This result supports the research hypothesis. According to the comparison of mean scores on knowledge level questions for both selected schools, the findings showed that the achievement of experimental group was significantly higher than that of control group. It can be interpreted that the use of instructional aids could bring about the improvement of students' ability to remember the basic knowledge. According to the comparison of mean scores on comprehension level questions in two selected schools, the findings pointed out that there were significant differences between experimental and control groups. Experimental students had been given the opportunity to learn science in more than one form such as still pictures, real objects, charts and videos. Instructional aids develop the proper image when students see, hear, taste and smell properly (Nikky, 2010). Instructional aids help students to understand more about the content they were learning. According to the comparison of mean scores on application level questions in two selected schools, the result pointed out that there were significant differences between the experimental and control groups. Experimental students got high marks in application questions. This indicates that students' transfer of learning has improved. In this study, the experimental students were given to visualize the real world situations through videos, pictures, charts and real objects. So, they can understand the main concepts clearly and improve higher order thinking skills and can transfer what they have learned at school to real life situations.

Suggestions

The rapidly changing world needs many people to be equipped with sound foundation of knowledge of science to live safely and to contribute to the world they live in. Science is a subject that is needed to be explained systematically and to be presented with validate evidence so that the students can understand, amaze, believe and be more interested in science. In our country, especially during these years, most students in urban regions have access to the internet through their phones and now they are living in a world concentrated with colorful images, videos and texts. When they come to school, one-sided printed book may be something boring that cannot attract their attention. Without attending to something, they cannot be given any knowledge and skills. Thus, it is important to attain students' attention on the lesson, but it will not be enough to get the attention at the very start. Attention is something that is needed to be maintained throughout the lesson.

To be able to motivate students and keep their attention throughout the lesson depends on the teacher who designs and prepares instructional aids. The teachers should be able to use internet to be able to learn and prepare instructional aids. And science teachers should discuss and share experiences with each other about the instructional aids. Because commercial instructional aids available in market may not contribute well to students' learning since they are not designed according to the students' mind works and most of them are designed by those who are not educational professionals. Moreover, the teacher knows about the students' level of knowledge, skills and the difficulty level they can deal with. Moreover, the teachers are the ones who have studied how students' mind works. So, the teacher should prepare instructional aids for the respective topics.

According to the results of this research, the use of instructional aids has a positive contribution to students' science achievement. The teacher should understand the role of instructional aids in teaching learning process. Moreover, the teacher should prepare and use instructional aids in teaching science. While selecting and using instructional aids, some precautions should be used.

- The aids should be fully checked up before using them in the class.
- Aids should be used at the right time and in proper condition.
- The teacher should consider cognitive psychology related to how people mind works.
- Aids should not be allowed to become masters in the teaching learning process.
- In a lesson, too many aids should not be used.
- The aids should have specific educational value besides being interesting and motivating.

These are suggestions consequent upon the findings of the study. But, no study is perfect in an effort. Thus, a need for further research is quite necessary. This research was done at the middle school level. It provides useful results and many suggestions to improve science education at the middle school level. Therefore, a large number of researches should be carried out at all levels such as primary and high school levels. Instructional aids can be used to the other subject areas. So, further researches should also be carried out in other subjects. And this study was done in the Naypyitaw Union Territory. Therefore, further researches should be carried out in other States and Regions. Moreover, science education is very important to improve students' higher order thinking. Many researches can provide good suggestions and recommendations to improve science education. Therefore, further researches in this line are needed for the improvement of science teaching.

Conclusions

The main purpose of this research was to study the effects of instructional aids on the science achievement of middle school level students. Both quantitative and descriptive studies were conducted to obtain the required data. Firstly, an experimental design was used to study the effects of instructional aids on the science achievement of middle school level students. Generalization can be drawn on the basis of results. According to posttest results, the means of students who were taught with instructional aids were significantly higher than those who were taught without instructional aids. And students' performance has significant difference on overall science achievement and achievement of knowledge, comprehension and application level questions. It can be concluded that the use of instructional aids improves students' memorization, conceptual understanding and critical thinking skills. Moreover, it is also interpreted that students can apply learning materials in new situations. Thus, instructional aids should be created and used in teaching science.

Secondly, a descriptive research was done to study the students' feelings, attitudes, experiences and opinions about instruction with instructional aids. Students expressed that they were very happy and satisfied the learning with instructional aids. It also promoted their conceptual understanding. Moreover, students described that they get much knowledge without repetition. They also felt that they desired to learn science subject by using instructional aids. The strengthened interest in science may lead the students onto a science related carrier path and establish higher quality scientific literacy. Thus, students' interest and attitudes are very important for science learning. According to this research, the descriptive research findings indicated that the attitudes, vales and opinions of students towards learning of science were positive. According to the results of this research, it is revealed that the use of instructional aids can significantly promote science achievement of middle school level students.

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Appendix A

A Lesson Plan for Experimental Group

၁။ အတန်း – ဆဋ္ဌမတန်း

၂။ ဘာသာ – အထွေထွေသိပ္ပံ

၃။ သင်ခန်းစာခေါင်းစဉ် – အခန်း(၅) ကမ္ဘာမြေကြီးနှင့်အာကာသ
မြေကမ္ဘာပတ်ဝန်းကျင်ထိန်းသိမ်းကာကွယ်ခြင်း
လူကြောင့်ပတ်ဝန်းကျင်ပျက်စီးရခြင်း
– လေညစ်ညမ်းမှုနှင့် ကမ္ဘာကြီးပူနွေးလာမှု

၄။ အချိန် – ၄၅ မိနစ်

၅။ သင်ယူမှုဦးတည်ချက်များ

(က)ယေျဘုယျဦးတည်ချက် – လေညစ်ညမ်းမှုနှင့်ကမ္ဘာကြီးပူနွေးလာမှုအကြောင်း သိရှိနားလည်စေရန်။

(ခ)အသေးစိတ်ဦးတည်ချက်များ – လေညစ်ညမ်းမှုကိုဖြစ်ပေါ်စေသော အကြောင်းအရင်းများ ကို ဖော်ပြတတ်စေရန်။
– လေညစ်ညမ်းမှုနှင့်ကမ္ဘာကြီးပူနွေးလာမှုတို့၏ ဆက်စပ်မှု ကို ရှင်းပြတတ်ရန်။
– ကမ္ဘာကြီးပူနွေးလာပုံကို ဆွေးနွေးတင်ပြတတ်စေရန်။

၆။ သင်ထောက်ကူပစ္စည်း - photo (1) – မော်တော်ယာဉ်စီးနင်းမှု ပိုများလာပုံ
photo (2) – ရေခဲပြင်များ အရည်ပျော်နေပုံ
photo (3) – လေထုညစ်ညမ်းလာပုံ
photo (4) – ကမာကြီးပူနွေးလာပုံ
photo(5)– လေညစ်ညမ်းမှုနှင့် ကမ္ဘာကြီးပူနွေးလာမ ဆက်စပ်နေပုံ
photo (6) – ပိုလာဝက်ဝံများ၊ ပင်ဂွင်းများ
video file – လေထုညစ်ညမ်းမှုကိုဖော်ပြသော video file

၇။သင်ကြားသင်ယူမှုလုပ်ငန်းစဉ်အဆင့်ဆင့်

Teaching Activities	Learning Activities	duration	T-L Materials	Important Points for T-L Process
နိဒါန်း ဓာတ်ပုံများကိုပြ၍ အောက်ပါ မေးခွန်းများမေးပါမည်။ (၁)မြန်မာနိုင်ငံ၏ ရာသီဥတုသည် ယခင်ကထက်ပို၍ အေးလာသလား (သို့) ပို၍ပူနွေး လာသလား။ (၂)မြန်မာနိုင်ငံတွင်မော်တော် ယာဉ်စီးနင်းမှုနှုန်းမှာယခင်နှင့်ယခုမည်သို့ကွာခြားလာသနည်း။ (၃)ဝင်ရိုးစွန်းဒေသများတွင် ရေခဲပြင်များ မည်သို့ဖြစ်လာသနည်း။ အဘယ့်ကြောင့်နည်း။	ဆရာမှမေးသောမေးခွန်းများကိုဖြေဆိုကြပါသည်	၅ (မိနစ်)	Photo (1) Photo (2)	သင်ခန်းစာအပေါ်ကလေးများ၏ စိတ်ဝင် စားမှု၊ အာရုံစူး စိုက်မှုကို ရယူခြင်း။
သင်ကြားမှုသင်ယူမှုလုပ်ငန်း စဉ်အဆင့်ဆင့် ကလေးများကိုအုပ်စုဖွဲ့ပါမည် **သင်ယူမှုလုပ်ငန်းစဉ်(၁)**	အုပ်စုဖွဲ့ကြပါ သည်။ ဆရာဖွင့်ပြ သော ဗီဒီယိုဖိုင်ကိုကြည့်ကြပါသည်။	၁၀ (မိနစ်)	Video	ကိုယ်တိုင်တွေ့ကြုံရသကဲ့သို့ခံစားရခြင်း

Teaching Activities	**Learning Activities**	**duration**	**T-L Materials**	**Important Points for T-L Process**
ဆရာမှစက်မှုလုပ်ငန်းများ၊ မော်တော်ယာဉ်များမှဓာတ်ငွေ့များထွက်ပေါ်လာပုံ၊ တောမီးများလောင်ကျွမ်းရာမှ မီးခိုးငွေ့များ ထွက်ပေါ်လာပုံနှင့် သက်ဆိုင်သော ဗီဒီယိုဖိုင်ကို ဖွင့်ပြ ပါမည်။ တွေ့ရှိချက်များကို ဆွေးနွေးပြီး အတန်းသို့ ပြန်လည်တင် ပြစေပါမည်။ **သင်ယူမှုလုပ်ငန်းစဉ် (၂)** လေညစ်ညမ်းမှုနှင့်ကမ္ဘာကြီး ပူနွေးလာမှုတို့၏ဆက်စပ်ချက်ကိုဖော်ပြသောဓာတ်ပုံများဝေပေးပါမည်။ ဓာတ်ပုံများကို အသုံးပြု၍ အောက်ပါမေးခွန်းကို ဆွေးနွေးတင်ပြစေပါမည်။ (၁) လေညစ်ညမ်းမှုကြောင့် ကမ္ဘာကြီး မည်သို့ ဖြစ်လာရသနည်း။ ဆွေးနွေး တင်ပြပါ။ **လုပ်ငန်းစဉ် (၃)** ဆရာမှကမ္ဘာကြီးပို၍ပူနွေးလာသဖြင့်ရရှိလာသော ဆိုးကျိုးများကိုဖော်ပြသည့်ဓာတ်ပုံ များကိုဝေပေးပါမည်။ – ဓာတ်ပုံများကိုအသုံးပြု၍ သင်ခန်းစာကို အုပ်စုလိုက် ဆွေးနွေးတင်ပြစေပါမည်။	ဆရာမေးသောမေးခွန်းကိုသင်ထောက်ကူများ အသုံးပြု၍ အုပ်စုအလိုက် ဆွေးနွေး တင်ပြကြ ပါသည်။ –လေညစ်ညမ်းမှုကြောင့်ကမ္ဘာကြီး ပူနွေးလာသည် –အပူချိန်များ ပိုမိုမြင့်တက်လာသည်။ တွေ့ရှိချက်များကို အုပ်စုလိုက်ဆွေးနွေး တင်ပြကြပါသည်။ –ရေခဲပြင်များ အရည်ပျော်လာသောကြောင့် ပိုလာဝက်ဝံများ ပင်ဂွင်းများ အသက်ရှင်ရပ်တည်ရန်ခက်ခဲလာသည်။	၁၀ (မိနစ်) ၁၀ (မိနစ်)	File Photo (1) Photo(3) Photo (4) Photo (5) Photo (2) Photo (6)	အုပ်စုတွင်ဆွေးနွေးမှုများ၊ အတန်းတွင်းဆွေးနွေးတင်ပြမှုများလုပ်ဆောင် ခွင့်ရကြသဖြင့် ကလေးများ၏ Communication skillsပိုမိုကောင်းမွန်လာခြင်း သင်ကြားသင်ယူမှုအကြောင်းအရာများကို ကောင်းစွာစုစည်းမှုပြုလုပ်နိုင်ခြင်း။ သင်ခန်းစာများကိုကောင်းစွာနားလည်၍ကြာရှည်စွာ မှတ်မိနိုင်ခြင်း။
နိဂုံးချုပ်ဆိုခြင်းနှင့်အကဲဖြတ်ခြင်း ဆရာနှင့်ကျောင်းသားများ အပြန်အလှန်ဆွေးနွေး၍ သင်ခန်းစာကိုနိဂုံးချုပ်ဆိုကြပါသည်။	ဆရာနှင့်အပြန်အလှန ဆွေးနွေး၍ သင်ခန်းစာကိုနိဂုံးချုပ်ဆိုကြပါသည်။ –စက်မှုလုပ်ငန်းနှင့်မော်တော်ယာဉ်တို့မှထွက်သောအန္တာယ်ရှိသည့်ဓာတ်ငွေ့များနှင့်မီးခိုးမှုန်တို့ကြောင့်လေညစ်ညမ်းရသည်။ –လေထု၏အောက်ဆုံးအလွှာတွင် ၄င်းဓာတ်ငွေ့များ ပိုမိုပါဝင်လာသဖြင့်ကမ္ဘာပေါ်သို့ကျရောက်သောအပူ၏ အချို့အဝက်	၅ (မိနစ်)	Photos, charts, white board	သင်ခန်းစာမှ ပေးလိုသော အသိသညာများကို မှန်ကန်စွာမှတ်သားနိုင်ခြင်း။

Teaching Activities	Learning Activities	duration	T-L Materials	Important Points for T-L Process
ဆရာမှအောက်ပါမေးခွန်းများမေး၍သင်ယူမှုဖြစ်စဉ်ကိုအ ကဲဖြတ်ပါမည်။ (၁)စက်မှုလုပ်ငန်းများ၊ မော်တော်ယာဉ်များ မှ လေထုထဲ သို့မည်သည့်အရာများ စွန့်ထုတ်သနည်း။ (၂) ကမ္ဘာပေါ်သို့ကျရောက်သော အပူအချို့ အဝက်သည် လေထုအထက်ပိုင်းသို့အဘယ်ကြောင့်ပြန်မထွက်နိုင်သနည်း။ (၃)ကမ္ဘာကြီး ပူနွေးလာပုံကို ဆွေးနွေးတင်ပြပါ။	ကိုလေထု အထက်ပိုင်းသို့ပြန် မထွက်နိုင်အောင်ကာထားသကဲ့သို ဖြစ်သွားသည်။ –ထိုအကြောင်းရင်းများကြောင့်ကမ္ဘာကြီးမှာပို၍ပူနွေးလာရသည်။ ဆရာမေးသောမေးခွန်းများကိုဖြေဆိုကြပါသည်အန္တရာယ်ရှိသောဓာတ်ငွေ့၊မီးခိုးမှုန်များ –လေထု၏အောက်ဆုံးအလွှာတွင် ၄င်းဓာတ်ငွေ့များပိုမိုပါဝင်လာသဖြင့် – ကမ္ဘာပေါ်သို့ ကျရောက်သော အပူအချို့အဝက် လေထုအထက်ပိုင်းသို့ပြန်မထွက်နိုင် သဖြင့်	၅ (မိနစ်)	Photos, charts, white board	ကလေးများ၏တတ်မြောက်မှုကိုစစ်ဆေးခြင်း။

Note: T-L= Teaching –Learning

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THE EFFECTS OF CONCEPT-BASED TEACHING ON STUDENTS' ACHIEVEMENT IN SCIENCE AT THE MIDDLE SCHOOL LEVEL

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Abstract

The major purpose of this research was to study the effects of concept-based teaching on students' achievement in science at the middle school level. Concept-based teaching is defined as a student-centered learning environment that fosters the development of reasoning skills using concepts. The experimental designed adopted in this study was a true experimental design, namely, posttest only control group design. For this study, an experimental study was used to investigate the effects of concept-based teaching. In this experimental study, the subjects were Grade seven students selected from No (1) BEHS Insein and No (2) BEHS Mayangone. For this study, (120) Grade Seven students were selected from both schools by random sampling method. These students were divided into two groups: control and experimental. The experimental group was treated with concept-based teaching and the control group was taught as formal instruction. After that, a posttest was administered to two groups. Independent samples *t*-test was used to test whether there was a significant difference between these two groups. Examination of the means and *t*-test at No (1) BEHS Insein ($t=12.19$, df = 58, MD=14.90, ***p<.001) and No (2) BEHS Mayangone (t=13.08, df=58, MD=4.90, ***p<.001) indicated that students who were taught by concept-based teaching demonstrated significantly better than those who were taught as formal instruction. In this study, (15) items questionnaires were used to observe the students' attitudes towards general science learning through concept-based teaching. The results showed that the students expressed their willingness to learn in concept-based teaching and they had positive attitudes towards this concept-based teaching. Research findings proved that concept-based teaching has positive contribution to the science teaching at the middle school level.

Keywords: concept, teaching, concept-based teaching, science, achievement

Introduction

The main aim of education is to help the children to learn their living and to make them dependent. Treagust (1995, cited in Trundle, 2009) suggests that children's conception stem from and are deeply rooted in the child's daily life context. Science education enables students to resolve their sorts of needs and consist of activities for giving the individuals the suggestions, skills and attitudes including scientific processes. Concept-based teaching focuses on continually moving students toward deeper conceptual understanding. With concept-based teaching, once the students understand the primary concept and have gained further knowledge can be applied in new environment and situation. One part of this study is also to explicate the conception of concepts based on recent developments in cognitive science and to bridge this view with views about the nature of scientific knowledge.

Aims

- The main purpose of this study is to investigate the effects of concept-based teaching on students' achievement in science.

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The specific purposes are as follows,

- To compare students' science achievement between experimental group and control group.
- To investigate the attitudes of students from experimental group on concept-based teaching in science.
- To give suggestions based on the data obtained for improving science teaching and learning at the middle school level.

Research Questions

Q1: Are there any significant differences in science achievement of students who receive learning with concept-based teaching and those who do not receive?

Q2: Are there any significant differences in science achievement of experimental group and control group in answering knowledge level questions?

Q3: Are there any significant differences in science achievement of experimental group and control group in answering comprehension level questions?

Q4: Are there any significant differences in science achievement of experimental group and control group in answering application level questions?

Q5: Can concept-based teaching make increase in scientific attitudes of students?

Scope of the Study

The following points are the scope of the study:

- This study is geographically restricted to Yangon Region.
- This study is limited to the selected chapter of Grade Seven general science textbook and is conducted in two sample schools in Yangon Region.
- Participants in this study are (120) Grade Seven students from the selected schools within the school year (2018-2019).
- This study is limited to the content areas from Grade Seven science textbook to investigate students' science achievement.

The methods uses in this study are concept-based teaching and formal instruction method.

Definition of Key Terms

Science "Science is the study of knowing about the universe through data collected by observation and controlled experimentation (Carin & Sund, 1989)."

Concept "A concept is a thought, an opinion, an idea, or a mental image (Good, 1959)" Broad, abstract ideas that, when used in a concept-based curriculum, are taught throughout the curriculum (Gidden et al., 2015)."

Teaching "Teaching is the act of instructing in an educational instruction;

Teaching is the act of providing activities, materials, and guidance that facilitate learning in either formal or informal situations. (Good, 1959)

Concept-based Teaching "Concept-based teaching is defined as a student-centered learning environment that fosters the development of reasoning skills using concepts."

Achievement "Achievement is the result of what an individual has learned from some educational experiences (Traver, 1970, p.447)."

Reviewed of Related Literature

Concept learning is one of the intellectual skills. It involves the ability to apply knowledge across a variety of instances or circumstances. Intellectual skills differ from declarative knowledge involves a memorization of an association between two or more entities. There are two distinctly different kinds of concepts: concrete and abstract. Concrete concepts are known by their physical characteristics, which may be discerned by any of senses-sight, smell, taste, touch, or hearing. Some of them, such as "bull market," have no appearance. They are abstract concepts, sometimes called defined concepts. In the actual design of instruction when teachers know the level of sophistication of learners the teacher may wish to consider whether the teachers are teaching a particular concept at the concrete or the abstract level because the way the teachers address the two types is somewhat different. Concept learning is not also the application of a principle that contains the concept. Learners who have acquired concepts are also able to supply their own examples of the concepts and apply the concepts appropriately in day-to-day encounters.

Essential Conditions of Learning Concepts

The essential conditions in a concept lesson are the features that promote generalization and discrimination and reduce over- and under generalization. Although the most critical features of a concept lesson lie in the events within the body of the lesson, we will describe important features within each of four main components of the lesson.

Two General Strategies of Concept Instruction

Concept instruction may follow one of two general strategies: a predominantly generative strategy or more supplanted one. One type of generative strategy is termed as inquiry approach. It is contrasted to a more typically supplanted strategy called an expository approach. Neither approach is particularly better than the other but one may be more appropriate than the other depending upon the context, the learners, and the learning task.

An inquiry strategy is often referred to as an expository strategy or a discovery approach. An inquiry strategy presents examples and no examples of the concept and prompts the learners to induce or "discover" the concept underlying the instances. Joyce and Weil's (1986, cited in Smit, & Ragan, 1999) "concept attainment model" is an example of an inquiry approach to teaching concepts. In this strategy learners are presented with a group of matched examples and no examples in verbal, auditory, or visual form.

An expository approach presents the concept, its label and its criteria attributes earlier in the sequence than in the inquiry approach. Expository instruction, like inquiry instruction, presents many examples and no examples: however, these instances follow a discussion of the expanded instructional events employs a more expository sequence.

(1) Introduction
(2) Establish Instructional Purpose
(3) Preview Lesson
(4) Process Information and Examples
(5) Focus attention
(6) Practice
(7) Evaluate Feedback

Employ Learning Strategies

Some strategies that a learner may employ in acquiring concepts have already been mentioned- elaborating by inventing one's own examples and isolating attributes and highlighting these attributes in some way. This strategy may be built "built into instruction" provided by the learner, promoted by the instruction, or a combination of all three. An approach to concept instruction proposed by Tessmer, Wilson, and Driscoll (1990, cited in Smit, & Ragan, 1999) emphasizes the use of analogies, learning strategies, and thinking strategies. It is discussed four strategies: the development of concept "tree" or "map," analogies, mnemonics, and the use of imagery.

Learning Science Concepts with Analogies

Analogies help learners understand new concepts by highlighting similarities to familiar ones. Glynn Russel and Noah (1997, cited in Alice, 2011) defined analogy as a strategy that helps students form initial mental models of key science concepts by facilitating introduction of the concepts in ways that are concrete, meaningful and relevant to students. According to Ruhl (2003, cited in Alice, 2011) an analogy is a comparison of something unfamiliar with something familiar in order to explain a shared principle. Like a bridge that spans the gap between what a teacher wants, a student to learn and what the student already knows. An analogy builds on the framework of the learners' existing knowledge so they are not starting from scratch. Sani (2006, cited in Alice, 2011) opined that analogy is one of the teaching strategies within the constructivist frame that has evidently proved effective in preventing and overcoming poor performance and wrong perception of the students. Venvile and Thiele (1992, cited in Alice, 2011) and Sani (2006, cited in Alice, 2011) reported three benefits of the use of analogies as a teaching technique for abstract concepts. These are: (i) it provides visualization of abstract concepts (ii) it helps compare similarities of the students' real world with the new concept; and (iii) it has a motivational function.

There are two domains of analogy: the analogue domains that exist in memory from which the analogy is drawn and the target domains which contain the science concepts under study that form the instructional objectives of the analogy (Sarantopoulos and Tsaparlis, 2004, cited in Alice, 2011). Analogies are of various types depending on the nature of what they represent and the problem they are intended to solve in the teaching and learning situation.

Teaching-With-Analogy model is preferred to other Analogy model for this study because the model simplifies a difficult concept or idea, provides a variety of approach to link an unfamiliar idea with and visualizes a structure or process. Above all, it puts into consideration the prior knowledge of the learner, which constructivist view that meaningful learning must necessarily involves students in integrating new information or knowledge with pre-existing schemata (Millar, 1989, cited in Alice, 2011). To maximize the benefit of analogies, the teaching with analogies model introduced by Glynn, Duit, and Thiele (1995, cited in Alice, 2011) consist of six operations as follow:

1. Introduce the target concept.
2. Cue the student's memory to the analogous situation
3. Identify the relevant features of target and analogy.
4. Map the similarities between the analogy and the target concepts
5. Identify where the analogy breaks down
6. Draw conclusions (Alice, 2011).

Method and Procedure

The research design for this study was true experimental design (Posttest-only control group design). All participants in this study were Grade Seven students. This study was conducted in Yangon Division. Two districts were selected in random. One township from each selected district was also selected in random. One high school from each township was selected. Participants in this study were selected by random sampling and they were randomly assigned to control group and experimental group. Experimental group learned with the Concept-Based teaching and the control group received the formal instruction. The achievements of experimental and control group were compared by using the independent samples '*t*' test.

Instruments

The instruments used for this study were test items for posttest and attitude questionnaire for students' attitude towards concept-based teaching.

(a) Posttest

This test was constructed to measure general science achievement of the students. It consisted of true or false items, completion items, multiple choice items, short question and long question items. Test items were constructed based on the Chapter (5) from the Grade Seven General Science Textbook. The test items were constructed according to the advice and guidance of the supervisor. In order to get validation, the copies of the table of specification and posttest questions were distributed to five experts who have special knowledge in science from Department of Methodology. According to their suggestions, the test items were modified again. The allocated time for this test was (90) minutes, and the given marks were (50). The reliability coefficient Cronbach's Alpha was used to determine whether each test item was appropriate or not. Its value was (0.79).

(b) Attitudes towards Concept-Based Teaching

In this study, (15) items were used to observe the students' attitudes towards general science learning through concept-based teaching. The questionnaire was constructed according to the advice and guidance of the supervisor. In order to get validation, the copies of questionnaire were distributed to five experts. According to their suggestions, the questionnaire was modified again. Pilot test was conducted with (10) students. The reliability coefficient Cronbach's Alpha was used to determine whether each item was appropriate or not. Its value was (0.84).

Results

For quantitative research findings, data were recorded systematically. These data were analyzed by using the independent samples *t*-test to compare the differences between the experimental and the control groups.

Table 1 "*t*" Values for Posttest Science Achievement Scores

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
School 1	Experimental	30	32.80	5.63	14.90	12.19	58	.000***
	Control	30	17.90	3.61				
School 2	Experimental	30	41.87	4.95	16.30	11.34	58	.000***
	Control	30	25.57	6.11				

Note: ***$p < .001$

The results showed that there was a significant difference on the overall scores of science achievement of the students who were taught by concept-based teaching and those who were taught as formal instruction in each school (See Figure 1).

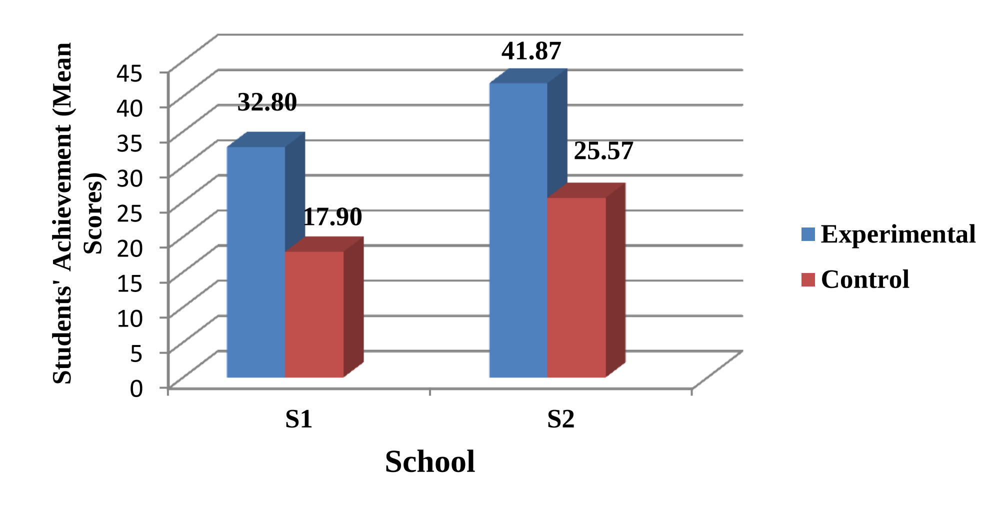

Figure 1 The Comparison of Means on Science Achievement

According to the findings, it can be interpreted that the use of concept-based teaching has significant effect on the overall science achievement of students. Thus, the concept-based teaching positively contributed to the science teaching methodology at the middle school level.

Table 2 "*t*" Values for Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
School 1	Experimental	30	11.73	1.41	4.90	13.08	58	.000***
	Control	30	6.83	1.48				
School 2	Experimental	30	12.33	0.95	3.10	8.21	58	.000***
	Control	30	9.23	1.83				

Note:. ***p< .001

Results of knowledge level questions showed that the means of the experimental groups were significantly higher than that of the control groups in each school. It showed that there was a significant difference on the scores of knowledge level questions of the students who receive concept-based teaching and those who do not receive as formal instruction in each selected school.

Table 3 *t* Values for Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
School 1	Experimental	30	11.60	2.20	3.73	6.98	58	.000***
	Control	30	7.87	1.92				
School 2	Experimental	30	14.03	1.81	4.43	8.40	58	.000***
	Control	30	9.60	2.25				

***Note: *****p* **< .001**

According to the scores on comprehension level questions, the means of the experimental groups were significantly higher than that of the control groups in each selected school. It showed that there was a significance difference on the scores of the comprehension level questions of the students who were taught by concept-based teaching and those who were taught as formal instruction in the selected schools.

Table 4 "*t*" Values for Scores on Application Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig.(2-tailed)
School 1	Experimental	30	9.47	3.53	6.27	8.75	58	.000***
	Control	30	3.20	1.71				
School 2	Experimental	30	15.50	2.92	8.77	10.66	58	.000***
	Control	30	6.73	3.42				

Note: $^{**}p < .01$, $^{***}p < .001$

As regards with the scores on the application level questions, the means of the experimental groups were significantly higher than that of the control groups in each school. It showed that there was a significant difference on the scores of the application level questions of the students who were taught by concept-based teaching and those who were taught as formal instruction in each selected school.

After using the concept-based teaching, in order to find out the attitudes of students who learned by concept-based teaching, a questionnaire concerned with their attitudes on the concept-based teaching was used (See Figure 2).

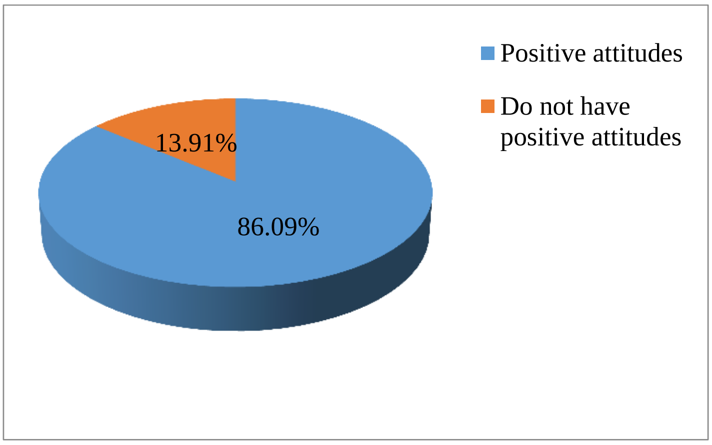

Figure 2 Total Percentage of Students' Feelings, Beliefs and Attitudes towards

Concept-Based Teaching

According to the results of (15) items five-point Likert-scale, (86.09%) of the students have positive attitude and (13.91%) have negative attitude towards concept-based teaching. In this study, it can be interpreted that scientific attitudes of students can be increased by using with concept-based teaching. By relating previous experiences with the new experiences, it can promote their logical thinking skills. Moreover, students learned scientific concepts with extra activities that are related to the lesson. Therefore, they have mastered their learning.

Discussion

According to the results of this study, it was found that the posttest mean score of experimental group was significantly higher than that of the control group for each school. This result pointed out that concept-based teaching had significant effect on science achievement of the students. Concept-based teaching gives the fruitful effects on science instruction at the middle school level. Although it is emphasized on student-centered teaching, the teacher plays a vital role to use it in the classroom appropriately. Concept-based teaching helps learners understand new concepts by highlighting similarities to familiarities ones. Teaching materials and teaching activities were effectively prepared for the students in experimental group to be effective and efficient in teaching. In formal, the teacher taught science by presenting facts and information, imparting knowledge and emphasizing main points with a little students' involvement in teaching learning situation.

According to the comparison of mean scores on knowledge level questions for all the selected schools, the finding showed that there were significant differences between experimental group and control group. This means that teaching science by concept-based teaching could bring about the improvement of students' memorization rate and recall the information more easily. This result is consistent with Alice (2011) who found that Teaching-With-Analogy improves students' academic performance and retention of evolution concepts.

According to the comparison of mean scores on comprehension level questions for all the selected schools, the finding showed that there was a significant difference between experimental group and control group. It can be said that concept-based teaching could bring about the improvement of students' conceptual understanding. This result is in line with Hinai, & Balushi, (2015) who remarked that analogy-based instruction impact on immediate and postponed science achievement.

As for the comparison of means scores on the application level questions for all the selected schools, the finding showed that there were significant differences between experimental group and control group. It can be concluded that students from experimental groups improve higher order thinking skills and can transfer what they have learned at school to real-life situations. This finding is in line with Frazier, (2013) who noted that concept-based teaching promotes emergence and progress of their conceptual understanding. This finding is also consistent with Ospanova, (2018) who noted that concept-based teaching increased students' critical thinking and improves their performance and higher order thinking.

According to (Figure 2), all students in experimental groups feel that they can make connections between scientific concepts and their life-world experiences, they can visualize the abstract concepts and they become more conceptual understanding on science by concept-based teaching. 96.6 percent of students feel more enjoyment by teaching science with concept-based teaching and that they can realize the concepts by thinking. 95 percent of students are interested in science by teaching related with concepts and 93.3 percent of students feel that they can get the chance to learn the main concepts. 90 percent of students feel more curiosity by using material related to the subject. 88.3 percent of students feel that they can understand the main concepts and they can understand the gained concepts by linking with real life. 86.6 percent of students feel that they can develop interesting in science by concept-based teaching. 83.3 percent of students feel that they can realize the meaning and value of science subject. 81.7 percent of students can get habit to investigate the environment and 80 percent of students feel that they can apply the previous knowledge by integrating with the new knowledge. 78.3 percent of students can describe environmental concepts by linking with own experience and 76.7 percent of students can understand unfamiliar concepts compared with familiar concepts. 73.3 percent of students can get more enjoyment to learn the other subject with concept-based teaching.

According to this result, 86.09 percent of students have positive attitudes and 13.91 percent of students have negative attitudes toward concept-based teaching.

Generalization can be drawn that the concept-based teaching can enhance positive attitude towards science teaching. Thus, the science teachers should use concept-based teaching in science classroom.

Conclusion

The main purpose of this research was to study the effects of concept-based teaching on students' achievement in science at the middle school level. Quantitative study was mainly used to compare students' science achievement between two groups; experimental group and control group. The students were selected by simple random sampling method. The instruments used in this research were a posttest to measure students' science achievement and a questionnaire to measure students' attitudes toward concept-based teaching.

Firstly, an experimental design was used to study the effects of concept-based teaching on students' achievement in science at the middle school level. Generalization can be drawn on the basis of results. According to posttest results, the means of students who were taught by concept-based teaching were significantly higher than those who were taught as formal instruction. It can be concluded that concept-based teaching improves students' memorization, conceptual understanding and critical thinking skills. Moreover, it is also interpreted that students can apply learning concepts in new situations. Thus, this concept-based teaching can achieve success in teaching science. Secondly, an attitude questionnaire was done to study the students' feelings, attitudes, experiences and opinions about science teaching with concept-based teaching. Students described that they were very happy and satisfied by using concept-based teaching also promoted their conceptual understanding.

According to the result of this study, concept-based teaching methods are useful methods in teaching-learning process. Teaching is effective when students relate prior knowledge to new one to understand the subject matter. Concept-based teaching helps students to think by themselves and identify their misconceptions. It also helps students to visualize abstract concepts and think about the relationships between different concepts. It can facilitate learning by explicitly integrating new and old knowledge and make students to visualize the relationships between target concepts which can lead students to learn meaningfully.

Concept-based teaching focuses on core concepts that foster knowledge and facilitates learning. The traditional method merely connects students to the source of information which may or may not be retained for a longer period of time, whereas, conceptual learning focuses on making the students understand the core idea so as to retain the information as valuable knowledge which they can apply throughout their lives.

A concept-driven education focuses on developing an effective approach to teaching and learning; empowering young people or a lifetime of learning, independently and in collaboration with others and preparing a community of learners that engage with global challenges through inquiry, action, and reflection. Concept-based teaching can introduce students to universal rules and engaged them in the true process of learning. It can help students create a connection with their prior experience creating a deeper connect with the understanding of content knowledge which further help students in responding to their learning with appropriate actions.

To improve science education, teaching learning situations and teaching approaches are very important. Students' engagements are central role to improve science education. The concept-based teaching is the bridge between theory and practices. Students can apply theory in their real life situations. This teaching promotes deeper understanding of scientific concepts. Moreover, this concept-based teaching is applicable to all students. Therefore, it is an applicable and useful method for the development of science teaching.

Moreover this study showed that students' learning based on their prior knowledge and concepts was more effective than learning as formal instruction. It improves not only students' learning rate but also promotes their thinking ability. Moreover, this result recommends many science teachers to achieve their teaching learning situation more effectively. The effective use of the concept-based teaching has significant effect on the overall science achievement of the students. Therefore concept-based teaching surely has positive contribution to the science teaching at the middle school.

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Appendix A

Sample Lesson Plan for Experimental Group

Sample Lesson Plan (1)

၁။အတန်း – ဆဌမတန်း
၂။ဘာသာ – အထွေထွေသိပ္ပံ
၃။သင်ခန်းစာခေါင်းစဉ် – အခန်း(၅)ကမ္ဘာမြေကြီးနှင့် အာကာသမြေကမ္ဘာ ပတ်ဝန်းကျင် ထိန်းသိမ်းကာကွယ်ခြင်း လူသားနှင့်ပတ်ဝန်းကျင်
– ပတ်ဝန်းကျင်အပေါ် မှီတည်နေရသောလူသား
၄။အချိန် – ၄၅မိနစ်
၅။သင်ယူမှုဦးတည်ချက်များ
(က)ယေဘုယျဦးတည်ချက် – လူသားတို့ဘဝရှင်သန်ရေးအတွက် ပတ်ဝန်းကျင်ရှိ သက်ရှိ သက်မဲ့တို့အကြောင်း ကောင်းစွာသိရှိနားလည်၍အထူး အလေးထားထိန်းသိမ်း ကာကွယ်စောင့်ရှောက် တတ်စေရန်။
(ခ)အသေးစိတ်ဦးတည်ချက်များ – ပတ်ဝန်းကျင်သည် လူသားများအတွက် အရေးပါကြောင်း ဖော်ပြတတ်စေရန်။
– လူသားနှင့်ပတ်ဝန်းကျင် ဆက်စပ်နေပုံကို ရှင်းပြတတ်ရန်။
– လူသားတို့၏ လုပ်ဆောင်ချက်ကြောင့် ပတ်ဝန်းကျင်ပျက်စီး ဆုံးရှုံးရကြောင်း ရှင်းလင်းဆွေးနွေးတတ်စေရန်။
၆။သင်ထောက်ကူပစ္စည်းများ - Textbook, Chart, Worksheets, Photographs, Video File.

၇။သင်ကြားမည့်အစီအစဉ်

သင်ကြားမည့်အကြောင်းအရာ	သင်ကြားမည့်အဆင့်	ဆရာ့လုပ်ငန်းစဉ်	သင်ယူသူလုပ်ငန်းစဉ်
ပတ်ဝန်းကျင်အပေါ်မှီတည်နေရသော လူသား	-Introducing the target concept –အစိက အသိသညာ ကို မိတ်ဆက်ခြင်း	–လူသားများအတွက်ပတ်ဝန်းကျင်သည် အရေးကြီးကြောင်း –လူသားများသည်ပတ်ဝန်းကျင်အပေါ်တွင်မှီခိုနေရကြောင်း –ပတ်ဝန်းကျင်ကိုထိန်းသိမ်းရန်လိုအပ်ကြောင်း –လူသားများကြောင့် ပတ်ဝန်းကျင် ပျက်စီးမှုများ ဖြစ်ပေါ်နိုင်ကြောင်း –ပတဝန်းကျင်ပျက်စီးမှုကြောင့်လူသားများအတွက်ဆိုးကျိုးဖြစ်ပေါ်နိုင်ကြောင်း	–ဆရာ၏မေးမြန်းချက်များကိုသေချာစွာနားထောင်၍ ပြန်လှန်ဆွေးနွေးဖြေကြားခြင်း
	-Cueing the students' memory –ကလေးများသိရှိပြီးသောအကြောင်းအရာများကိုလှုံ့ဆော်ပေးခြင်း	–ပတ်ဝန်းကျင်နှင့် လူသားမ‌ား ဆက်စပ်နေပုံကို လေ့လာ၍ ဆွေးနွေးစေခြင်း။ –နေအိမ်၊ ကျောင်းနှင့် ပတ်ဝန်းကျင် ဆက်စပ်နေပုံကို ဆွေးနွေးစေခြင်း။ –နေအိမ်နှင့်ကျောင်း ပတ်ဝန်းကျင် ပျက်စီးစေသော အကြောင်းအရာများ အကြောင်း ဆွေးနွေးစေခြင်း။ – နေအိမ်၊ ကျောင်းနှင့်အတန်းပတ်ဝန်းကျင်ပျက်စီးမှုကြောင့် ဖြစ်ပေါ်လာနိုင်သော ဆိုးကျိုးများအကြောင်းဆွေးနွေးစေခြင်း။	–မိမိတို့နေအိမ်၊ ကျောင်းနှင့် အတန်းပတ်ဝန်းကျင်ကိုစူးစမ်းလေ့လာ၍ဆွေးနွေးခြင်း။ ပတ်ဝန်းကျင် ပျက်စီးမှုကြောင့် ဖြစ်ပေါ်လာနိုင်သော ဆိုးကျိုးများ အကြောင်းဆွေး နွေးခြင်း။ – အမှိုက်များကို စည်းကမ်းမဲ့စွာ စွန့်ပစ်ခြင်းကြောင့်ပတ် ဝန်းကျင် ညစ်ညမ်းလာခြင်း။ –၎င်းအမှိုက်များစုပုံလာခြင်းကြောင့်လေထုညစ်ညမ်းလာပြီး လူသားများကျန်းမာရေးထိခိုက်လာနိုင်ကြောင်းဆွေးနွေးခြင်း။

	-Identifying the relevant features –အဓိကအကြောင်းအရာကိုသတ်မှတ်ဖော်ပြခြင်း	– ကမ္ဘာကြီးသည် လူသားများ မပါဘဲ ဆက်လက်တည်တံ့နိုင်ကြောင်း –လူသားများသည်သဘာဝပတ်ဝန်းကျင်အပေါ်မှီခိုနေရကြောင်း –လူသားများ ကျန်းမာစွာ အသက်ရှင်နေနိုင်ရန်လိုအပ်ချက်များစွာရှိနေကြောင်း – အေရယ်ပင်လယ်ရေအိုင်ကြီး အဘယ်ကြောင့်သေးငယ်သွားရကြောင်း – အေရယ်ပင်လယ်ရေအိုင်ကြီးသေးငယ်သွားခြင်းကြောင့်ဖြစ်ပေါ်လာသောဆိုးကျိုးများအကြောင်း	– ကမ္ဘာကြီးနှင့် လူသားများ ဆက်စပ်ပုံ၊ ကမ္ဘာကြီးမရှိဘဲလူသားများအသက်မရှင်နိုင်ကြောင်း ဆွေးနွေး ခြင်း။ လူသားများ အနေဖြင့်သဘာဝပတ်ဝန်းကျင်ကိုမှီခိုနေရကြောင်းအသက်ရှုရန်လေကောင်းလေသန့်၊ သောက်သုံးရန်ရေချို ရေသန့်၊ စိုက်ပျိုးရန်မြေဆီလွှာ၊ စားသုံးရန်ပင်လယ်နေ သတ္တဝါများ၊ သတ္တုတွင်းထွက်များစသည်တို့ရှိပါမှလူများသည်ကျန်းမာစွာ အသက်ရှင်နေနိုင်ကြောင်း ဆွေးနွေးခြင်း။ စိမ်းစိုသာယာသော ရေမြေတောတောင်များနှင့်တကွသားရဲတိရစ္ဆာန်ကျေးငှက်သာရကာများပါရှိပါမှသာ လူသားများသည် စိတ်ပျော်ရွှင်ချမ်းမြေ့နိုင်ကြောင်း ဆွေးနွေးခြင်း။ –အေရယ် ပင်လယ်သည် ကမ္ဘာပေါ်တွင် စတုတ္ထအကြီးဆုံးရေအိုင်ဖြစ်ကြောင်း –(၆၈၀၀၀၀) စတုရန်းကီလိုမီတာကျယ်ဝန်းပြီး(၁၆)မီတာနက်ကြောင်း၄င်းအိုင်ကြီးထဲသို့စီးဝင်သောမြစ်ကြီးနှစ်စင်းပေါ်တွင် ဆည်များ တည်ဆောက်၍ဆည်ရေဖြင့် စိုက်ပျိုးရေး တိုးချဲ့လုပ်ကိုင်ခဲ့သည်။ ထို့ကြောင့် ရေစီးဝင်မလျော့နည်းခဲ့ရာအိုင်ကြီး၏ ပမာဏကျုံ့သွား ကြောင်း ဆွေးနွေးခြင်း။ – ရေပမာဏ နည်းလာမှုကြောင့် အပူချိန်မြင့်တက်လာပြီးမိုးရွာသွန်းမှုရော့နည်းလာခြင်း၊ရေအိုင်အတွင်းရှိဆားဓါတ်ပါသော မြေများပျံ့နှံ့မှုကြောင့်စိုက်ပျုးမြေများ ပျက်စီးခြင်းအကြောင်းဆွေးနွေးခြင်း။ –ရေချိုများညစ်ညမ်း၍ကျန်းမာရေးထိခိုက်ကြောင်းကိုပုံများ ကားချပ်များပြ၍ဆွေးနွေးစေခြင်း။
	-Mapping the similarities –တူညီသောအကြောင်းအရာများကိုချိတ်	–မိမိတို့အသက်ရှင်သန်ရန်ပတ်ဝန်းကျင်ရှိသက်ရှိသက်မဲ့အမျိုးမျိုးတို့အပေါ်၌မှီခိုနေရကြောင်း – နေအိမ်၊ ကျောင်းနှင့်ပတ်ဝန်းကျင်သည် လူသားများဆက်စပ်နေပုံ	–ဆရာ့၏ ဆွေးနွေးမှုကိုသေချာစွာနားထောင်၍ရရှိလာသောအချက်အလက်များကိုပုံများ၊ ကားချပ်များ၊ video များကိုလေ့လာ၍ချိတ်ဆက်ဖော်ပြခြင်း။

	ဆက်ပေးခြင်း	–အသက်ရှုရန်–လေကောင်းလေသန့် –သောက်သုံးရန်–ရေချိုရေသန့် –စိုက်ပျိုးရန်–မြေဆီလွှာ –စားသုံးရန်–ပင်လယ်နေသတ္တဝါများ –အသုံးပြုရန်–သတ္တုတွင်းထွက်များ –မိမိတို့ပတ်ဝန်းကျင်ပျက်စီးမှုကြောင့်မိမိတို့အတွက်ဆိုးကျိုးများဖြစ်လာနိုင်ကြောင်း –မြန်မာနိုင်ငံနေရာအတော်များများတွင်ဆည်များတည်ဆောက်၍စိုက်ပျိုးရေးလုပ်ငန်းများ ဆောင်ရွက်ခြင်းကြောင့်ရေကြီးရေလျှံမှုဖြစ်ပေါ်လာနိုင်ကြောင်း ချိတ်ဆက်ဆွေးနွေးစေခြင်း။ အေရယ်ပင်လယ်ရေအိုင်ကြီး၏အခြေအနေကိုပုံများကို လေ့လာ၍ ဆွေးနွေးခြင်း။ အေရယ်ပင်လယ်ရေအိုင်ကြီးသေးငယ်သွားခြင်းကြောင့်ဖြစ်ပေါ်လာနိုင်သောဆိုးကျိုးများအကြောင်းချိတ်ဆက်ဆွေးနွေးခြင်း။	
	-Identifying where the analogy breaks down –ဆက်စပ်သောအကြောင်းအရာနှစ်ခုကြားတွင်လိုအပ်ချက်များကိုရှာဖွေသတ်မှတ်ခြင်း	–နေအိမ်၊ကျောင်းနှင့်ကျောင်းပတ်ဝန်းကျင်ရှိလူသားများဆက်စပ်နေသကဲ့သို့ ကမ္ဘာကြီးနှင့်လူသားများဆက်စပ်နေပုံကို ဖြည့်စွက်ဆွေးနွေးပေးခြင်း။ –နေအိမ်၊ကျောင်းနှင့်အတန်းပတ်ဝန်းကျင်ပျက်စီးမှုကြောင့် ဖြစ်ပေါ်လာနိုင်သောဆိုးကျိုးများဖြစ်သလိုကမ္ဘာမြေပေါ်ရှိ သဘာဝ ပတ်ဝန်းကျင်ပျက်စီးလျှင် လူသားများအတွက်ဆိုးကျိုးများဖြစ်လာနိုင်ကြောင်း ဆွေးနွေးခြင်း။ –အာရတိုက်ရှိ အေရယ်ပင်လယ် အကြောင်း ဆွေးနွေးခြင်း။ –မြန်မာနိုင်ငံရှိဆည်များ အကြောင်း ဆွေးနွေးခြင်း။ –ကျောင်းရှိစွန့်ပစ်အမှိုက်များကြောင့် အနီးအနားရှိ ရေအိုင်များ၏ ပမာဏ လျော့ကျလာခြင်း။ –ပလပ်စတစ်များကြောင့် မြေဆီလွှာများ ပျက်စီးလာခြင်း။ –ရေများညစ်ညမ်းလာခြင်း အကြောင်း ဆွေးနွေးခြင်။	–ပတ်ဝန်းကျင်ရှိအကြောင်းအရာများကိုလေ့လာ၍ကမ္ဘာပေါ်ရှိအဖြစ်အပျက်များကို လေ့လာ ဆွေးနွေးခြင်း။
	-Drawing conclusions about the target concept	–လိုအပ်သည်များကိုဆရာကဖြည့်စွက်၍ နိဂုံးချုပ်ဆွေးနွေးပေးခြင်း (၁)လူသားများကျန်းမာပျော်ရွှင်အသက်ရှင်နိုင်ရန်မည်သည်တို့လိုအပ်သနည်း။	–မိမိတို့သိရှိပြီးသောအသိသညာများကိုအခြေခံ၍နိဂုံးချုပ်ဆိုခြင်း။ (၁)လူသားများကျန်းမာပျော်ရွှင်အသက်ရှင်နိုင်ရန် အသက်ရှုရန်လေကောင်းလေသန့် –သောက်သုံးရန်–ရေချိုရေသန့်

	–အဓိက အသိသညာနှင့် ပတ်သက်၍ နိဂုံးချုပ်ခြင်း	(၂) အေရယ်ပင်လယ်ကြီးသည်အဘယ်ကြောင့်ပမာဏကျုံ့သွားရသနည်း။ (၃)ရေအိုင်ပျက်စီးမှုကြောင့်လူသားတို့တွက်မည်သို့သောဆိုးကျိုးများခံစားရသနည်း။	–စိုက်ပျိုးရန်–မြေဆီလွှာ –စားသုံးရန်ပင်လယ်နေသတ္တဝါများ –အသုံးပြုရန်သတ္တုတွင်းထွက်များလိုအပ်သည်။ (၂)အေရယ်ရေအိုင်ကြီးထဲသို့စီးဝင်သောမြစ်ကြီးနှစ်စင်း ပေါ်တွင်ဆည်များတည် ဆောက်၍ဆည်ရေဖြင့်စိုက် ပျိုးရေးတိုးချဲ့လုပ်ကိုင်ခဲ့သည်။ ထို့ကြောင့် ရေစီးဝင်မှုလျော့နည်း ခဲ့ရာအိုင်ကြီး၏ပမာဏသေးငယ်သွားရသည်။ (၃)ရေအိုင်ပျက်စီးမှုကြောင့် ရေပမာဏ နည်းလာ၍အပူချိန် မြင့်တက်လာပြီးမိုးရွာသွန်းမှုရော့နည်း လာခြင်း၊ ရေအိုင်အတွင်း ရှိဆားဓါတ်ပါသောမြေများပျံ့နှံ့မှုကြောင့် စိုက်ပျိုးမြေများပျက်စီးရသည်။

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A STUDY OF MIDDLE SCHOOL STUDENTS' MATHEMATICAL PROFICIENCY IN THE MATHEMATICS CLASSROOM

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Abstract

This study investigated middle school students' mathematical proficiency in the mathematics classroom featured in conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition among six hundred Grade (8) students in Yangon Region. A descriptive research design was adopted and two types of instruments: a mathematical proficiency test reflected in former four strands and a productive disposition questionnaire towards mathematics were employed. The internal consistency reliability coefficient for the test was (.714) and that for questionnaire was (.704). The collected data were analyzed using descriptive statistics of frequency, percentage, mean, and standard deviation and inferential statistics of Pearson product-moment correlation. Research findings revealed that most of the students had moderate level of mathematical proficiency. Moreover, the results showed that students' procedural fluency was the highest and strategic competence was the lowest among the former four strands. There was a significant positive relationship among five strands of mathematical proficiency. Grounded on this baseline study, it was thus, suggested that first, a nationwide survey on mathematical proficiency at all grades should be conducted and then, intervention program should be mapped out to cater students' current level.

Keywords: Mathematical Proficiency, Conceptual Understanding, Procedural Fluency, Strategic Competence, Adaptive Reasoning, Productive Disposition

Introduction

In this age, routine is different. The world is gradually filled with more technological advancements at an alarming rate. However, there is no exaggeration that all those expansions concern somewhat with mathematics. Thus, the idea that mathematics every person needs is to be able to execute solely basic computations has been old-fashioned. Rather, today society members require the ability to have greater understanding of mathematical ideas, use mathematical reasoning and logic, and solve many problems to adapt to those changes. In the same vein, they all need to have increased mathematical proficiency so that they will meet current and future demands of society.

Ally (2011) pointed out the importance of background mathematical knowledge for all students. According to him, if one has flaws in his or her mathematical background knowledge or lacks a solid grasp of facts, procedure, definitions, and concepts of mathematics, he or she will significantly be handicapped in mathematics. Along with this, every student's idea on any domain of mathematics is shaped by his or her experiences in touch with the subject at all levels passed. National Council of Teachers of Mathematics (NCTM, 2000) supported this view that students' understanding of mathematics, their ability to use it to solve problems, and their confidence in, and disposition toward mathematics are all shaped by the teaching they had encountered in school.

Sadly, current teaching situations in Myanmar traditionally focus on rote learning (CESR, 2013). It aims to have students reproducing content, no matter if they make sense or not. Put the

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other way, it does not consider students' actual understanding and own thinking, instead, forgoes on replicating mathematical ideas. When the individuals memorize something that they do not fully understand, they cannot construct any link between the new information and the stored one (Ausubel, 1968). That is why students cannot connect different bits of mathematical ideas in their brain and preserve them last longer.

Likewise, they cannot utilize them in solving many problems. Also, they cannot determine whether the computational procedure is appropriate or not. As a result, their motivation towards mathematics leads to decline at a certain level and so, they can get more difficulties in learning mathematics. In other words, their level of mathematical proficiency may be lower as much as possible. To cherry-pick this situation, there is an urgent need to determine students' level of mathematical proficiency.

Moreover, if the diagnostic result shows a poor outcome, something better can still be done. There were many instances confirmed that such assessment had positive great impact on students' progress in mathematics education. As an example, the result from National Assessment of Educational Progress (NAEP) in 1999 underlined that only 21% of Grade (4) students, 24% of Grade (8) students, and 16% of Grade (12) students are nationally proficient in mathematics. Teachers, principals, parents, policy makers, and researchers all had used this result in developing ways to improve mathematics education in the U.S. As a result, all these graders scored higher than in recent previous assessment. For example, in 2009, 26% of twelve-graders performed at or above the proficient level. That is why there is a need to diagnose students' mathematical proficiency.

Basically, it is undeniable that today society requirement, current mathematics teaching orientations, and the impact of NAEP assessment on American mathematics education were the primary derives to undertake this study.

Purposes of the Study

The present study generally tends to investigate middle school students' mathematical proficiency in the mathematics classroom. Specifically, it aims to

- investigate students' mathematical proficiency in mathematics,
- compare former four strands of mathematical proficiency among students,
- find out the relationship among five strands of students' mathematical proficiency, and
- make suggestions for promoting five strands of mathematical proficiency of the students.

Research Questions

This study sought to address the following questions.

Q_1: To what extent do the students possess mathematical proficiency in mathematics?

Q_2: Which strands are the highest and the lowest among former four strands of mathematical proficiency?

Q_3: Is there any significant relationship among the strands of mathematical proficiency of the students?

Scope of the Study

Even though this research reached its goals, there were some unavoidable limitations. First, because of the time limit, this study was conducted on a small size of middle (Grade 8) students came from eight selected basic education high schools only in Yangon Region within the academic year (2018-2019). Second, this study is concerned only with mathematical proficiency reflected in five strands (conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition) due to the 2001 consensus report by National Research Council (NRC). Finally, the content area to be studied is limited to number domain. There are many reasons of being this domain targeted. First of all, Kilpatrick et al. (2001) suggests that number sense is the foundation of all later number work. Moreover, number is a basis to describe and understand the world. In addition, every mathematics curriculum during all school years is not outside the number domain. Furthermore, this domain supports other branches of mathematics like algebra, geometry, probability and statistics and vice versa. For example, a better understanding of number basis would enable students to handle algebraic operations and manipulation stronger (Watson, 1990).

Theoretical Framework

Kilpatrick and his colleagues coined the term mathematical proficiency with five strands as conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition (Kilpatrick et al., 2001) and the following concepts hereby provide the bases for this study:

Conceptual understanding is defined as an integrated and functional grasp of mathematical ideas like concepts, operations and procedures (Kilpatrick et al., 2001). Such understanding allows students to build new knowledge through making connections with the previously learned knowledge. It promotes retention and fosters the development of fluency. Therefore, students with conceptual understanding truly know more than isolated facts and methods. They understand why a mathematical idea is important and the kinds of contexts in which it is useful. Also, they have the ability to represent different mathematical situations and to connect these representations.

Procedural fluency means ‘skills in carrying out procedures flexibly, accurately, efficiently, and appropriately’ (Kilpatrick et al., 2001). So, students displaying procedural fluency know procedures, and when and how to use them appropriately, and can apply them flexibly, accurately and efficiently. It is worthy for teachers to note that students’ learning and practicing procedures should be based on understanding in that those who learn procedures without understanding can typically do no more than apply the learned procedures, whereas ones who learn with understanding can modify or adapt procedures to make them easier to use.

Strategic competence refers to ‘the ability to formulate mathematical problems, represent them, and solve them’ (Kilpatrick, et al., 2001). By the same token, this strand is generally concerned with a person’s ability to formulate a problem mathematically, and then use his or her previous knowledge to solve it. Having strategic competence enables a person to make out which strategies may be useful and appropriate in solving the problem. Hence, a student with strong strategic competence is able to have several approaches to the solution of a problem and then, choose flexibly among them through reasoning and reflecting on his or her experiences. Rather, students who do not possess adequate strategic competence will approach a mathematical problem through a trial and error strategy frequently.

Adaptive reasoning stands for the capacity to think logically, reflect, explain and justify one's answer (Kilpatrick et al., 2001). It is the glue that holds everything together, the lodestar that guides learning' in that adaptive reasoning allows for concepts and procedures to connect together in sensible ways, suggests possibilities for problem-solving, and allows for disagreements to be settled in reasoned ways. More specifically, it includes not only formal proofs and deductive reasoning, but also informal explanations or justification about mathematical ideas, intuition and inductive reasoning based on patterns, analogy and metaphor. Therefore, students using adaptive reasoning can think logically about the relationships among concepts and situations, consider appropriate alternatives, reason correctly and justify the conclusions.

Productive disposition is the tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics (Kilpatrick et al., 2001). Rather than seeing mathematics as a set of arbitrary rules that one must memorize, students with productive disposition view mathematics as a system of connected conceptions that can be understood with perseverance and diligent effort. Students with strong productive disposition are confident in their knowledge and ability, they see that mathematics is reasonable and understandable, and believe that appropriate effort and experiences makes them achieved mathematics. Then, they believe that mathematics is for everyone and reject the mathematics mystery. Moreover, Siegfried (2012) used eight constructs: affect; beliefs; goals; identity; mathematical integrity; motivation; risk taking; self-efficacy appropriately in attempts to define the term 'productive disposition'.

In addition, Kilpatrick and his colleagues (2001) also noted that these five strands are interwoven and interdependent in the development of mathematical proficiency. Besides, these five strands provide a framework for discussing the knowledge, skills, abilities, and beliefs that constitute mathematical proficiency which enables students to cope with the mathematical challenges of daily life and also enables them to continue their study of mathematics in high school and beyond.

Research Method

Research Design

The research design used in this study was a descriptive design under quantitative approach.

Instruments

To address the above research questions, two instruments were used. They include a mathematical proficiency test composed of former four strands and a questionnaire about productive disposition towards mathematics. The test questions were adopted from standardized question banks (TIMSS, NAEP) with a little modification to align with Myanmar mathematics curriculum. Items in the questionnaire were developed on the basis of the definition of productive disposition by Siegfried (2012).

Afterwards, to attain the reliable data, expert validation was conducted through the careful assessment of six experts who are very special in mathematics education and teaching from Department of Methodology in both Yangon and Sagaing Universities of Education. Thereafter, making necessary changes will be carried out under the consultation of the supervisor.

Pilot Testing

A pilot test was administered on November 25, 2018 to (40) Grade Eight students in No. (7), Basic Education High School in Alone. To measure the reliability of the instrument, the Cronbach's Alpha was calculated. This process gave rise to the internal consistency reliability coefficient (.714) for mathematical proficiency test and (.704) for questionnaire.

Population and Sample

There were (600) Grade Eight students coming from Yangon Region involved as participants in this study (see Table 1). Moreover, the equal-sized (non-proportional) random sampling technique was utilized.

Table 1 Population and Sample Size

No.	Township	School	No. of Participant	
			Population	Participant
1	North Dagon	BEHS 3	492	75
2		BEHS 5	254	75
3	Dagon	BEHS 1	696	75
4		BEHS 2	237	75
5	Thanlyin	BEHS 1	452	75
6		BEHS 4	186	75
7	Mingaladon	BEHS 3	440	75
8		BEHS 2	260	75
	Total			600

Note: BEHS = Basic Education High School

Data Collection

The modified instrument was distributed to all participants of the eight sample schools with the help of the headmaster/headmistress of those schools in December, 2018. Then, all data will be collected, and entered into the computer data file.

Data Analysis

Once the data were collected, both mathematical proficiency test and questionnaire were coded using the Statistical Package for the Social Science (SPSS). Then, the data were analyzed by using descriptive statistics. In order to measure the level of students' mathematical proficiency, mean, standard deviation, frequency and percentage were used. Furthermore, Pearson product-moment correlation was employed to determine the relationship among the strands of mathematical proficiency.

Research Findings

Findings about Mathematical Proficiency among Students

A total score was computed from the five strands of mathematical proficiency. Then, it was found that (a) the scores were ranged from (67) to (153), and (b) the sample mean for eight selected schools was (111.66) with its standard deviation (15.01). With respect to those results, the level of mathematical proficiency was sorted into three categories: poor (scores below 96.65), moderate (between 96.65 and 126.67 both inclusive), and high (scores above 126.67).

Afterwards, as can be seen in Table (2), 15.17% of the students (N = 91) got in touch with poor level, 69.83% of the students (N = 419) with moderate and 15% of the students (N = 90) with high levels respectively.

Table 2 Students' Level of Mathematical Proficiency

Mathematical Proficiency	No. of Student	Level		
		Poor (%)	Moderate (%)	High (%)
	600	15.17	69.83	15

Findings about Mathematical Proficiency in Former Four Strands

A total score for the first four dimensions was calculated separately from the group of items under each strand whereas the full score were fixed as (13) points for every aspect. Every single group includes (7) items respectively with (5) multiple choices, one short-response and one long-response.

Then, it got a message that (a) on conceptual understanding, the score ranged from (0) to (13), and the sample mean was (6.13) with standard deviation (2.54), (b) on procedural fluency, the score ranged from (0) to (13), the sample mean was (6.34) and the standard deviation was (3.40), (c) for strategic competence, the score ranged from (0) to (12), the sample mean was (4.41) and the standard deviation was (1.81), and (d) for adaptive reasoning, the score ranged from (0) to (13), the sample mean was (5.52) with standard deviation (2.76).

Manipulating these results yields students' mathematical proficiency for each strand to three categories: poor, moderate, and high. Students with scores above the (+1) standard deviation from the sample mean came up with high level and those with scores below the (-1) standard deviation from the sample mean were at the poor level. Then, the students with the scores between (+1) and (-1) standard deviation from the sample mean were fallen in the category with moderate level. Table (3) pinpoints students' mathematical proficiency in five strands.

Table 3 Students' Level of Mathematical Proficiency in Former Four Strands

Level	Mathematical Proficiency in Former Four Strands (%)			
	Conceptual Understanding	Procedural Fluency	Strategic Competence	Adaptive Reasoning
Low	16	16	16.33	14.67
Moderate	72.67	70.17	75.67	71.83
High	11.33	13.83	8	13.5

Along with these findings, it was significantly to be found that only 17.3% of the students (N=104) got the mean value (0.17) in item one among five multiple choices and 82% of the students with score under mean value i.e. zero chose the option B.

To measure the extent of productive disposition, five-point Likert scale items were used. The total score (percentage) was performed from the eight constructs together with (3) items each which all comprises productive disposition towards mathematics. Then, it was noticed that 66.40% of the students (N=398) had positive productive disposition, 19% of the students (N=114) had negative productive disposition and the rest 14.60% of the students (N=88) had neither (see Table 4).

Table 4 Students' Degree of Mathematical Proficiency in Productive Disposition

Productive Disposition	No. of Student	Level of Agreement (%)		
		Positive	Neutral	Negative
	600	66.4	19	14.6

Findings about Comparison for Former Four Strands of Mathematical Proficiency

With respect to mean scores in former four strands: conceptual understanding, procedural fluency, strategic competence, and adaptive reasoning, it was noted that the highest mean value was (6.42) equals to that of procedural fluency subscale and the lowest was (4.42) refers to that of strategic competence subscale, too. Table (5) shows the comparison of mean scores with their respective standard deviation.

Table 5 Comparison of Mean Scores for the Former Four Strands

Strand of Mathematical Proficiency	No. of Student	Mean	Standard Deviation
Conceptual Understanding (CU)	600	6.13	2.54
Procedural Fluency (PF)	600	**6.34**	3.40
Strategic Competence (SC)	600	**4.41**	1.81
Adaptive Reasoning (AR)	600	5.52	2.76

Findings about Relationship among the Five Strands of Mathematical Proficiency

To determine the interrelationship among five strands of mathematical proficiency, Pearson product-moment correlation was used. According to Gay and Airasian (2003), the correlation coefficient less than plus or minus (.35) was interpreted as low or no relation, between plus or minus (.35) and (.65) as moderate relation and higher than plus or minus (.65) as high relation. Then, as can be seen in Table (6), there was a significant positively moderate correlation among the five strands of mathematical proficiency.

Table 6 Correlation among Five Strands of Mathematical Proficiency

Correlation					
	CU	**PF**	**SC**	**AR**	**PD**
CU	1	.584**	.552**	.537**	.375**
PF		1	.561**	.561**	.418**
SC			1	.512**	.424**
AR				1	.374**
PD					1
Correlation is significant at the 0.01 level (2-tailed)					

Note: CU = Conceptual Understanding, PF = Procedural Fluency, SC = Strategic Competence, AR = Adaptive Reasoning, PD = Productive Disposition

Discussion, Suggestions and Conclusion

Discussion

This section attempts to discuss serious findings about the three research questions framed for this study.

Discussion for Research Question One

The results relating to the research question one: To what extent do the students possess mathematical proficiency in mathematics? exhibited in Table (2) indicates that most of the students (69.83%) from the selected schools had moderate level of mathematical proficiency with 15.17% poor level of mathematical proficiency and only just few students (15%) showed high level of mathematical proficiency.

Moreover, it is apparent that this finding is a bit different with the result from the Awofala's research conducted in Nigeria, 2017. Evidence from his research revealed that most of senior secondary school students from the elitist schools had high levels of mathematical proficiency (Awofala, 2017). Personally, this disparity may be due to one possibility. According to the results in Table (3), it was found that most of students possess moderate level of ability in all four strands with mostly strong productive disposition. That is why most of the students had moderate level of mathematical proficiency in that all those strands had a great impact on their mathematical proficiency. In other words, all those strands represent the comprehensive term 'mathematical proficiency'.

Like an evolution process, those results in all former strands may be due to the effect of teaching-learning process adopted in the classroom. Traditionally, mathematics education in Myanmar put more emphasis on rote learning (CESR, 2013) which less emphasizes on providing students opportunities for learning though as NRC (2001) pointed, teaching-learning should be enactment, on the mutual and interdependent interaction of three elements: mathematics content, teacher, and student.

Significantly, in item one which assesses procedural fluency about order of operation only 17.3% of the students got the correct answer. This means that most of the students cannot add and multiply numbers in a right procedure. Moreover, 82% of the students chose Option B as the correct answer in this item. This exhibits that most of the students had misconception in the process of four basic operations. This additional result is similar with the findings of Moodley (2008) that misconception influenced the achievement of the students on procedural fluency. This may be due to the fact that teaching procedural fluency does not ground on sound conceptual understanding.

Discussion for Research Question Two

The results relating to the research question two: What are the highest and the lowest among former four strands of mathematical proficiency? exhibited in Table (5) indicates that the mean score of procedural fluency was the highest but on the other hand, that of strategic competence was the lowest. It means that most of the students in this study outperformed in procedural fluency rather than other strands. In other view, facility in computation at a higher degree, did not lead the students to develop other strands completely i.e. skill in procedural fluency is not to be counted into the development of other strands.

This result is also similar with the finding of Wu (2008) in China that Chinese students' procedural fluency was at a higher level compared to other strands: conceptual understanding and word problem. From personal point of view, this may be associated with traditional teaching method of mathematics held in the classroom. Samuelsson (2010) showed that there were no significant differences between traditional and problem solving teaching methods when assessing procedural fluency but students' progress in conceptual understanding, strategic competence, and adaptive reasoning was significantly better when teachers taught with a problem-based curriculum. In other words, it indirectly highlights that current traditional mathematics teaching methods weightage on practicing students' procedural fluency.

Discussion for Research Question Three

The results in Table (6) which attempts to answer the research question three: Is there any significant relationship among the strands of mathematical proficiency of the students? indicate that there was a significant moderate correlation at $p < 0.1$ among five strands of mathematical proficiency. Since a positive linear correlation was found, it can be concluded that (a) the strands are significantly correlated with each other and (b) when one is high, the others will be high and while one is low, there will be the others low.

This finding is supported by the literature explained by National Research Council (NRC, 2001). As a student gains conceptual understanding, computational procedures are remembered better and use more flexibly to solve new problems. In turn, as a procedure becomes more automatic, he is enabled to think about other aspects of a problem and to tackle new kinds of problems, which leads to new understanding. Solving challenging problems develops new understanding and fluency. Moreover, adaptive reasoning is the glue that holds all strands to be a network. It states that this strand is interrelated with other strands and vice versa. Students without proper developing the four strands prescribed will not engage in mathematics tasks in long-lasting and in turn, students without proper productive disposition will do so.

Suggestions

The mathematics to which students are exposed from preschool to Grade Eight has many aspects. They have already learned many things about number for at least eight years at school. But, according to the findings of this study, most of the sample students had moderate level of mathematical proficiency and even in procedural fluency, misconception influenced the students' achievement. This underlines that such proficiency requires to be developed in right manner. Actually, the ways in which mathematical proficiency is developed may be a pedagogical challenge for most of mathematics teachers. So, with the aim of developing mathematical proficiency at least with misconceptions, the following points are suggested in accordance with the related literature.

1. Teaching and learning should be the product of trilateral interaction among three elements: teacher, content and students rather than relying on teacher.
2. A mathematics curriculum should be coherent, focused on many important mathematics ideas from different areas, and well-articulated across the grades.
3. The classroom practices should give students the opportunities to develop mathematical proficiency in five strands.

4. The opportunities to develop conceptual understanding should place more emphasis on connection of many mathematical ideas through reasoning and justifying.
5. The opportunities to develop procedural fluency should stem on methodical, well-timed practices using different mathematical operations but rooted in conceptual understanding.
6. The opportunities to develop strategic competence should rely on frequent exposure to many mathematical problems that reflect real-world situations and focus on choosing the appropriate problem-solving strategy to the mathematical situation.
7. The opportunities to develop adaptive reasoning should emphasize on encouraging to actively engage in justification.
8. The opportunities to develop productive disposition towards mathematics should make a focal point on demonstrating sensitivity towards learner's previous difficulties, encouraging persistence, and accepting mistakes as part of learning.

Conclusion

According to National Mathematics Advisory Panel (2008), a strong foundation in high school mathematics through Algebra II is strongly correlated with access to college, graduation from college, and earning in the top quartile of income from employment. It highlights the importance of mathematical proficiency or experiences students took with them. Therefore, this study was conducted for the purpose of studying middle school students' mathematical proficiency in the mathematics classroom. The descriptive survey method was utilized. To gather the necessary data for this study, two measuring tools: mathematical proficiency test reflected in four parts and productive disposition questionnaire were used whereas test items came from the NAEP and the TIMSS study. Six-hundred middle students in Yangon Region during the school year 2018-19 were involved as respondents.

The analysis was structured in accordance with the five strands of mathematical proficiency. To determine the level of students' mathematical proficiency, the data from the test items were analyzed by using a Statistical Package for Social Science (SPSS) and the questionnaire was analyzed thematically. Then, the findings of this study are summed up in line with three research questions as follows.

1. Most of the students from the selected schools had moderate level of mathematical proficiency but with misconception in procedural fluency.
2. Most of the students from the sample schools outperformed in procedural fluency than other strands.
3. There was a significant positive moderate correlation among five strands of mathematical proficiency.

Actually, what kind of instruction given by the teacher in the classroom also affects the development of students' mathematical proficiency. Moreover, the instruction is in context (cited in Adding It Up, 2001). This means that mathematical proficiency cannot be achieved through isolated efforts. All interested stakeholders have to work together to improve mathematics at school. Furthermore, based on the limitations, findings and suggestions sections, some of the following recommendations for further studies can be underscored as follows.

1. Conducting this study only at middle school level, there should be further studies at other levels in that it takes time to develop mathematical proficiency.

2. Restricting this inquiry only in Yangon Region, further studies should be carried out in other regions for replication.
3. Being the study area in number domain, there should be investigated in other domains because mathematics curriculum has not been confined to this area only.
4. Framing this research only in survey within a short duration, further studies should be in qualitative such as opportunities to develop students' mathematical proficiency.
5. With the aim to improve students' proficiency in mathematics further studies should be concerned with instructional practices that promote mathematical proficiency.
6. In order to overcome the teachers on the danger of misconception, additional studies should explore the factors that influence students' mathematical proficiency for all grades.

As a significant factor, it can be expected that this study can help the teachers and many curriculum developers to take the results: students' current mathematical proficiency from this study as a beginning point in their teaching or reforming curriculum.

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UNIVERSITY OF EDUCATION STUDENT TEACHERS' GENDER AWARENESS AND ATTITUDE TOWARDS GENDER EQUALITY

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Abstract

This study intends to investigate University of Education student teachers' gender awareness and attitude towards gender equality and compare postgraduate and undergraduate student teachers' gender awareness and attitude. Two hundred and twenty postgraduate student teachers and two hundred and forty undergraduate student teachers from Yangon University of Education and Sagaing University of Education were involved as participants. A descriptive research design was adopted for this study. A survey questionnaire was used to investigate student teachers' gender awareness of personality related behaviors and job related behaviors, and attitudes towards gender equality, and open-ended items oriented to reveal student teachers' expectations and attitudes in terms of treating the issue of gender equality. The reliability of instrument was calculated through pilot testing with (30) student teachers. The internal consistency (Cronbach's Alpha) of the questionnaire was (.749). Moreover, the collected quantitative data were analyzed by using descriptive statistics of frequency and percentage, and inferential statistics of independent samples '*t*' test. The qualitative data were interpreted by categorizing the common points. Quantitative findings revealed that 70% of postgraduate student teachers and 45% of undergraduate student teachers have gender awareness of personality related behaviors and 56% of postgraduate student teachers and 49% of undergraduate student teachers have gender awareness of job related behaviors. The family or environment of postgraduate student teachers (78%) and undergraduate student teachers (74%) have the attitude towards gender equality. Further, the findings indicated that all student teachers accepted in union that all males and females should have equal right in gender.

Keywords: Attitudes, Gender, Gender Awareness, Gender Equality, Gender Mainstreaming

Introduction

There are several social challenges in the 21st century. Along with accelerated globalization forces, society is becoming more and more complex. Many people, especially migrant ones, are perceived as a threat in some communities because traditional, political and social balances and consensus are weakening due to migration. Social inequality has increased and discrimination against minorities arises everywhere as a reaction to this trend. Moreover, gender discrimination is still prevalent in some communities. Some groups of women face additional forms of discrimination based on their age, ethnicity, nationality, religion, health status, marital status, education, and socioeconomic status among other groups. In these contexts, school cannot stay apart of the social changes. It should prepare student teachers to understand what is going on around them. Today schools should provide students with knowledge, skills and tools to face the challenges of social inequality and instability in their community. Gender inequality is one dimension of a more broad and ambitious task that the schools should take into consideration.

Statement of the Problem

If a country wishes to contribute to a social welfare of women, it is necessary to adopt the gender approach in school as much as possible. Educational policies and programmes should be aware of and address gender differences. Teachers need to incorporate the gender perspective in their teaching. So having gender awareness and attitude towards gender equality among the teachers is crucial. They should aim to provide a global and critical view on gender equality.

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Awareness and attitude towards gender equality is a considerable factor for building democratize society without discrimination.

Purposes of the Study

The main purpose of this study is to investigate University of Education student teachers' awareness and attitude towards gender equality. The specific purposes are as follows:

- To investigate the Universities of Education student teachers' gender awareness of personality related behaviors and job related behaviors.
- To investigate the attitudes of the family or environment of the student teachers from the Universities of Education towards gender equality.
- To compare between postgraduate and undergraduate student teachers' awareness and attitude towards gender equality.
- To investigate the expectations and attitudes of the Universities of Education student teachers in terms of treating the issue of gender equality.

Research Questions

(1) Do the student teachers from the Universities of Education have gender awareness of personality related behaviors?

(2) Do the student teachers from the Universities of Education have gender awareness of job related behaviors?

(3) Do the families or environment of the student teachers from the Universities of Education have positive attitudes towards gender equality?

(4) Is there a significant difference between postgraduate and undergraduate student teachers awareness and attitudes towards gender equality?

(5) What are the expectations and attitudes of the Universities of Education student teachers in terms of treating the issue of gender equality?

Scope of the Study

This research has its own particular limitations. The first limitation is related to selected universities. There are three Universities of Education in Myanmar, however, Yangon University of Education and Sagaing University of Education are selected for this study. The second limitation deals with selected departments. There are three educational departments in each university: department of educational theory, department of educational psychology and department of methodology. Among them, the participants came from only department of methodology. The student teachers from PhD and MEd programs are selected as postgraduate student teachers and first year BEd student teachers are selected as undergraduate student teachers. The last limitation deals with the areas of the study. The University of Education student teachers' awareness and attitude are investigated into only two areas: personal related behaviors and job related behaviors.

Definition of Key Terms

Attitudes

Attitudes are defined as beliefs that individuals express regarding appropriate roles for men and women in a given institutional and cultural environment (Andreβ & Quack, 2015).

Gender

Gender refers to socially constructed identities, attributes and roles for women and men (UN, 2014).

Gender Awareness

Gender awareness is the ability to view society from the perspective of gender roles (UNIFEM, 2005).

Gender Equality

Gender equality means that women and men, and girls and boys, enjoy the same rights, resources, opportunities and protections (UN Millennium Project, 2005).

Gender Mainstreaming

Gender mainstreaming is a strategy for making girls' and women's, as well as boy's and men's, concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes so that girls and boys and women and men benefit equality, and inequality is not perpetuated (UNICEF, 2017).

Significance of the Study

Gender equality is regarded one of the core factors to build democratic society and the essential component of economic growth and societal well-being. At the same time, education is often considered as a human right and an essential tool for achieving the goals of equity, development and peace and to be one of the key factors that should be addressed in order to promote equal opportunities and mainstream gender equality. On the one hand, education and school are informed by the values and attitudes that are prevalent in the society. Education becomes a powerful tool for changing the societal attitudes and empowering the next generation. Therefore, it is important to mainstream gender equality in the curricula, school culture, teaching materials and methods in order to prevent the reproduction of gender stereotypes. Successful mainstreaming of gender equality, therefore, cannot be achieved without having the necessary knowledge, tools and teaching methods to understand and tackle gender stereotypes and mainstream gender equality among the teachers. With this view, it is necessary to investigate the University of Education student teachers' gender awareness and attitudes towards gender equality because they will be the leaders of tomorrow classrooms.

Theoretical Framework

International Groundwork for Women's Rights

Women's rights have been at the heart of a series of international conferences that have produced significant political commitments to women's human rights and equality. Starting in 1975, which was also international women's year, Mexico City in Mexico hosted the world conference on the international women's year, which resulted in the world plan of action and the designation of 1975–1985 as the United Nations Decade for Women. In 1980, another international conference on women was held in Copenhagen, capital of Denmark, and the convention on the elimination of all forms of discrimination against women was opened for signature. The third world conference on women was held in Nairobi, capital of Kenya, with the Committee on the Elimination of Discrimination against Women having begun its work in 1982.

These three world conferences witnessed extraordinary activism on the part of women from around the world and laid the groundwork for the world conferences in the 1990s to address women's rights, including the fourth world conference on women held in Beijing in 1995 (UN, 2014).

There are five international level groundwork deals with women rights.

(1) Vienna Declaration and Programme of Action

In 1993, the world conference on human rights was held in Vienna. It sought to review the status of the human rights machinery in place at the time. Women's rights activists mobilized to ensure that woman's human rights were fully on the agenda of the international community under the rallying cry 'Women's Rights are Human Rights'.

(2) International Conference on Population and Development

In 1994, the international conference on population and development was held in Cairo, Egypt represented a milestone for women's rights. The issues taken up in its programme are fundamentally related to women's human rights, including gender equality, reproductive health, birth control and family planning, women's health, as well as immigration and education of women.

(3) Beijing Declaration and Platform for Action

Adopted during the fourth world conference on women in September 1995, the Beijing declaration and platform for action focused on (12) areas concerning the implementation of women's human rights and set out an agenda for women's empowerment. It builds on the results of the previous three world conferences on women, but is considered a significant achievement in explicitly articulating women's rights as human rights. The platform for action is the most comprehensive expression of states' commitments to the human rights of women.

(4) Millennium Development Goals

In 2000, the international community agreed to eight time-bound development goals to be achieved by 2015 at UN Headquarters in New York, including a goal on gender equality and the empowerment of women, as well as one on the reduction of maternal mortality. Seven of the goals have specific targets to measure progress. Although they have shortcomings from a human rights perspective, the Millennium development goals are an important political commitment which has galvanized international support for some of the world's most daunting problems. Millennium development goal (3) with respect to women's rights is to promote gender equality and empower women.

The United Nations Conference on Sustainable Development

The United Nations conference on sustainable development brought Heads of State and Government to Brazil in 2012. The outcome document of the conference states that "gender equality and the effective participation of women are important for effective action on all aspects of sustainable development" and calls for the repeal of discriminatory laws and for ensuring women's equal access to justice (UN, 2014).

CEDAW and Myanmar

Myanmar is a signatory to the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) (1997), and is committed to international policy initiatives to improve the situation of women, including the International Conference on Population and Development, the Beijing Declaration and Platform for Action, and the Millennium Declaration. The Association of South East Asia Nations (ASEAN) has established the ASEAN Commission on Protection and Promotion of the Rights of Women and Children (ACWC), and the ASEAN Committee on Women (ACW), of which Myanmar is a member. Myanmar, as an active member of both committees, has drafted the National Strategic Plan for the Advancement of Women based on the Constitution 2008, CEDAW and the (12) Priority Areas of the Beijing Platform for Action. The National Strategic Plan for the Advancement of Women (NSPAW) will provide support to improve the situation of women and to fully enjoy their rights in accordance with the features of the Constitution of Republic of the Union of Myanmar (2008) (MNCWA, n.d.).

National Strategies Plan for the Advancement of Women (NSPAW) (2013-2022)

After participation at the fourth world conference on women (Beijing, 1995), the Ministry of Social Welfare, Relief and Resettlement established the Myanmar National Committee for Women Affairs (MNCWA) in 1996 to enhance the advancement of women, and was reestablished in 2012 according to the policies of the new Government. MNCWA draw the national strategic plan for the advancement of women (2013-2022) which is based on the (12) priority areas of CEDAW and the Beijing Platform for Action. These (12) critical areas are:

1. Women and livelihoods,
2. Women and education and vocational training,
3. Women and health,
4. Violence against women,
5. Women and emergencies,
6. Women and economy,
7. Women and decision making,
8. Institutional mechanism for the advancement of women,
9. Women and human rights,
10. Women and the media,
11. Women and the environment, and
12. The protection and empowerment of girls.

For each of the priority area, sub-committees have been established comprising focal Ministries and other stakeholders working in different sectors. Terms of reference for each sub-committee related to NSPAW have been established. In the Ministries involved in the implementation of NSPAW, at least one focal person have been designated to coordinate and monitor work on all the priority areas that specific Ministry is engaged in. The management committee for NSPAW have been developed a (5) year operational plan to coordinate and prioritize the implementation of strategic policies, plans and legislative reforms developed by the working group/task forces for each of the (12) priority areas. The management committee for NSPAW reviews progress towards the objectives of NSPAW and the extent to which efforts are leading towards meeting anticipated outcomes according to the core indicators. The monitoring framework, including data collection mechanisms have been reviewed annually and will continue to be developed and refined. Reporting guidelines and timelines have been developed by the management committee for NSPAW. In the area of women and education and training, the key objective is to strengthen systems, structures and practices for ensuring access to quality formal and non-formal education for women and girls. It consists of four main parts: (1) research and surveys, (2) awareness raising, (3) implementation, and (4) budget and policy making.

Research Method

Research Design

A descriptive research design was used to collect quantitative and qualitative data for this study.

Population and Sample

Two hundred and twenty postgraduate student teachers and two hundred and forty undergraduate student teachers participated in this study. The population and sample size of postgraduate and undergraduate student teachers are presented in Table (1).

Table 1 Population and Sample Size

No.	Program	YUOE				SUOE			
		Population	Sample			Population	Sample		
			Male	Female	Total		Male	Female	Total
1	PhD (Prelim)	14	4	10	14	8	2	6	8
2	MEd (Second Year)	34	4	30	34	42	6	36	42
3	MEd (First Year)	28	4	24	28	47	10	37	47
4	MEd (Q)	25	2	23	25	22	-	22	22
	Total	**101**	**14**	**87**	**101**	**Total**	**18**	**101**	**119**
5	BEd (First Year)	408	60	60	120	354	60	60	120
		Total	**60**	**60**	**120**	**Total**	**60**	**60**	**120**

Procedure for the Study

Awareness and attitude towards gender equality is a considerable factor for building democratize society without discrimination. Firstly, the literature related to this study were compiled through training materials on gender mainstreaming in teacher education in Myanmar, books and the Internet sources. After that, a questionnaire was constructed for this study. The aim of this questionnaire is to investigate student teachers' awareness and attitude towards gender equality. To find the reliability of the instruments a pilot test with (30) student teachers was conducted. Then, two Universities of Education were selected randomly. Two hundred and twenty postgraduate student teachers and two hundred and forty undergraduate student teachers were also selected as participants. The required data were collected in February 2019 and then the data were entered into the computer data file and analyzed using the Statistical Package for the Social Science (SPSS).

Instrument

In this study, a survey questionnaire was used to investigate student teachers' gender awareness of personality related behaviors and job related behaviors, and the family and environment of student's attitudes towards gender equality, and open-ended items oriented to reveal the expectations and attitudes of student teachers towards the issue of gender equality. This questionnaire was developed based on the ideas and understanding gained from the Training Workshop on Gender Mainstreaming in Teacher Education in Myanmar which held in November 2018 at Pinlong Hall, Yangon University. There are three mains part in this questionnaire.

In the first part, there are two sections: (1) student teachers' gender awareness of personality related behaviors and (2) job related behaviors. There are total of ten items in each section and each item has three options. The three options are (1) girls' related behavior, (2) boy's related behavior and (3) both girls' and boys' related behavior. If the respondent chooses (1) or (2), it can be interpreted as he/she does not have gender awareness, and if (3) is chosen, it can be interpreted as having gender awareness.

The second part is related to the families or environment of student teachers' attitudes towards gender equality which includes four dichotomous items. The last involves two open-ended questions concerning the expectations and attitudes of the Universities of Education student teachers in terms of treating the issue of gender equality.

Data Analysis

The collected quantitative data were analyzed by using Statistical Package for Social Science (SPSS) with descriptive statistics of frequency and percentage, and influential statistics of independent samples 't' test. The qualitative data were interpreted by categorizing the common points.

Research Findings

Quantitative Findings

(i) Postgraduate Student Teachers' Gender Awareness of Personality Related Behaviors

Research findings indicated that majority of the postgraduate student teachers (70%) have gender awareness in personality related behaviors. The results of gender awareness for each class are presented in Table 2.

Table 2 Postgraduate Student Teachers' Gender Awareness of Personality Related Behaviors

No.	Class	No. of Participant	Percentage (%)	
			Having Gender Awareness	Not Having Gender Awareness
1	Ph D (Prelim)	22	72	28
2	MEd (2nd Year)	76	71	29
3	MEd (1st Year)	75	75	25
4	MEd (Q)	47	60	40
	Over All	**220**	**70**	**30**

The detailed findings of gender awareness of personality related behaviors for each item are presented in Table 3.

Table 3 Postgraduate Student Teachers' Gender Awareness of Personality Related Behaviors for Each Item

No.	Personality Behavior	No. of Participant	Responded Percentages (%) Behavior		
			Girl	Boy	Both Boy & Girl
1	Gentleness	220	65	-	35
2	Sound mind	220	3	22	75
3	Caring	220	7	10	83
4	Preventing	220	4	24	72
5	Management	220	6	6	88
6	Creativity	220	3	24	73
7	Pioneering	220	10	12	78
8	Patience	220	33	10	57
9	Kindness	220	38	4	58
10	Responsiveness	220	6	14	80

(ii) Undergraduate Student Teachers' Gender Awareness of Personality Related Behaviors

Research findings revealed that majority of the undergraduate student teachers (45%) have gender awareness in personality related behaviors. The results of gender awareness for each class are presented in Table 4.

Table 4 Undergraduate Student Teachers' Gender Awareness of Personality Related Behaviors

No.	Class	No. of Participant	Percentage (%)	
			Having Gender Awareness	Not Having Gender Awareness
1	BEd 1st Year (YUOE)	120	36	64
2	BEd 1st Year (SUOE)	120	54	46
Over All		**240**	**45**	**55**

The detailed findings of gender awareness of personality related behaviors for each item are presented in Table 5.

Table 5 Undergraduate Student Teachers' Gender Awareness of Personality Related Behaviors for Each Item

No.	Personality Behavior	No. of Participant	Responded Percentages (%) Behavior		
			Girl	Boy	Both Boy & Girl
1	Gentleness	240	64	2	34
2	Sound mind	240	3	30	67
3	Caring	240	8	15	77
4	Preventing	240	3	46	51
5	Management	240	7	17	76
6	Creativity	240	3	30	67
7	Pioneering	240	15	15	70
8	Patience	240	27	14	59
9	Kindness	240	35	5	60
10	Responsiveness	240	7	30	63

(iii) Postgraduate Student Teachers' Gender Awareness of Job Related Behaviors

Research findings indicated that the majority of the postgraduate student teachers (56%) have gender awareness in job related behaviors. The results of gender awareness for each class are presented in Table 6.

Table 6 Postgraduate Student Teachers' Gender Awareness of Job Related Behaviors

No.	Class	No. of Participant	Percentage (%)	
			Having Gender Awareness	Not Having Gender Awareness
1	Ph D (Prelim)	22	60	40
2	MEd (2nd Year)	76	56	44
3	MEd (1st Year)	75	60	40
4	MEd (Q)	47	48	52
	Over All	**220**	**56**	**44**

The detailed findings of gender awareness of job related behaviors for each item are presented in Table 7.

Table 7 Postgraduate Student Teachers' Gender Awareness of Job Related Behaviors for Each Item

No.	Personality Behavior	No. of Participant	Responded Percentages (%)		
			Behavior		
			Girl	Boy	Both Boy & Girl
1	Carrying heavy things	220	5	85	10
2	Cooking	220	50	1	49
3	Driving	220	-	15	85
4	Domestic (Chores)	220	39	-	61
5	Doing community welfare	220	20	-	80
6	Parenting	220	24	3	73
7	Selling and buying car	220	-	82	18
8	Construction career	220	-	70	30
9	Volunteering	220	-	-	100
10	Nursing	220	48	4	48

(iv) Undergraduate Student Teachers' Gender Awareness of Job Related Behaviors

Research findings revealed that majority of undergraduate student teachers (49%) have gender awareness in job related behaviors. The results of gender awareness for each class are presented in Table 8.

Table 8 Undergraduate Student Teachers' Gender Awareness of Job Related Behaviors

No.	Class	No. of Student	Percentage	
			Having Gender Awareness	Not Having Gender Awareness
1	BEd 1st Year YUOE)	120	40	60
2	BEd 1st Year (SUOE)	120	58	42
	Over All	**240**	**49**	**51**

The detailed findings of gender awareness of job related behaviors for each item are presented in Table 9.

Table 9 Undergraduate Student Teachers' Gender Awareness of Job Related Behaviors for Each Item

No.	Personality Behavior	No. of Participant	Responded Percentages (%)		
			Behavior		
			Girl	Boy	Both Boy & Girl
1	Carrying heavy things	240	4	86	10
2	Cooking	240	71	3	26
3	Driving	240	2	33	65
4	Domestic (Chores)	240	64	2	34
5	Doing community welfare	240	1	33	66
6	Parenting	240	37	4	59
7	Selling and buying car	240	4	75	21
8	Construction career	240	3	68	29
9	Volunteering	240	2	5	93
10	Nursing	240	62	5	33

(v) Attitudes of the Family or Environment of the Postgraduate Student Teachers towards Gender Equality

Research findings indicated that the family or environment of the postgraduate student teachers (78%) have the attitude towards gender equality. The results of each class are presented in Table 10.

Table 10 Attitudes of the Family or Environment of the Postgraduate Student Teachers towards Gender Equality

No.	Class	No. of Student	Percentage (%)	
			Having Gender Equality	Not Having Gender Equality
1	Ph D (Prelim)	22	65	35
2	MEd (2nd Year)	76	79	21
3	MEd (1st Year)	75	87	13
4	MEd (Q)	47	79	21
	Over All	**220**	**78**	**22**

Attitudes of the Family or Environment of the Undergraduate Student Teachers towards Gender Equality

Research findings indicated that the family or environment of the undergraduate student teachers (74%) have the attitude towards gender equality. The results of each class are presented in Table 11.

Table 11 Attitudes of the Family or Environment of the Undergraduate Student Teachers towards Gender Equality

No.	Class	No. of Student	Percentage (%)	
			Having Gender Equality	Not Having Gender Equality
1	BEd 1st Year (YUOE)	120	75	25
2	BEd 1st Year (SUOE)	120	72	27
	Over All	**240**	**74**	**26**

The Comparison between Postgraduate and Undergraduate Student Teachers' Awareness and Attitudes towards Gender Equality

Three areas of gender awareness and attitudes between postgraduate and undergraduate are compared.

Table 12 The Comparison between Postgraduate and Undergraduate Student Teachers' Awareness and Attitudes towards Gender Equality

	Group	N	M	SD	MD	*t*	*df*	Sig. (2 Tailed)
Personality Related Behaviors	Postgraduate	220	6.78	2.58	0.50	2.200	458	0.028*
	Undergraduate	240	6.28	2.30				
Job Related behaviors	Postgraduate	220	5.41	2.03	1.01	5.407	458	0.000***
	Undergraduate	240	4.40	1.99				
Family & Environment Attitudes	Postgraduate	220	3.21	1.09	0.14	1.380	458	0.168 (ns)
	Undergraduate	240	3.07	1.17				
Total	Postgraduate	220	15.40	4.31	1.65	4.297	458	0.000***
	Undergraduate	240	13.75	3.97				

Note: *** $p < .001$, * $p < .05$, ns = not significant

Qualitative Findings

In asking question number seven, which is finding out their attitude of gender equality, hundred percent of responses are agreed on the idea of gender equality. All participants responded that both males and females should have equal opportunities.

Question number eight explored the factors that they want to modify from the culture of Myanmar traditional, rules and regulations, the findings are presented as follows:

- Domestic chores are concerned with women, not with men.
- Men have to make important decisions.
- Unequal opportunities in religious affairs.
- Earnings are concerned with men.
- Giving priority to men in job related affairs.
- Women are being felt guilty on humiliating possibility.
- Discrimination in matriculation exam marks.
- Too much veneration on men.
- Surroundings are trying to influence on women conduct.
- Women are being prohibited in some areas of paying homage to Buddha.
- Feeling disappointed on the idea of 'Ladies First'.
- Women are unnecessary to educate.

Discussion, Suggestions, Conclusion

Discussion

The findings of research question one: Do the student teachers from the Universities of Education have gender awareness of personality related behaviors? indicated that 70% of postgraduate student teachers and 45% of undergraduate student teachers have gender awareness of personality related behaviors. The amount of percentages is different. Generally student teachers have gender awareness however it is necessary to provide gender awareness and attitude among citizens. Detailed findings of gender awareness of personality related behaviors tables expressed that both postgraduate and undergraduate student teachers assume gentleness, kindness and patience are girls' behavior and preventing, creativity sound mind and responsiveness are boys' behavior.

The findings of research question two: Do the student teachers from the Universities of Education have gender awareness of job related behaviors? revealed that 56% of postgraduate student teachers and 49% of undergraduate student teachers have gender awareness of job related behaviors. Having the attitude of job related behaviors; it is less than personality related behaviors. Postgraduate student teachers said that driving, selling and buying car, construction career and volunteering are not girls' behaviors and domestic (chores), doing community welfare and volunteering are not boys' behaviors. Undergraduate student teachers said that cooking, domestic (chores), parenting and nursing are girls' behavior and carrying heavy things, driving, doing community welfare, selling and buying cars and construction career are boys' behaviors.

The findings of research question three: Do the families or environment of the student teachers from the Universities of Education have positive attitudes towards gender equality? showed that 78% of postgraduate student teachers and 74% of undergraduate student teachers' family or environment have the attitude of gender equality. These findings pointed out that Myanmar culture and family do not have gender discrimination.

The findings of research question four: Is there a significant difference between postgraduate and undergraduate student teachers awareness and attitudes towards gender equality? revealed that there are significant differences between two groups of student teachers on personal related behaviors and job related behaviors. However, there is no significant difference on family and environment attitude towards gender equality. Generally, the mean scores of postgraduate students is higher than undergraduate students in each dimension. It can be easily seen that education or learning experiences of student teachers can deduce gender bias attitude.

The findings of research question five: What are the expectations and attitudes of the Universities of Education student teachers in terms of treating the issue of gender equality? revealed twelve issues about the expectations and attitudes of the Universities of Education student teachers who want to change in the Myanmar traditional or cultural views. Some respondents mentioned that there is unequal opportunities in religious affairs. This can be their perceptions. It is assumed that this perception cannot generalize for the whole country. It is obvious that people are free to hold their religious affairs respectively in Myanmar. Some respondents said that discrimination in matriculation marks between boys and girls. Discrimination in matriculation marks between boys and girls is the case of the past. At present, the admission process to Yangon University of Education is based on the proportional system. It means half of student teachers is boy and another half is girl. It is not based on the discrimination of exam marks. Some respondents mentioned that women are being prohibited in some areas of paying homage to Buddha. This perception is related to Myanmar traditional culture. But in most places, men and women have equal opportunities to pay homage to Buddha.

Nevertheless, research findings revealed that student teachers love and accept the idea of human rights and gender equality.

Suggestions

Myanmar commitments to gender equality can be easily seen by respecting the commitment of CEDAW, Beijing Declaration, Constitution of the Union of Myanmar (2008), and implementation of NSPAW, and Sustainable Development Plan. Moreover, it is education transformation period of Myanmar. At this time, ownership and commitment by all stakeholders is necessary for mainstreaming. All should involve in gender mainstreaming. With this view, the following points are suggested.

- Responsibility persons (every citizens) should pay attention to the unique needs of females, valuing their perspectives, respecting their experiences, understanding developmental differences between girls and boys, women and men and ultimately empowering girls and women.
- In addressing unequal access to and inadequate educational opportunities, Government and other sectors should promote a visible policy of mainstreaming a gender perspective into all policies and programmes.
- Education policies should be aware of and address gender equality.
- A gender sensitive educational system should be created in order to ensure equal educational opportunities and full and equal participation of women in educational administration and decision making.
- Educational programmes should be gender responsive.
- Human right education programmes that incorporate the gender dimension should be developed at all levels of education.
- Training programmes and materials for teachers and educators to raise awareness of their own role in the educational process with a view to providing them with effective strategies for gender sensitive teaching.
- The awareness of gender issues is necessary for teaching profession so these topics should be integrated into the curriculum of teacher training programmes.
- The mass media are a powerful means of education. As an educational tool the mass media should be used for promoting gender awareness in the public.
- Research should be conducted on gender issues and information dissemination should be made in the entire nation.
- This study dealt with only student teachers' gender awareness and attitude toward gender equality. Future studies should be conducted how to impart (ways and means) gender awareness among Myanmar citizens.

Finally, it is sure that society without full participation of women will never reach its full potential.

Conclusion

Education is often considered to be one of the key factors that should be addressed in order to promote equal opportunities and mainstream gender equality. On the one hand, education and school are informed by the values and attitudes that are prevalent in the society. At the same time, education is a powerful tool for changing the societal attitudes and empowering the next generation. Therefore, it is important to mainstream gender equality in the curricula, school culture, teaching materials and methods in order to prevent the reproduction of gender stereotypes that influence the well-being of pupils. Successful mainstreaming of gender equality, therefore, cannot be achieved without having among today teachers the necessary knowledge, tools and teaching methods to understand and tackle gender stereotypes and mainstream gender equality.

The United Nations (UN) declares that they firmly believe in the ideas of human dignity and gender equality. The Republic of the Union of Myanmar, a member country of UN, has responsibility to deal with gender equality. Especially, the schools are mainly concerned to spread out the ideas of gender equality. To fulfill this requirement, the teachers have to believe and give the student value on the ideas of human dignity and gender equality.

This study is mainly aimed to explore the University of Education student teachers' understanding on gender equality. Although the student teachers who are both in-service and pre-service, are not weak in the ideas of gender equality, the responsible persons have to cooperate in implementing the gender equality affairs. In this way, a society in which no gender discrimination and serving gender equality will be created.

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နောက်ဆက်တွဲ

ကျား၊မ ရေးရာ နားလည်သဘောပေါက်မှု ဆန်းစစ်လွှာ

ကျား/မ ---------------------- အတန်း -----------------------

အပိုင်း (က)

၁။ ဖော်ပြပါ အမှုအကျင့်များနှင့် ပတ်သက်၍ သင်၏ထင်မြင်ယူဆချက် နှင့်ကိုက်ညီသော နေရာတွင် အမှန်ခြစ် (✔)အမှတ်အသားပြု၍ ဖော်ပြပါ။

၁ = မိန်းကလေး၏အမှုအကျင့် ၂ = ယောကျ်ားလေး၏အမှုအကျင့်

၃ = ကျား/မနှစ်ဦးလုံး ၏အမှုအကျင့်

စဉ်	အမှုအကျင့်	၁	၂	၃
၁	နူးညံ့သိမ်မွေ့ခြင်း			
၂	စိတ်ဓာတ်ကြံ့ခိုင်ခြင်း			
၃	သူတစ်ပါးကို စောင့်ရှောက်တတ်ခြင်း			
၄	ကာကွယ်တတ်ခြင်း			
၅	အလုပ်ကိစ္စရေးရာများကို စီမံခန့်ခွဲနိုင်ခြင်း			
၆	တီထွင်ဖန်တီးနိုင်စွမ်းရှိခြင်း			
၇	လမ်းပြတတ်ခြင်း			
၈	သည်းခံတတ်ခြင်း			
၉	ကြင်နာတတ်ခြင်း			
၁၀	တာဝန်ယူတတ်ခြင်း			

၂။ ဖော်ပြပါ လုပ်ငန်းများနှင့် ပတ်သက်၍ သင်၏ထင်မြင်ယူဆချက်နှင့်ကိုက်ညီသော နေရာတွင် အမှန်ခြစ် (✔) အမှတ်အသားပြု၍ ဖော်ပြပါ။

၁ = မိန်းကလေး၏လုပ်ငန်း ၂ = ယောကျ်ားလေး၏ လုပ်ငန်း

၃ = ကျား/မနှစ်ဦးလုံး၏ လုပ်ငန်း

စဉ်	လုပ်ငန်း	၁	၂	၃
၁	လေးလံသည့်အရာများကို သယ်ဆောင်ခြင်း			
၂	အချက်အပြုတ်လုပ်ငန်း လုပ်ဆောင်ခြင်း			
၃	ကားမောင်းခြင်း			
၄	အိမ်သန့်ရှင်းရေးလုပ်ခြင်း			
၅	ရပ်ရွာဖွံ့ဖြိုးတိုးတက်ရေးလုပ်ငန်းများဆောင်ရွက်ခြင်း			
၆	ကလေးများကို ပြုစုပျိုးထောင်ခြင်း			
၇	ကားအရောင်းအဝယ်လုပ်ခြင်း			
၈	ဆောက်လုပ်ရေးလုပ်ငန်းများ လုပ်ဆောင်ခြင်း			
၉	ပရဟိတလုပ်ငန်းများဆောင်ရွက်ခြင်း			
၁၀	သူနာပြုလုပ်ငန်းဖြင့်အသက်မွေးဝမ်းကျောင်းပြုခြင်း			

အပိုင်း (ခ)

၃။ သင်၏မိသားစု (သို့) အသိုင်းအဝိုင်းတွင် မိန်းကလေးနှင့်ယောကျ်ားလေးကိုတန်းတူထား၍ ပြောဆိုဆက်ဆံပါသလား။

တန်းတူဆက်ဆံပါသည် ☐ တန်းတူမဆက်ဆံပါ ☐

၄။ သင်၏မိသားစု (သို့) အသိုင်းအဝိုင်းတွင် မိန်းကလေးနှင့်ယောကျ်ားလေးကို ညီတူညီမျှ ချစ်ခင်ကြင်နာပါသလား။

ညီတူညီမျှချစ်ခင်ပါသည် ☐ ညီတူညီမျှမချစ်ခင်ပါ ☐

၅။ သင်၏မိသားစု (သို့) အသိုင်းအဝိုင်းတွင် မိန်းကလေးနှင့်ယောကျ်ားလေးကို ညီတူညီမျှ ဂရုစိုက်ပါသလား။

ညီတူညီမျှဂရုစိုက်ပါသည် ☐ ညီတူညီမျှဂရုမစိုက်ပါ ☐

၆။ သင်၏မိသားစု (သို့) အသိုင်းအဝိုင်းတွင် မိန်းကလေးနှင့်ယောကျ်ားလေးကို ညီတူညီမျှ အခွင့်အလမ်းပေးပါသလား။

ညီတူညီမျှအခွင့်အလမ်းပေးပါသည် ☐ ညီတူညီမျှအခွင့်အလမ်းမပေးပါ ☐

အပိုင်း (ဂ)

၇။ သင်သည် မိန်းကလေးများနှင့် ယောကျ်ားလေးများကို တန်းတူဖြစ်သည်ဟု သဘောထားပါသလား။ အဘယ့်ကြောင့်နည်း။

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၈။ ကျား၊မ ရေးရာ နှင့် ပတ်သက်၍ မြန်မာ့လူ့ဘောင်အဖွဲ့အစည်း၏ အစဉ်အလာ သတ်မှတ်ချက်များ၊ ဓလေ့ထုံးစံများနှင့် သက်ဆိုင်သော သင်မကြိုက်သည့် (သို့) သင် ပြောင်းလဲ လိုသည့် အချက်များရှိပါက ဖော်ပြဆွေးနွေးပါ။

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THE EFFECT OF MASTERY LEARNING STRATEGY ON STUDENTS' MATHEMATICS ACHIEVEMENT AT THE MIDDLE SCHOOL LEVEL

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Abstract

The main purpose of the study was to study the effect of mastery learning strategy on students' mathematics achievement at the middle school level. Mixed-method, QUAN-Qual model was used to investigate the effect of mastery learning strategy. For quantitative research method, an experimental study was carried out to compare the students' achievement between experimental and control group. The design used in the study was one of the true experimental designs, viz, posttest only control group design. The instrument used in the study was a posttest. Two sample schools, No. (4) BEHS Kamayut and No. (2) BEMS Yankin were selected by a simple random sampling method. The subjects were (60) Grade Eight students from each school. There were two experimental groups and two control groups. The students from experimental groups were taught by using mastery learning strategy and the students from control groups were taught by using formal instruction. After the treatment, the posttest was administered to two groups. The independent samples *t*-test was used to compare the differences between two groups. The results showed that there were significant differences between two groups in No. (4) BEHS Kamayut ($t = 3.02$, $p < .01$) and No. (2) BEMS Yankin ($t = 4.72$, $p < .001$). For qualitative research method, the students in the experimental groups from two selected schools were given a questionnaire. The questionnaire consists of 18 items. 15 items of these are coded with five-point Likert-scale and 3 items are open-ended questions. The results showed that the students had positive attitude towards learning, retention of learned materials and involvement in instructional activities. Thus mastery learning strategy had positively contributed to the improvement of mathematics teaching and learning at the middle school level.

Keywords: Mastery learning, Mastery Learning Strategy

Introduction

Changes always happen in everything, everywhere and every situation. Society's thinking changes from decade to decade, generation to generation and century to century. Education depends on society. Since society changes, the vision for education must change. So the teaching and learning also change. The vision of the people on education should be accommodated with society (Underhill, 1981).

In relation to the development of society's thinking in the 21st century, mathematics occupies a crucial and unique role in the human's societies and represents a strategic key in the development of the whole mankind (Fatima, n.d.).

At every level, learning mathematics should be a natural outgrowth from the children themselves. Learning should be interesting for the children, should challenge their imagination and should beget creative solutions. Learning mathematics should be devoid of boredom, meaninglessness and coercion (Cruikshank & Shieffield, 1988).

Bloom contended that mastery learning is the theory that suggests that virtually all students can attain high degree of learning if given the needed time and appropriate learning conditions and that if teachers could provide these appropriate conditions, all students could reach a high level of achievement and their differences in their level of achievement would vanish (Guskey, 2007).

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Statement of the Problem

Mathematics has been considered as a difficult subject matter by the students in school practically all levels from primary to higher education. Students who have low aptitude typically thought that mathematics was very difficult subject and they have been discouraged by the teachers who are unable to deliver the subject matter due to the lack of Mathematics (United Nations Educational Scientific and Cultural Organizations [UNESCO], 2012).

Mastery learning is an innovative method providing the opportunity to all students who are taking mathematics with plenty of time to understand any topic in mathematics course based on their ability and capacity to learn mathematics at their own pace within the realm of their levels. Thus the researcher believes that attaining mastery in respective subjects for students is one of the important factors to promote mathematics education in Myanmar.

Purposes of the Study

The main purpose is to study the effect of mastery learning strategy on students' mathematics achievement at the middle school level.

The specific purposes are as follows:

- To study the theoretical foundation of mastery learning strategy in teaching mathematics
- To investigate the effect of mastery learning strategy on students' mathematics achievement
- To investigate the students' attitude towards mastery learning strategy
- To give suggestions for improving mathematics teaching and learning at the middle school level

Research Hypotheses

- There is a significant difference between mathematics achievement of the students who are taught with mastery learning strategy and those who are not.
- There is a significant difference between mathematics achievement of the students who are taught with mastery learning strategy and those who are not in performing knowledge level questions.
- There is a significant difference between mathematics achievement of the students who are taught with mastery learning strategy and those who are not in performing comprehension level questions.
- There is a significant difference between mathematics achievement of the students who are taught with mastery learning strategy and those who are not in performing application level questions.
- The students who learned with mastery learning strategy have positive attitude towards learning, retention of learned materials and involvement in instructional activities.

Definitions of the Key Terms

Mastery learning: mastery learning is a group-based, teacher-paced approach to mastery instruction wherein students learn, for the most part, cooperatively with their classmates. (Block & Burns, 1976)

Mastery learning strategy: A formative assessment strategy that involves the use of specific interventions, called correctives to address the specific comprehension needs of the learner (Bloom, 1968).

Scope of the Study

The following points indicate the scope of the study.

- This study is geographically restricted to Yangon Region.
- Subjects in this study are (60) Grade (8) students from the selected schools within the school-year (2018-2019).
- This study is limited to the content areas of Chapter (10) Equations with Literal Coefficients, Chapter (11) Formulae and Change of Subject and Chapter (12) Formulae Points in Rectangular Co-ordinates from Grade (8) mathematics textbook Volume I and Chapter (5) Areas and Volumes from Grade (8) mathematics textbook Volume II prescribed by the Department of Educational and Planning and Training, Myanmar, 2013.

Definitions of the Key Terms

- Mastery learning: mastery learning is a group-based, teacher-paced approach to mastery instruction wherein students learn, for the most part, cooperatively with their classmates. (Block & Burns, 1976)
- Mastery learning strategy: A formative assessment strategy that involves the use of specific interventions, called correctives to address the specific comprehension needs of the learner. (Bloom, 1968)

Significance of the Study

Learning is the active process. It is not achieved in any single way but through a variety of activities and is approached through a variety of avenues. All of these activities need to involve thinking. These activities need to be so planned that they will bring the learners along the path toward understanding and mastery of the subject at their levels of achievement (Highet, 1965).

(1973) and Bloom (1974) proposed that learners with high ability learn quickly and learners with low ability learn slowly. This conceptualization of learning give rise to the concept of mastery learning instead of formal instruction. In formal instructional environments, time to learn was held constant and the levels of performance varied. In mastery learning, the situation is reversed. Performance is held constant and time to learn is allowed to vary. In mastery learning, the learners are compared on the basis of amount learned during a certain period of time. In other words, the goals are changing from achieving some specified objectives in a given time period, to achieving all the objectives in a varying time period (Underhill, 1981).

Theoretical Framework

Importance of Mathematics

Mathematics comprises different topical strands, such as algebra and geometry, but these strands are highly interconnected. The interconnections should be displayed prominently in the curriculum and in instructional materials and lessons. A coherent curriculum effectively organized and integrates importance mathematical ideas so that students can see how the ideas build on, or connect with other ideas thus enabling them to develop new understandings and skills (National Council of Teachers of Mathematics [NCTM], 2000). To implement the curriculum effectively, the teachers use variation of teaching methods and variations of instructional activities to close the children's achievement gaps (Guskey, 2007).

Teaching mathematics well involves creating, enriching, maintaining and adapting instruction to move towards mathematical goals, capture and sustain interests and engage students in building mathematical understanding. Teachers establish and nurture an environment conducive to learning mathematics through the decisions they make, the conversation they orchestrate, make the physical setting they create. In effective teaching, worthwhile mathematical tasks are used to introduce important mathematical ideas and to engage and challenge the students intellectually. Effective teaching involves observing students, listing carefully to their ideas and explanations, having mathematical goals and using the information to make instructional decisions. To improve their mathematics instruction, teachers must be able to analyze what they and their students are doing and consider how those actions are affecting students' learning (NCTM, 2000). Thus Bloom (Guskey, 2010) suggested that although students vary widely in their learning rates if teachers provide the necessary time and appropriate learning conditions, nearly all students could reach a high level of achievement.

Mastery learning

The theory of mastery learning is based on the belief that all students can learn when provided with conditions that are appropriate for their learning.

Steps in Mastery Learning

Bloom has suggested that the steps for effective mastery learning.

1. Defining the Mastery

The teacher should first define what materials students will be expected to learn or what is meant by mastery of the subject. They are also explained the concepts involved, the processes to be followed and adopted, the skills to be employed and the amount of time to be taken for the mastery of a particular content area. The teacher also prepares a summative test by covering all objectives and decides the standard. Suppose a teacher decides that scoring at least 80% to 90% in the examination would indicate mastery of the standard would be regarded as 'masters' and those who do not would be regarded as 'non-masters' (Block, 1971; Block & Burns, 1976).

2. Planning for mastery

Planning must be consistent with the way in which mastery has been defined. Especially the plan must include activities, materials related to the unit objectives and also include additional supplementary activities and materials for those students who fail to attain the performance standard on the unit formative test (Block, 1971; Block & Burns, 1976).

Planning for mastery involve following tasks;

i. The teacher divides the course to be taught for mastery into a series of smaller sequence learning units, each of which cover in two weeks time.

ii. For each unit, teacher constructs a formative test or a brief diagnostic progress test. These tests are designed to provide specific information of feedback to both the teacher and the student about how the student is changing as a result of group-based instruction.

iii. Then the teacher specifies a score or performance standard on each formative test, which will be indicative of unit mastery. Generally a score of 80-90% indicated mastery.

If the instruction material is not followed, the teacher develops a set of alternative instructional material or correctives for each unit to master the content, and to overcome the learning problems before proceeding to the next step or subsequent learning (Block, 1971; Block & Burns, 1976).

3. Orienting for Mastery

After planning for mastery, the teacher is now ready to teach. But the students are not accustomed to mastery learning. So before the teacher starts teaching for mastery. It is essential that the teacher should explain to the students what they are going to learn, how they are going to learn, what should be the outcome for learning and what standard of attainment is expected of them. This will provide the necessary orientation and motivation to the students for learning (Block, 1971).

4. Teaching for Mastery

After proper orientation and motivation the teacher teaches the 1st learning unit using the group based teaching methods. After teaching one unit of the lesson, the teacher administers the unit's formative test to the entire class. On the basis of the test scores, the teacher identifies those who have achieved the unit mastery standard and those who have not. For non-master the teacher follows the alternative instructional material and corrective formative test till the achievement of mastery. The masters are engaged either in enrichment activities or serve as tutor for non-masters. This procedure continues till the completion of all the units (Block, 1971; Block & Burns, 1976).

5. Grading for Mastery

The final step and major task is grading for mastery. After teaching all the units, the teacher administers the summative evaluation test and awards grades. The teacher awards 'A' grade whose scores are at or above the predetermined mastery performance standard and scores below this level are awarded grades appropriate to the level they have achieved (Block, 1971).

Evaluation of Mastery Learning

An effective mastery learning requires two types of evaluation.

(1) Formative evaluation

Formative evaluation is used to provide information useful for directing students study and teacher practice. Formative tests have two purposes.

(a) To find out how much the pupils have learned in a restricted area of content at the end of a unit of instruction.

(b) To diagnose pupils difficulties.

(2) Summative evaluation

Achievement test at the end of periods of instructions are summative test and its attempt to sum-up total achievement in a course. In mastery learning, the primary purpose of summative evaluation is to grade students according to their achievement of the aims of the course or the criteria (Block, 1971).

Mastery Learning Instructional Process

Through this process of formative classroom assessment combined with the systematic correction of individual learning difficulties, Bloom (Guskey, 1987, 2005) believed that all students could be provided with a more appropriate quality of instruction than the traditional instruction. As a result, nearly all learn well and truly master the unit concepts or learning goals. This also drastically reduce the variation in achievement levels and eliminate the achievement gaps.

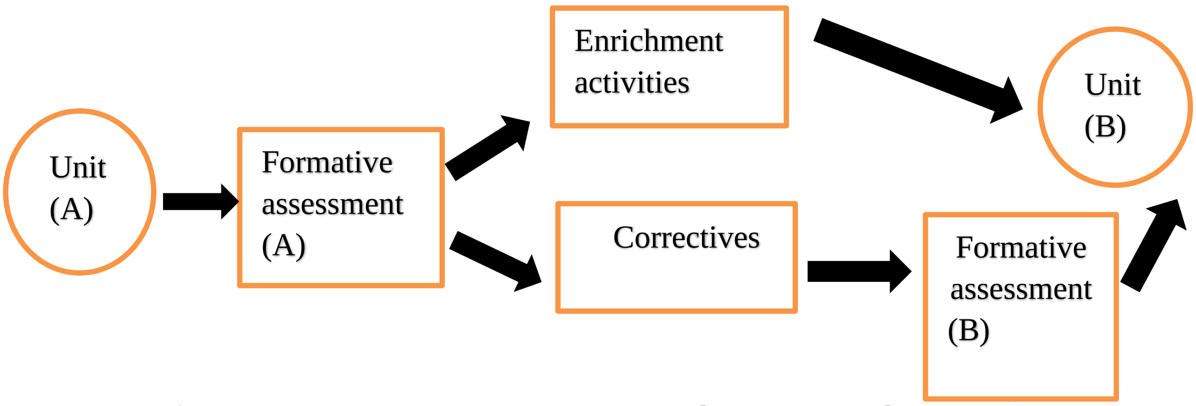

Figure 2.2 Mastery Learning Instructional Process (Guskey, 1987).

Unit A: Mastery learning starts teaching by asking the previous knowledge of the students. Mastery learning stresses the importance of administering a quick and targeted pre-assessment to all students before beginning instruction to determine whether they have the perquisite knowledge and skills for success in the upcoming learning sequences. Some teachers pre-assess students orally by asking them about previous learning experiences or understanding. Pre-assessing makes the teacher to ensure the conditions for success before the instruction begins (Guskey, 2010).

Formative assessment (A): The use of regular formative assessments systematically monitor student progress and give students prescriptive feedback. These brief classroom assessments measure the most important learning goals from the instructional unit and typically are administered after a week or two of the instruction. They reinforce precisely what the students were expected to learn, identify what they learned well and describe what they need to learn better.

Formative assessments vary in form depending on the subject area, the grade level and the learning outcomes involved. They may be short quizzes, written assignments oral presentations, skill demonstration or performances. The important feature of formative assessments are that the teachers use them to gather evidence of students learning. Formative assessments provide the basis for all programs that emphasize assessment “for” learning as opposed to assessment “of” learning (Guskey, 2010).

Corrective instruction: After the formative assessment (A), corrective instruction was followed to remedy whatever learning problems the assessment identified. Corrective instruction is not the same as reteaching. Mastery learning teachers use corrective instruction that accommodate differences in students' learning styles, learning modalities or types of intelligence. Corrective instruction can also be used as peer tutoring or cooperative learning groups. Corrective instruction might last one or two days. Corrective instruction guarantees that students have the learning perquisites for subsequent units, initial instruction in later units can proceed more rapidly (Guskey, 2010).

Formative assessment (B): In mastery learning, assessment is an ongoing effort to help the students learn. So after corrective instruction, mastery learning teachers give students a second, parallel formative assessment that helps to determine the effectiveness of the corrective instruction and offers students a second chance to demonstrate mastery and experience success. Mastery learning teachers make a point of recognizing those who do well on the second formative assessment have learned just as much and deserve the same grades as those who scored well on the first try (Guskey, 2010).

Enrichment activities: Mastery learning teachers offer effective enrichment activities that provide valuable, challenging and rewarding learning experiences for learners who have mastered the material and do not need corrective instruction. These activities should enable successful learners to explore in greater depth a range of related topics that keenly interest them but lie beyond the established curriculum. Many teachers draw from activities developed for gifted or talented students when planning enrichment activities including academic games and peer tutoring.

Students engaged in enrichment activities gain valuable learning experiences without necessarily moving ahead in the instructional sequence. This makes it easier for other students who have been doing corrective work to resume their place in the regular instructional sequence when they are done (Guskey, 2010).

Unit B: Unit B means the next lesson or the next topic. If the students achieve 80% and above for Unit A in summative evaluation test, the teacher continues to Unit B.

Research Methodology

Research Design

The design used in this study was one of the true experimental design, viz, posttest only control group design.

Procedure for the Study

This study was to investigate the effect of mastery learning strategy on Grade Eight students' achievement in mathematics in Yangon Region. Students were divided into two groups in each school; the experimental and control groups by using simple random sampling method.

There were (30) students in each group. In each school, the control group was provided a treatment by using formal instruction and the experimental group was provided by using mastery learning strategy. The posttest was administered at the end of the treatment period. All the participants have to take a posttest.

Instruments

The instrument used for this study was the posttest and attitude questionnaire. To examine the students' attitude towards learning, retention of learned materials and involvement in instructional activities, a questionnaire was constructed. It consists of (18) items. (15) items of these are coded with five-point Likert-scale and (3) items are open-ended questions. The statements of the (15) items were described by five responses: strongly disagreed, disagreed, undecided, agreed and strongly agreed. Arbitrary scoring weight (1,2,3,4,5) was assigned for the responses. Moreover, the participants were allowed to express their attitude freely towards mastery learning strategy through three open-ended questions.

Population and Sample Size

This study was geographically restricted to Yangon Region. The required sample schools were selected by using simple random sampling method. The sample schools were BEHS (4) Kamayut and BEMS (2) Yankin. BEHS (4) Kamayut was selected from West District in Yangon Region and BEMS (2) Yankin was selected from East District in Yangon Region. The population in this study was (105) students in Grade Eight at BEHS (4) Kamayut and (69) students in Grade Eight at BEMS (2) Yankin. Only (60) students from each school were selected by using a simple random sampling method.

Data Analysis

The data were analyzed by using the Statistical Package for the Social Science (SPSS) with descriptive statistics, mean and standard deviation.

Research Findings

Quantitative Research Findings

For quantitative research findings, the data were recorded systematically. These data were analyzed by using the independent samples t-test to compare the differences between the experimental and the control groups (Gay & Airasian, 2003).

Table 1 *t*-Values for Posttest Mathematics Achievement Scores

School	Group	N	Mean	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS(4) Kamayut	Experimental	30	34.87	9.10	6.2	3.02	58	.004**
	Control	30	28.67	6.64				
BEMS (2)Yankin	Experimental	30	35.50	9.67	9.53	4.72	58	.000***
	Control	30	25.97	6.58				

Note: $^{**}p < .01$ $^{***}p < .001$

The means of the experimental group were significantly higher than that of the control group in each school. It showed that there was a significant difference between students who were taught by using mastery learning strategy and those who were taught as formal on the overall scores of mathematics achievement in both selected schools.

Table 2 t-Values for Scores on Knowledge Level Questions

School	Group	N	Mean	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS(4) Kamayut	Experimental	30	1.70	.70	0.13	.75	58	.458 (ns)
	Control	30	1.57	.68				
BEMS (2)Yankin	Experimental	30	1.83	.86	0.26	1.42	58	.716 (ns)
	Control	30	1.57	.77				

Note: ns = not significant

Results of knowledge level questions showed that the means of the experimental groups were not significantly higher than that of the control groups in both selected schools. It showed that there was no significant difference between the experimental and the control groups for the scores on knowledge level questions in both selected schools.

Table 3 *t*-Values for Scores on Comprehension Level Questions

School	Group	N	Mean	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS(4) Kamayut	Experimental	30	14.77	4.15	4.44	3.20	58	.000***
	Control	30	10.33	2.83				
BEMS (2)Yankin	Experimental	30	15.43	4.10	4.70	4.36	58	.000***
	Control	30	10.73	4.24				

Note: ***p < .001

According to the scores on comprehension level questions, the means of the experimental groups were significantly higher than that of the control groups in both selected schools. It showed that there was a significant difference between the experimental and the control groups for the scores on the comprehension level questions in both selected schools.

Table 4 *t*-Values for Scores on Application Level Questions

School	Group	N	Mean	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS(4) Kamayut	Experimental	30	18.67	6.53	4.90	3.27	58	.002**
	Control	30	13.77	4.97				
BEMS (2)Yankin	Experimental	30	18.60	7.06	5.93	3.96	58	.000***
	Control	30	12.67	4.19				

Note: ***p* < .01 ****p* < .001

As regards with the scores on the application level questions, the means of the experimental groups were significantly higher than that of the control groups in both selected schools. It showed that there was a significant difference between the experimental and the control groups for the scores on application level questions in both selected schools.

Qualitative Research Findings

The attitude, feelings, experiences and opinions of students that were found in the study were presented in this part. A qualitative study was carried out with a questionnaire. It consists of (15) items in (3) dimensions; attitude towards learning, retention of learned materials and involvement in instructional activities and (3) open-ended questions. (15) items are coded with five-point Likert-scale. For (15) items, the percentages of students' positive and do not have positive attitude towards each dimension are as follows.

Table 5 Percentages of Students' Attitude towards Each Dimension

No.	Dimension	Positive Attitude (%)	Do not have Positive Attitude (%)
1.	Attitude towards Learning	93%	7%
2.	Retention of Learned Materials	94%	6%
3.	Involvement in Instructional Activities	94%	6%

According to the above results, most of the students have positive attitude towards each dimension. But some of the students do not have positive attitude. This is because they have no experience in solving problems in this new way. They have no confidence to solve the problems themselves and so they don't fully understand the concepts in mathematics. And they've never seen this type of teaching. They always solve the problems by following the teacher's instruction. In new strategy, they solve the problems themselves so they can't learn well the problems. Moreover, they have no experience in learning by doing activities to solve the problems and to derive the formulae. They thought that learning by doing is time-consuming. They are solely interested to solve the problems with teacher's help.

Discussion, Suggestions, Conclusion

Discussion

In quantitative study, the posttest was administered after the treatment period. When the posttest means are compared, the results showed that the means of the experimental group were significantly higher than that of control group in each school. Thus teaching with mastery learning strategy has significant effect on students' mathematics achievement when compared with formal instruction.

According to the comparison of means on knowledge level questions in two selected schools, the results pointed out that there is no significance between the control groups and the experimental groups. It can be said that the students can learn well knowledge level questions when the teacher uses either mastery learning strategy or formal instruction. It can be concluded that formal instruction is effective to some extent in mathematics teaching and helps the students to achieve lower cognitive skills.

When the means of comprehension level questions are compared, the results showed that there were significant difference between the two groups. This results claimed that the achievement of students who are taught with mastery learning strategy was higher than the achievement of students who are taught with formal instruction.

Moreover, when the means of application level questions are compared, the results showed that there were significant difference between the two groups. The results contended that the students in experimental group show their ability in solving problems by using previous learned materials in new situations.

In qualitative study, the questionnaire was administered for the students in experimental groups. The questionnaire included three dimensions. The students explore their opinions for each dimension openly.

For dimension 1 - attitude towards learning, most of the students showed that they have positive attitude towards mastery learning strategy. They can solve the problems more easily and using various methods according to their background knowledge.

For dimension 2 – retention of learned materials, most of the students positively responded the questions. They can use their own ideas and their classmates' ideas to solve problems. They have sufficient time to learn and they receive immediate feedback for their learning.

For dimension 3 – involvement in instructional activities, it can be found that most of the students revealed that they have positive attitude towards involvement in instructional activities. This is because they can solve the problems cooperatively with their classmates rather than solving the problems by following the instruction of the teacher.

For (3) open-ended questions, the students responded that they feel happy in learning mathematics more and more with this new strategy. They revealed that the relationship between the teachers and the students are better than previous teaching and so they learn mathematics more easily. This is because they can ask the teacher when they have difficulty in solving problems. They are more interesting new learning strategy because their role changed from passive learners to active learners. They participate in learning activities and can solve the problems themselves. Thus they contended that learning mathematics with mastery learning strategy is really effective.

Suggestions

In this study, the researcher studied the effect of mastery learning strategy by using quantitative and qualitative methods. According to quantitative results, the students' achievements are not varied at the knowledge level questions but are varied at the comprehension and application level questions. This is because new learning strategy is more effective than formal instruction. These results suggested that mathematics teaching should not solely emphasize on getting solution but it should focus on the general mental operations or problem solving process that can be used and applied to any problems. Thus the teachers should try to promote their teaching strategies. They should teach the mathematics concepts by doing activities. They should train the students to be able to solve the problems themselves. The role of the teachers should be as a facilitator and be always dynamic.

According to the qualitative results, most of the students showed that they have positive attitude towards new learning strategy. They are more likely to solve the problems as a group activity. Thus the teachers should provide opportunities for the students to work together in a group. It is clear that working together in a small group is essential to improve the achievement of the students. The teachers should adopt the various methods of teaching to promote the students' attitude towards mathematics and should create positive learning environment for their students' learning. Classroom climate is related to some extent in the achievement of the students. The learning environment should be designed to promote students' thinking skills. The teachers should create the learning environment where the students can apply their own knowledge to solve the problems. So that the students can become independent learners.

Conclusion

The main purpose of the study is to study the effect of mastery learning strategy on students' mathematics achievement at the middle school level. Both quantitative and qualitative studies were conducted to obtain the required data. For the quantitative study, one of the true experimental design, viz., posttest only control group design was adopted to compare the students' mathematics achievement between two groups: control group and experimental group. For qualitative study, a questionnaire was used to interpret the students' attitude towards learning, retention of learned materials and involvement in instructional activities.

In each school, students were randomly divided into two groups. The experimental group was given the treatment by using mastery learning strategy and the control group was treated by formal instruction.

In experimental group, the students were taught with small groups. The instructional process begins to learn a unit by adopting appropriate teaching methods. After teaching each unit, students' performance is assessed by giving an assessment in order to provide information or feedback on their learning. Students must exhibit and achieve mastery one unit before moving on next unit. Students who fail to achieve mastery are subjected to receive remediation through additional activities like peer tutoring, learner-centered activities or additional assignments. The students who are mastered the first assignment are provided with enrichment activities. And then all the students are administered a summative evaluation test. Sufficient time for learning is provided for these students. Students continued the cycle of studying and testing until mastery is achieved and then move to the next unit.

In control group, the students were taught learning materials under the whole class instruction. The students solve the problems under the control of the teacher. And the students follow the teachers' instruction. They rely on the information provided by the teacher to solve the problems.

Conclusion can be drawn on the basis of the results of research findings. In terms of the statistical results, students' performance between control and experimental groups had significant difference on overall mathematics achievement, comprehension level questions and application level questions. All the students showed that they have positive attitude towards mastery learning strategy.

Today, modern society demands high quality teaching and learning from teachers. Teachers have to possess a great deal of knowledge and skills with regard to both teaching and assignment practice in order to meet those demands and standards of quality education. Teaching with high quality teaching tend to do and find out more about their own craft, pushing out the boundaries of their learning and teaching, looking for the new topics and ways teach.

Mastery learning provides the teachers a strong sense of personal responsibility for students' learning. Students do not compete against each other but rather work together to attain a shared goal. Thus, the teachers help the students to reach high standard of learning. The students in mastery learning classes are able to learn abstract ideas related to particular subjects, they can apply these ideas to new problems and they retain these ideas longer. Thus the drop-out rate among students has been cut off in learning with mastery learning strategy (Guskey, 1985).

It can be concluded that teaching by mastery learning strategy has positively contributed to the improvement of mathematics teaching and learning at the middle school level. Thus using mastery learning strategy in the classroom will promote the students' achievement, participation in learning activities and develop problem solving skills. Thus the research on mastery learning strategies supports both quantitative and qualitative effects on mathematics teaching and learning. And attaining mastery in respective subjects for students is one of the important factors to promote mathematics education in Myanmar.

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Appendix (A)
Achievement Test
၂၀၁၈–၂၀၁၉ ပညာသင်နှစ်

သတမတန်း **သင်္ချာ** **ခွင့်ပြုချိန် (၁း၃၀) နာရီ**

အပိုင်း (က)

၁. အောက်ပါတို့အနက်မှ အဖြေမှန်ကိုရွေးပါ။ **(၁၀) မှတ်**

(၁) အောက်ပါညီမျှခြင်းများမှ အက္ခရာမြောက်ဖော်ကိန်းပါ ညီမျှခြင်းမှာ

A. $ax + bx = abc$ B. $3x + 4 = 5$ C. $\frac{2x}{3} + \frac{3y}{4} = 9$ D. $\frac{y}{4} = 3$ ဖြစ်သည်။

(2) $v = \frac{4}{3}\pi r^3$ ပုံသေနည်းမှ π ကိုရှာရန် ပုံသေနည်းမှာ

A. $\frac{3r}{\pi}$ B. $\frac{4v}{3r^3}$ C. $\frac{4r^3}{3v}$ D. $\frac{3v}{4r^3}$ ဖြစ်သည်။

(၃) လျှပ်စစ်ဓာတ်အား သုံးစွဲသည့်အခါ ပေးဆောင်ရမည့်ငွေသည်မီတာထိန်းသိမ်းစောင့်ရှောက်ခ အတွက် ၁၀၀၀ ကျပ် နှင့် ဓာတ်အားခအတွက် တစ်ယနစ် ၅၀ ကျပ်နှုန်းဖြစ်သည်။ လျှပ်စစ် ဓာတ်းအားခ ထ ယူနစ်သုံးစွဲသည့်အတွက် ပေးဆောင်ရမည့် ငွေ ႕ ကျပ်ကိုရှာရန်ပုံသေနည်းမှာ

A. $k = 1000x + 50$ B. $k = 50x + 1000$ C. $k = 1000 - 50x$ D. $k = 50x – 1000$ ဖြစ်သည်။

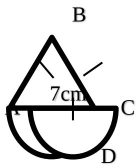
(၄) ဋ ဝင်ရိုးနှင့် ့ ဝင်ရိုး ထောင့်မှန်ကျသော အမှတ်သည်

A. ပေးရင်းအမှတ် B. မူလအမှတ် C. စမှတ် D. ဆုံးမှတ် ဖြစ်သည်။

(၅) အောက်ပါတို့အနက်မှ စက်ဝန်းရှာသောပုံသေနည်းမှာ ခ =

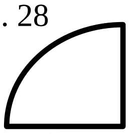
A. $2\pi r$ B. $2\pi r^2$ C. $\frac{4}{3}\pi r^2$ D. $2\pi r^2 h$ ဖြစ်သည်။

(၆) ပုံတွင် ΔABC သည် သုံးနားညီတြိဂံဖြစ်၍ ADC သည်စက်ဝိုင်းခြမ်းတစ်ခုဖြစ်သည်။ ပေးထားသောပုံ၏ ပတ်လည် အနားမှာ



A. 14 B. 25 C. 28 D. 36 cm ဖြစ်သည်။

(၇) ပုံပါစက်ဝိုင်းစိတ်၏ ဧရိယာမှာ



A. $15.24\ cm^2$ B. $14.7\ cm^2$ C. $12.56\ cm^2$ D. $11.22\ cm^2$ ဖြစ်သည်။

(၈) ထုလုံးရှည်မှန်တစ်ခု၏ မျက်နှာပြင်ခုံး ဧရိယာမှာ A =

A. $\pi r^2 h$ B. $\frac{1}{2}\pi r^2 h$ C. πdh D. $\pi r^2 h^2$ ဖြစ်သည်။

(၉) ထုလုံးရှည်တစ်ခု၏ အချင်းဝက်မှာ ၄ခာ ရှိ၍ အမြင့် ၁၄ခာ ရှိသော် ၎င်း၏ ထုထည်မှာ

A. 704 B. 352 C. 1408 D. 88 cm^3 ဖြစ်သည်။

(၁၀) ဥဿုံညီဗဟုဂံ၏ ဧရိယာကို ရှာသော ပုံသေနည်းမှာ A =

A. $\frac{1}{2}bp$ B. $\frac{1}{2}hp$ C. $\frac{1}{2}bh$ D. $\frac{1}{4}bh$ ဖြစ်သည်။

အပိုင်း (ခ)

၂။ မေးခွန်းအားလုံးဖြေဆိုပါ။ (၁၅) မှတ်

(၁) မော်တော်တစ်စင်းသည် ခရီးတစ်ခုကိုသွားရာ ရေဆန်ဖြစ်၍ တစ်နာရီလျှင် d မိုင်နှုန်းသာ သွားနိုင်၏။ အပြန် ရေစုန်ခရီးတွင်မူ တစ်နာရီ f မိုင်နှုန်းသွားနိုင်သဖြင့် အသွားအပြန် အချိန်နှစ်ရပ်ပေါင်း h နာရီဖြစ်သော် ခရီးမိုင်ပေါင်းကိုရှာပါ။

(2) $\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$ ပုံသေနည်းကို လ ပဓာနကိန်းရှိသောပုံသေနည်းသို့ ပြောင်းပါ။

(၃) အောက်ပါအမှတ်များသည် မည်သည့်လေးပိုင်းစိတ်အတွင်းတွင်ရှိသနည်း။

A(1,3), B(-6,-1), C(2,-2)

(၄) စက်ဝိုင်းတစ်ခုတွင် စက်ဝန်းပိုင်းတစ်ခုက ဗဟို၌ခံဆောင်ထောင့် 90° ဖြစ်၍ စက်ဝိုင်း အချင်းဝက်သည် 3 ½ cm ဖြစ်လျှင် ထိုစက်ဝန်းပိုင်း၏ အလျားကိုရှာပါ။

(၅) ဓာတ်ဆီထည့်သော ကန်တစ်ကန်သည် ဆလင်ဒါပုံဖြစ်၍ အချင်း 14cm နှင့် အမြင့် 5cm ဖြစ်လျှင် မျက်နှာပြင်ခုံး၏ ဧရိယာနှင့် ထိပ်ဝဧရိယာတို့ကိုရှာပါ။

အပိုင်း (ဂ)

မေးခွန်းအားလုံးဖြေဆိုပါ။ (၂၅) မှတ်

၃။ လူတစ်ယောက်သည် သူ၏သားထက် n နှစ်ပို၍ကြီး၏။ လွန်ခဲ့သော m နှစ်က အဖ၏ အသက်သည် သားအသက်၏ p ဆဖြစ်လျှင် သားအဖနှစ်ယောက်၏ ယခုအသက် အသီးသီး ကိုရှာပါ။

၄။ အနားအရေအတွက် n ရှိသော ဗဟုဂံ၏ အတွင်းထောင့်ပေါင်းလဒ် R သည် (2n-4) ထောင့်မှန်နှင့်ညီမျှ၏။

(a) n ကိုရှာရန်ပုံသေနည်းသို့ပြောင်းပါ။

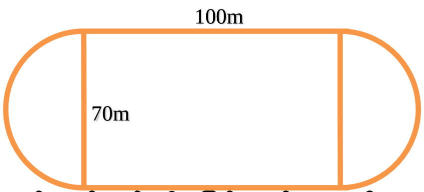
(b) R = 10 ဖြစ်လျှင် n မည်မျှနည်း။

(c) n = 20 ဖြစ်လျှင် R မည်မျှနည်း။

၅။ အောက်ပါအမှတ်များကို နေရာချပေးပါ။

(0, 3), (-6,-1), (2,-2),(0,0), (-2,2)

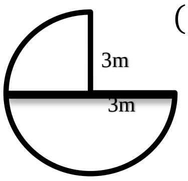
6.



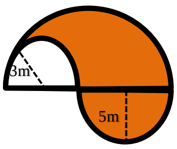
ပုံသည် ဘောလုံးကွင်းတစ်ကွင်း၏ပုံဖြစ်သည်။ ဂိုးနောက်ပိုင်းသည် စက်ဝိုင်းခြမ်းပုံဖြစ်သည်။ အကယ်၍ ထောင့်မှန်စတုဂံပုံ ဘောလုံးကွင်းသည် အလျား 100m ၊ အနံ 70m ဖြစ်လျှင် စက်ဝိုင်းခြမ်းများအပါအဝင် ကွင်း၏ ပတ်လည်အနားသည် မည်မျှဖြစ်သနည်း။

7. အောက်ပါပုံများ၏ဧရိယာကိုရှာပါ။

(*i*)



(*ii*)



Appendix (B)

Attitude Questionnaires

Mastery Learning Strategy သင်နည်းနှင့် ပတ်သက်သော သဘောထားစစ်ဆေးလွှာ

အောက်ပါတို့ကို ဖတ်ရှု၍ သင်နှင့်ကိုက်ညီမည့် သင့်လျော်ရာနံပါတ်ကို ဝိုင်းပါ။

၁ = အလွန်သဘောမတူပါ။ ၂ = သဘောမတူပါ။ ၃ = မသေချာပါ။

၄ = သဘောတူပါသည်။ ၅ = အလွန်သဘောတူပါသည်။

စဉ်	အကြောင်းအရာ					
	သင်ယူခြင်းနှင့်ပတ်သက်သော သဘောထား					
(၁)	ယခုသင်ယူခဲ့ရသော နည်းသစ်ဖြင့် သင်္ချာဘာသာရပ်ကို သင်ယူရခြင်းကို နှစ်သက်ပါသည်။	၁	၂	၃	၄	၅
(၂)	ဤနည်းဖြင့် သင်္ချာဘာသာရပ်ကို သင်ယူရာတွင် သင်္ချာ ပုစ္ဆာများ ဖြေရှင်းရာ၌ မိမိကိုယ်ကိုယ် ယုံကြည်မှု ပိုရှိလာပါသည်။	၁	၂	၃	၄	၅
(၃)	ဤနည်းဖြင့် သင်္ချာသင်ယူရာတွင် မိမိ၏ကိုယ်ပိုင်အယူအဆ များကို ဖော်ထုတ်ခွင့်ရှိသည် ဟုထင်မြင်မိပါသည်။	၁	၂	၃	၄	၅
(၄)	ဤနည်းဖြင့် သင်္ချာဘာသာ သင်ယရာတွင် သင်ခန်းစာပါ အကြောင်းအရာများကို အပြည့်အဝနားလည်သောကြောင့် သင်္ချာဘာသာရပ်ကို ပိုမိုကြိုက်နှစ်သက်ပါသည်။	၁	၂	၃	၄	၅
(၅)	ဤနည်းဖြင့် သင်ယူရာတွင် ရရှိလာသော ဗဟုသုတများကို လက်တွေ့ ဘဝတွင်လည်း ပြန်လည်အသုံးချနိုင်သောကြောင့် သင်္ချာဘာသာရပ်ကို ဆက်လက်လေ့လာလိုသော ဆန္ဒများ ပေါ်ပေါက်လာပါသည်။	၁	၂	၃	၄	၅
	သင်ယူခဲ့ပြီးသော အကြောင်းအရာများကို ကြာရှည်စွာ မှတ်မိခြင်း					
(၆)	ဤနည်းဖြင့် သင်္ချာဘာသာရပ်ကိုသင်ယူရာတွင်သင်ခန်းစာပါ အကြောင်းအရာများကို ကြာရှည်စွာ မှတ်မိပါသည်။	၁	၂	၃	၄	၅
(၇)	ဤနည်းဖြင့်သင်္ချာဘာသာရပ်ကိုသင်ယူရာတွင်သိထားပြီးသော အသိများကို အခြေခံသောကြောင့် အကြောင်းအရာအသစ်များကို ပိုမိုစွဲမြဲစွာ မှတ်မိပါသည်။	၁	၂	၃	၄	၅
(၈)	သင်ခန်းစာပါအကြောင်းအရာများကို ကိုယ်တိုင်လက်တွေ့ လုပ်ဆောင် ကာ သင်ယူရသောကြောင့် ထိုအကြောင်းအရာ များကို ပိုမို မှတ်မိလာ ပါသည်။	၁	၂	၃	၄	၅
(၉)	သင်္ချာပုစ္ဆာများဖြေရှင်းရာတွင် နည်းအမျိုးမျိုးကိုအသုံးပြု၍ ဖြေရှင်းရသောကြောင့် သင်္ချာပုစ္ဆာများကို လွယ်ကူစွာ မမေ့တော့ပါ။	၁	၂	၃	၄	၅
(၁၀)	ဤနည်းဖြင့် သင်ယူရသောကြောင့် စာမေးပွဲများတွင် သင်္ချာဘာသာရပ် ကို ကောင်းစွာဖြေဆိုနိုင်ပါသည်။	၁	၂	၃	၄	၅
	သင်ယူမှုလုပ်ငန်းများတွင် ပါဝင်ဆောင်ရွက်ခြင်း					
(၁၁)	ဤနည်းဖြင့် သင်္ချာဘာသာရပ်ကို သင်ယူရာတွင်သင်ယူမှု လုပ်ငန်း များတွင် ကျောင်းသားများတက်ကြွစွာပါဝင်ရပါသည်။	၁	၂	၃	၄	၅
(၁၂)	ဤနည်းဖြင့် သင်္ချာသင်ယူရာတွင်ကိုယ်တိုင်ပါဝင်လုပ်ဆောင် ရသော ကြောင့် အချို့ပုစ္ဆာများကို ဆရာ၏ အကူအညီ မယူဘဲ ဖြေရှင်းနိုင် ပါသည်။	၁	၂	၃	၄	၅
(၁၃)	ဤနည်းဖြင့် သင်္ချာသင်ယူရာတွင် အတန်းဖော်များ၏ အယူအဆ များကိုလည်း သိနိုင်ပါသည်။	၁	၂	၃	၄	၅
(၁၄)	ဤနည်းဖြင့် သင်္ချာသင်ယူရာတွင် လက်တွေ့လုပ်ငန်းများမှ တစ်ဆင့် သင်ယူရသောကြောင့် သင်ယူသူများသည် စူးစမ်းလေ့လာတတ်သော အလေ့အကျင့်များရရှိလာပါသည်။	၁	၂	၃	၄	၅
(၁၅)	ဤနည်းဖြင့် သင်္ချာဘာသာရပ်ကို သင်ယူရာတွင် သင်ယူသူ များသည် အတန်းဖော်များနှင့် ပူးပေါင်းဆောင်ရွက်ခွင့် ရပါသည်။	၁	၂	၃	၄	၅

(၁၆) ဤနည်းဖြင့်သင်္ချာသင်ယူရာတွင် သင်၏ခံစားချက်များကို ဖော်ပြပါ။

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–– (၁၇)
ဤနည်းဖြင့်သင်္ချာသင်ယူရာတွင်ယခင်သင်နည်းနှင့်ကွဲပြားသောသင်၏ပါဝင်ဆောင်ရွက်ခွင့် များကို ဖော်ပြပါ။

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––(၁၈) ဤသင်နည်းနှင့်ပတ်သက်၍
သင်၏ထင်မြင်ယူဆချက်များကို ရေးပါ။

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THE EFFECT OF VAN HIELE'S INSTRUCTIONAL MODEL ON STUDENTS' ACHIEVEMENTIN GEOMETRY

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Abstract

The main purpose of this study was to study the effect of van Hiele's instructional model on students' achievement in geometry. This study was conducted with both quantitative and qualitative research methods. For quantitative research, an experimental study was used to study the effect of van Hiele's instructional model. In this experimental study, the subjects were Grade seven students selected from No. (7), BEMS, Hlaing and No. (9), BEMS, Insein. The experimental designed adopted in this study was a true experimental design, namely, posttest only control group design. For this study, (60) Grade Seven students from No. (7), BEMS, Hlaing and (62) Grade Seven students from No. (9), BEMS, Insein were selected by random sampling method. These students were divided into two groups: control and experimental. The experimental group was treated with van Hiele's instructional model and the control group was taught with formal instruction. After that, a posttest was administered to two groups. Independent samples *t*-test was used to compare the differences between the two groups. The results showed that the students who received a treatment by van Hiele's instructional model demonstrated significantly better than those who received by formal instruction in No. (7), BEMS, Hlaing ($t = 12.776$, $p < .001$) and in No. (9), BEMS, Insein ($t= 11.778$, $p < .001$). The qualitative data also supported the findings from the experimentation. For this research study, students of the experimental groups were given a questionnaire. It consists of (15) items five-point Likert-scale and (3) open ended questions. The results showed that the students expressed their willingness to learn in van Hiele's instructional model and they had positive attitudes towards van Hiele's instructional model. Research findings proved that van Hiele's instructional model has positive contribution to the geometry teaching at the middle school level.

Keywords: van Hiele levels, van Hiele's instructional model, geometric thinking

Introduction

Geometry is an important branch of mathematics and it has been identified as a basic mathematical skill. It is also applied in other branches of mathematics. According to National Council of Teachers of Mathematics (2000; cited in Ozcakir, 2013), geometry provides describing, analyzing and understanding the world around. Regarding the learning of geometry, students should be able to analyze characteristics and properties of geometric shapes, develop mathematical arguments about geometric relationships, use visualization spatial reasoning and geometric modeling to solve problems.

Many students in various part of the world have been facing difficulties in learning geometry. Pierrer van Hiele and Dian van Hiele-Geldof (1985, cited in Noparit, 2005) formulated a model to explain why students had those difficulties. Because of the importance are of geometry in the daily life of students and the emphasis on the topic of geometry in the mathematics curriculum, the process of teaching and learning geometry should be made more meaningful and should be emphasizing hands-on exploration, creative thinking and the ability to argue and generate conjectures about geometry. The geometry instruction is suggested to be organized according to van Hiele model. So, van Hiele's instructional model can be used to guide

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instruction as well as assess students' abilities. The importance of learning action between students and teacher is emphasized within van Hiele's instructional model. According to this model, students' thinking in geometry progresses sequentially through levels.

Statement of the Problem

Many studies have attempted to develop students' geometric thinking, the statistical data shows that students still lack behind in geometry in comparison to national and international averages. Before, many studies have found that students have difficulties in learning geometry. Usiskin (1982, cited in Abulyasas, 2016) said that if students have their geometric thinking lower than level 2, then they will not be successful in learning geometry in high school or at other higher levels. This failure to the students' weakness in geometric thinking and the teachers' failure to use effective and appropriate teaching methods that can help them overcome the difficulty of teaching geometry. In the traditional class room, the teacher's role is to introduce geometric concepts and theorems on the board and in the front of the class without any active contributions from students in formulating new knowledge. This does not show appreciation for their minds and abilities. Therefore, how to progress the process of teaching and learning geometry is a real problem for current mathematics teachers in order to get high level of achievement in geometry among their students. The van Hiele model related to teaching and learning of geometry and this instruction shows it has been successful in developing students' geometric thinking. Thus, the teachers can give the opportunities and environment which encourages students to think independently as much as possible by emphasizing van Hiele's instructional model in order to enhance students' geometric thinking.

Purpose of the Study

The main purpose of the study is to study the effect of van Hiele's instructional model on students' achievement in geometry. The specific objectives are as follows:

- To study the theoretical foundation of van Hiele's instructional model in teaching geometry.
- To investigate the effect of van Hiele's instructional model on students' achievement in geometry.
- To investigate the attitudes of students from experimental groups on teaching of geometry with the van Hiele's instructional model.
- To give suggestions for the improving of geometry teaching and learning at the middle school level.

Research Hypotheses

1. There is a significant difference in the achievement of van Hiele geometric thinking levels between students who are taught by using van Hiele's instructional model and those who are not.
2. There is a significant difference in the achievement of visualization level of van Hiele geometric thinking between students who are taught by using van Hiele's instructional model and who are not.
3. There is a significant difference in the achievement of analysis level of van Hiele geometric thinking between students who are taught by using van Hiele's instructional model and who are not.

4. There is a significant difference in the achievement of informal deduction level of van Hiele geometric thinking between students who are taught by using van Hiele's instructional model and who are not.
5. The students who learnt with van Hiele's instructional model have positive attitudes, experiences and opinions learning geometry topics.

Scope of the Study

The following points indicate the scope of the study.

1. In terms of geographical area, this study is geographically restricted to Yangon Region.
2. Participants in this study are (120) Grade-7 students from the selected school within the school-year 2018-2019.
3. This study is limited to the content areas of Chapter (6) and Chapter (7) from Mathematics Textbook Volume II prescribed by the Department of Educational Planning and Training, Myanmar.
4. According to the nature of content, this study is limited to visualization level, analysis level and informal deduction level from the van Hiele geometric thinking levels.

Definition of Key Terms

van Hiele levels: The levels of geometric thinking range from level 0 to 4 which are Visualization (level 0), Analysis (level 1), Informal Deduction (level 2), Deduction (level 3) and Rigor (level 4) (Burger & Shaughnessy, 1986, van Hiele, 1986).

van Hiele's Instructional Model: The instruction proposed by van Hiele in order to make the students' geometric thinking levels way up. It has five steps which are Information (step 1), Guided Orientation (step 2), Explicitation (step 3), Free Orientation (step 4) and Integration (step 5) (van Hiele, 1986).

Geometric thinking: The ability to think reasonably in geometric context which have five levels of thinking as seen through the van Hiele levels of geometric development defined by van Hiele's model (Walle, 2004).

Significance of the Study

Geometry is an important branch of mathematics, requires abstract thinking and it has been identified as basic mathematical skill. Geometrical skills have a wide application in other fields of life. According to Serkoak (1996, cited in Abulyasas, 2016), when students have an understanding of geometric concepts, they will be able to learn geometry at the higher level without difficulties and have good attitude towards learning geometry. Nowadays, traditional instruction does not seem effective in developing students' geometric thinking. Teachers need to consider and improve their teaching well because in today's world, the needs and interests of children are very different from the children in the past decades. For effective, all children should be encouraged to express their views, ideas, and feelings. The present teaching method emphasizes only on lecture method which leads to rote learning. Higher level thinking such as reasoning, problem solving, critical thinking, and creative thinking are still weak as Learner Centered Approach is not used in teaching.

In geometry, teachers need to plan classroom activities in a way that can help the learners understand the nature and the concepts of geometry. Teachers can give the opportunities and environment which encourages students to think independently as much as possible by emphasizing van Hiele's instructional model in order to enhance students' geometric thinking. This model indicates that effective learning takes place when student's activity experiences the objects of study in appropriate contexts. This model provides an opportunity for students to solve problems by their own geometric thinking as well as to see a variety of solution from other students. The steps in the model, particularly the fourth step which is "free orientation" will encourage students in solving problems. Teachers can assess their students' levels of thought and provide instruction at those levels. Therefore, teacher should provide experience organized according to the steps of van Hiele's instructional model to develop each successive level of understanding.

Moreover, a research for studying the effect of van Hiele's instructional model on students' achievement in geometry is necessary.

Theoretical Framework

Importance of Teaching Geometry

In the past, most elementary and middle grades teachers spent very little time on geometry. Possibly they felt uncomfortable with the topic themselves or did not regard the topics as important. Traditional norm-referenced tests did not give a lot of weight to geometric thinking. Thanks to the increased NCTM emphasis on geometry and its inclusion in state testing programs, more geometry is being taught. Here are a few reasons that come to mind.

1. Geometry can provide a more complete appreciation of the world. Geometry can be found in the structure of the solar system and in geological formations.
2. Geometric explorations can develop problem solving skills. Spatial reasoning is an important form of problem solving, and problem solving is one of the major reasons for studying mathematics.
3. Geometry plays a key role in the study of other areas of mathematics. E.g. fraction concept of similarity. Measurement and geometry are clearly related.
4. Geometry is used daily by many people. Scientists of all sorts, architects and artists, engineers, and land developers are just a few of the professions that use geometry regularly.
5. Geometry is enjoyable. If geometry increases students' fondness for mathematics more in general, that makes the effort worthwhile.

The van Hiele Model

Constructivists claim that both mathematical truths and the existence of mathematical objects must be established by constructive methods. This means that mathematical constructions are needed to establish truth or existence, as opposed to methods relying on proof by contradiction. Constructivists will no longer expect a mathematical problem to have only one solution strategy, and they will expect solution explanation from the learners. There are many elements in the van Hiele model that are consistent with constructivist ideas about teaching and learning (Arebe, 2008).

In mathematics education, the van Hiele model is a theory that describes how students learn geometry. The theory originated in 1957 in the doctoral dissertations of Dina van Hiele-Geldof and Pierre van Hiele (wife and husband) at Utrecht University, in the Netherlands. The Soviets did research on the theory in the 1960s and integrated their findings into their curricula. The van Hiele model was created to provide geometric understanding and to develop geometric understanding in learners (Erdogan et al, 2009). This model provides useful empirically-based descriptions of what are likely to be relatively stable and qualitatively different states of understanding in learners. The van Hiele model has three aspects: the existence of levels, the properties of the levels, and the progress from one level to the next level.

The best known part of the van Hiele model is the five levels which the van Hieles postulated to describe how children learn to reason in geometry. Students cannot be expected to prove geometric theorems until they have built up an extensive understanding of the systems of relationships between geometric ideas. These systems cannot be learned by rote, but must be developed through familiarity by experiencing numerous examples and counterexamples. Each of the five levels describes the thinking processes used in geometric contexts. These levels describe how learners think about geometric ideas. The five van Hiele levels are sometimes misunderstood to be descriptions of how students understand shape classification, but the levels actually describe the way that students reason about shapes and other geometric ideas.

In general, these levels are a product of experience and instruction rather than age. A child must have enough experiences with those geometric ideas to move to a higher level of sophistication. The levels are as follows:

Level 0: Visualization

Level 1: Analysis

Level 2: Informal Deduction

Level 3: Deduction

Level 4: Rigor

Visualization: At this level, the objects of thought are shapes and what they "look like". The products of thought are classes or groupings of shapes that seem "alike". Students recognize and name figures based in the global visual characteristics of the figure. Because appearance is dominant at this level, appearances can overpower properties of a shape. The focus of a child's thinking is on individual shapes, which the child is learning to classify by judging their holistic appearance. Children at this level often believe something is true based on a single example.

Analysis: At this level, the objects of thought are classes of shapes rather than individual shapes which the child has learned to analyze as having properties. The shapes become bearers of their properties. Students operating may be able to list all the properties of squares, rectangles, and parallelograms but may not see that these are subclasses of one another. The properties are more important than the appearance of the shape. Properties are not yet ordered at this level. Children can discuss the properties of the basic figures and recognize them by these properties, but generally do not allow categories to overlap because they understand each property in isolation from the others.

Informal Deduction: Children at the informal deduction level not only think about properties but also are able to notice relationships within and between figures. Children are able to formulate meaningful definitions. As students begin to be able to think about properties of geometric objects without the constraints of a particular object, they are able to develop relationships between and among these properties. At this level, properties are ordered. The objects of thought are geometric properties, which the student has learned to connect deductively. The student understands that properties are related and one set of properties may simply another property. Students can reason with simply arguments about geometric figures.

Deduction: Students at this level understand the meaning of deduction. The object of thought is deductive reasoning (simply proofs), which the student learns to combine to form a system of formal proofs (Euclidean geometry). The student at this level is able to work abstract statements about geometric properties and make conclusions based more on logic than intuition. There students build on a list of axioms and definitions to create theorems. They also prove theorems using clearly articulated logical reasoning. They understand how to do a formal proof and understand why it is needed. They understand the role of undefined terms, definitions, axioms and theorems in Euclidean geometry.

Rigor: At this level, geometry is understood at the level of a mathematician. Children at this level can think in terms of abstract mathematical systems. Students understand that definitions are arbitrary and need not actually refer to any concrete realization. The object of thought is deductive geometric systems, for which the learner compares axiomatic systems. There is an appreciation of the distinctions and relationships between different axiomatic systems. Learners can study non-Euclidean geometries with understanding.

van Hiele believes that the level of an individual is influences by learning rather than by age, attended grade or biological maturity (van Hiele, 1957; cited in Fuya, Geddes & Tischer, 1988). van Hiele emphasized the importance of experience; he stated that students cannot operate properly on some level, if they have no experience, allowing them to think at this level. Each level uses its own language and symbols. Students pass through the levels "step by step". This hierarchical order helps them to achieve better understanding and results. A significant difference between one level to the next level is the objects of thought- what they are able to think about geometrically. The products of thought at each level are the same as the objects of thought at the next.

Properties of the van Hiele Levels

The van Hiele added the properties: sequential, intrinsic and extrinsic, linguistics, separation, and advancement to clarify certain presumptions that they had about the levels of thought. These properties and a short discussion using comments of the seminal authors are given below.

Sequential (Fixed sequence): According to van Hiele, the levels are sequential and learners must pass through and acquire the lower levels before proceeding to next level (Walle, 2004). Due to the sequential nature, learners cannot skip a level. A student cannot be at level N without having gone through level (N-1). Therefore, the student must go through the levels in order as their understanding increases (except for gifted children). Although, if the learners receive instruction that it may allow them to progress more quickly.

Intrinsic and extrinsic (Adjacent): Properties which are intrinsic at one level becomes extrinsic at the next level. To move from one level to the next, children need to have many experiences in which they are actively involved in exploring and communicating about their observations of shapes, properties, and relationships. Concepts that are implicitly understood at one level become explicitly understood when learners reach the next level.

Linguistics (Distinction): For learning to take place, language must match the child's level of understanding. Each level has its own language or linguistic symbols and way of thinking (van Hiele, 1986; cited in Steyn, 2016). The meaning of a linguistic symbol is more than its explicit definition; it includes the experiences which the speaker associates with the given symbol. If the language that the teacher uses is at a higher level than the level of the learner, the learner will not be able to follow the thought processes and there will be a lack of communication.

Separation: Two persons at different levels cannot understand each other. A teacher who is reasoning at one level speaks a different "language" from a student at a lower level, preventing understanding. When a teacher speaks of a "square" she or he means a special type of rectangle. A student at level 0 or 1 will not have the same understanding of this term. The student does not understand the teacher, and the teacher does not understand how the student is reasoning, frequently concluding that the student's answers are simply "wrong".

Advancement (Attainment): In order to advance from one level to the next requires "direct instruction, exploration and reflection" by the learner (Pegg, 1992; cited in Steyn, 2016). This is one of the differences between the theories of van Hiele and Piaget. In Piaget's theory, development is age dependent whereas in van Hiele progress to the next level depends more on the content and method of instruction than on the age of the learner.

The van Hiele's Instructional Model

van Hiele believed that cognitive progress in geometry can be accelerated by instruction. The progress from one level to the next one is more dependent upon instruction than on age or maturity. He gave clear explanations of how the teacher should proceed to guide students from one level to the next level. The instructional steps were made up of five steps which were to ensure that students move from one van Hiele learning level to a higher one in their geometric thinking. These steps are given below.

i. **Information:** The first step is the step in which the geometric thinking levels of students are determined. In this step, the students' geometric thinking levels are determined through communication between the teacher and the student. Students get the material and start discovering its structure. The teacher holds a conversation with the pupils, in well-known language symbols, in which the context he wants to use becomes clear.

ii. **Guided Orientation:** In this step, students deal with tasks which help them to explore implicit relationships. The teacher suggests activities that enable students to recognize the properties of the new concepts. The relations belonging to the context are discovered and discussed. The teacher gives instructions and assignments related to the studies which will be done in the light of the answers he gets from the students. The purpose of the teacher giving assignments is to make students explore the structures about the topic by means of research.

iii. **Explicitation:** Teacher introduces the topic to students in this step and students combine their experiences with the words they used related to the topic. In this step, it is important for the teacher to arouse students' interests. Students formulate what they have discovered, new terminology is introduced. They share their opinions on the relationships they have discovered in they activity. The van Hieles thought it is more useful to learn terminology after students have had an opportunity to become familiar with the concept.

iv. **Free Orientation:** Students work on different solutions of multiphase problems in this step. The effect of the van Hiele Model based among the various objects of the structure in the topic they work on. The teacher should guide students in their thinking about different solutions. Students solve more complex tasks independently. It brings them to master the network of relationships in the materials. They know the properties being studied, but they need to develop understanding of relationships in various situations. This type of activity is much more open-ended.

v. **Integration:** This step is the step in which students summarize and gather what they learned. Students internalize what they learned as a new thinking structure. The teacher should give to the students an overview of everything they have learned. It is important that the teacher does not present any new material during this phase, but only a summary of what has already been learned.

The teacher has different roles in various stages: task planning, directing a student's attention to geometric properties of shapes, introducing the terminology, fostering students to use appropriate terminology, and promoting student's explanations and problem solving. The major relevance of the van Hiele learning steps is their link with the level descriptions. The description of the van Hiele steps given above appears to be consistent with constructivism as a theory of instruction in education.

Research Methodology

Research Design

The design used in this study was one of the true experimental designs, known as the posttest only control group design.

Procedures

In exploring the effects of van Hiele's instructional model on student's achievement in teaching geometry, one of the experimental designs, the posttest only control group design was adopted. Participants were first selected by random assignment and then they were divided into groups an experimental group and a control group by using their mid-term grades. The experimental group was taught by using van Hiele's instructional model and the control group was taught by using formal instruction. The treatment period was from November 12, 2018 to December 7, 2018. At the end of the treatment period, all the selected students will to sit for posttest. The allocated time for posttest was (45) minutes and given marks were 30 marks. A questionnaire was used to explore students' attitude towards learning through van Hiele's instructional model.

Instruments

In this study, a posttest for students' achievement of van Hiele geometric thinking levels and questionnaire for students' attitude towards van Hiele's instructional model.

(a) Posttest

A posttest was constructed to measure students' achievement of van Hiele geometric thinking levels. They were (30) multiple choice items. Test items were constructed based on the content areas of Chapters (6) and (7) from Grade Seven Mathematics Textbook Volume II with the advice and guidance of the supervisor. The students had to answer all the questions there were no choice of items. This test was constructed based on van Hiele geometric thinking levels: visualization, analysis and informal deduction. In order to get validation, the posttest questions were distributed to six experienced mathematics teachers. According to their suggestions, test items were modified again and its marking scheme was also presented.

(b) Questionnaire

A questionnaire was used to observe the students' attitudes, experiences and opinions towards learning through the van Hiele's instructional model. It consists (15) items five-point Likert-scale and (3) open ended questions (see Appendix D). The questionnaire was constructed according to the advice and guidance of the supervisor. In order to get the validation, the copies of questionnaire were modified again.

Population and Sample Size

This study was geographically restricted to Yangon Region. There are four districts in Yangon Region. Two districts (North and West) were randomly selected. One township from each district was selected by using a randomly sampling method. The required sample schools were selected by using a randomly sampling method. The sample schools were No. (7) BEMS, Hlaing and No. (9) BEMS, Insein. The population in this study was (106) students who were learning mathematics in Grade Seven at No. (7) BEMS, Hlaing and (62) students who were learning mathematics in Grade Seven at No. (9) BEMS, Insein. To obtain the required data, (60) students from No. (7) BEMS, Hlaing and (62) students from No. (9) BEMS, Insein were selected by using a random sampling method.

Data Analysis

The data were analyzed by using descriptive statistics (mean and standard deviation) and independent sample '*t*' test. The independent sample '*t*' test was used to compare the achievement of students who learned by van Hiele's instructional model and that of students who learned by formal instruction at virtualization, analysis and informal deduction levels.

Research Findings

Quantitative Research Findings

The researcher provided the treatment to the experimental groups in the selected schools. At the end of the treatment period, the posttest was administered to measure the geometric achievement of students. The data were analyzed by using the Statistical Package of Social Sciences (SPSS). In order to compare geometric achievement, the *t*-test of independent samples was used. The results are presented in Table (4.1).

Table 4.1 *t*-Values for Students' Geometric Achievement on Posttest

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEMS (7) Hlaing	Experimental	30	24.73	2.765	7.63	12.776	58	.000***
	Control	30	17.10	1.748				
BEMS (9) Insein	Experimental	31	25.13	2.692	7.68	11.778	60	.000***
	Control	31	17.45	2.433				

Note: ***$p < .001$

The results showed that there were significant differences between the experimental and control groups for the scores on the geometry achievement on the posttest in each school. It means that the scores of the experimental group were significantly higher than that of the control group on posttest in each school.

It can be shown that there were significant differences between the experimental and control groups for the scores on the geometry achievement on the posttest in each school. It means that the use of van Hiele's instructional model had positively contributed to the geometric teaching and learning at the middle school level.

In order to compare the students' achievement at visualizing level between the experimental and control groups. The results are presented in Table (4.2).

Table 4.2 *t*-Values for Scores on Visualization Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEMS (7) Hlaing	Experimental	30	8.33	.758	1.26	4.513	58	.000***
	Control	30	7.07	1.337				
BEMS (9) Insein	Experimental	31	8.42	.764	1.07	4.971	60	.000***
	Control	31	7.35	.914				

Note: ***$p < .001$

The results showed that there were significant differences between the achievement of experimental and control groups on visualization level questions in each school. It means that the scores of experimental group were significantly higher than that of control group on visualization level questions in each school.

It can be interpreted that students of experimental groups could recognize and name figures based in the global visual characteristics than students of control groups.

In order to compare the students' achievement at analysis level between the experimental and control groups, the independent samples *t*- test was used. The results are presented in Table (4.3).

Table 4.3 *t*-Values for Scores on Analysis Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEMS (7) Hlaing	Experimental	30	9.07	1.363	3.54	10.457	58	.000***
	Control	30	5.53	1.252				
BEMS (9) Insein	Experimental	31	8.55	1.410	3.33	9.445	60	.000***
	Control	31	5.22	1.359				

Note: ***$p < .001$

The results showed that there were significant differences between the experimental and control groups for the scores on analysis level questions in both schools. It means that the scores of the experimental group were significantly higher than that of control group on analysis level questions in each school.

The results of the two selected schools can be interpreted that students' ability to list all the properties of figures and discuss the properties of the figures and recognize them by these properties than the use of formal instruction.

In order to compare the students' achievement at informal deduction level between the experimental and control groups, the independent samples *t*- test was used. The results are presented in Table (4.4).

Table 4.4 *t*-Values for Scores on Informal Deduction Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEMS (7) Hlaing	Experimental	30	7.33	1.56	2.83	8.268	58	.000***
	Control	30	4.50	1.042				
BEMS (9) Insein	Experimental	31	8.22	1.116	3.35	9.229	60	.000***
	Control	31	4.87	1.688				

Note: ***$p < .001$

The results showed that there were significant differences between the experimental and control groups for the scores on informal deduction level questions in both schools. It means that the scores of the experimental group were significantly higher than that of control group on informal deduction level questions in each school.

The results of the two selected schools can be interpreted that the use of van Hiele's instructional model in geometry teaching could bring about more improvement of students' ability to formulate meaningful definitions and develop relationships of between these properties than the use of formal instruction. Students of experimental groups could understand that properties are related and one set of properties may simply another property. They could understand necessary and sufficient conditions and could write concise definitions.

Qualitative Research Findings

The following table is constructed to describe only the percentage of students' positive and negative attitude towards each dimension.

Table 4.5 Percentage of Students' Positive and Do Not Have Positive Attitude towards Each Dimension.

No.	Dimension	Percentage of Positive Attitude	Percentage of Do Not Have Positive Attitude
1	Attitude towards Learning	98%	2%
2	Experience towards Learning	95%	5%
3	Opinion towards Learning	95%	5%

According to the results of (15) items five Likert-scale, (96%) of the students have positive attitudes and (4%) do not have positive attitudes towards experimental learning towards van Hiele's instructional model.

In this research, the qualitative study for students from the experimental group of two selected schools was carried out with a questionnaire. It consists of (15) items five-point Likert-scale and (3) open ended questions. In this study, it was found that learning by doing increase students' conceptual understanding. Moreover, this learning also developed students' self-reliance and self-confidence. Most of students expressed that they were very excite and happy by using hands-on activities. They gained the habit of cooperation with others. By relating previous experiences with the new experiences, it can promote their logical thinking skills. Moreover, students learned geometric concepts with extra activities that are related to the lesson. Therefore, they have mastered their learning. Moreover, students expressed that their knowledge was increased and they have willingness to learn more from experience than as usual. Some students do not have positive attitudes because they have had no experience in that kind of asking questions and discussion in the classroom. Therefore, experiential learning has positive contribution to the geometry teaching and learning at the middle school level.

Discussion, Suggestions, Conclusion

Discussion

In this study, the geometrical thinking levels of experimental groups which were given instruction according to the van Hiele's instructional model and of control groups which were given instruction according to the formal instruction. In this context, when the post test results of geometry achievement test of the participants were examined, a significant difference was found in favor of experimental group. In other words, it was found that the instruction given according to the van Hiele's instructional model was more effective than the formal instruction in developing geometrical thinking levels of students. Therefore, this result supports the first hypothesis. It can be claimed that the instruction given according to van Hiele's instructional model was effective in developing geometrical thinking levels of students. This finding of the study is consistent with the other research (Siew, Chong & Abdukkah, 2013).

According to the comparison of means on visualization level in two selected schools, the results pointed out that there were significant differences between the control and experimental groups. The result supports the second hypothesis. By using concrete or virtual models, using models to focus on defining properties, making properties lists, and discussing sufficient conditions to define a shape and classifying using properties of shapes were used in this study for analysis level. The result generalized that van Hiele's instructional model provided students with an opportunities to recognize and identify certain geometric shapes based on the overall entity of the objects. They had the opportunity to participate actively in the instructional process.

Besides, there were a significant between the experimental group and the control group in two selected schools for the mean scores on Analysis Level. The result supports the third hypothesis. The result generalized that students of experimental groups had adequate understanding regarding the identification of the geometric shapes using their properties and their orientation in space. In this study, the students shared their idea and opinion when they were at the information, explicitation, and integration steps. They had the opportunity to participate actively in the instructional process.

Moreover, the results of mean scores of the informal deduction level were also significantly higher of experimental group than of control group in two selected schools. The result supports the fourth hypothesis. The result indicates that the implementation of van Hiele's instructional model assisted students in achieving better levels of geometric thinking as compared to those students who learned the topics conventionally. The students change to the higher level is based on the open approach. This finding of the study is consistent with the other research (Chew Chew Meng, 2009). So, the van Hiele's instructional model takes the Learner Centered Approach such as cooperative learning, learning by doing, and experience as the basis.

In this study, (15) items five-point Likert-scale and (3) open ended questions for analyzing of Grade Seven students' attitudes towards van Hiele's instructional model was used. According to the results of (15) items five Likert-scale, (96%) of the students have positive attitudes and (4%) of the students do not have positive attitudes towards experimental learning towards van Hiele's instructional model. According to the findings of students' attitude survey, most of the selected students from each experimental group expressed that they enjoyed their learning by using van Hiele's instructional model. In this study, students must cooperate together, questioning, researching, analyzing and finding solution to problems. Some students do not have positive attitudes because they have had no experience in that kind of asking questions and discussion in the classroom. On the other hand, they have no experiences in solving problems in this new way and they've never seen this type. They always solve the problems by following the teacher's instruction. So, they have no confidence to solve problems themselves.

The study has also found that improvement from one level of geometric thinking to a higher level of geometric thinking depends on the lesson taken by the students and not on their maturity. Therefore, the method and learning organization and also the contents and teaching aids used are the important elements of the pedagogy. In this study, the students went through all the five steps in their first learning session to assist them to advance from first level of geometric thinking, visualization to the second level of geometric thinking, analysis. The van Hiele's instructional model is dynamic and not static. It focuses on students' actively participation. Students can apply their learning experiences, concepts and ideas in real world. Therefore, successful learning can be achieved by using the van Hiele's instructional model.

Suggestions

Findings and discussion in the research will contribute to the development of geometry teaching at the middle school level in Myanmar. Geometry teachers should strive to use van Hiele's instructional model in order to reinforce student's logical reasoning and deductive thinking for modeling abstract problems. Besides, teachers should consider the importance of the strategies which can be used to encourage effective participation by all members in the group. Students should be developed reasoning and thinking powers more and demanded less from memory. Students should come to realize that thinking makes successful students of all the subjects. According to Locke, cited in Sidhu, 1995; "Mathematics is a way to settle in the mind a habit of reasoning". Therefore, mathematics teachers should build new mathematical knowledge through problems and introduce most mathematical concepts through problem solving. Teachers should create students to explore ideas and think problems.

The van Hiele model of geometric thought can be used to guide instruction as well as assess student abilities. The van Hiele's instructional model indicates that effective learning take place when students actively experience the objects of the study in appropriate contexts. Therefore, it is suggested that by using van Hiele's instructional model, the geometry teachers should provide experiences organized according to the steps of learning to develop each successive level of understanding. Teachers should be to refine the steps of learning develop van Hiele based materials and philosophies in the classroom setting. Students should be accessible geometric thinking.

Learning through memorization without understanding is considered not achieving the levels of van Hiele model. Therefore, the teaching of geometry should be done systematically to help students move from one level to another. Furthermore, the presence of various educational technologies can facilitate the process of teaching and learning geometry in the classroom. The geometric thinking level of the students should be identified before the teaching program. To improve geometry teaching, teachers should be to develop tasks or activities that help them better understand the nature of their students' geometric reasoning and they also should have an understanding about research concerning such reasoning.

Changes in the instructional practices should be coupled with the changes in the curriculum to observe the efforts on students' achievement. Constructive activities should be encouraged. Learners should be made familiar with the techniques of drawing and folding for enhancing their geometric thinking. Higher levels of geometric thinking can be attained by the implementation educator guided, learner centered, hands on instructional programme. The process of gradually moving from the concrete to abstract and from passive to active learning under the guidance of the teachers would make objectives should be to help students to gain insight and understanding of the subject matter and consolidate their conceptual understanding.

In this study, the researcher used van Hiele's instructional model. According to the research, time was an issue. It is difficult for the teacher to apply van Hiele's instructional model in a short period of time. Therefore, teachers should carefully arrange sets of guiding activities designed to be performed actively by the students to reduce time constraints. Class size was also a factor. If the class size is large, the students can miss the main points about the topic, lack of chance to answer the teacher's question, lack of opportunity the teaching aids independently, and low chance to discuss with the teacher. Therefore, the class size should be (30) students to grasp the merits of van Hiele's instructional model. Furthermore, the emphasis of instruction and assessment should be based on the exploration of students' ideas and reasoning rather than on factual information.

This research was conducted to develop the teaching of geometry at the middle school level. However, no study is perfect in a single effort. As this study had to be carried out in four weeks duration for each group, the time was too short to be able to yield reliable and valid results. So, further research studies require necessary with long time duration. This study was dealt with the efforts of van Hiele's instructional model on students' achievement in geometry at the middle school level. Further research should be carried out at primary and high school levels. Moreover, further study should be used the van Hiele's instructional model to carry out in other levels and areas. Therefore, mathematics teachers should use the van Hiele's instructional model in teaching geometry at all level.

Conclusion

This study found that van Hiele's instructional model can be used to help students to move from shape properties to geometrical properties, namely relationship among shapes and their properties. These activities may help students progressing from shape properties to geometrical properties. Therefore, students can easily explore and analyze how the shapes change or what measures change when manipulating, and they can understand the relationships among shapes which is the basic requirement for van Hiele geometric thinking levels.

The van Hiele's instructional model develops students' geometric thinking and learners to be more independent, resourceful, interactive and cooperative as well as enabling them to build interpersonal relationships. This model produces learners that think creatively to solve problems, mange themselves and others, and possess independence skills. The van Hiele's instructional model fosters cooperation then competition. Thus, students develop a sense of responsibility and can transfer the learned skills into real life situations. Therefore, van Hiele’s instructional model can encourage the improvement of the students’ higher order thinking skills, social skills, communication skills, and reasoning skills in learning geometry.

According to the posttest scores for geometric achievement, there were significant differences between van Hiele’s instructional model and formal instruction on the geometric achievement in each school. Conclusions can be drawn on the basic of the results of research findings. In terms of the statistical results, students’ achievement between van Hiele’s instructional model and formal instruction had significant difference on overall geometric achievement. It can be concluded that van Hiele’s instructional model had positively contributed to the improvement of geometry achievement and can promote the students’ geometric thinking levels.

A qualitative study was done to study the students’ feelings, attitudes, experiences and opinions about geometry teaching with van Hiele’s instructional model. Most of the students described that they were very happy and satisfied by using the van Hiele’s instructional model. It also promoted their conceptual understanding. They also felt that they wanted to learn geometry by doing experiments and activities. Thus, students’ interest and attitudes are very important for geometry learning. According to this research, the qualitative research findings indicated that the attitudes, experiences and opinions of students towards learning of geometry were positive. Therefore, van Hiele’s instructional model is a useful strategy in the school system.

Finally, using statistical analysis and findings of the study the conclusions drawn were as follows:

1. The van Hiele’s instructional model has positive impact on teaching geometry.
2. The van Hiele’s instructional model plays an important role in teaching of geometry.
3. The geometric thinking levels of students who were taught by van Hiele’s instructional model were better than that of students who were not taught by formal instruction.
4. The van Hiele’s instructional model helps students to develop their levels of geometric thinking. Moreover, their problem solving skills and their academic achievement also developed.

In teaching and learning of mathematics at the basic education level in Myanmar, teaching-learning process needs to be transformed: from the current teacher-centered approach to learner-centered approach. The students should become active and independent learners in the active learning classroom with the help and guidance of their mathematics teachers. So, if possible, van Hiele’s instructional model should be used in teaching geometry. There is no one best way of teaching for all kinds situations. Each teacher must decide for himself what strategies work best for him with his students. Although this model cannot manipulate all the issues that found in the teaching and learning environment of geometry, it is hoped that this study can be beneficial to some extent for geometry teaching in Myanmar.

It can be concluded that van Hiele’s instructional model brings positive contributions to the geometry teaching at the middle school level. It is essential in teaching geometry. It can also develop geometric thinking, the core of teaching geometry. So, further researches are recommended to explore the effect of van Hiele’s instructional model in all levels for the improvement of geometry teaching.

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AN INVESTIGATION INTO THE EFFECTIVENESS OF DISCOVERY LEARNING IN TEACHING LOWER SECONDARY SCIENCE

Thida Wai[1] and Soe Than[2]

Abstract

The major purpose of this study is to investigate the effectiveness of discovery learning in teaching lower secondary science. The study was conducted with both quantitative and qualitative research methods. Firstly, a descriptive study was made to explore whether there is a link between the junior assistant science teachers' teaching-learning activities and the six stages of discovery learning cycle. The subjects for this study were selected from the Yangon City Development Area by using a stratified random sampling method. A total of (198) junior assistant science teachers from (36) schools were selected for the study. According to the results, the activities of the junior assistant science teachers are strongly linked with the engagement and readiness stage, but weakly linked with the exploration and discovery stage of the discovery learning cycle. Secondly, an experimental study was used to investigate the effectiveness of discovery learning. In this experimental study, the subjects were Grade Six students selected from the schools where there have moderate teachers' teaching-learning activities on discovery learning in each strata. The experimental design adopted in this study was one of the quasi-experimental designs, namely, nonequivalent control group design. The experimental group was treated with discovery learning and the control group was taught by using teacher-centered method. After that, a posttest was administered to two groups. Independent samples *t*-test was used to test whether there were significant differences between the two groups. Findings indicated that those who received a treatment by using discovery learning demonstrated significantly better than those who do not received it. Findings proved that discovery learning has positive contribution to the science teaching at the middle school level and could encourage the improvement of students' higher order thinking skills.

Keywords: Effectiveness, Discovery Learning, Science

Introduction

Today, the world is passing through rapid changes. In such a world, education cannot resist to change. Memorizing facts and information is not the most important skill in today's world. The important point is an understanding of how to get and make sense of the mass of data. In a society in which education has focused on transmitting "what we know," it is a challenge to develop a widespread view that "how we come to know" is very important in modern society. The teacher's role was to help raise the interest of learners, guide them in discovery and ensure relevance of the exercises.

Schools need to go beyond data and information accumulation and move toward the generation of useful and applicable knowledge. The child should make them his own, and should understand their application here and now in the circumstances of his actual life. From the very beginning of his education, the child should experience the joy of discovery. The discovery which he has to make is that general give an understanding of that stream of events which pours through his life, which is his life. Of course, education should be useful, whatever the aim of life (Whitehead, 1967).

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Education is the acquisition of the art, of the utilization of knowledge. This is an art very difficult to impart. In education, the broad primrose path leads to a nasty place. This evil path is represented by a book or set of lectures which will practically enable the student to learn by heart all questions likely to be asked at the next examination. It contains within itself the problem of keeping knowledge alive, of preventing it from becoming inert, which is the central problem of all education.

Instruction is geared toward helping the students to develop learning and thinking strategies that are appropriate for working within various subjects domains. In the discovery learning process, learners always personally construct their understanding. The key notion is that people learn best by actively constructing their own understanding. It is a very personal endeavor, whereby internalized concepts, rules and principles may consequently be applied in a practical real-world context.

Purposes

The purposes of this study are as follows:

1. To explore whether junior assistant science teachers' teaching-learning activities are linked with discovery learning.
2. To develop an instructional design for science teachers to apply discovery learning in science teaching.
3. To investigate the effectiveness of discovery learning in Grade Six students, whose science teachers' teaching learning activities are linked with discovery learning.
4. To give suggestion for improving middle school science teaching based on the data obtained from this study.

Research Questions

This study is intended to answer the following research questions:

1. What degree do junior assistant science teachers use the activities that are linked with discovery learning?
2. Do students from the discovery learning group perform better than those from the teacher-centered learning group on the overall science achievement test?
3. How do students and teachers feel towards discovery learning in science teaching?

Definition of the Key Terms

Effectiveness

Effectiveness (effective) means having power to produce, or producing, a desire result (Times-Chambers, 1992).

Discovery Learning

Discovery learning is the act of finding out something that before was unknown to mankind, including all forms of obtaining knowledge for oneself by the use of one's own mind (Bruner, 1997).

Discovery learning is the mental process of assimilating concepts and principles. Discovery learning occurs when an individual is mainly involved in using his mental process to mediate (or discover) some concept or principle (Trowbridge & Bybee, 1990).

Limitations

The following points indicate the scope of the study.

(1) This study is geographically restricted to Yangon Region.

(2) For the descriptive research design, participants are only junior assistant science teachers from the selected schools.

(3) For the experimental research design, participants are chosen from Grade Six students in the four selected schools in which junior assistant science teachers' teaching learning activities are linked with discovery learning.

Review of Related Literature

Theoretical Foundation of Discovery Learning

In developing the discovery learning for science teaching, constructivism is deeply taken into consideration. Constructivism is a way of teaching and learning that intends to maximize student understanding. Constructivism is defined as teaching that emphasizes the active role of the learner in building understanding and making sense of information (Cruickshank & Jenkins, 2006). Constructivists believe that to gain understanding requires students to engage in group experiences in which they learn through active involvement, by doing. Constructivists believe that the role of the teacher is to facilitate active involvement and to support groups and individuals to increase their likelihood for success. Social constructivists view the classroom as a community charged with the task of developing knowledge. Social constructivists view learning as an active process where learners should learn to discover principles, concepts and facts for themselves. Bruner's definition of "discovery" was not restricted to "the act of finding out something that before was unknown to mankind, but rather included all forms of obtaining knowledge for oneself by the use of one's own mind" (Bruner, 1977).

According to Dewey, education should not be separate from life itself that education should be child-centered, guided by a well-trained teacher who is grounded in pedagogical and subject knowledge. He advocated that child-centered learning must be based on real-world experiences. In his book "Democracy and Education", Dewey argued that it was critical for teaching to go beyond the presentation of facts. In the discovery learning process, students interact with the environment by exploring and manipulating objects, wrestling with the questions and controversies, or performing experiments, solving the problems and making decision. Discovery learning is a forerunner to constructivist thinking of learning and recognizes that knowledge is constructed by the learner in their own mind.

Developing Discovery Learning for Science Teaching

Today, science teaching is an important and vital topic in modern education. Science is the system of knowing about the universe through data collected by observation and controlled experimentation. It is a way of thinking, a way of understanding the world (Carin & Sund, 1989). Ways of thinking in science are called the process skills. In the discovery learning process, the learner uses the mind in logical and mathematical ways to organize and internalize concepts and principles of the world.

In 1962, Robert Karplus and J. Myron Atkin developed the three-phase learning cycle for discovery learning. Originally, the three phases of the cycle were referred to as exploration, invention, and discovery (see Figure 1).

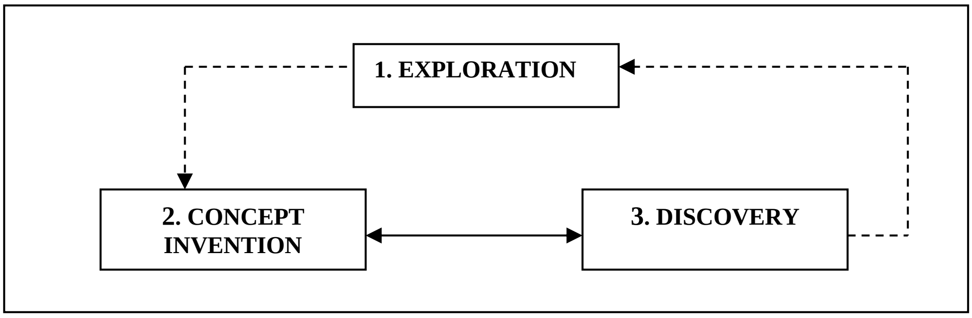
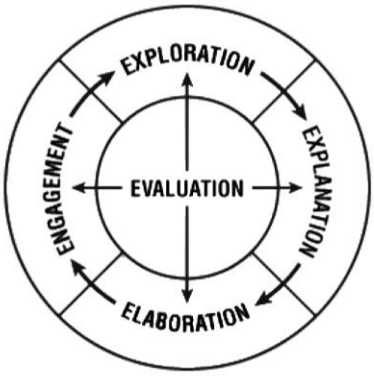


Figure 1: The Three-phase Discovery Learning Cycle
Sources: From Carin & Sund, (1989), p. 99

In the late 1980s, Rodger Bybee modified the learning cycle to include additional phases such as engagement, exploration, explanation, elaboration, and evaluation (see Figure 2).



Sources: From Moyre, Hackett & Everett, (2007), p. 12
Figure 2 The 5E Discovery Learning Cycle

In 2008, Page Keeley formulated the science assessment, instruction, and learning cycle consists of engagement and readiness, eliciting prior knowledge, exploration and discovery, concept and skill development, concept and skill transfer, and self-assessment and reflection. Based on the above consideration factors of discovery learning, researcher develops the proposed discovery learning model for science teaching in basic education.

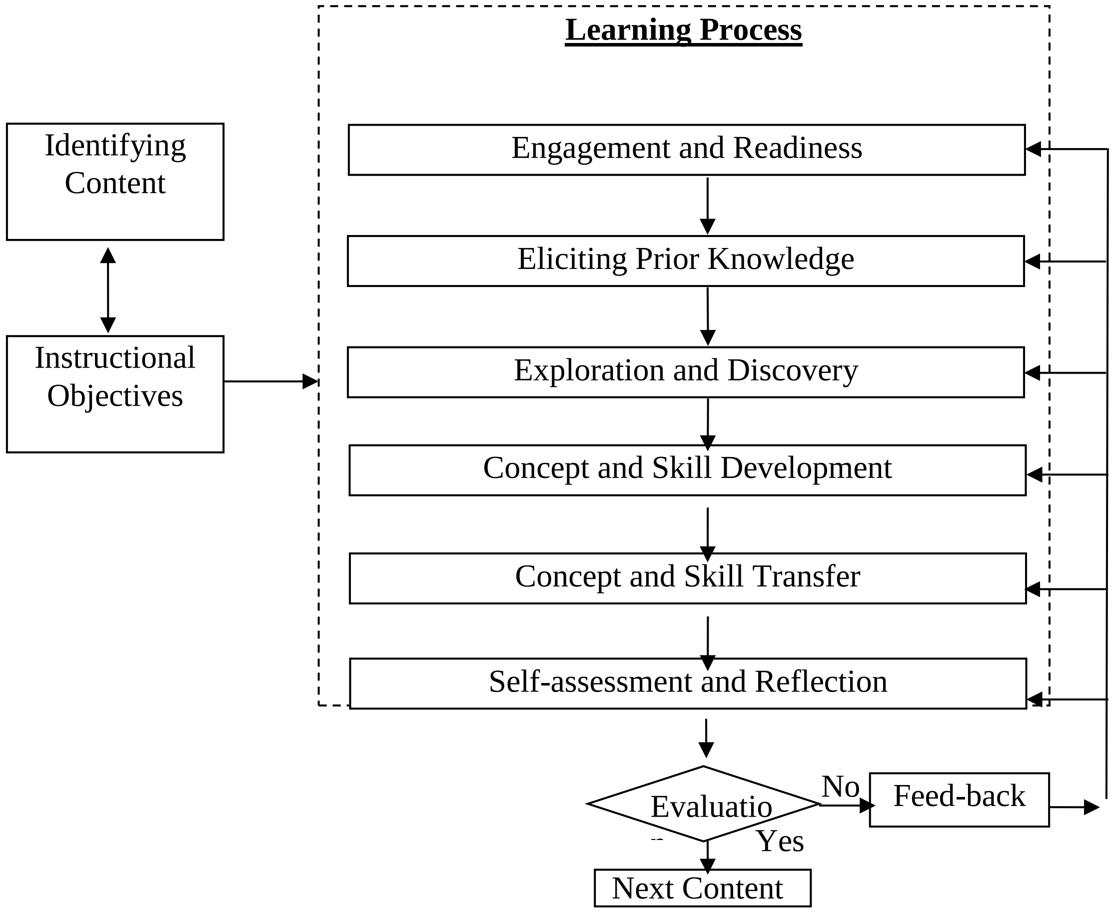


Figure 3 Proposed Discovery Learning Model for Science Teaching in Basic Education Methodology

The study was conducted with both quantitative and qualitative research methods. Quantitatively, it consists of both descriptive study and experimental study.

Quantitative Research Method

Descriptive Study

Subjects

The subjects for this study were selected from the Yangon City Development Area by using stratified random sampling method.

Table 1 Selected Townships and Subjects from Yangon City Development Area

Strata	No.of Townships	No.of Selected Townships	No.of Subjects from Each Township	No. of Selected Subjects from Each Strata
Inner City	8	2	22	44
Inner Suburb	9	2	22	44
Outer Suburb	6	2	22	44
Satellite	10	3	22	66
Total	**33**	**9**	**88**	**198**

Instrument

For this study, a set of questionnaires was used to find out whether junior assistant science teachers', especially Grade Six science teachers' teaching-learning activities were linked with the six stages of the discovery learning cycle. The six stages of the discovery learning cycle are (1) Engagement and Readiness (ER), (2) Eliciting Prior Knowledge (EPK), (3) Exploration and Discovery (ED), (4) Concept and Skill Development (CSD), (5) Concept and Skill Transfer (CST), (6) Self-Assessment and Reflection (SAR). It was developed by Page Keeley, (2008). The questionnaire include (44) items of questions to describe teachers' teaching-learning activities in science teaching comprising (42) items of five-point Likert-scale and two open-ended questions.

Procedure

First, literature study concerning with discovery learning was explored and a questionnaire was constructed based on the six stages of discovery learning cycle for junior assistant teachers' teaching- learning activities under the supervision of the supervisor and co-supervisor. For the validation of the research instrument, questionnaires were sent to teacher educators and junior assistant science teachers. Necessary modifications were made under the supervision of the supervisor and co-supervisor. After getting the validation, a pilot test was conducted with (50) junior assistant science teachers from schools in Sanchaung Township in June, 2013. After the pilot test, the major survey was conducted in July, 2013. Questionnaires were distributed to (198) junior assistant science teachers from selected schools. After collecting the questionnaires, data were analyzed by using the Statistical Package for the Social Science (SPSS 20).

Data Analysis

The data were analyzed by using descriptive statistics (mean, standard deviation, frequency, percentage) and one way ANOVA (analysis of variance).

Experimental Study

Subjects

In the experimental study, the subjects were Grade Six students selected from the schools in which the teachers' teaching-learning activities are moderately linked to discovery learning.

Table 2 Sample Size from Four Selected Schools

Strata	Name of School	No. of Subjects		
		Control	Experimental	Total
Inner City	BEMS (1),Mingalartaungnyunt	47	47	94
Inner Suburb	BEMS (4), Hlaing	50	50	100
Outer Suburb	BEMS (5), Mingalardon	43	43	86
Satellite	BEHS (3), North Okkalapa	56	56	112

Experimental Design

The experimental design adopted in this study was one of the quasi-experimental designs, namely, nonequivalent control group design.

Table 3 Experimental Design

Group	No. of Subjects				Pretest	Treatment	Posttest
	BEMS(1)	BEMS(4)	BEMS(5)	BEHS(3)			
Control	47	50	43	56	BSK	Teacher-Centered	SA
Experimental	47	50	43	56	BSK	Discovery Learning	SA

Note: BSK= Basic Science Knowledge, SA= Science Achievement

Instrument

(a) Pretest

The pretest consists of (30) multiple choice items. Test items were constructed based on Grade Five Basic Science textbook.

(b) Posttest

The posttest consists of two sections. Section (A) consists of (30) multiple choice items and section (B) consists of (10) short-answer items. Test items were constructed on Chapter (4), "Energy" from Grade Six General Science textbook.

Procedure

In order to measure the prerequisite knowledge of the selected sample students, a pretest was administered before the treatment was provided. All the selected students had to take it. After that the experimental group was treated with discovery learning and the control group was taught as usual. Posttest was conducted in order to identify whether there is any significant difference between those who did discovery learning and those who did not.

Data Analysis

The data were analyzed by using descriptive statistics, the independent samples *t*-test to compare the differences between the control group and experimental group.

Qualitative Research Method

A qualitative study was conducted to collect the information that could not be observed directly such as students' attitudes, feelings, experiences, and opinions towards discovery learning.

Subjects

To obtain the necessary qualitative data, students were selected from the experimental groups of four schools (see Table 4).

Table 4 Sample Size from Four Selected Schools

Strata	Name of School	No. of Subjects
Inner City	BEMS(1), Mingalartaungnyunt	47
Inner Suburb	BEMS (4), Hlaing	50
Outer Suburb	BEMS (5), Mingalardon	43
Satellite	BEHS (3), North Okkalapa	56

Instrument

To examine the students' attitudes, feelings, experiences, and opinions, a questionnaire was constructed with (15) items of four-point Likert-scale and (5) open ended questions. For four science teachers from the four selected schools, ten open-ended questions were also constructed to interview their attitude towards discovery learning.

Findings

Quantitative Research Findings

Findings of Descriptive Study

According to the finding, the mean score of the engagement and readiness stage is the highest and the mean score of the exploration and discovery stage is the lowest in the six stages of discovery learning (see Table 5). It can be interpreted that, the activities of the junior assistant science teachers are strongly linked with the engagement and readiness stage but weakly linked with the exploration and discovery stage of the discovery learning cycle.

Table 5 Mean and Standard Deviation of Junior Assistant Science Teachers' Teaching-Learning Activities on Six Stages of Discovery Learning Cycle

Teaching Stage	No. of Subjects	Mean	Standard Deviation
Engagement and Readiness (ER)	198	4.33	.470
Eliciting Prior Knowledge (EPK)	198	4.01	.609
Exploration and Discovery (ED)	198	3.67	.621
Concept and Skill Development (CSD)	198	3.89	.739
Concept and Skill Transfer (CST)	198	3.84	.733
Self-Assessment and Reflection (SAR)	198	3.90	.685
Total	**198**	**3.89**	**.488**

Findings of Experimental Study

Findings of Posttest

The mean score of the experimental group was significantly higher than that of the control group in each school (see Table 6). It can be interpreted that the use of discovery learning has significant effect on the overall science achievement of the students

Table 6 *t*-values for Posttest Science Achievement Scores from Four Selected Schools

School	Group	N	M	SD	MD	*t*	*df*	Sig(2tailed)
BEMS (1) Mingalar taungnyunt	Control	47	24.98	5.52	−11.74	− 13.91	92	.000***
	Experimental	47	36.72	2.43				
BEMS (4) Hlaing	Control	50	26.44	3.67	− 9.32	−13.54	98	.000***
	Experimental	50	35.76	3.19				
BEMS (5) Mingalardon	Control	43	25.07	4.41	− 9.46	− 11.63	84	.000***
	Experimental	43	34.53	3.00				
BEHS (3) North Okkalapa	Control	56	27.82	3.71	− 9.86	−16.96	110	.000***
	Experimental	56	37.68	2.26				

Note: ****p*<.001

There was a significant difference between the control group and experimental group in No. (4) BEMS Hlaing. But there was no significant difference between the control group and the experimental group in three schools. It can be interpreted that teacher-centered technique can also bring about the improvement of students' ability to remember previously learned materials as discovery learning (see Table 7).

Table 7 *t*-values for Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig (2tailed)
BEMS (1) Mingalar-taungnyunt	Control	47	3.72	0.54	− 0.15	− 1.60	92	.112
	Experimental	47	3.87	0.34				
BEMS (4) Hlaing	Control	50	3.08	0.77	− 0.62	− 4.72	98	.000***
	Experimental	50	3.70	0.50				
BEMS (5) Mingalardon	Control	43	3.47	0.79	− 0.18	− 1.21	84	.238
	Experimental	43	3.65	0.62				
BEHS (3) North Okkalapa	Control	56	3.79	0.45	− 0.07	− 0.93	110	.356
	Experimental	56	3.86	0.35				

Note: **********p*<.001

On the comprehension level questions, the mean score of experimental group was significantly higher than that of control group in each school (see Table 8). It can be interpreted that discovery learning can encourage the improvement of students' conceptual understanding.

Table 8 *t*-values for Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig (2tailed)
BEMS (1) Mingalar-taungnyunt	Control	47	7.23	1.56	− 2.28	− 9.28	92	.000***
	Experimental	47	9.51	0.62				
BEMS (4) Hlaing	Control	50	7.60	1.37	− 1.42	− 6.05	98	.000***
	Experimental	50	9.02	0.94				
BEMS (5) Mingalardon	Control	43	7.49	1.50	− 1.30	− 4.61	84	.000***
	Experimental	43	8.79	1.08				
BEHS (3) North Okkalapa	Control	56	7.73	1.24	− 1.59	− 7.70	110	.000***
	Experimental	56	9.32	0.92				

Note: ***p<.001

On the application level questions, the mean score of experimental group was significantly higher than that of control group in each school (see Table 9). It can be interpreted that discovery learning can bring about the improvement of students' ability to apply science concepts in new situations.

Table 9 *t*-values for Scores on Application Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig (2tailed)
BEMS (1) Mingalar-taungnyunt	Control	47	6.11	1.68	− 3.06	− 10.95	92	.000***
	Experimental	47	9.17	0.95				
BEMS (4) Hlaing	Control	50	6.64	1.27	− 1.92	− 7.71	98	.000***
	Experimental	50	8.56	1.21				
BEMS (5) Mingalardon	Control	43	6.40	1.61	− 3.13	− 10.65	84	.000***
	Experimental	43	9.53	1.08				
BEHS (3) North Okkalapa	Control	56	5.96	1.38	− 2.61	− 12.71	110	.000***
	Experimental	56	8.57	0.65				

Note: ***p<.001

On the analysis level questions, the mean score of experimental group was significantly higher than that of control group in each school (see Table 10). It can be interpreted that discovery learning can enhance the ability of students' analytical understanding of science concepts.

Table 10 *t*-values for Scores on Analysis Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig (2tailed)
BEMS (1) Mingalar-taungnyunt	Control	47	7.28	2.09	− 3.40	− 9.67	92	.000***
	Experimental	47	10.68	1.20				
BEMS (4) Hlaing	Control	50	8.06	1.79	− 2.86	− 9.76	98	.000***
	Experimental	50	10.92	1.04				
BEMS (5) Mingalardon	Control	43	7.05	1.86	− 2.42	− 7.41	84	.000***
	Experimental	43	9.47	1.05				
BEHS (3) North Okkalapa	Control	56	8.41	1.42	− 2.77	− 11.59	110	.000***
	Experimental	56	11.18	1.08				

Note: ***p<.001

On the synthesis level questions, the mean score of experimental group was significantly higher than that of control group in each school (see Table 11). It can be interpreted that discovery learning can enhance the students' ability to synthesize their science concepts and ideas.

Table 11 *t*-values for Scores on Synthesis Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig (2tailed)
BEMS (1) Mingalar-taungnyunt	Control	47	0.98	0.49	− 0.91	− 10.82	92	.000***
	Experimental	47	1.89	0.31				
BEMS (4) Hlaing	Control	50	1.04	0.40	− 0.82	− 10.87	98	.000***
	Experimental	50	1.86	0.35				
BEMS (5) Mingalardon	Control	43	1.33	0.61	− 0.62	− 6.41	84	.000***
	Experimental	43	1.95	0.21				
BEHS (3) North Okkalapa	Control	56	1.27	0.56	− 0.66	− 8.06	110	.000***
	Experimental	56	1.93	0.26				

Note: ***p<.001

On the evaluation level questions, the mean score of experimental group was significantly higher than that of control group in each school (see Table 12). It can be interpreted that discovery learning can bring about the improvement of students' evaluation skill.

Table 12 *t*-values for Scores on Evaluation Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig (2tailed)
BEMS (1) Mingalar-taungnyunt	Control	47	0.87	1.01	− 1.73	− 9.82	92	.000***
	Experimental	47	2.60	0.65				
BEMS (4) Hlaing	Control	50	0.80	0.88	− 1.82	− 11.28	98	.000***
	Experimental	50	2.62	0.72				
BEMS (5) Mingalardon	Control	43	0.30	0.51	− 2.12	− 17.79	84	.000***
	Experimental	43	2.42	0.59				
BEHS (3) North Okkalapa	Control	56	0.88	0.83	− 1.94	− 15.53	110	.000***
	Experimental	56	2.82	0.43				

Note: ***p<.001

In summary, there was a significant difference between the control and experimental groups for the scores on the overall science achievement in all the selected schools. It can be interpreted that the use of discovery learning has significant effect on the overall science achievement of the students.

Qualitative Research Findings

In this research study, the qualitative study for the students from the experimental group of four selected schools was carried out with a questionnaire. It consists of (15) items four-point Likert-scale and five open ended questions. In this study, it was found that learning by doing makes the students develop their self-reliance and self-confidence. Most of the students expressed that they were very happy by using teaching learning materials in the discovery learning. They learned their classmates' opinions during discussion. They gained the habit of cooperation with others. Moreover, this learning was really new experiences as they had never worked in groups, they had a good chance to cooperate with their classmates in doing the activities.

For the qualitative study for the teachers from the experimental group of four selected schools, ten open-ended questions were constructed to interview their attitudes towards discovery learning. Most of the science teachers described that the discovery learning has many advantages for students, science lessons become very alive by using teaching aids effectively in this learning. Students can understand the learning materials very easily and clearly. But, some of the science teachers mentioned that there were some difficulties to perform this learning because of the limitation of time, over-crowded students in a classroom, the limitations of the space of classroom and shortage of teaching aids. Although there are some difficulties to perform the discovery learning effectively, most of the science teachers mentioned that the use of discovery learning had significant effect on the overall science achievement of the students. Thus, discovery learning has positive contribution to the science teaching and learning at the middle school level.

Discussion and Suggestions

Science teaching is an important and vital topic in modern education. In science teaching, teacher's role expands to helping students use various strategies to understand how well they are learning. When students are challenged by something they want to learn, they try to consider any incoming data in the light of related information from previous experiences. The more they are involved in solving problems, the more likely they are to learn to generalize what they have learned into a style of discovery that serves them best. In the discovery learning process, the students draw on their past experiences and existing knowledge to discover facts and relationships and new truths to be learned. Students interact with the world by exploring and manipulating objects and performing experiments.

According to the descriptive results, the mean score of the engagement and readiness stage is the highest and the mean score of the exploration and discovery stage is the lowest in the six stages of discovery learning. It can be interpreted that, the activities of the junior assistant science teachers are strongly linked with the engagement and readiness stage but weakly linked with the exploration and discovery stage of the discovery learning cycle.

According to the experimental results, there was no significant difference between the control and the experimental groups for the pretest in each school. It can be interpreted that, the students from the control group and experimental group in each school had the same prior knowledge before the treatment was provided. The posttest mean score of the experimental groups was significantly higher than that of the control group in each school. The findings point out that the discovery learning has significant effect on the science achievement of the students. This finding supports the research report of Holfwolt (1984): discovery learning produces significant learner achievement in science learning that compared to more traditional teacher and textbook centered.

In the responses of open-ended questions, most of the students describes that they were pleased when they could find the answer by doing the activities in the discovery learning. It can be interpreted that, most of the students want to learn the science lessons by doing the activities themselves. Bruner (1977) suggested that students are more likely to remember concepts if they discover them on their own. He stated that students could be more successful learners by working in environments that facilitated discovery, actively exploring information in order to find connections with what they already know and forming conclusions from this exploration.

The students expressed in the responses of open-ended questions that they were very happy in learning by using discovery learning, because they did not need to memorize everything in that learning. They gained the habit of self-reliance and self-confidence by answering the questions that are based on their own experiences. Some students (20%) from No. (4) BEMS Hlaing and (15%) from No. (3) BEHS North Okkalapa did not strongly agree to the item that learning by asking questions, answering questions and discussing their opinions make the students develop their desire to learn. Some of the students described that they had worries in asking questions and discussing their opinions because this experience was unusual for them. It is one of the responsibilities of the science teachers to cultivate the students to develop their interpersonal skill by making discussion, asking questions, expression and sharing their own opinions with others.

In the responses of open-ended questions, some science teachers mentioned that they realized that discovery learning is of great value for the teachers and students for science teaching and learning, but there were some difficulties to perform this learning because of the limitation of time, over-crowded students in the classroom, the limitations of the space of classroom and shortage of teaching aids. It is suggested that the arrangement of the space should be made easy and natural for the students to work together and talk to each other.

During the observation, it was found that there are not enough classrooms in some schools. The space of the classroom is also one of the difficulties for doing activities. If the schools have enough teaching learning materials, classrooms and teachers, discovery learning can be appropriately and effectively used in science classrooms. The trend towards hands-on learning cannot take place in science classroom in the absence of equipment and supplies. It is suggested that teachers should be encouraged to use a variety of instructional materials and resources. Moreover, the Ministry of Education should provide greater support for science education, particularly in terms of equipment and supplies budget.

At the last stage of the discovery learning cycle, reflection and self-assessment, the students from the experimental group were given the opportunity to think about how ideas have changed and how well one understands the concept and skills. Some students have difficulties to perform at this stage because this experience was unusual for them. Therefore, science teachers have to cultivate the students to develop this self-assessment and reflection skills. This skill is very important for students to successful learning in the discovery learning. Moreover, one of the difficulties of the teachers is that the content of the syllabus is to be taught for the final exam and all become exam-centered, that can hinder the use of discovery learning in science teaching. Another important issue is that the students' outcomes are associated with memorization of facts without understanding the concepts. Therefore, it is suggested that the focus of instruction and assessment should be changed from factual information to exploration of students' ideas and reasoning that emphasize understanding of science concepts. In doing so, teachers should evaluate students' understanding of cognitive processes by asking students "What, How, Why" questions related to the targeted skill.

The examination oriented system that determines the students' grade may not be the most appropriate and fair assessment of students' abilities and is conducive to rote learning. Therefore, it is suggested that the assessment system should be changed to the continuous assessment of the practical or activity based work and the weightage for continuous assessment be added to the final examination to calculate final grade or score to be awarded to a student. In the responses of open-ended questions, most of the teachers expressed that they have so many tasks to perform in the time available. They feel overloaded especially for monthly tests. Therefore, it is suggested that teachers need enough time to prepare the materials for their science activities. The degree to which teachers have preparation time positively influences the degree to which they use hands-on, minds-on, interactive teaching approaches to achieve students' science process skills. When curriculum is implemented, sufficient emphasis should be placed on the development of students' understanding, process skills and high level cognitive outcomes.

It is hoped that by using discover learning in the classroom, students can be well prepared to meet the challenges of their future in a rapidly changing world. Although discovery learning cannot solve all the problems faced by the teachers in teaching and learning science today, it is hoped that this learning can be useful to some extent for science teaching.

Conclusion

The main purpose of this research is to investigate the effectiveness of discovery learning in teaching lower secondary science. Both quantitative and qualitative studies were conducted to obtain the required data. Firstly, a descriptive survey was made to explore whether there was a link between the junior assistant science teachers' teaching-learning activities and the six stages of discovery learning cycle. Data were collected through a questionnaire. According to the descriptive results, the activities of the junior assistant science teachers are strongly linked with the engagement and readiness stage of the discovery learning cycle, but weakly linked with the exploration and discovery stage of the discovery learning cycle. Moreover, one way ANOVA was also used to examine the differences among the strata. It was found that there were no significant differences among the strata concerning junior assistant science teachers' teaching-learning activities on discovery learning cycle.

Secondly, an experimental research design was used to investigate the effectiveness of discovery learning. Posttest results showed that there was a significant difference between the control group and experimental group on the overall science achievement in each school.

Generalization can be drawn on the basis of the results. In terms of the statistical results, students' performance had significant difference on the overall science achievement and achievement of comprehension, application, analysis, synthesis, and evaluation level questions. Teacher and textbook centered techniques can also bring about the improvement of lower levels of cognitive domain as discovery learning. It can be interpreted that discovery learning can encourage the improvement of the students' higher order thinking skills.

The results of qualitative findings indicate that the attitude and values of students towards the subjects, towards themselves and towards others were also developed. Students described that they could express their own opinions in the discovery learning. Moreover, they learned their classmates' opinions during discussion. They gained the habit of cooperation with others. Some of the students described that they were afraid at the beginning and later became happy. They were pleased when they could find the answer by themselves.

Most of the science teachers described that the discovery learning has many advantages for students, science lessons become very alive by using teaching aids effectively in this learning.

Students can understand the learning materials very easily and clearly. It can be interpreted that, student become very active participant by using teaching aids effectively in discover learning. Most of the science teachers mentioned that the use of discovery learning had significant effect on the overall science achievement of the students. The qualitative data also supported the findings of the quantitative data.

To sum up, this study showed that discovery learning can provide teachers with many insights into how students can learn about and appreciate science. Moreover discovery learning is useful not only in improving achievement but also in helping students to construct their views about science and develop thinking ability. The effective use of discovery learning has significant effect on the overall science achievement of the students. Discovery learning surely has positive contribution to the science teaching at the middle school level.

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THE EFFECTIVENESS OF ADVANCE ORGANIZER MODEL ON STUDENTS' SCIENCE ACHIEVEMENT AT THE MIDDLE SCHOOL LEVEL

Swe Zin Thant[1] and Thida Wai[2]

Abstract

The major purpose of this research was to study effectiveness of Advance Organizer Model on students' science achievement at the middle school level. This study was conducted with both quantitative and qualitative research methods. For quantitative research, an experimental study was used to study effectiveness of Advance Organizer Model. In this experimental study, the subjects were Grade Eight students selected from No (1) BEHS Latha and No (4) BEHS Pazundaung. The experimental designed adopted in this study was a true experimental design, namely, posttest only control group design. For this study, (120) Grade Eight students were selected from both schools by random sampling method. These students were divided into two groups: control and experimental. The experimental group was treated with Advance Organizer Model and the control group was taught with formal instruction. After that, a posttest was administered to two groups. Independent samples t-test was used to test whether there was significant difference between these two groups. Examination of the means and t-test at No (1) BEHS Latha (t=11.99, df =58, MD=7.94, p=.000) and No (4) BEHS Pazundaung (t=13.90, df=58, MD=8.30, p=.000) indicated that students who were taught by Advance Organizer Model demonstrated significantly better than those who were taught with formal instruction. The qualitative data also supported the findings from the experimentation. For this research study, students from the experimental group from two selected schools were given a questionnaire. The results showed that the students expressed their willingness to learn in Advance Organizer Model and they had positive attitudes towards this Advance Organizer Model. Research findings proved that Advance Organizer Model has positive contribution to the science teaching at the middle school level.

Keywords: Effectiveness, Advance Organizer Model, Science, Achievement

Introduction

Education is a continuous and lifelong process. The aim of education is not to prepare people only for the present, but also to prepare them for the future and to train them in such a manner that they can meet the challenges of the future in an appropriate manner. In addition, education is a foundation for socioeconomic development of a country. In national education strategic plan (NESP), the purpose of Myanmar's national education system is to equip students, youth and adult learners with the knowledge and skills they need to succeed in the 21st century (Ministry of Education [MOE], 2016).

In 21st century, the world has dramatically changed and many challenges have been emerged. In order to keep up with and to confront them, teaching demands a complicated activity that requires creative thinking and a commitment to lifelong learning. Thus, teachers must not give a fish to students and they must teach them how to get a fish. Teachers must decide wisely which teaching methods are the best suitable for their students like painters and sculptors. In making decisions for teaching methods, learners' needs and societal needs will be taken into

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account. Accordingly, teaching methods used in the classroom must be aligned with 21st century skills. Nevertheless, the purpose of teaching is to facilitate learning.

Learning should be meaningful to prepare students for confrontation with the challenges of 21^{st} century. Ausubel (2000) described that meaningful learning occurs when material is related to existing cognitive structure in nonverbatim and nonarbitrary manner. In rote learning, students have to overlearn for retrieval of learned information from the memory. They have to put more effort into their learning without understanding the relationships between concepts, rules and propositions. In this way, learning becomes a burden for students. Rote learning gives boredom to students and locks their thinking skills. Teachers should have a key to unlock this door for students' thinking skills. Only meaningful learning encourages thinking, creativity and innovation. Not to occur rote learning in students, teachers can use Advance Organizer Model which is based on meaningful verbal learning. The purpose of this research is to investigate the effectiveness of Advance Organizer Model (AOM) on students' science achievement at the middle school level.

Purposes of the Study

The major purpose of this study is to study the effectiveness of Advance Organizer Model on students' science achievement at the middle school level.

The specific purposes are as follow:

- To compare science achievement between students who are taught by Advance Organizer Model and those who are not
- To investigate students' attitudes towards Advance Organizer Model
- To make suggestions for improving science teaching based on the data obtained from this study

Research Hypotheses

1. There is a significant difference in the achievement on science learning between Grade Eight students who are taught by Advance Organizer Model and those who are not.
2. There is a significant difference in performing knowledge level questions on science learning between Grade Eight students who are taught by Advance Organizer Model and those who are not.
3. There is a significant difference in performing comprehension level questions on science learning between Grade Eight students who are taught by Advance Organizer Model and those who are not.
4. There is a significant difference in performing application level questions on science learning between Grade Eight students who are taught by Advance Organizer Model and those who are not.
5. The students who learned with Advance Organizer Model have positive attitudes toward learning, interest in inquiry, and habits of precise thinking.

Definition of the Key Terms

- **Effectiveness is** a measure of the match between stated goals and their achievement (Fraser, 1994, as cited in Harvey, 2018).

- **Advance organizer** can be defined as introductory material presented ahead of the learning task and at a higher level of abstraction and inclusiveness than the learning task itself (Ausubel, 1968, as cited in Joyce & Weil, 2003).
- **Science** can be defined as an interconnected series of concepts and conceptual; schemes that have developed as a result of experimentation and observation (Conant, 1951).
- **Achievement** can be defined as the students' grasp of some body of knowledge or proficiency in certain skills (Tinambunan, 1988).

Scope of the Study

The following points are the scope of the study.

- This study is geographically restricted to Yangon Region.
- No (1) BEHS Latha and No (4) BEHS Pazundaung are selected for this study.
- Participants of this study are (120) Grade Eight students from selected schools in the academic year (2018-2019).
- The content area is limited to chapter five: The Earth and Space from Grade Eight General Science Textbook.

Review of Related Literature

The philosophy of education is the most important aspect of teacher training because it explains how educational theories arise. By examining the philosophy of education, teachers are able to see why and how theories complement or oppose each other. Educational theories are backbones of successful teaching and learning processes. If teachers understand and avail them effectively, they can bring meaningful learning to students.

Information Processing Theory

Information processing theory focuses on how people attend to environmental events, encode information to be learned and relate it to knowledge in memory, store new knowledge in memory, and retrieve it as needed (Shuell, 1986 as cited in Schunk, 2012). According to Mayer (1996), humans are processors of information. The mind is an information-processing system. Cognition is a series of mental processes. Learning is the acquisition of mental representations. Learners are active seekers and processors of information. If teachers understand how learners process information, they can design learning experiences that optimize this activity.

Meaningful Reception Learning Theory

The acquisition of new meanings from presented learning material makes meaningful reception learning. To be meaningful, there are two requirements: a meaningful learning set and the presentation of potentially meaningful materials to the learner. Meaningful learning and the learning of meaningful material are not same. First, the learning material is only potentially meaningful. Second, a meaningful learning set must be present. Learning material may consist of already meaningful components, but each component of the learning task and the learning task as a whole is not logically meaningful. If the learner's learning set is not meaningful, even logically meaningful material may be learned by rote (Ausubel, 2000). Three kinds of meaningful reception learning may be distinguished: representational learning, concept learning and propositional learning.

Like all learning, reception learning is meaningful when the learning task is related in nonarbitrary and nonverbatim fashion to relevant aspects of what the learner already knows. Meaningful reception learning is inherently an active process because it requires at the very least (i) the kind of cognitive analysis necessary for ascertaining which aspects of existing cognitive structure are most relevant to the new potentially meaningful material; (ii) some degree of reconciliation with existing ideas in cognitive structure; and (iii) reformulation of the learning material in terms of the idiosyncratic intellectual background and vocabulary of the particular learner.

Advance Organizer Model

Advance Organizer Model was based on meaningful verbal learning theory developed by David Ausubel. This theory deals with some concerns: how knowledge is organized, how the mind works to process new information, and how teachers can apply these ideas about curriculum and learning when they present new material to students. In other words, they are curriculum, learning and instruction. Primary goal is to help teachers organize and convey large amounts of information as meaningfully and efficiently as possible.

Advance organizers were "an introductory material presented ahead of the learning task and at a higher level of abstraction and inclusiveness than the learning task itself" (Ausubel, 1978). The heart of Ausubel's definition of an advance organizer is its ability to provide ideational scaffolding. The aim of the advance organizer is not only to provide ideational scaffolding for the specifics in the learning passage, but also to increase discriminability between the new ideas and the previously learned ideas by pointing out explicitly the principal similarities and differences between them (Ausubel, 1978).

Guidelines for Constructing an Advance Organizer

Constructing an advance organizer is the task of the teacher. The teacher determines the structure of the discipline, content, or subject to be mastered and then develops the organizer. Some guidelines for this process may be helpful.

1. Short set of verbal or visual information.
2. Presented prior to learning a larger body of to-be-learned information.
3. Containing no specific content from the to-be-learned information.
4. Providing a means of generating the logical relationships among the elements to be learned information.
5. Influencing the learner's encoding process (Mayer, 1979).

The specific construction of advance organizer will depend on subject matter, learners, and the desired learning outcome.

Characteristics of Advance Organizer Model

Advance Organizer Model has the following characteristics.

(i) Syntax of Advance Organizer Model

Advance Organizer Model consists of three phases: the presentation of the advance organizer, the presentation of the learning task or learning material and the strengthening of cognitive organization. Phase one includes of three activities: clarifying the aims of the lesson, presenting the advance organizer, and prompting awareness of relevant knowledge. In phase two, the learning material is presented in the form of lectures, discussions, films, experiments, or reading. Phase three tests the relationship of the learning material to existing ideas to bring about an active learning process. The purpose of phase three is to anchor the new learning material in the students' existing cognitive structure. It will strengthen the student's cognitive organization (Joyce & Weil, 2003).

Table 1 Syntax of Advance Organizer Model

Phase One: Presentation of Advance Organizer
Clarify the aims of the lesson. Present organizer: • Identify defining attributes. • Give examples or illustrations where appropriate. • Provide context. • Repeat. Prompt awareness of learner's relevant knowledge and experience.
Phase Two: Presentation of Learning Task or Material
Present material. Maintain attention. Make organization explicit. Make logical order of learning material explicit.
Phase Three: Strengthening Cognitive Organization
Use principles of integrative reconciliation. Promote active reception learning. Elicit critical approach to subject matter. Clarify ideas (such as by testing them).

Source: From Joyce & Weil (2003)

(ii) Social System

In this model, the teacher retains control of the intellectual structure, since it is continually necessary to relate the learning material to the organizers and to help students differentiate new material from previously learned material.

(iii) Principles of Reaction

The teacher's solicited or unsolicited responses to the learners' reactions will be guided by the purpose of clarifying the meaning of the new learning material, differentiating it from and reconciling it with existing knowledge, making it personally relevant to the students, and helping to promote a critical approach to knowledge. Ideally, students will initiate their own questions in response to their own drives for meaning.

(iv) Support System

Well-organized material is the critical support requirement of this model. The effectiveness of an advance organizer depends on an integral and appropriate relationship between the conceptual organizer and the content. This model provides guidelines for building (or reorganizing) instructional materials.

(v) Application

Advance Organizer Model is especially useful to structure extended curriculum sequences or courses and to instruct students systematically in the key ideas of a field.

The model can also be shaped to teach the skills of effective reception learning. Critical thinking and cognitive reorganization can be explained to the learners, who receive direct instruction in orderly thinking and in the notion of knowledge hierarchies. This model can increase effectiveness in reading and watching films, and in other "reception" activities.

(vi) Instructional and Nurturant Effects

The probable instructional values of this model seem clear because the ideas themselves that are used as the organizer are learned, as well as information presented to the students. The ability to learn from reading, lectures, and other media used for presentations is another effect, as are an interest in inquiry and precise habits of thinking.

Method

Population and Sample size

Two Basic Education High Schools in Yangon Region were selected as the sample schools for experimental design by using simple random sampling method. These sample schools were No (1) BEHS Latha and No (4) BEHS Pazundaung. All the participants in the sample were Grade Eight students. In both schools, only 60 students were selected by random sampling method from Grade Eight in the academic year 2018-2019.

Table 2 Population and Sample Size

Name of School	No. of Population	No. of Student
BEHS (Latha)	235	60
BEHS (Pazundaung)	172	60

Research Design

The design adopted in this study was one of the true experimental designs, namely, the posttest only control group design (Gay & Airasian, 2003).

Table 3 Experimental Design

<table>
<tr><th rowspan="2">Assignment</th><th rowspan="2">Group</th><th colspan="3">No. of Students</th><th rowspan="2">Treatment (X)</th><th rowspan="2">Posttest (O)</th></tr>
<tr><th>BEHS (Latha)</th><th>BEHS (Pazundaung)</th><th>Total</th></tr>
<tr><td rowspan="2">Random (R)</td><td>Experimental</td><td>30</td><td>30</td><td>60</td><td>Advance Organizer Model</td><td rowspan="2">SA</td></tr>
<tr><td>Control</td><td>30</td><td>30</td><td>60</td><td>Formal Instruction</td></tr>
<tr><td colspan="2">Total</td><td>60</td><td>60</td><td>120</td><td></td><td></td></tr>
</table>

Note: SA = Science Achievement

Instrument

The instrument used for this study was a posttest (Achievement test). To establish the reliability of the instrument, a pilot study was conducted with Grade Eight students at No (2)

BEHS Dagon Seikkan. Before the test, validation related to the achievement test was asked from (5) experienced teachers. And then, the teacher gave instruction which was based on Advance Organizer Model to students. And these students were given enough time to answer the questions of the test. The reliability coefficient, Cronbach's alpha was computed to show the internal consistency of the test. Its value was 0.72. The instrument was constructed in line with the first three levels of Bloom's taxonomy. The allocate time for the posttest was (45) minutes and the given marks were (25). To examine students' attitudes, feelings, experiences and opinions, a questionnaire was constructed with the advices and guidance of the supervisor. It consists of (15) items four point Likert-scale.

Procedure

This study was to investigate the effectiveness of Advance Organizer Model on science achievement of Grade Eight students. Students were divided into two groups in each school: the control group and the experimental group. There were 30 students in each group. For the control group, the teacher taught as usual in the classroom. The experimental group was provided a treatment by using Advance Organizer Model. For the experimental group, the teacher used the phases in Advance Organizer Model. At the end of the treatment period, all the selected students had to sit for the posttest in both schools. And then, a follow up program was found out by a questionnaire to interpret students' attitudes, feelings, experiences and opinions about Advance Organizer Model.

Data Analysis

The independent samples "*t*" test was used to compare the achievement of students who learned by Advance Organizer Model and that of students who learned by formal instruction.

Findings

This section is concerned with findings of the selected students' achievement on the posttest questions, the summary of the findings and interpretations of the study.

Table 4 *t* Values for Posttest Science Achievement Scores

School	Group	N	M	SD	MD	*t*	*df*	Sig.(2-tailed)
BEHS (Latha)	Experimental	30	22.37	1.43	7.94	11.99	58	.000***
	Control	30	14.43	3.33				
BEHS (Pazundaung)	Experimental	30	22.40	1.40	8.30	13.90	58	.000***
	Control	30	14.10	2.29				

Note: ***$p < .001$

The mean scores of the experimental groups were significantly higher than that of the control groups in each school (see Table 4). It showed that there was a significant difference between students who were taught by Advance Organizer Model and those who were taught with formal instruction on the overall scores of science achievement in each school.

Table 5 *t* Values for Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (Latha)	Experimental	30	6.27	0.94	1.54	5.85	58	.000***
	Control	30	4.73	1.08				
BEHS (Pazundaung)	Experimental	30	6.30	0.92	1.67	7.00	58	.000***
	Control	30	4.63	0.93				

Note: ****p* < .001

Results of knowledge level questions showed that the mean scores of the experimental groups were significantly higher than that of the control groups in each school (see Table 5). It showed that there was a significant difference between students who were taught by Advance Organizer Model and those who were taught with formal instruction on the scores of knowledge level questions in each selected school.

Table 6 *t* Values for Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
BEHS (Latha)	Experimental	30	6.63	0.94	2.36	6.81	58	.000***
	Control	30	4.27	1.61				
BEHS (Pazundaung)	Experimental	30	6.63	0.99	2.56	8.63	58	.000***
	Control	30	4.07	1.29				

Note: ****p* < .001

According to the scores on comprehension level questions, the mean scores of the experimental groups were significantly higher than that of the control groups in each selected school (see Table 6). It showed that there was a significance difference between students who were taught by Advance Organizer Model and those who were taught with formal instruction on the scores of the comprehension level questions in the selected schools.

Table 7 *t* Values for Scores on Application Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig.(2-tailed)
BEHS (Latha)	Experimental	30	9.47	0.81	3.90	11.57	58	.000***
	Control	30	5.57	1.65				
BEHS (Pazundaung)	Experimental	30	9.77	1.92	4.34	8.60	58	.000***
	Control	30	5.43	1.97				

Note: ****p* < .001

As regards with the scores on the application level questions, the mean scores of the experimental groups were significantly higher than that of the control groups in each school (see Table 7). It showed that there was a significant difference between students who were taught by Advance Organizer Model and those who were taught with formal instruction on the scores of the application level questions in each selected school.

Students' Attitudes towards Advance Organizer Model

The attitudes, feelings, experiences and opinions of students were examined by a questionnaire which consists of 15 items four point Likert-scale. For (15) items, strongly agreed, agreed, disagreed and strongly disagreed percentage were shown in two selected schools such as No (1) BEHS Latha and No (4) BEHS Pazundaung.

(1) The first item deals with learning by Advance Organizer Model increase students' interest in the lesson. In both schools, (48%) of the students strongly agreed and (52%) agreed to this item.

(2) The second item deals with learning by the use of advance organizer at the start of the lesson enhance students' interest. In both schools, (34%) of the students strongly agreed and (66%) agreed to this item.

(3) The third items deals with activities in the science classrooms bring happy mode to students. In both schools, (35%) of the students strongly agreed, (58%) agreed and (7%) disagreed to this item.

(4) The fourth items deals with learning science make students use time efficiently. In both schools, (48%) of the students strongly agreed and (52%) agreed to this item.

(5) The fifth item deals with seeing pictures and photographs clearly increase students' better understanding in the lessons. In both schools, (53%) of the students strongly agreed, (43%) agreed and (4%) disagreed to this item.

(6) The sixth item deals with guidance of learning by the use of asking questions during teaching learning periods promote students' attention. In both schools, (42%) of the students strongly agreed and (58%) agreed to this item.

(7) The seventh item deals with listening to other students' discussion and explanation create an atmosphere to get new ideas. In both schools, (38%) of the students strongly agreed, (52%) agreed and (10%) disagreed to this item.

(8) The eighth item deals with students who can apply their experience during discussion and explanation. In both schools, (43%) of the students strongly agreed, (55%) agreed and (2%) disagreed to this item.

(9) The ninth item deals with students who can enhance logical thinking. In both schools, (40%) of the students strongly agreed, (57%) agreed and (3%) disagreed to this item.

(10) The tenth item deals with students who want to investigate other events that are related to the lesson. In both of schools, (55%) of the students agreed, (42%) disagreed and (3%) disagreed to this item.

(11) The eleventh item deals with learning by making a connection with environment make students' better understanding. In both schools, (40%) of the students strongly agreed, (58%) agreed and (2%) disagreed to this item.

(12) The twelfth item deals with students who like to read scientific newspapers and articles. In both schools, (37%) of the students strongly agreed, (47%) agreed, (5%) strongly disagreed and (11%) disagreed to this item.

(13) The thirteenth item deals with allowing students express their ideas and thinking develop self-confidence. In both schools, (48%) of the students strongly agreed, (47%) agreed, (2%) strongly disagreed and (3%) disagreed to this item.

(14) The fourteenth item deals with lessons taught in science classroom are useful in outside of the school. In both schools, (50%) of the students strongly agreed, (45%) agreed and (5%) disagreed to this item.

(15) The fifteenth item deals with students who become more interest in science subject and improve their respect on science learning. In both schools, (60%) of the students strongly agreed, (38%) agreed and (2%) strongly disagreed to this item.

According to the results of (15) items four-point Likert-scale, (97%) of the students have positive attitudes and (3%) do not have positive attitudes towards Advance Organizer Model (see Figure 4.7). Some students do not have positive attitudes because certain attitudes are not easy to change within a shorter time frame. Furthermore, they have had no experience in that kind of asking questions and discussion in the classroom. The following figure shows percentage of students' attitudes towards Advance Organizer Model.

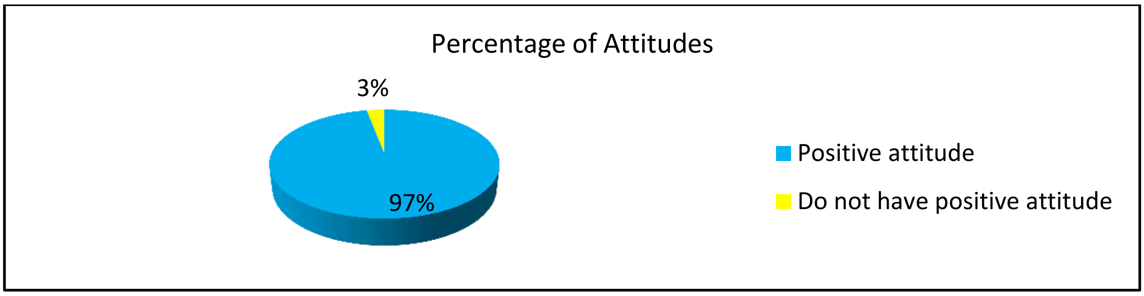

Figure 1 Percentage of Students' Attitudes towards Advance Organizer Model

Summary of Findings

From the experimental findings, the following results were found.

- There was a significant difference between students' science achievement of experimental groups and control groups.
- There was a significant difference between students' science achievement of experimental groups and control groups on the scores of knowledge level questions. It can be interpreted that Advance Organizer Model can improve students' knowledge retention rate and recall the information more easily.
- There was a significant difference between students' science achievement of experimental groups and control groups on the scores of comprehension level questions. It can be interpreted that Advance Organizer Model could bring about the improvement of students' ability to understand logically the structure behind the subject or content area.
- There was a significant difference between students' science achievement of experimental groups and control groups on the scores of application level questions. It can be interpreted that Advance Organizer Model can bring about the development of students' ability to apply their learning in new situation. Therefore, Advance Organizer Model has positive contribution to science teaching at the middle school level.

According to the questionnaires, the following results were found.

- Learning by the use of Advance Organizer Model increases students' retention and conceptual understanding.
- Students developed habits of precise thinking and interest in inquiry.

- Most of students expressed that they were very interested in advance organizers presented by the teacher.
- Learning science is a joyful activity.
- Students expressed that their knowledge was increased and they have willingness to learn more from experience than as usual.

Discussion

In this study, it was found that AOM has significant effect on the science achievement of the students. The findings point out that the mean scores of students who were taught by AOM were significantly higher than those who were taught with formal instruction. Thus, this findings support the research of David Ausubel (197): the mean scores of the experimental were higher than control groups in the use of advance organizers in the learning and retention of meaningful verbal material.

According to the results, there were significant differences between the experimental and control groups according to the comparison of the mean scores on knowledge, comprehension and application level questions for two selected schools. The mean scores of science students who were taught by AOM were significantly higher than that of students who were taught with formal instruction in each achievement level. It can be concluded that students who were taught by AOM improve knowledge retention, interest in inquiry and conceptual understanding. Moreover, it can be interpreted that knowledge retention rate of the students is increased with the help of advance organizers presented by the teacher. Additionally, they develop the habits of precise thinking.

At the first phase of AOM, students were exposed to an advance organizer, which has higher level of abstraction and inclusiveness of the lesson. Owing to the fact that the advance organizer links the previously learned material with new learning material, students could learn meaningfully. Although advance organizers include concepts and abstractions, they do not include in details of the lessons. In this study, three types of organizers were used alternately not to be boredom of lessons for students. All the students described that they were interested in advance organizers presented by the teacher. Thus, providing advance organizers in ahead of the lessons enhances students' attention and interest to the lessons. This step is a distinct feature between AOM and other methods of teaching. In fact, the first step makes students desire to learn the lessons. In other word, it prepares the learners to have readiness to learn.

At the second phase of AOM, the learning material was presented in the form of lectures, discussions, experiments, or reading. In this study, content area was chapter five: The Earth and Space, so lectures and discussions were mainly used in this phase. The teacher also used questions to guide the direction of the learning and to provoke students' thoughts. Learning materials were organized explicitly in order to be meaningful and easy to learn. In this phase, meaningful learning occurs by linking the previous advance organizer and the critical points of the lesson.

The final phase of AOM strengthens students' cognitive organization deeply and learning is an interactive process in which students are come alive with many questions and comments. They had to relate the advance organizers and the lessons. They had to summarize the lessons all they had learned and pick up the critical points. Finally, they had to generate their own ideas and opinions for real situations in which they faced. This step is called "clarify ideas" and ideas and opinions were tested by orally or writing either individual or group. And it was a climax of AOM. During the first few days of the study, students in the experimental groups were unfamiliar to it, but after three periods of teaching, they had the ability to clarify their ideas. Thus, thinking could be nurtured like a habit. In this way, active reception learning was promoted and the teacher could give feedback to the lessons if necessary. After studying lessons, the teacher assigned students to read newspapers dealing with lessons as a supplementary activity for this teaching model.

To know students' attitudes, feelings, experiences and opinions about AOM, a questionnaire was used. Students expressed openly their opinions about this teaching model. It was amazing that all the students agreed that AOM increase students' interest in the lesson. The reason was that the use of advance organizer at the start of the lesson enhances students' interest. With the help of advance organizers they could easily learn and their knowledge retention rate was increased without rote learning. Therefore, all students assumed that learning in science class was interesting and this kind of learning made their time efficiently. In addition, they all responded to positive attitude toward teacher's questions during teaching periods. The teacher's questions promoted their attention, interest and led them to the aim of the lesson.

According to the findings of research, this study indicated that AOM had positive effect in learning general science. However, no study is perfect in an effort. Thus, a need for further research is quite necessary. After treatment, only knowledge, comprehension and application level questions were used as the posttest. Hence, analysis, synthesis and evaluation questions can also be expanded for further researches. This research was done at the middle school level. It provides useful results and many suggestions to improve science education at the middle school level. As a result, a large number of researches should be carried out at all levels such as primary and high school levels.

Moreover, this AOM is applicable to the other subject areas. So, further researches should also be carried out in other subjects. In this study, simple texts, pictures, and concept maps were used as advance organizers, so other types of advance organizers should be investigated in further studies. In addition, this study was done in the Yangon Region. Therefore, further researches in this line should be carried out in other States and Regions and are needed for the improvement of science teaching.

Conclusion

Today's education system is characterized by a gap between how students live and what they learn and how they learn. Thus, improvement of science education is concerned with development of education. Science is recognized as being a subject of great importance both in school and in wider society. Its concepts and processes are essential in a wide range of disciplines, professions and areas of life. Moreover, science can be used as a tool for solving the problems of hunger, poverty, insanitation, illiteracy, superstition, deadening custom and tradition. Improvements of science teaching are fruitful to development of a nation. Thus, AOM was investigated to study its effectiveness on students' science achievement at the middle school level.

In addition, Advance Organizer Model is compatible with every lesson and every subject. With technology or without technology it is also compatible again in the classrooms. Thus, this model can also be used not only in urban schools but also in rural schools. This flexibility of AOM can attract many teachers to apply this model in their real classroom setting. According to the results of the study, students' learning with AOM was more effective than formal instruction. This study has also contributions to curriculum planners. The effective use of AOM has significant effect on the overall science achievement of students. Therefore, AOM certainly has positive contribution to the science teaching at the middle school.

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A STUDY OF THE RELATIONSHIP BETWEEN STUDENTS' SPATIAL ABILITY AND THEIR GEOMETRICAL PERFORMANCE IN MATHEMATICS AT THE MIDDLE SCHOOL LEVEL

Phyo Khin Khin[1] and Wai Wai Oo[2]

Abstract

The main purpose of this research is to study the correlation between students' spatial ability and their geometrical performance in mathematics at the middle school level. Especially, this study aims to study students' spatial ability in terms of visualization, spatial relation, closure speed, flexibility of closure and perceptual speed. A descriptive research design was used for this study. Four townships were randomly selected from four districts in Yangon Region. Two high schools were chosen in each township. A total of eight basic education high schools were included in this study. The participants in this study were (600) Grade Seven students. As the research instruments, a test for spatial ability and a test for geometrical performance test were used. To obtain the reliability of these instruments, a pilot test was administered. The internal consistency (Cronbach's Alpha) of the test for students' spatial ability was (.682) and the test for students' geometrical performance was (.625). In order to address the research questions, a descriptive statistics (percentage) and Pearson product-moment correlation were used. The percentage of low, moderate and high levels of students' spatial ability were 12.67% (N=76), 75% (N=450) and 12.33% (N=74) respectively. The percentage of low, moderate and high levels of students' geometrical performance were 7% (N=42), 84.17% (N=505) and 8.83% (N=53) respectively. So, the students' spatial ability and geometrical performance were found the highest in moderate level. According to the Pearson product-moment correlation result, there was a positive correlation between students' spatial ability and their geometrical performance ($r = .685$, $p < .01$). This means that a high level of students' spatial ability will bring about a high level of their geometrical performance in mathematics.

Keywords: spatial ability, spatial visualization, spatial relation, closure speed, flexibility of closure, perceptual speed, geometry, performance

Introduction

Nowadays, education plays a critical role in the development of any nation since it is fundamental to the expended human capabilities which lie at the heart of the meaning of development. Mathematics is an indispensable part of education. It is a very useful subject for many vocations and higher specialized courses of learning. The ability to visualize mathematical relationships is an essential part of knowledge of mathematics and communicating ideas about mathematics. Especially, spatial ability is one of the necessary factors for achievement of mathematics as it helps to recognize symbols such as numbers and operation signs or visualize mental images. Spatial ability is the capacity to understand and remember the spatial relations among objects. Spatial visualization is necessary for interpreting, understanding, and appreciating the geometric world (NCTM, 1989). Students with strong spatial ability can imagine a shape from different view points, or they can easily comprehend drawings by visualizing spatial patterns quickly and solve problems by thinking in different ways. This study focused on the correlation between students' spatial ability and geometrical performance in mathematics and it is also essential to improve mathematics teaching and learning at the middle school level.

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Purposes of the Study

The main purpose of this research is to study the relationship between students' spatial ability and their geometrical performance in mathematics at the middle school level. The specific purposes of this research are as follows:

- To investigate students' spatial ability in the selected schools
- To assess students' geometrical performance in mathematics in the selected schools
- To explore the relationship between students' spatial ability and their geometrical performance in mathematics
- To give suggestions for improving spatial ability in mathematics at the middle school level

Research Questions

1. To what extent do students possess spatial ability?
2. To what extent do students perform geometrical tasks in mathematics?
3. Is there any significant relationship between students' spatial ability and their geometrical performance in mathematics?

Review of Related Literature

Computation is a vital component of mathematics. But, students need to focus on more than just accuracy in calculation. The cognitive abilities like numerical reasoning ability, sequential ability and spatial ability together comprise as necessary factors for achievement of mathematics. Teaching mathematics is not only for problem-solving but also for enhancing higher cognitive abilities. The ability to make mental representations of number and space is one of the most critical cognitive abilities for mathematics learning. Spatial aspect of mathematics is one of the important mental representations for children. Mental representations include the characteristics of objects, relative positions of objects, rotations of objects as the same object, composition and decomposition of objects, recognition of symbols, spatial orientation, and interpretation of drawings and even some concepts of time.

Spatial Ability: It plays an important role in ones’ lives and it is used unconsciously. Spatial perception accompanies man from birth. Its development is connected not only with the cognitive processes but also with education. According to Linn and Peterson (1985), spatial ability refers to skill in representing, transforming, generating, and recalling symbolic, non-linguistic information. It is not a unitary construct, but it is a combination of sub-skills such as using maps, solving geometry questions and recognizing two dimensional representations of three-dimensional objects.

Visualization in mathematics is the kind of reasoning activity based on the use of visual and spatial elements, either mental or physical, performed to solve problems or prove properties. According to Olkum (2003), spatial ability is used for mental the abilities related to the use of space. Spatial ability has been an area of study for decades as a collection of cognitive skills that enable one interact with his environment. For academic and vocational training programs, spatial ability tests correlate with course grades in mechanical drawings, shop courses, art, mathematics, physics and mechanics. High levels of spatial ability have frequently been linked to creativity, not only in the arts, but in science and mathematics.

Classifications and Subdivisions of Spatial Ability: McGee (1979) stated that spatial ability has two of principal factors; spatial visualization and spatial orientation. Spatial visualization refers to the ability to mentally rotate, manipulate and twist two or three dimensional stimulus objects. Spatial orientation involves the comprehension of the arrangement of elements within a visual stimulus pattern. Early research made by Linn and Petersen (1985), they classified spatial test into three categories as spatial perception, spatial visualization and mental rotation or spatial manipulation. They defined spatial perception as the ability to determine spatial relation despite distracting information; spatial visualization as the ability to manipulate complex spatial information when several stages are needed to produce correct solution and mental rotation as the ability to rotate, in imagination quickly or accurately two or three dimensional figures.

Lohman (1979) identified two main aspects of spatial ability; spatial orientation and spatial visualization. Spatial orientation involved the ability to imagine how a given object or sets of objects would appear from a spatial perspective different form that in which the objects are shown. Lohman, Pelegrino, Alderton, and Regian (1987) proposed the existence of (10) significant subdivisions of spatial abilities. Table 1 lists these (10) distinct and minor spatial sub-factors.

Table 1 Lists of Spatial Subdivisions

Factor Label	Factor Name	Test that define the factor
Vz	Visualization	Paper Folding, Paper Form board, Surface Development
SO	Spatial Orientation	Card Rotation, Cube Comparison, Water Level
CF	Flexibility of Closure	Embedded Figures, Hidden Figures, Copying, Hidden Patterns
SR	Speeded Rotation	Cards, Flags, Figures
SS	Spatial Scanning	Maze Tracing, Choosing a Path, Way Finding
PS	Perceptual Speed	Comparing Figures and Symbols
SI	Serial Integration	Successive Perception, Picture Identification
CS	Closure Speed	Gestalt Completion, Concealed words
VM	Visual Memory	Location memory, Memory for Design
K	Kinesthetic	Hands

Source: From Lohman, 1987.

Carroll's Five Major Factors of Spatial Ability: Carroll (1993) analyzed more than (140)datasets and detected five major clusters: Visualization (Vz), Spatial Relations (SR), Closure Speed (CS), Flexibility of Closure (CF), and Perceptual Speed (PS).Carroll's definition of Vz factor does not differ from than that of other researchers mentioned. Spatial Relations factor (SR) can be considered as another name for the Speeded Rotation factor defined by Lohman (1987) for three dimensional objects. Closure Speed (CS) factor concerns individual differences in ability to access spatial representations in long-term memory when incomplete or obscured cues to those representations are presented. The subjects are not told what to look for in a given representation.

Flexibility of closure (CF) is the ability to identify a visual figure or pattern embedded in a complex distracting or disguised visual pattern or array, when knowing in advance what the object is. Perceptual Speed (PS) factor is characterized by the speed in finding a given configuration in a mess of distracting material. The task may include comparing pairs of items, locating a unique item in a group of identical items, or locating a visual pattern in an extended visual field. According to French (1951), cited in Carroll, (1993), perceptual speed is the speed in scanning figures, or symbols and comparing them or carrying out other very simple tasks involving visual perception.

Spatial Ability and Mathematics Education: Children's early mathematics ability is an important predictive factor to later mathematics achievement. So, how to promote children's early mathematics competency is of critical importance. It is a save report that there is a positive correlation between spatial ability and mathematics achievement (Battista, 1990). Furthermore, according to Van Garderen (2003), spatial ability is a significant factor in specific areas of mathematics such as geometry and in particular complex problems.The National Council of Teachers of Mathematics (2000) emphasize the importance of spatial abilities in mathematics education and recommend that mathematics instruction programs should pay attention to geometry and spatial sense so that all students use visualization and spatial reasoning to solve problems both within and outside of mathematics. Therefore, spatial sense or imagery is an important part of geometry and mathematics learning.

Spatial ability especially spatial visualization is an important component in solving many types of mathematics. Especially, the way to improve pupils' problem-solving ability is to encourage students to use imagery and visualization strategies. A creative problem solving is depending on combining spatial relations, classifications, transforming, and rotation and visualization activities together. So, many researchers supported that spatial ability is important to the development of mathematical thinking and mathematics education.

Spatial Sense and Geometric Reasoning: Geometry is a "network of concepts, ways of reasoning and representation systems" used to explore and analyze shape and space (Battista, 2007 cited in Walle et al., 2013). Geometry provides a rich context for learners to experience mathematical activity and the communication of this activity. Geometry is an important domain of purely mathematical activity.

It is useful to think about the geometry objectives in terms of two related frameworks: (1) spatial sense and geometric reasoning and (2) the specific geometric content. The first frame has to do with the way students think and reason about shape and space. The second framework is content in the more traditional sense _ knowing about symmetry, triangles, parallel lines, and so forth (NCTM, 2000). Spatial sense can be defined as the intuition about shapes and the relationships between shapes and is considered a core area of mathematical study, like number (Sarama & Clements, 2009, cited in Walle, et al., 2013). Spatial sense includes the ability to mentally visualize objects and spatial relationships to turn around in our mind. It includes a comfort with geometric description of objects and position. People with well-developed spatial sense appreciate geometric form in art, nature, and architecture and they use geometric ideas to describe and analyze their world. Mathematics instruction programmes should pay attention to geometry and spatial sense so that all students use visualization and spatial reasoning to solve problems both within and outside of mathematics.

Research Method

Research Design

The research design for this study was a descriptive research design, in which the researcher sought to determine whether and to what degree, a relationship exists between five variables (students' visualization, spatial relation, closure speed, flexibility of closure and perceptual speed) and geometrical performance in mathematics. In this study, the data were collected through a quantitative method. A quantitative method is a research technique that is used to gather quantitative data-information dealing with numbers and anything that is measurable (Gay & Airasian, 2003).

Sample of the Study

The total of (600) Grade Seven students were randomly selected from eight basic education high schools from four townships (Yankin, Dagon, Twantay and Mingalardon) in Yangon Region during (2017-2018) as participants for this study.

Instruments

In this study, a test for students' spatial ability and a test for measuring students' geometrical performance were used as the instruments. A test for students' spatial ability was mainly based on Carroll's five major factors of spatial ability (Visualization, Spatial Relation, Closure Speed, Flexibility of Closure and Perceptual Speed). A test for students' geometrical performance was constructed based on van Hiele's model of geometric thought.

Procedures

First, the related literature about the study was explored and then constructed the spatial ability test that is based on Carroll's five major factors and geometrical performance test that is based on the first three levels of Van Hiele's model of geometric thought. Expert review was conducted for the validation of the tests by five experienced mathematics teacher educators of Methodology Department in Yangon University of Education. After getting the validation, a pilot test was conducted with (50) Grade Seven students from B.E.H.S (3) Sanchaung in December, 2017. The data obtained from the pilot study was used to calculate Cronbach's alpha coefficient. The internal consistency of the test for spatial ability was (0.682) and the test for geometrical performance was (0.625). The real data collection was done in the first week of January 2018. After that, students' answer sheets for both spatial ability and geometrical performance were scored manually based on the marking scheme. All the data were organized in the computer data file. Then, the data were systematically analyzed by using the Statistical Package for the Social Science (SPSS 23) as it is widely used in quantitative research.

Research Findings

(1) Findings of Students' Visualization in Spatial Ability in the Selected Schools

Table 1 described the means of students' visualization in spatial ability in the selected schools.

Table 2 Means of Students' Visualization in Spatial Ability in the Selected Schools

School	No. of Student	Mean	Standard Deviation	Minimum	Maximum
BEHS (1) Yankin (S1)	75	6.37	1.514	3	10
BEHS (2) Yankin (S2)	75	7.03	1.414	5	10
BEHS (1) Dagon (S3)	75	6.88	1.506	3	10
BEHS (2) Dagon (S4)	75	6.69	1.355	5	10
BEHS (1) Twantay (S5)	75	**6.11**	1.921	2	10
BEHS (2) Twantay (S6)	75	6.81	1.343	5	9
BEHS (1) Mingalardon (S7)	75	6.93	1.446	5	10
BEHS (2) Mingalardon (S8)	75	**7.37**	1.292	5	10
Total / Average	**600**	**6.77**	**1.474**	**4.125**	**9.875**

According to the results, the lowest mean and the highest mean were (6.11) and (7.37) respectively. Therefore, students' visualization in Basic Education High School No. (1), Twantay was the lowest and students' visualization in Basic Education High School No.(2), Mingalardon was the highest among the selected schools. students' visualization in the selected schools (see Figure 1).

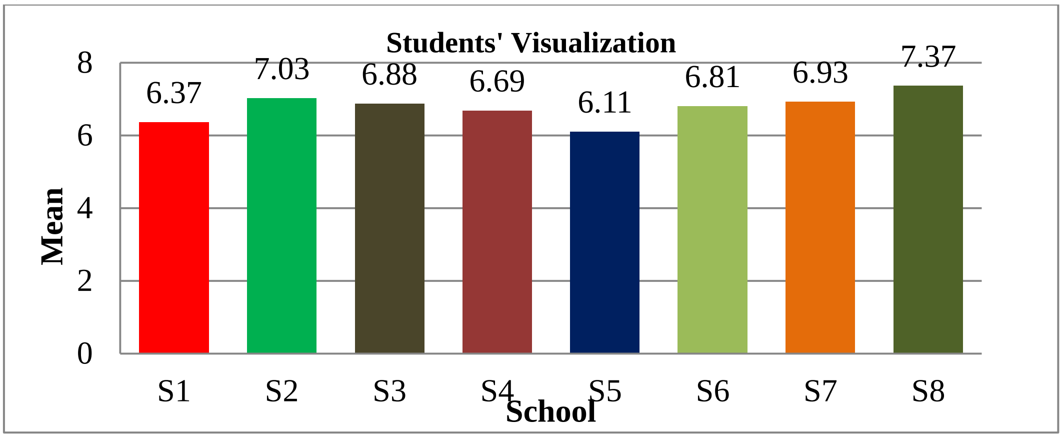

Figure 1 Comparison of Means of Students' Visualization in Spatial Ability in the Selected Schools

(2) Findings of Students' Spatial Relation in Spatial Ability in the Selected Schools

Table 3 described the means of students' spatial relation in spatial ability in the selected schools.

Table 3 Means of Students' Spatial Relation in Spatial Ability in the Selected Schools

School	No. of Student	Mean	Standard Deviation	Minimum	Maximum
BEHS (1) Yankin (S1)	75	5.08	1.136	4	8
BEHS (2) Yankin (S2)	75	5.63	1.292	3	9
BEHS (1) Dagon (S3)	75	5.67	1.446	4	9
BEHS (2) Dagon (S4)	75	5.09	1.210	3	9
BEHS (1) Twantay (S5)	75	**4.53**	1.119	2	8
BEHS (2) Twantay (S6)	75	4.87	1.143	4	8
BEHS (1) Mingalardon (S7)	75	5.71	1.440	4	10
BEHS (2) Mingalardon (S8)	75	**5.76**	1.364	4	9
Total / Average	**600**	**5.29**	**1.268**	**3**	**8.75**

According to the results, the lowest mean and the highest mean were (4.53) and (5.76) respectively. The students from Basic Education High School No.(1), Twantay have the lowest spatial relation and the students from Basic Education High School No.(2) Mingalardon have the highest spatial relation among the selected schools. Moreover, Figure 2 illustrated the comparison of the means of students' spatial relation in the selected schools.

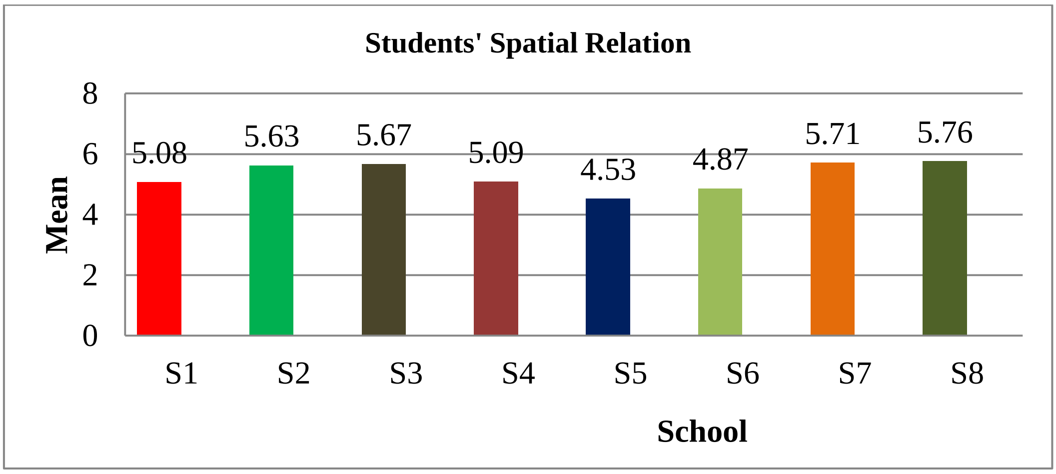

Figure 2 Comparison of Means of Students' Spatial Relation in Spatial Ability in the Selected School

(3) Findings of Students' Closure Speed in Spatial Ability in the Selected Schools

Table 4 described the means of students' closure speed in spatial ability in the selected schools.

School	No. of Student	Mean	Standard Deviation	Minimum	Maximum
BEHS (1) Yankin (S1)	75	6.51	1.554	3	9
BEHS (2) Yankin (S2)	75	6.87	1.735	3	10
BEHS (1) Dagon (S3)	75	6.84	1.748	3	10
BEHS (2) Dagon (S4)	75	6.85	1.768	3	10
BEHS (1) Twantay (S5)	75	6.52	1.727	3	10
BEHS (2) Twantay (S6)	75	**5.87**	1.571	2	9
BEHS (1) Mingalardon (S7)	75	6.56	1.862	3	10
BEHS (2) Mingalardon (S8)	75	**7.44**	1.233	4	10
Total / Average	**600**	**6.68**	**1.702**	**3**	**9.75**

Based on the results, the lowest mean and the highest mean were (5.87) and (7.44) respectively. The students from Basic Education High School No.(2) Twantay have the lowest closure speed while the students from Basic Education High School No.(2) Mingalardon have the highest closure speed among the selected schools (see Figure 3).

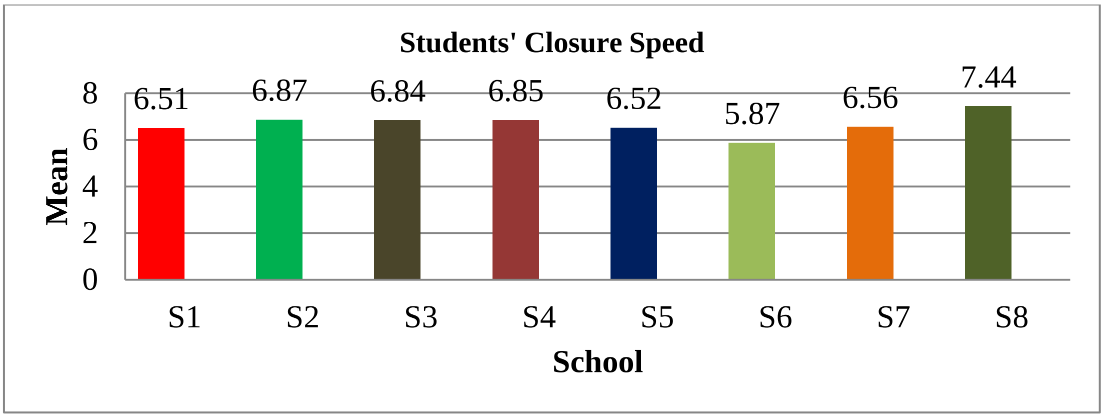

Figure 3 Comparison of Means of Students' Closure Speed in Spatial Ability in the Selected Schools

(4) Findings of Students' Flexibility of Closure in Spatial Ability in the Selected Schools

Table 5 described the means of students' flexibility of closure in spatial ability in the selected schools.

Table 4 Means of Students' Flexibility of Closure in Spatial Ability in the Selected Schools

School	No. of Student	Mean	Standard Deviation	Minimum	Maximum
BEHS (1) Yankin (S1)	75	5.07	1.742	1	9
BEHS (2) Yankin (S2)	75	4.51	1.455	2	8
BEHS (1) Dagon (S3)	75	4.69	1.365	2	8
BEHS (2) Dagon (S4)	75	4.69	1.507	2	8
BEHS (1) Twantay (S5)	75	**4.47**	1.388	2	7
BEHS (2) Twantay (S6)	75	4.68	1.629	1	8
BEHS (1) Mingalardon (S7)	75	5.05	1.793	2	10
BEHS (2) Mingalardon (S8)	75	**5.80**	1.433	3	9
Total / Average	**600**	**4.87**	**1.591**	**1.875**	**8.375**

Based on the results, the students who have the lowest flexibility of closure were from Basic Education High School No.(1) Twantay and the students who have the highest flexibility of closure were from Basic Education High School No.(2) Mingalardon respectively (see Figure 4).

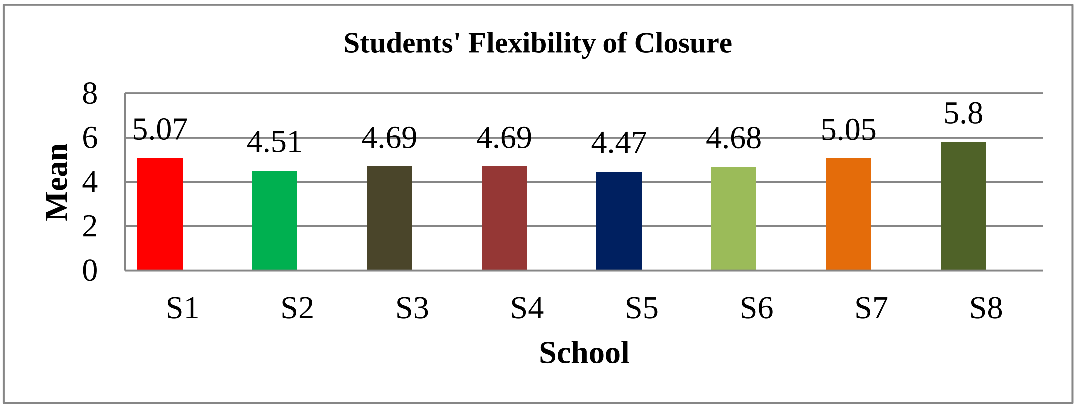

Figure 4 Comparison of Means of Students' Flexibility of Closure in Spatial Ability in the Selected Schools

(5) Findings of Students' Perceptual Speed in Spatial Ability in the Selected Schools

Table 6 Means of Students' Perceptual Speed in Spatial Ability in the Selected Schools

School	No. of Students	Mean	Standard Deviation	Minimum	Maximum
BEHS (1) Yankin (S1)	75	8.33	1.288	4	10
BEHS (2) Yankin (S2)	75	8.53	1.473	1	10
BEHS (1) Dagon (S3)	75	8.64	1.181	6	10
BEHS (2) Dagon (S4)	75	8.85	1.182	6	10
BEHS (1) Twantay (S5)	75	**8.04**	1.511	4	10
BEHS (2) Twantay (S6)	75	8.51	1.349	6	10
BEHS (1) Mingalardon (S7)	75	**9.07**	0.991	6	10
BEHS (2) Mingalardon (S8)	75	8.65	1.133	6	10
Total / Average	**600**	**8.58**	**1.300**	**4.875**	**10**

Based on the results, the lowest mean and the highest mean were (8.04) and (9.07) respectively. The students from Basic Education High School No.(1) Twantay have the lowest perceptual speed while the students from Basic Education High School No.(1) Mingalardon have the highest perceptual speed (see Figure 5).

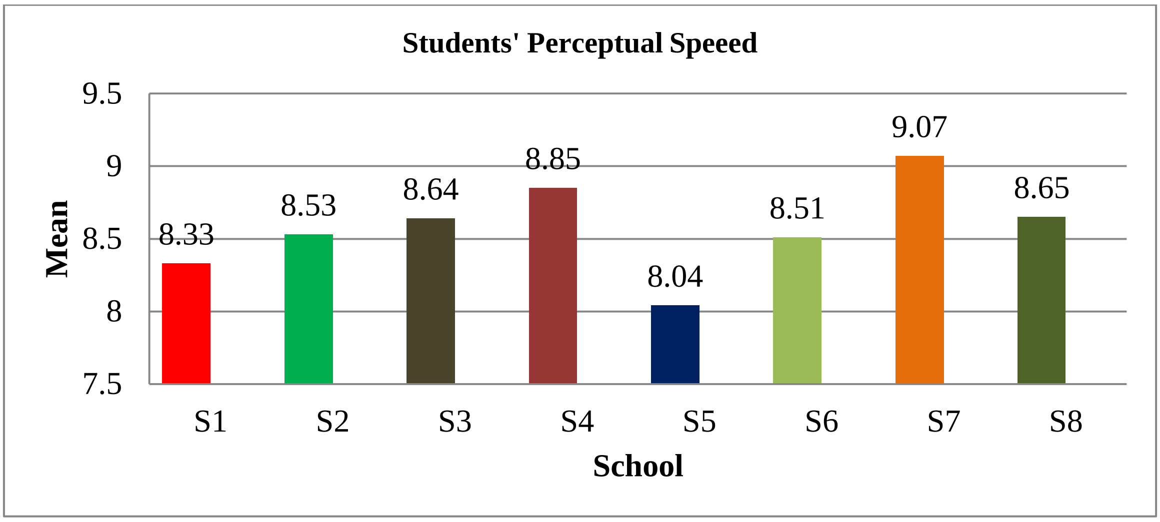

Figure 5 Comparison of Means of Students' Perceptual Speed in Spatial Ability in the Selected Schools

(6) Findings of Students' Spatial Ability in the Selected Schools

Table 6 described the means of students' spatial ability in the selected schools.

Table 7 Means of Students' Spatial Ability in the Selected Schools

School	No. of Student	Mean	Standard Deviation	Minimum	Maximum
BEHS (1) Yankin (S1)	75	31.35	3.981	22	40
BEHS (2) Yankin (S2)	75	32.43	4.205	25	42
BEHS (1) Dagon (S3)	75	32.91	4.765	23	43
BEHS (2) Dagon (S4)	75	31.96	4.388	22	42
BEHS (1) Twantay (S5)	75	**29.84**	4.520	20	39
BEHS (2) Twantay (S6)	75	30.72	3.754	24	39
BEHS (1) Mingalardon (S7)	75	33.25	4.756	24	45
BEHS (2) Mingalardon (S8)	75	**35.00**	3.720	28	42
Total / Average	**600**	**32.18**	**4.512**	**23.5**	**41.5**

Based on the results, the mean of Basic Education High School No.(1) Twantay was the lowest and the mean of Basic Education High School No.(2) Mingalardon was the highest. This means that the students from Basic Education High School No.(1) Twantay have the lowest spatial ability and the students from Basic Education High School No.(2) Mingalardon have the highest spatial ability. In addition, Figure 6 illustrated the comparison of the means of students' spatial ability in the selected schools.

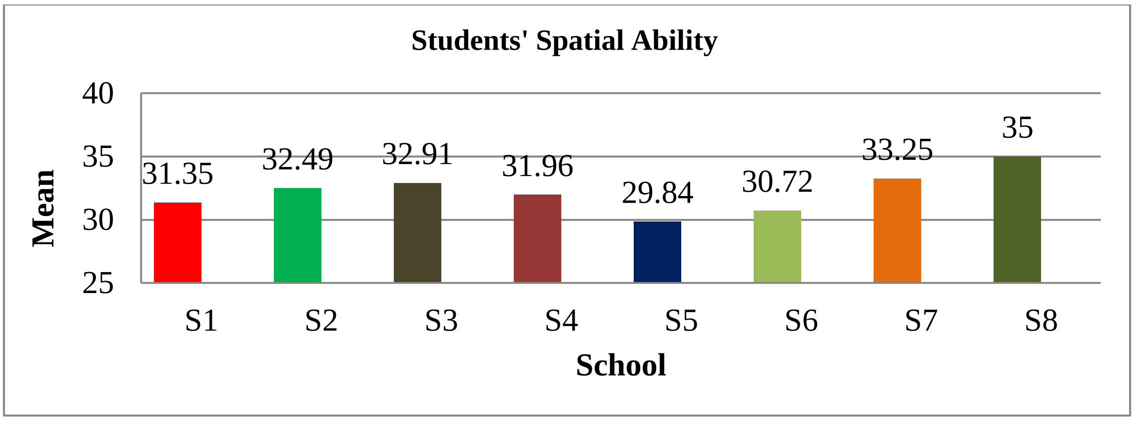

Figure 6 Comparison of Means of Students' Spatial Ability in the Selected Schools

It is necessary to examine the percentage of the students (600) who have low, moderate and high spatial ability. Therefore, a descriptive statistics (percentage) was used. The total score of spatial ability test was (50) marks. The means and standard deviation of all the participants were (32.18) and (4.512) respectively. By using one standard deviation, students who possessed marks above (37) were defined as high achieving in spatial ability. Students who possessed marks between (28) to (37) were defined as moderate achieving in spatial ability and students who possessed marks under (27) were defined as low achieving in spatial ability. Table 8 described the percentage of low, moderate and high levels of students' spatial ability.

Table 8 Students' Spatial Ability Level

Students' Spatial Ability Level	Score	No. of Student	Percentage (%)
Low	0-27	76	12.67
Moderate	28-37	450	75
High	38-50	74	12.33
Total		**600**	**100**

Figure 7 obviously demonstrated the percentage of the students according to their spatial ability level.

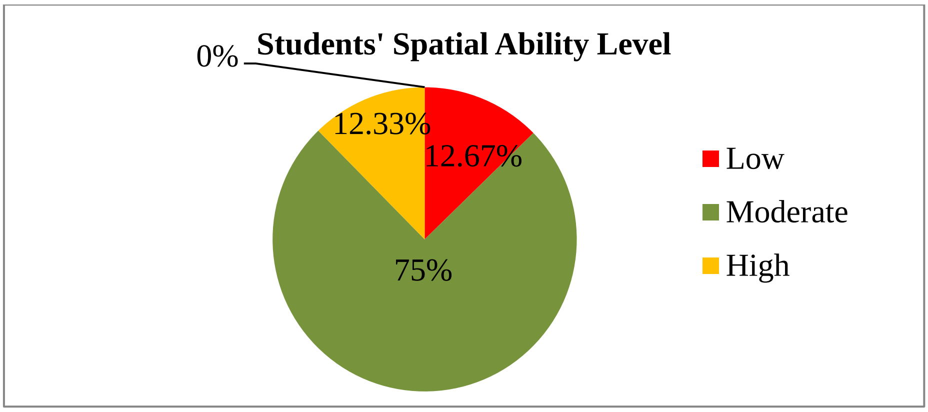

Figure 7 Students' Spatial Ability Level

(7) Findings of Students' Geometrical Performance in the Selected Schools

In order to examine the students' geometrical performance, a test for geometrical performance was administered. It covered three parts: visualization that includes ten multiple choice items, each scoring (1) mark, analysis that includes ten multiple choice items, each scoring (2) mark and informal deduction that includes four problems, each scoring (5) mark. The total score was (50) marks. Table 8 described the comparison of the means of students' geometrical performance in each selected school.

Table 9 Means of Students' Geometrical Performance in the Selected Schools

School	No. of Student	Mean	Standard Deviation	Minimum	Maximum
BEHS (1) Yankin (S1)	75	30.36	3.733	21	39
BEHS (2) Yankin (S2)	75	30.91	3.912	21	43
BEHS (1) Dagon (S3)	75	33.97	5.112	25	47
BEHS (2) Dagon (S4)	75	32.60	3.572	25	45
BEHS (1) Twantay (S5)	75	**29.92**	3.344	20	39
BEHS (2) Twantay (S6)	75	31.47	2.762	27	39
BEHS (1) Mingalardon (S7)	75	32.49	4.134	26	45
BEHS (2) Mingalardon (S8)	75	**36.56**	4.091	28	47
Total / Average	**600**	**32.29**	**4.367**	**24.125**	**43**

According to the results, the lowest mean and the highest mean were (29.92) and (36.56) respectively. Based on the results, students' geometrical performance in Basic Education High School No.(1), Twantay was the lowest and students' geometrical performance in Basic Education High School No.(2) Mingalardon was the highest among the selected schools. Additionally, Figure 8 illustrated the comparison of the means of students' geometrical performance in the selected schools.

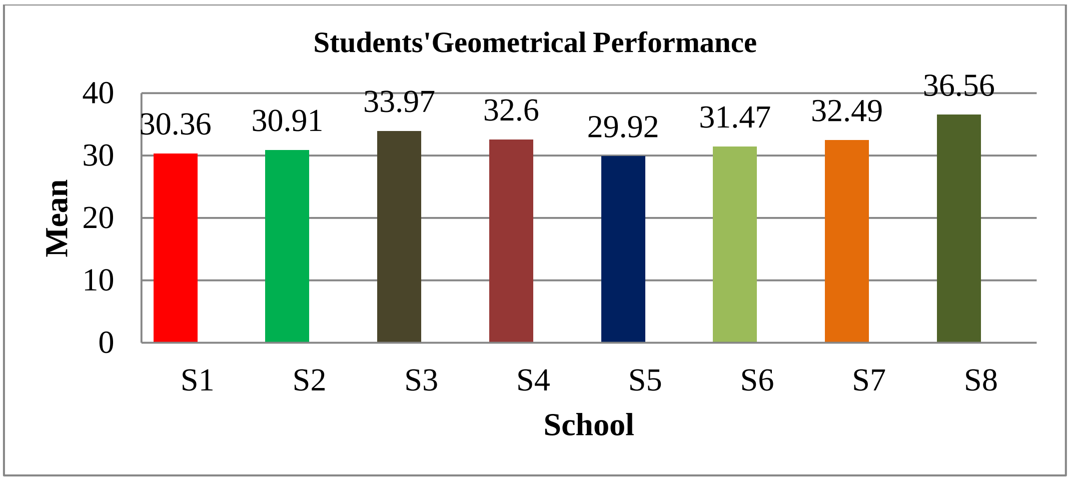

Figure 8 Comparison of Means of Students' Geometrical Performance in the Selected Schools

Moreover, it is necessary to investigate the percentage of the total students (600) who have low, moderate and high geometrical performance. Therefore, a descriptive statistics (percentage) was used. The total score of geometrical performance test was (50) marks. The means and standard deviation of all the participants were (32.29) and (4.367) respectively. By using one standard deviation, students who possessed marks above (39) were defined as high achieving in geometrical performance. Students who possessed marks between (28) to (38) were defined as moderate achieving in geometrical performance and students who possessed marks under (27) were defined as low achieving in geometrical performance. Table 10 described the percentage of low, moderate and high levels of students' geometrical performance.

Table 10 Students' Geometrical Performance Level

Students' Geometrical Performance	Score	No. of Students	Percentage (%)
Low	0-27	42	7
Moderate	28-38	505	84.17
High	39-50	53	8.83
Total		**600**	**100**

Figure 9 obviously illustrated the percentage of the students according to their geometrical performance level in mathematics.

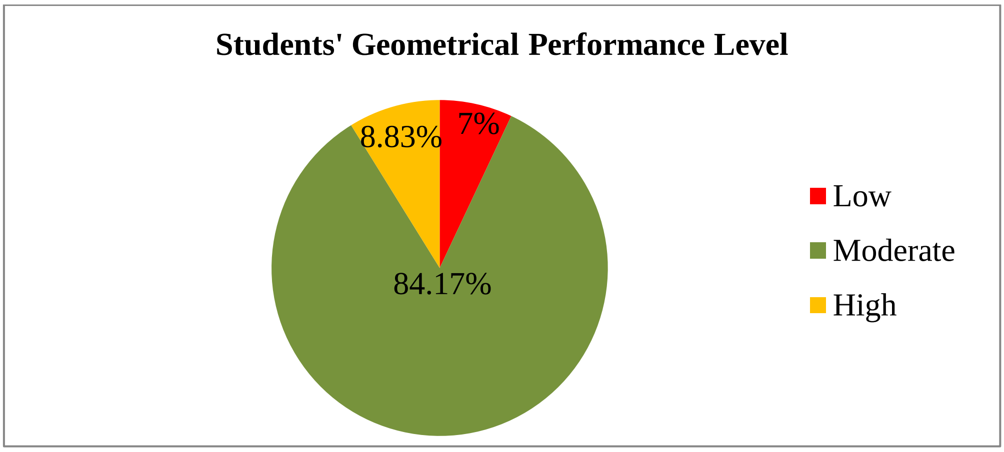

Figure 9 Students' Geometrical Performance Level

(8) Finding the Correlation between Students' Spatial Ability and their Geometrical Performance in Mathematics in the Selected Schools

To investigate the correlation between students' spatial ability and their geometrical performance in mathematics, Pearson product-moment correlation was used. According to Gay & Airasian (2003), correlation coefficient below plus or minus (.35) was interpreted as low or no relation, correlation coefficient between plus or minus (.35) and (.65) was interpreted as moderate relation and correlation coefficient higher than plus or minus (.35) and (.65) was interpreted as high relation.

By using Pearson product-moment correlation, the correlation between students' spatial ability and their geometrical performance was studied. Based on the results, there was a significant correlation ($r\ (6) = .685$, $p < .01$) between students' spatial ability and their geometrical performance at the 0.01 level. Table 11 described the correlation between students' spatial ability and their geometrical performance in mathematics.

Table 11 Correlation between Students' Spatial Ability and their Geometrical Performance in Mathematics in the Selected Schools

Correlation			
		Students' Spatial Ability	**Students' Geometrical Performance**
Students' Spatial Ability	Pearson Correlation	1	.685**
	Sig. (2-tailed)		.000
	N	600	600
Students' Geometrical Performance	Pearson Correlation	.685**	1
	Sig. (2-tailed)	.000	
	N	600	600

** Correlation is significant at the 0.01 level (2-tailed).

It was found that the direction of correlation was positive and students' spatial ability and their geometrical performance were highly correlated. This means that if the students are good at spatial ability, they will get high marks in geometrical performance.

Discussion, Suggestions and Conclusion

Discussion

Children's early mathematics ability is an important predictive factor to later mathematics achievement. Understanding and promoting children's spatial ability improves children's early mathematics competency. Mulligan (2015) defined spatial ability as the process of recognizing and manipulating spatial properties of objects and the spatial relations among objects. It is very important and necessary to improve students' spatial ability in mathematics classrooms as it helps students develop mathematical thinking and perform better in mathematical activities. So, how to assess spatial ability is an educational priority. With this view, this study seeks to address this demand by investigating the relationship between students' spatial ability and their geometrical performance.

The percentage of low, moderate and high levels of students' spatial ability were 12.67% (N=76), 75% (N=450) and 12.33% (N=74) respectively. So, these findings reveal the answer to the first question: To what extent do students possess spatial ability?

The percentage of low, moderate and high levels of students' geometrical performance were 7% (N=42), 84.17% (N=505) and 8.83% (N=53) respectively. So, these findings reveal the answer to the second question: To what extent do students perform geometrical tasks?

The correlation between students' spatial ability and their geometrical performance was ($r(6) = .685$, $p < .01$). This result showed that the direction of correlation was positive and a high correlation. It pointed out that if the students' spatial ability was high, their geometrical performance was also high or if the students' spatial ability was low, their geometrical performance was also low. So, this finding revealed the answer to the third question: Is there any significant relationship between students' spatial ability and their geometrical performance in mathematics?

The finding of the correlation between students' spatial ability and their geometrical performance in mathematics supports the finding of Hassan (2002): there was a significant relationship between visual perception of geometric shapes and achievement of secondary school students in geometry. According to Tsutsumi et al., (2005), spatial thinking was also an effective means of enhancing students' mathematical thinking.

Spatial ability is not a unitary construct, but it is a combination of sub-skills such as using maps, solving geometry questions and recognition of two dimensional representations of three-dimensional objects. However, spatial ability is often deprioritized within the classroom because it is rarely assessed. In an age of accountability where students and teachers are being held to higher standards for teaching and learning, educators and policy makers need to take a broad look at the measures and expectations for students' achievement. Grades, standardizes test scores, and cognitive skill assessments such as spatial skill, should all be taken into account when looking at students' learning outcomes.

Additionally, the researcher noticed that students were good at perceptual speed rather than the other spatial performance because they can scan figures and symbols well. They are weak in flexibility of closure because they have few experiences in finding embedded figures. So, the teacher should use instructional strategies to encourage the development of spatial ability. Some specific classroom learning activities should be used to enhance spatial ability such as paper folding, mental rotation tasks, and creating virtual reality environments to make students see virtual buildings from different position and using the tridio learning material. The tridio learning material consists of cubes, with white, black and green sides, mosaic pieces (rhombuses and triangles) in the same color and a board to place the cubes on.

According to the results of the research, a generalization can be drawn that students' spatial ability significantly influenced the students' geometrical performance. Therefore, it can be realized that it is very crucial to enhance students' spatial ability for improving their geometrical performance in mathematics.

Suggestions

Teaching students to become spatial thinkers is increasingly recognized as a goal of education. Spatial ability is found as an important component of success in a variety of scientific, technical and mathematical related occupations. Visual-spatial ability is increasingly important for everyone in rapidly changing technologically oriented world. So, it is necessary to enhance students' spatial ability to face the challenges of 21st century. Teachers' role, students' role and classroom activities for improving spatial ability, assessment for promoting spatial ability and suggestions for further study are given as suggestions.

(i) Teachers' role, students' role and classroom activities for improving spatial ability: Visualization level is where students use imaginary movements in three-dimensional place. In order to develop visualization, the students should understand the arrangements of spatial patterns and several stages to produce the correct solution. And also, the teachers should probe students, act as resource and guide students in direction of outcomes. Moreover, in order to improve students' visualization, the teachers should carry out classroom activities such as paper-based exercises: paper folding, paper form board and surface development tasks.

Spatial relation is where students mentally rotate spatial objects fast and correctly. In order to develop spatial relation, the students should be good at thinking about how an object will look when rotated. This skill can be improved with practice. So, the teachers should integrate some specific activities such as card rotation, flag rotation and cube rotation tasks in mathematics classrooms.

Closure speed is where students quickly identify a familiar meaningful visual object from incomplete visual stimuli without knowing in advance what the object is. To develop this skill, the students must understand gestalt completion and be good at concealed words and figures. This skill can also be improved with practice. So, the teachers should use such learning materials as tangram puzzle and tridio to understand gestalt completion and find concealed words and figures.

Flexibility of closure is where students identify a visual figure or pattern embedded in a complex distracting visual pattern. In order to develop flexibility of closure, the students must be good at noticing embedded figures and hidden patterns. And also, the teachers should provide such learning experiences as finding hidden figures, patterns in teaching-learning process.

Perceptual speed is where students compare figures or symbols or carry out very simple tasks involving visual perception. In order to develop perceptual speed, the students must visualize figures and symbols fast and correctly. And also, the teachers should provide students such learning experiences as comparing figures, scanning symbols and maze tracing in mathematics classrooms.

(ii) Assessment for promoting spatial ability: Multiple-choice items are mostly used in assessment of spatial ability. For this reason, the researcher studied spatial ability using multiple-choice items based on different spatial tasks. Different researchers used spatial ability tests for different purposes. Soma spatial tests are non-verbal tests, perceptual tests for career selection. Teachers should adopt different assessment methods such as paper-based exercises that allow students to visualize spatial patterns fast and correctly. And also, teachers should use games and puzzles that allow students gestalt completion and find hidden figures correctly.

(iii) Suggestions for further study: With this view, some suggestions are provided for further research. In the 21st century, spatial ability is essential in specific areas of engineering, science and mathematics. This research study contributed to the improvement of students' spatial ability in mathematics in the middle schools.

However, no study is perfect in a single effort. In this study, the sample schools were randomly selected from Yangon Region. So, future research should be carried out for the other States and Regions for replication. Moreover, this research is concerned with only the middle school students. That is so, other studies with the primary and the high school students and also the college and the university students should be conducted. In addition, this study was dealt with the students' spatial ability such as visualization, spatial relation, closure speed, flexibility of closure and perceptual speed from Carroll's five major factors of spatial ability. Therefore, future studies should be conducted with other spatial skills. Moreover, future studies should be conducted with other assessments which measure the spatial ability of students.

Conclusion

Education is important because it gives people the baseline skills to survive as adults in the world. These skills include basic literacy and numeracy, problem-solving skill, critical thinking skill and communicating skill. Spatial ability is essential in problem-solving skill and ability to see the relations. People with strong spatial ability can imagine a shape from different view-points or they can quickly understand the spatial patterns. Spatial thinking has a significant role in many school subjects, in everyday life, and in many occupations.

Spatial perception accompanies man from birth. Its development is connected not only with the cognitive processes but also with education. The effective use of spatial information is one aspect of human cognition .Promoting spatial ability in mathematics classes is crucial in the development of successful students. Mathematics teachers should be aware that students must be provided with maximum opportunity of participation to develop their fullest potential.

When students think spatially in mathematics, they easily recognize the relations between geometrical figures, perform better in mathematical activities. Moreover, spatial ability can be improved with practice. Teachers must use classroom activities and games that allow students to improve their spatial ability. Tangram puzzle, a game in which smaller shapes must combine form a larger shape enhances students' spatial thinking.

Finally, the researcher concluded that there was relationship between students' spatial ability and their geometrical performance in mathematics. According to the literature, spatial ability is important not only in daily lives but also in academic life. It can lead to the development of students' ability to recognize the relations, students' performance in geometry and students' problem-solving skill. Additionally, spatial ability supports the students' vocational outcomes. Three major components of spatial ability: space, tools of representation and process of reasoning are helpful for encouraging children in grasping the world and developing mathematical thinking. So, every teacher should create a learning environment in which students think spatially rather than memorizing facts. Although this study cannot fulfill the aim of teaching and learning mathematics in the middle schools, it can be a support for teachers to foster the middle school students' spatial ability in Myanmar.

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AN EXPLORATION OF INFLUENCING FACTORS ON TEACHER TRAINING PROGRAMMES IN EDUCATION COLLEGES

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Abstract

The main purpose of this study is to study the exploration of influencing factors on teacher training programmes in education colleges. The three factors such as social factors, technical factors and managerial factors are examined to know what extent they effect, which are the highest and lowest influence and the interrelationships among them for the improvement of quality transformation in education colleges. A quantitative research method and descriptive research design were used in this study. This study was conducted in fourteen education colleges. The samples education colleges for this study were randomly selected. The (561) teacher educators were administered to obtain the required data. A Questionnaire was used as instruments. To measure the reliability of the instrument, a pilot test was conducted to (66) teacher educators from two education colleges. The internal consistency (Cronbach's Alpha) of Questionnaire was (.844). The data were analyzed by using the descriptive analysis techniques and Pearson product moment correlation. The research findings revealed that the influencing level of social factors had the (71%), the technical factors had the (69%) and the managerial factors had the (72%). It showed that these factors were moderately influenced on the pre-service teacher training programmes. Among the three factors, the social factors have greater average means (82.27) than the technical factors (72.40) and the managerial factors (72.46). The relationship between social factors and technical factors was r (12)=.435, $p< .01$, between social factors and managerial factors was r (12)= .454, $p< .01$ and between the technical factors and managerial factors was r (12)= .734, $p< .01$. They were significant positively relationships.

Keyword: Quality Assurance, Quality of teacher Education, Teacher Training

Introduction

Education shifts from product-oriented to process-oriented trend by using the energy from environment as innovation according to the view point of system approach. The education system must produce the educated persons who have sound body and healthy mind with qualitative attitudes of education. Mukhopadhyay (2001) classified the outcome of the education in four levels such as informed, cultured, emancipated and self-actualized. Education development should provide individual's values, knowledge, skills and competencies for living and participation in quality society. So, the aim of education for sustainable development is to empower people to participate in shaping a future. Everywhere in the world, reforms and innovation are jointly presented among the most urgent preoccupations of educational system circle (Porter & Goble, 1977). Therefore, the current formal educational trend requires for this purpose and calls for the innovation.

According to Bishop (1986), the innovation will be essential to bring about qualitative change in education. These changes are needed to increase efficiency and improve the quality and equity of learning opportunities. Efficiency means the balance between input resources invested and the output in term of student's performance in quality and equity. All systems cannot exist in vacuum; respond to their environment and have vulnerable to change (Bertalanffy, 1972). These changes are needed to increase efficiency and improve the quality and equity of learning opportunities. Matei and Iwinska (2016) pointed out that quality in higher

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education and quality assurance are important for Myanmar during the current period of transformations in the country. Especially education colleges need to innovate not only in product but also in process in cyclic quality improvement.

National Education Strategic Plan (NESP) is a comprehensive, widely-owner and evidence-based roadmap intended to reform the entire education sector over the next five years for the period of 2016-2021. MOE has identified nine transformational shifts that will collectively contribute to achievement of the NESP goal (NESP, 2016). Therefore, the MOE has prioritized and integrated a comprehensive approach to teacher education and which has conducted three strategies having ten components. This includes the component two of second strategies of NESP. There will be some needs as the problems of teacher training programmes for innovation. This study tries to explore the influencing factors on the component of teacher training programmes in education colleges.

Significance of the Study

According to NESP report, MOE is facing a number of challenges in deploying qualified teachers to all schools. There are three major challenges such as to ensure development and retention of quality teachers in the education management mechanisms and access to quality in both in-service and pre-service teacher education. In education colleges, it is essential to implement feasible management strategies that can attract new entrances with considerable potential to become quality teacher. In-service teachers training requires quality as continuous professional development programmes. During pre-service teacher training, teacher trainees need more opportunities to practice their new knowledge skill and pedagogic skills. Thus, pre-service teacher training needs to be redesigned.

Education colleges seek more effective system to address the restructuring the organization with the performance of higher education system. In educational terms, there has been a shift away from formal mode in which most students might have been viewed as passive recipients of teaching, absorbing information in an uncritical way, to a growing enthusiasm for active independent learning which encourages deep rather than superficial processing of information. In responses to the necessity for reforming education colleges, teaching programmes require to be in line with the needs and expectations of quality development in new dimensions.

Thus, based on the finding, three factors have been translated into actual situations in social, technical and managerial sub-system of education colleges for changing in quality development of the teacher training programmes.

Purposes of the Study

The main purpose of this study is to explore the influencing factors on teacher training programmes in education colleges. The specific objectives are as follows.

- To investigate the social factors, the technical factors, and the managerial factors that influence on pre-service teacher training programmes in education colleges.
- To examine the highest and lowest factors that influence on pre-service teacher training programmes in education colleges.
- To study the interrelationships between the three factors that influence on pre-service teacher training programmes in education colleges.

Research Questions

Q_1: To what extent do the social factors, technical factors, the managerial factors influence on pre-service teacher training programmes in education colleges?

Q_2: Which factors are the highest and lowest influencing on pre-service teacher training programmes in education colleges?

Q_3: Are there interrelationships between the three factors that influence on pre-service teacher training programmes in education colleges?

Scope of the Study

The first limitation is selecting the sample education colleges. There were twenty five education colleges in Myanmar out of them, fourteen education colleges from fourteen state and region of Myanmar (Education Colleges — Myintkyina, Loikaw, Hpaan, Haktha, Mawlamying, Kyaukphyu, Lashio, Monywa, Dawei, Taungoo, Magway, Mandalay, Yankin, Pathein) were selected randomly. The second limitation dealt with the participants who were selected randomly from the selected education colleges. The third limitation is that this study was based on systems concept although the subsystem process is especially emphasized and was only concerned with three factors (social, technical and managerial) that influence on teacher training programmes. The final limitation is the selected programme. Education colleges conduct both pre-service and in-service, teachers training program. This study focuses only on the pre-service teacher training programmes, Diploma in Teacher Education Training Programme and Pre-service Primary Teacher Training programme.

Definition of Key Terms

Quality assurance (QA)

Quality assurance is the processes that seek to ensure the learning environment (including teaching and research) reaches an acceptable threshold of quality (QQI, 2016).

Quality of teacher education

Quality of teacher education means combining the excellence, threshold, improvement and fitness for purposes (Venkataiah, 2011).

Teacher training

Teacher training refers to professional preparation of teachers, usually through formal course work and practice teaching (Darling-Hammond & Lieberman, 2013).

Theoretical Framework

Quality in Education

The concept of quality has been defined in several ways (Campell & Rozsnayi, 2002, cited in Mizikaci, 2006). Adams (1993) claimed that the terms efficiency, effectiveness, equity and quality have often been used synonymously in quality education. Establishing a contextualized understanding of quality means including the relevant stakeholders. Quality is indeed a multi-layered and complex word. So, the integration of the four sub layers will be summited as quality in education such as defining the quality, quality assurance and principles, excellent characters of educational institution. So, the definition of quality has been opened and altered in not only probabilistic system but also deterministic system nature. Teacher Education is neither mere pedagogy nor acquisition development of the younger generation. It is inculcation of commitment and generation to contribute at the highest level of efficiency through a quality based approach (Venkataiah, 2011).Thus quality of teacher education means combining the excellence, threshold, improvement and fitness for purposes.

Quality Assurance and Principles

According to an integrated agency for Quality and Qualification in Ireland (QQI, 2016) quality assurance guide line defined that the quality assurance (QA) is the processes that seek to ensure the learning environment (including teaching and research) reaches an acceptable threshold of quality. A fundamental ASEAN's national qualification framework principle stated that quality assurance of higher education is the quality primarily rests with it education institutions themselves. The statements provide ten guidelines on the quality assurance processes systems through which higher education institutions demonstrate the accountability and safeguard the interests of stakeholders including students and society.

The Importance of Quality in Education Colleges

In the 21st century, qualitative transformation is required in higher education institutions which are functionally interdependent because the world workforce markets needs qualified person. The higher education sector, comprising various professional institutions should be venues where quality teaching, learning and training are conducted, quality researches undertaken and quality service rendered. This is because of society's needs and expectations towards higher education. It depends ultimately on the quality of its staff, students, teachers, programme, infrastructure and academic environments (Thein Myint, n.d., MOE, 2016).

Reasons for Requirement of Quality Assurance in Teacher Education

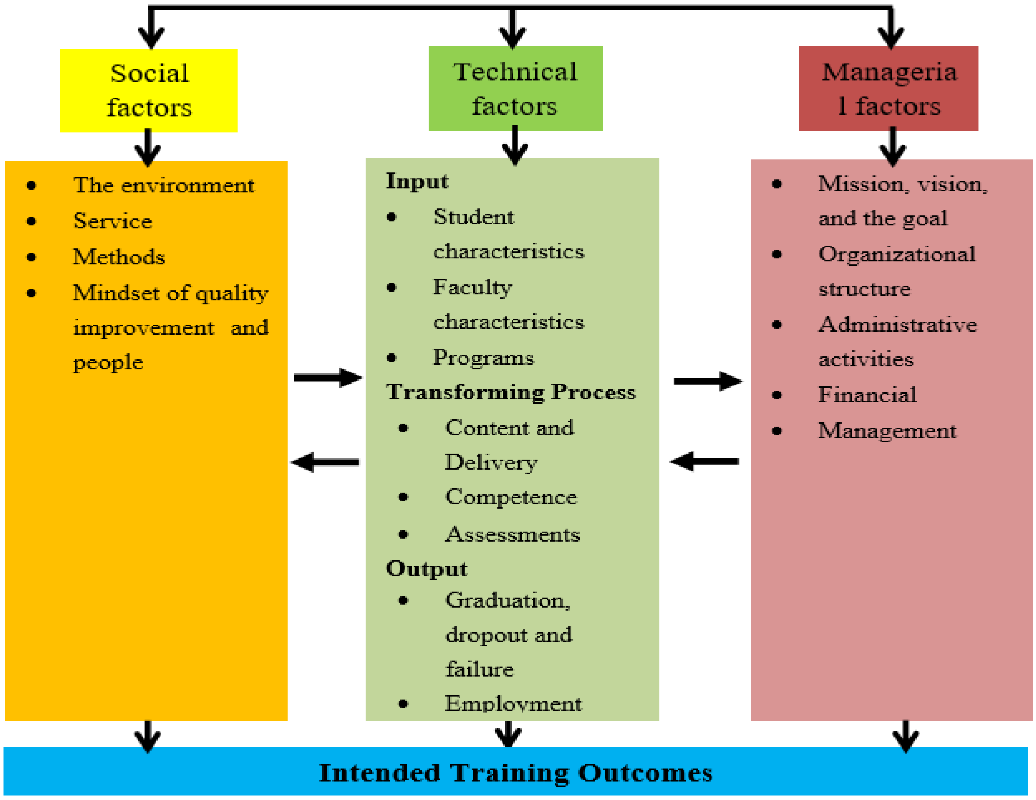
Quality assurance system needs to be transparent and provide sufficient information to the public and relevant stakeholders (Matei & Iwinska, 2016). Therefore, teacher training programmes should aspire to satisfy the requirement of their stakeholders and society. All the indicators for quality assurance are provided in the design and implementation of the programme for its proper assessment, which could bring out the problems faced in its implementation and for affordable corrective measures (Umar, 2007). Mizikaci (2006) proved that the implementing model has shown effective in encouraging cross-departmental and cross-institutional strategies for highlighting awareness of common issues, expectations of performance, facilitating communication and collaboration among, and within the branches, based on a common understanding of key values and concepts. Therefore**,** quality can be assumed a system approach or systematic plan and applied especially in the context of education colleges.

Systems Approach

The word "system" rooted from Greek origin systema, derives from syn meaning together and histemi meaning to set. A system is simply an assemblage or combination of things or parts forming a complex whole (Jenkins, n.d.). A concept and definition of the systems approach is a methodology for solving problem (Chen, 1975). The systems approach can assist in studying the structure and functions of education colleges and has been utilized as the inter-relations in various functions.

Educational Institution as a Sub-system

Bertalanffy (1972) verified that the overall system can be designed, fitted, checked and operated by the sub-systems to achieve the overall objective efficiently. So, educational institution is a system or sub system- it has inputs like students, infrastructure, financial resources, instructional resources, etc. The processes are admission, instruction, evaluation, etc., and outputs are the graduates - their behavioral, academic and physical qualities. Mukhopadhyay (2001) said that these components as inputs, processes and outputs are dependent on one another, in a systemic framework. Mizikaci (2006) proposed a model based on Tribus' model and which is preceded by establishing social, technical and managerial systems simultaneously. There are some adaptionss of this model for the transformative nature of education colleges.



Source: Adaptive From Mizikaci (2006).

Figure 1 Pre-service Teacher Training Programme in Education Colleges

Research Methodology

Research Design

The research design for this study was a descriptive design.

Procedure for the Study

Researcher found out the related literature after formulating the problems and shooting the research questions. After that, the set of questionnaires was developed under the guidance of supervisor and discussions were taken with teacher educators from the methodology department to iron out the problem of questionnaire before sending to field expert persons. After preparing the instruments in order to get validation, expert review was conducted by nine experienced teacher educators from the education colleges. When ambiguities were found in the questionnaire and test, some changes were made in the questionnaire and test after consulting with the experts. To find the reliability of the instrument a pilot test was administered with (66) teacher educators from Hlegu education college and Thingangyun education college in January second week. The same procedures of data collection was conducted in all state and regions to reduce the bias of study in collection the data. The data were collected with the help of principals and participants and then data were both input and analyzed by using the Statistical Package for the Social Science (SPSS 20).

Instrument

A questionnaire was used to investigate the influencing factors on pre-services teacher training programmes. The questionnaire was constructed based on The European Union Programme for Human Resources Development, on improving the institutional capacity of the Education and Teacher Training, Agency's (ETTA) assessment of the needs for teacher straining. The questionnaire consisted of Likert-type scale and open-ended questions. The total items were (60) on five point Likert-type scale from (1) to (5). In this questionnaire, Likert-type scale were composed into the three sections: social factors, technical factors and managerial factors. Twenty items for each factor were used. For items, the score closer to (1) indicated “Never/Strongly Disagree” and “Always/ Strongly Agree” was indicated by the score closer to (5).

Population and Sample Size

Among twenty five education colleges out of them fourteen education colleges from respective state and region of country (Myintkyina, Loikaw, Hpaan, Haktha, Mawlamying, Kyaukphyu, Lashio, Monywa, Dawei, Taungoo, Magway, Mandalay, Yankin, Pathein) were selected rondomly. There were randomly selected teacher educators (561) who were participated from five academic department and finance managements departments.

Data Analysis

The data were systematically analyzed by using the Statistical Package for the Social Science (SPSS20). The descriptive analysis techniques were used to calculate the means, the standard deviation and the percentage. Moreover, Pearson product- moment correlation was used to describe the relationship between three factors.

Research Findings

Findings of Influencing Factors on Teacher Training Programmes in Education Colleges

The categories and subcategories of influencing factors were adapted from Mizikaci’s (2006) proposed an evaluation model for the quality implementations in higher education which was used to explore the influencing factors on teacher training programmes in education colleges in this research. The three main categories are: (1) social factors, (2) technical factors, and (3) managerial factors.

Findings of Influencing Factors in terms of Social Factors

In order to find out the influencing factors in terms of social factors, (20) items were used. The mean was (82.27) and the standard deviation was (8.606). According to the results, the lowest mean and the highest mean were (77.38) and (87.16) respectively. Figure 2 presents the comparison of the means of all the selected education colleges.

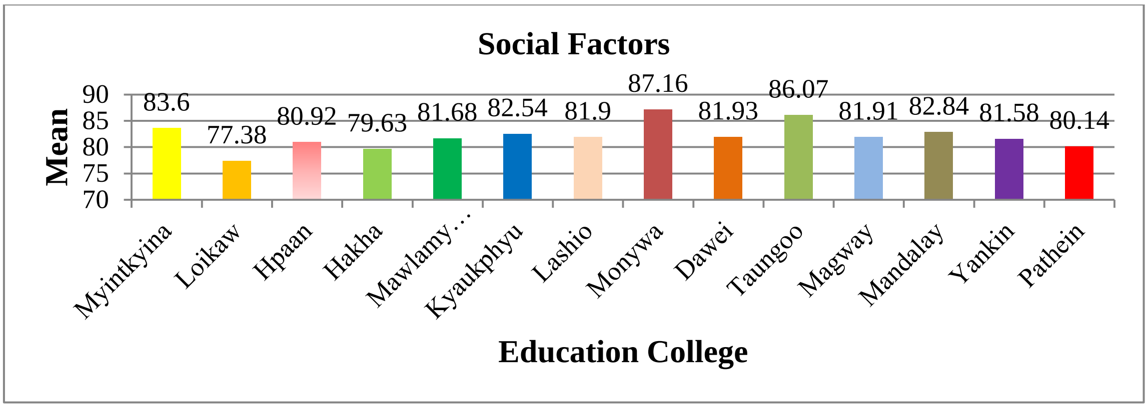


Figure 2 Means of Influencing Factors in terms of Social Factors on Teacher Training Programmes in the Selected Education Colleges

Besides, it is necessary to find out the percentage of the influencing levels for the social factors which are influencing on pre-service teacher training programmes. The full score for questionnaire of social factors was (100). The sample mean and the standard deviation in influencing social factors were (82.27) and (8.606) respectively. Based on the scores of the questionnaire of social factors the score below (74) were identified as low influencing level, and the score between (91) and (74) were considered as moderate influencing level, and the score above (91) were identified as high influencing level. These scores refer to the performance scores of participants.

Table 1 Influencing Level of Social Factors

Influencing Level of Social Factors	Score (x)	Percentage (%)
Low	x <74	18
Moderate	74≤ x ≤ 91	71
High	x >91	11
Total		**100%**

Findings of Influencing Factors in terms of Technical Factors

In order to find out the influencing factors in terms of technical factors, (20) items were used. The mean is (72.40) and the standard deviation is (11.280). According to the results, the lowest mean and the highest mean were (67.08) and (77.38) respectively. Figure 3 presents the comparison of the means of all the selected education colleges.

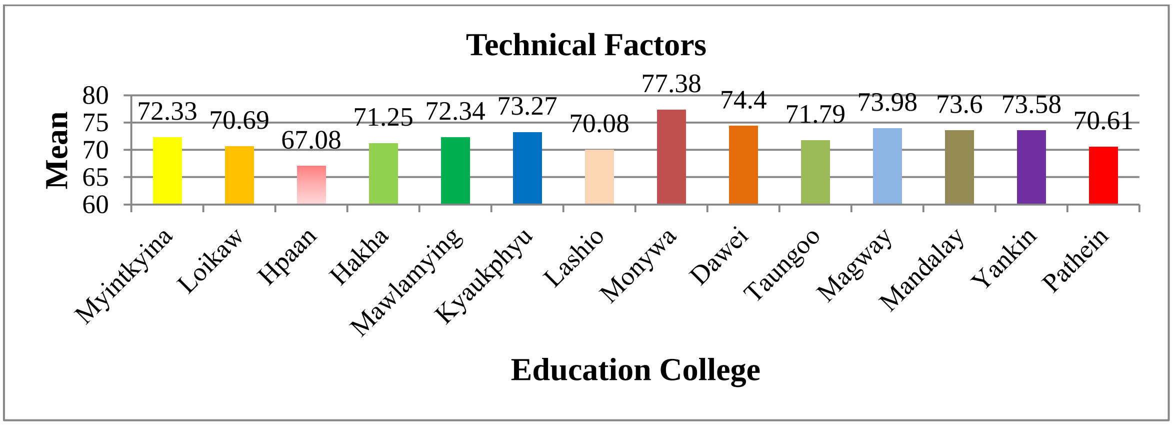


Figure 3 The comparison of the means of all the selected education colleges

The full score for questionnaire of technical factors was (100). The sample mean and the standard deviation in influencing technical factors were (72.40) and (11.280) respectively.

Based on the scores of the questionnaire of technical factors which are influencing on pre-service teacher training programmes, the score below (61) were identified as low influencing level, and the score between (84) and (61) were considered as moderate influencing level, and the score above (84) were identified as high influencing level. These scores referred to the performance scores of participants. The (99) participants had low level of performance so influencing level 18% was the low influencing level , (388) participants had moderate level of performance so influencing level 69% was the moderate influencing level , and (74) participants had high level of performance so influencing level 13% was the high influencing level.

Table 2 Influencing Level of Technical Factors

Influencing Level of Technical Factors	Score (x)	Percentage (%)
Low	x <61	18
Moderate	61≤ x ≤ 84	69
High	x >84	13
Total		**100%**

Findings of Influencing Factors in terms of Managerial Factors

In order to find out the influencing factors in terms of managerial factors, (20) items of questionnaire were used. The mean is (72.46) and the standard deviation is (12.141).

According to the results, the lowest mean and the highest mean were (66.66) and (77.40) respectively. Figure 4 presents the comparison of the means of all the education colleges.

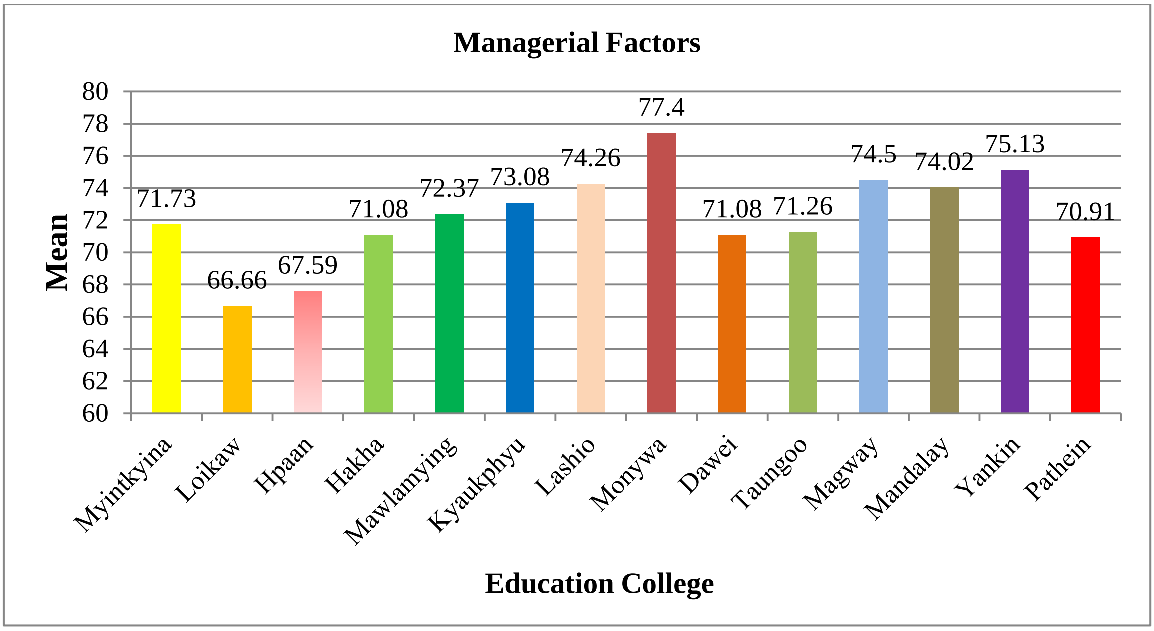


Figure 4 The Comparison of the Means of All the Education Colleges

The sample mean and the standard deviation in influencing managerial factors were (72.46) and (12.141) respectively. Based on the scores of the questionnaire of managerial factors which are influencing on pre-service teacher training programmes, the score below (60) were identified as low influencing level, and the score between (85) and (60) were considered as moderate influencing level, and the score above (85) were identified as high influencing level. These scores refer to the performance scores of participants.

Table 3 Influencing Level of Managerial Factors

Influencing Level of Managerial Factors	Score (x)	Percentage (%)
Low	x <60	15
Moderate	60≤ x ≤ 85	72
High	x >85	13
Total		**100%**

Findings of Total Influencing Factors on the Pre-service Teacher Training Programmes in Education Colleges

In order to find out the influencing factors: the social, technical and managerial factors on the pre-service teacher training programmes, (60) items of questionnaire were used. The mean is (227.14) and the standard deviation is (26.998). The score for influencing social factors ranged from (124) to (290).

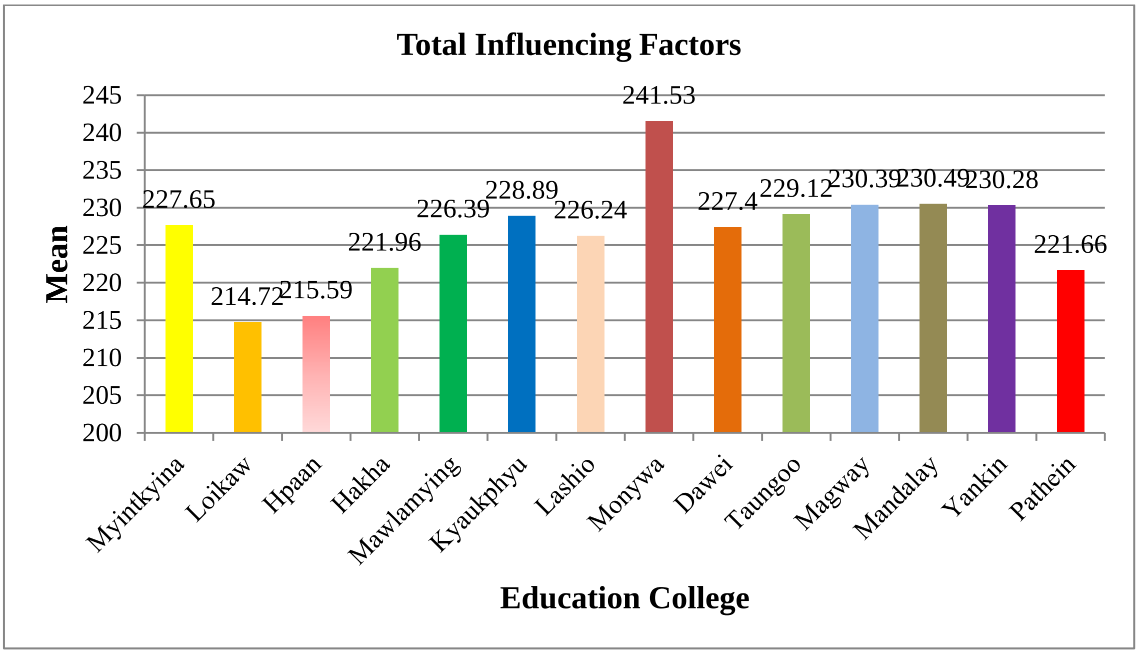


Figure 5 The Comparison of the Means of Total Influencing Factors on Teachers Training Programmes in the Selected Education Colledges

The sample mean and the standard deviation in influencing factors were (227.14) and (26.998) respectively. Based on the scores of the questionnaire of all influencing factors which are influencing on pre-service teacher training programmes, the score below (200) were identified as low influencing level, and the score between (254) and (200) were considered as moderate influencing level, and the score above (254) were identified as high influencing level. These scores referred to the performance scores of participants.

Table 4 Influencing Level According to Three Factors

Influencing Level of All Three Factors	Score (x)	Percentage (%)
Low	x <200	16
Moderate	200≤ x ≤ 254	69
High	x >254	15
Total		**100%**

Findings of Interrelationships of Three Factors on Teacher Training Programmes of Education Colleges

Further analysis was conducted to examine the relationships among the influencing factors on pre-service teacher training programmes of education colleges: social factors, technical factors and managerial factors. The Pearson product-moment correlation was used to determine the interrelationships, of three categories of influencing factors (see Table 5).

Table 5 The Interrelationships between the Three Influencing Factors on Teacher Training Programmes of the Selected Education Colleges

Correlation			
	S	**T**	**M**
Social Factors (S)	1	.435**	.454 **
Technical Factors (T)		1	.734**
Managerial Factors (M)			1

**. Correlation is significant at the 0.01 level (2-tailed).

It was significant high relationships. The direction of the relationships were positive. This means that if one of the influencing factors is high, the other influencing factors are likely to be high or if one of the influencing factors is low, the other influencing factors are likely to below.

Discussion, Suggestions, Conclusion

Discussion

Under the guidance of NESP strategic seven, all education colleges have implemented to achieve the quality improvement and quality assurance. The dynamic aspect of quality system, such as the outputs and the process perspective refer to the teacher education and its quality is easy to revert to managerial concepts such as quality mechanisms (Hudson, Brian, Zgaga, Pavel & Åstrand, Björn, 2010). At the view point of system approach there is transforming into open system to achieve the quality by pragmatists who are more willing to put that belief into practice (Ozmom, 1986).

Thus social factors moderately influenced on teacher training programmes. The social system of teacher training programmes possessed adequate judicious environment, reasonable service and innovated working method to support the pre-service training programmes. The physical aspects of the learning environment can affect psychological and social behavior (Moos, 1979). The Influencing of social factors confirmed that adequate learning environment can provide the quality improvement. So, influencing factors, social system influenced as hallmarks of education colleges and its training programmes. These potentiality should be driven force as energetic input for others sub-systems (technical and managerial factors) development in cyclic process.

Secondly, according to the findings, the technical factors moderately influenced on teacher training programmes. Technical factors demented strengthening in its component sub factors. So, most of teacher educators comprehended in pedagogical delivery although not all utilize effectively in technical transforming process. Navaratnam (1997) pointed out that in case of input and output, it is necessary to identify various processes in the school with qualitative attributes. So, teacher educators should have potentially adopted and adapted in the technical transformation process in the professional field. Effective training program recognized the teachers' quality and requested to teacher competency frame work for professional development. So, there are essentially demands for upgrading in those factors of quality transformation.

Thirdly, according to the findings, managerial factors are moderately influenced on teacher training programmes. Mukhopadhyay (2001) said that recognize the management profitability is essential to future success. Participatory management and team work are natural associates of total quality management Mukhoadhyay (2001).Thus managerial factors as cooperative structures and adaptive systems, which governed the steady state for open system nature. So, moderate level of management considered there was participatory management provided exposure and engaged the pre-service teacher training programmes.

Fourthly, the social factors were the most influenced among the others factors. the technical factors were the lowest influenced among the others factors on teacher training. This finding showed that the managerial factors were nearly similar to the technical factors. Therefore, it is assumed that not only the managerial factors but also the technical factors were less influence than social factors.

The system point of view those three sub system were composed as pre-service teacher training programmes, in which the social sub-system had the tendency to confine sociological observations to the positive contribution to system and most of teacher educators have the dysfunctions. Although technical sub - system, managerial sub - system had manifest function in more contribution to adjustment and adaptation of system development and quality improvement. Pre-service teacher training programme of education colleges should try to be more open system nature and should be improved by more supporting in resources, technical, finical, physical and psychosocial-environment and other supports.

This finding proved that Bertalanffy (1972) viewed as a system as a set of elements standing in interrelation among themselves and with the environment. The research findings were in line with system thinking, all system; physical or soft must have predetermined objective that the interrelated components strive to achieve (Patton & McCalman, 2000, cited in Mukhopadhyay, 2001). To sum up, the pre-service teacher training programmes of education colleges were influenced by moderate level in the social factors, technical factors and managerial factors among them, the social factors were the highest and technical factors were lowerest. Besides, three factors had intercorrelation as well as significantly positive relationships. Thus proved Bertalanffy's systems theory, is that the whole is more than the sum of its parts that the whole determines the nature of the parts, and the parts are dynamically interrelated and cannot be understood in isolation from the whole.

Suggestions for Social System

Education colleges having the sound environment, health and safety and access to their stakeholder, should be more established and implemented. (eg: electronic library, health care center, recreation center, information and news center). That suitable maintenance staff should be trained or appointed to improve the physical conditions and resources. That the relationship among education colleges, education institutes, other university, basic education schools and community should be more continued and improved where necessary.

Suggestions for Technical System

System to redesign, develop, review and approve curricula for the teacher training programmes and contents with relevant and up-to-date for educational innovation. That a long term action plan for curriculum renewal should be designed and implemented. Teacher competences in the various level of categories should be identified and legally prescribed. Key performance indicators and targets should be established to measure the performance of teachers' competency and strategic goals of the programmes. The appropriate incentive schemes should be developed to attract the most competence teacher educators into the education colleges. Making the research and using the results in educational training programmes should be reflected and encourage for quality improvement of education colleges. The process of student assessment including the grading criteria should be documented and communicated to students on commencement of a programme and employability. Employability of graduates of the training programmes should be established the probation and tenureship process for monitoring and examining.

Suggestions for Managerial System

The mission of education colleges should be more cascaded and demonstrated for implementation under the. Full strength of staff capacity should be urgently appointed. Each college should prepare staff development plans which incorporate reflective research activities for each staff member's. External relations, networks and partnerships should be established and improved to achieve the strategic goals of the education colleges. Funds should be established available for education colleges to pursue research and areas of interest and relevance to improve the quality for teacher training programmes of education colleges.

Conclusion

The study for the exploration an influencing factors on teacher training programmes has been conceived as a tool to introduce the system perspective to all aspects of pre-service teacher training programmes, notably, social system, technical system and managerial system for quality improvement. It was recognized teacher training programmes, sub –system of teacher education system should have the nature and the character of open system for quality development. It was teacher training programmes reflected the overall expectation of quality education open system and faced ever-increasing demand for equifinality of the system.

All teacher educators should sustain and strengthen the existing positive factors of the programmes and establish not only the quality system but also the local networks in regions and states. These network can serve as platforms to exchange information and good practice, disseminate knowledge, increases the understanding of development and challengences as well as professional expertise of teachers' educators. This study can take parts as the small corner point of view for quality improvement in pre-service teacher education. The finding reveal that there are positive influencing factors and a clear understanding of what needs to be done to improve pre-service teacher training programmes. In addition these factors have translated into actual situations for changing in quality development of the teacher training programmes. The findings should be taken account in prioritization and transforming process to try and generalize these positive influencing factors across the system as a whole. Therefore, to improve the quality of teacher education programmes further studies should be conducted to evaluate both in-service and pre-service teacher training programmes of education colleges.

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A STUDY OF THE INFLUENCE OF CLASSROOM ENVIRONMENT ON THE ACADEMIC ACHIEVEMENT OFHIGH SCHOOL STUDENTS

Htay Lwin[1] and Sann Cho[2]

Abstract

The main purpose of this study is to investigate the influence of classroom environment on the academic achievement of high schools students. Questionnaire survey method was used and six sample schools were selected by a simple random sampling method. A total of (360) Grade Nine students (140 male students and 220 female students) from three high schools and three high school (branch) from Taze Township participated in this study. In order to get the required data, the questionnaire having 40 items with five points Likert scale was used. The questionnaire was based on five dimensions: school climate, communication, teachers' performance, classroom management and opportunity for learning. The reliability coefficient of the questionnaire was 0.879. Descriptive statistics, independent samples *t* test, one-way ANOVA and Pearson product moment correlation were applied to analyze each research question. The results showed that female students more positively perceived their classroom environment than male students. The results of the ANOVA showed that there was no significant difference in the students' perceptions among the six schools. Pearson correlation revealed that the classroom environment was significantly related to the students' academic achievement. Therefore, students' academic achievement can be predicted by examining their classroom environment.

Keywords: classroom environment, achievement, academic achievement

Introduction

Importance of the Research

Education is an essential factor for effective development of any country and plays a vital role in the development of human resources. The quality of education is a central theme in education systems and is linked with an individual's well-being and opportunities for better living. The quality of education not only depends on the teachers as reflected in the performance of their duties, but also in the effective coordination of the school environment.

In any school setting, whether it is elementary, secondary, or higher education, classroom environment is specially regarded as one of the most critical determinants of students learning outcomes. Classroom Environment is included in school climate or educational climate, part of the larger focus on school environment. Classroom environment identifies relationships among students with each other, the teacher and how this translates into learning. So, it is important to determine classroom environment and then to use the results as part of the comprehensive plan for school environment.

Classroom and social environment factors were found to be particularly important influences on student outcomes, even when a number of other factors were controlled. Classroom practices and developments have indicated that a positive classroom climate is needed for effective learning. International relationships, student-teacher relationship, peer relationships, teachers' beliefs and behaviors, teachers' communication style, classroom management and group processes are themes that can be considered to be included in the concept of the social climate of learning environments. That is why this study investigates classroom environment

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considering school climate, student-teacher relationship, peer relationships, teachers' performance and communicate style in class, classroom management and opportunity for learning.

Classroom Environment can influence students' academic outcomes. Creating a positive classroom environment is an important aspect of effective teaching. By creating positive classroom environment, teachers are provided the opportunity for better classroom discipline and management. A positive classroom environment is essential in keeping behavior problems to a minimum. It also provides the students with an opportunity to think and behave in a positive manner. Positive classroom environment helps to enhance, promote and encourage students' learning in all academic settings.

In Myanmar, male and female students are significantly different in academic performance especially for early adolescents. Similarly, there is also a great variation of students' performance among schools or learning environments. So, this study will examine the differences to improve the classroom environments and leaning outcomes of Myanmar Education. It is hoped that this study will provide information for parents, educators and school administrators to reflect upon various factors that help students in achieving their academic goals.

Purpose

The main purpose of the research is to investigate the influence of classroom environment on the academic achievement of high school students.

Objectives

The specific objectives of the research are as follows:

1. To identify the difference in students' perceptions on their classroom environment by gender.
2. To identify the difference in students' perceptions on their classroom environment in terms of school.
3. To explore the relationship between the classroom environment and the academic achievement of students.
4. To give suggestions and recommendations based on the results of the study.

Research Questions

1. Is there any difference in the students' perceptions on their classroom environment in terms of gender?
2. Is there any difference in the students' perceptions on their classroom environment in terms of school?
3. Is there any relationship between the classroom environment and the high school students' academic achievement?

Definition of Key Terms

Classroom Environment - Classroom environment encompasses a broad range of educational concepts, including the physical setting, the psychological environment created through social contexts, and numerous instructional components related to teacher characteristics and behaviors (Miler & Cunningham, n.d.).

Achievement - Achievement is defined as a product which can be measured by means of achievement tests (Annie & Stoker, 1996).

Academic Achievement - Academic achievement is the extent to which students, teachers or institutions have achieved their short or long-term educational goals (Annie& Stoker, 1996).

Scope of the Study

The researcher selected three hundred and sixty Grade Nine students from six high schools by using a systematic sampling method. To investigate the influence of the classroom environment on the academic achievement of high school students, this study was organized with five dimensions such as school climate, communication, teachers' performance, classroom management, and opportunity for learning.

Review of Related Literature

Classroom Environment

Classroom environment encompasses a broad range of educational concepts, including the physical setting, the psychological environment created through social contexts, and numerous instructional components related to teacher characteristics and behaviors. The study of classroom environment has been widespread across nearly all sub-specializations of educational psychology. Researchers are interested in relationships between environment constructs and multiple outcomes, including learning, engagement, motivation, social relationships, and group dynamics. Early researchers recognized that behavior is a function of people's personal characteristics and their environment (Miler & Cunningham, n.d.).

The classroom is an environment in which educational goals such as concern for community and concern for others must be promoted and modeled if they are to be acquired. This learning environment contains learners with their own personal histories, values, assumptions, beliefs, rights, duties, obligations and learning styles, for whom the learning task is a mean of perceiving and using linguistic affordances as appropriate, fostered by a climate of cooperative social interaction which produces new, elaborate, advanced psychological processes that are unavailable to the organism working in isolation (Vygotsky, 1986, cited in Finch, 2001).

Classroom environment within the school is a major influence in the development of students' self-concept. Landis (1972, cited in Persad, 1980) suggested that the classroom environment is an important aspect of the student's frame or reference. Landis found that students who achieve well in school exhibit higher self-concepts than do those who achieve poorly. Combs (1962, cited in Persad, 1980) indicated that the child learns about himself not only through his own success and failure, but also from the reactions of people toward him. He suggested that classroom environments should be more flexible, thus providing opportunity for students to explore and expand on their learning preferences.

Classroom has great impact on academic achievement. Teacher's attitude and behaviors are vitally important, and genuine involvement of student in class activities, flexibility of rules by teachers, communication, competition, staff morale also playacrucial role. The use of new techniques, planning various activities and assignments, encouraging creative thinking in student, affiliation between classmates and teacher are various factors which influence academic achievement of students (Ranka, 2016).

The classroom learning environment has a strong influence on students' outcomes and plays an important role in improving the efficiency of learning in all levels of classrooms (Arisoy, 2007). Classroom environment has two aspects: one is the physical environment (the material setting of the classroom such as furniture, lighting, spaces, desks, chairs) that affects the safety, the comfort of students, and learning and personal development of students. The other is the psychological environment referring to the social quality of the school and classroom. It is concerned about the perceptions and feelings about social relation among students and teachers (Arisoy, 2007).

To conclude, the classroom environment is a reflection of students' opinions concerning their academic performance. This includes students' perceptions of the rigor of the class, their interactions with their instructor and class peers, and their involvement in the class. Although each student will develop his or her individual sense of the classroom environment, there is also a common sense among the students and the instructor. Classroom learning environment has a strong influence on students, outcomes and plays an important role in improving the efficacy of learning in all levels of classrooms.

Concept of Academic Achievement

Educational institutions are mandated to use education as a tool for social transformation. The success of a school is measured by the quality of students it produces. The success of any institution is measured by the performance of its students in both academic and non-academic tests. Academic achievement is the educational goal that is achieved by a student, teacher or institution achieves over a certain period. The academic achievement of students heavily depends upon the parental involvement in their academic activities to attain the higher level of quality in academic success (Lemessa, 2015).

Academic achievement is commonly measured by examinations or continuous assessment but there is no general agreement on how it is best tested or which aspects are most important. According to Annie, Howard, Stoker and Mildred (1996, cited in Oldeh, et al., 2015) academic achievement is the outcome federal the extent to which a student, teacher or institution has achieved their educational goals.

Bossaert, Doumen, Buyse and Verschueren (2011, cited in Oldeh, et al., 2015) defines academic achievement as student's success in meeting short or long term goals in education in the big picture. According to the authors, academic achievement means completing high school or earning a college degree. Lassiter (1995, cited in Oldeh, et al., 2015) looks at students' academic achievement as referring to a students' strong performance in a given academic area. A student who earns good grades or awards in science has achieved in the academic field of science. In classrooms, students perform their potentials efficiently, as a result of it, learning takes place and the learning outcome changes the behavior pattern of the student through different subjects.

To summarize, academic achievement is often used as an indicator of school quality because it is easily measurable using standardized tests. In this study, academic achievement was defined according to how well a student accomplishes work in all subjects. It was assessed by the students' total scores of all subjects in October Examination.

Factors Influencing Students' Academic Achievement in the Classroom Environment

Classroom Environment is very important for students so as to learn happily and freely in it and to improve their academic achievement. There are many essential factors that can influence students' academic achievement in the Classroom Environment. Some of them are;

School Climate

School climate is determined by the prevailing attitudes of teachers and administrators. School climate suggests level of teacher and administrator expectations of learners. It defines pattern of interaction among learners, teachers and administrators. When teachers, learners and principals all believe that academic achievement is possible, the school climate is conducive to learning, and achievement tends to be higher than otherwise would be predicted (Good and Brophy, 1986, cited in Armstrong, Henson & Savage, 1989).

School climate can be a positive influence on the health of the learning environment or a significant barrier to learning. The school environment can affect many areas and people within schools. A positive school climate has been associated with fewer behavioral and emotional problems for students.

Communication

Communication is an important form of interpersonal interaction and its forms can really help teachers improve their teaching style, strengthening the bound between them and their students (Babonea&Munteanu, 2012). Communication has helped to build relationships, and the extent to which students have liked and respected one another has been shown to impact the level of academic performance. Students who have been accepted by their peers and liked them in return, have felt better about being in the classroom. The effectiveness of the teaching and learning in the classroom environment is determined by the quality of the communication process.

Teachers' Performance

Teacher performance is the most crucial input in the field of education. Whatever policies may be laid down, in the ultimate analysis these have to be interpreted and implemented by the teachers, as much as through their personal examples as through teaching-learning process. Performance refers to an act of accomplishing or executing a given task (Owei, 1999, cited in Adejumobi, 2013).

The term teaching performance is referring to the conduct of instruction: posing questions, providing explanations, giving directions, showing approval, engaging in the myriad instructional acts that a teacher performs in the classroom. Performance could be described: an act of accomplishing or excuting a given task, the ability to combine skillfully the right behavior towards the achievement of organizational goals and objectives, the ability to combine relevant inputs for the enhancement of teaching and learning process (Adeyemi, 2010).

Classroom Management

One major aspect of the classroom climate that has fallen under the control of the teacher is that of classroom management and discipline. Classroom management refers to actions taken to create and maintain a learning environment conducive to successful instruction. According to Dugguh (2007, cited in Kedir, 2015), classroom management is the action a teacher takes to create an environment that supports and facilitates instructions, academic, social and emotional learning.

Classroom management is a critical part of effective and successful instruction. Effective classroom management, which initiates with well-organized and efficient lesson planning preparation, helps a teacher to teach and students to learn. Classroom management includes these activities which impact academic achievement: management of curriculum planning, management of student behavior and procedure. Classroom management enhances students' questioning and exploration only if the learning environment is conducive. Effective learning depends completely on a well-managed classroom. If a classroom is not well-managed, it may have disordered and disruptive, and carelessness and poor learning may result. It is obvious that classroom management is important in student academic achievement (Kedir, 2015).Classroom management is the heart of teaching and learning in school setting. A well-managed classroom can provide an exciting and dynamic experience for everyone involved.

Opportunity for Learning

The achievement of students depends on the teachers' effort and preparation or creation of learning environments. There are so many factors that make a positive learning environment. In creating learning environment, teachers should considered the following factors:

- Teachers should have the feeling of connectedness
- Address learners' needs
- Keep it possible
- Provide feedback
- Celebrate success
- Safety
- Employ interactive games and activities.

There are ten characteristics of a highly effective learning environment.

- Encourage students to ask questions.
- Pay more emphasis on questions, not the answers.
- Be open to ideas.
- Mix up teachers' learning techniques.
- Teacher teaching reaches beyond the classroom walls.
- Personalize teachers' learning.
- Do away with a clinically based assessment plan.
- Ensure that students understand the criteria for success.
- Relearn learning habits.

Developing Positive Classroom Environments

Creating a positive classroom environment is an important aspect of effective teaching. By creating positive classroom environments, teachers are provided the opportunity for better classroom discipline and management. A positive classroom environment is essential in keeping behavior problems to a minimum. It also provides the students with an opportunity to think and behave in a positive manner. Positive classroom environments help to enhance, promote, and encourage students' learning in all academic settings. The classroom environment can be defined in terms of the students' and teachers' shared perceptions in that environment (Fraser & Pickett, 2010).

There are a number of ways in which teachers can create positive classroom environments. Some suggestions for creating a positive classroom environment includes: starting the year with high expectations, encouraging student involvement, making the classroom visually appealing, getting parents involved, and using effective praise and effective feedback.

A positive classroom environment is an important tool for establishing a successful and effective school year. There are numerous factors that may have an influence on positive classroom environments. However, it is critical that teachers create a positive classroom environment to encourage the students' growth. A positive classroom environment enhances the students' ability to learn and to be productive in and out of the classroom.

Research Method

Participants

Six Basic Education High Schools in Taze Township were selected by using a random sampling method. Grade Nine students in these selected schools were considered as the sample of the study. A sample of (360) high school students from these schools were selected by using a systematic sampling method.

Instrument

As an instrument, a questionnaire to explore the influence of classroom environment on the academic achievement of high school students was constructed on the basis of the questionnaires of Mcghee, Lowell &Lemire (2007). The questionnaire included five-point Likert-scale items for five dimensions as follows:

1. School Climate
2. Communication
3. Teachers' Performance
4. Classroom Management
5. Opportunity for Learning

Procedure

First of all, the researcher explored the relevant literature concerning with the research. Secondly, in order to get the required data, the researcher constructed an instrument. For the validation of the instruments, the questionnaire was distributed to three experience teachers in Sagaing University of Education. The instruments were modified before the preliminary survey. The preliminary survey was conducted on 18th November, 2017 with forty Grade Nine students at No.(2), BEHS, Shwebo. For the internal consistency reliability, Cronbach's alpha coefficient was used. The reliability coefficient of the questionnaire was 0.879.

And then, the major survey (main study) was conducted on 27th November, 2017. Finally, the data obtained from the survey were analyzed. The academic achievement scores of Grade Nine students from October first semester examination were used as the criterion measure of students' academic achievement in the present study.

Analysis of the Data

The data were analyzed by using a descriptive statistics (mean, percentage and standard deviation), independent samples *t*-test and one-way ANOVA. The independent samples *t*-test was applied to compare the differences in Grade Nine students' perceptions on classroom environment by gender. One-way ANOVA was applied to compare the differences in students' perceptions on their classroom environment by each school. Moreover, Pearson product moment correlation was used to determine the interrelationship between Grade Nine students' perceptions on classroom environment and their academic achievement.

Research Findings

Descriptive Statistics for Students' Perceptions on Classroom Environment

In order to examine the Classroom Environment, students' perceptions on classroom environment were surveyed with the use of the Classroom Learning Environment (CLE) Questionnaire is based on questionnaires of Mcghee, Lowell &Lemire (2007).

Table 1 Means and Standard Deviations of Students' Perceptions on Classroom Environment

Components	*N*	*Minimum*	*Maximum*	*M*	*SD*
School Climate (SC)	360	22	40	34.75	3.459
Communication (C)	360	18	40	33.76	4.390
Teachers' Performance (TP)	360	18	38	29.81	3.721
Classroom Management (CM)	360	18	39	30.11	4.062
Opportunity for Learning (OL)	360	8	40	29.38	5.205
Total	360	20	39	31.65	2.931

It can be found that Grade Nine students' perceptions on their classroom environment were satisfactory. In studying the means related to school climate, communication, teachers' performance, classroom management, and opportunity for learning, it was found that the students positively perceived school climate because it has the highest mean of 34.75 and students' perception was the least in opportunity for learning because it has the lowest mean of 29.38. Then, learning opportunities and activities for students should be promoted in schools, while physical environment for students was favorable to some extent.

Comparison of Students' Perceptions on Classroom Environment by Gender

In order to explore the gender differences in students' perceptions on classroom environment, the independent samples *t*-test was used. The results were shown in Table 2.

Table 2 The Results of t-test for Students' Perceptions on Classroom Environment by Gender

Components	Gender	N	M	SD	t	df	Sig.(2-tailed)
SC	Male	140	33.91	3.887	-1.375	358	.000***
	Female	220	35.28	3.048			
C	Male	140	32.68	4.668	-1.771	358	.000***
	Female	220	34.45	4.006			
TP	Male	140	29.44	3.392	-5.98	358	.137
	Female	220	30.34	3.570			
CM	Male	140	28.26	4.187	-2.031	358	.000***
	Female	220	30.90	3.783			
OL	Male	140	28.26	5.605	-2.568	358	.000***
	Female	220	30.83	4.679			
Overall	Male	140	30.63	3.058	-5.474	358	.000***
	Female	220	32.30	2.634			

Note: ***p<.001

As shown in Table 2, there were significant gender differences in all the components of classroom environment, except for the component of teachers' performance. It can be found that female students were more highly perceived their classroom environment than the male students. But, the mean of male students did not differ significantly from that of female students on teachers' performance in classroom environment. So, there was no significant gender difference in the students' perceptions on teachers' performance.

However, in general, it was statistically significant in the students' perceptions on classroom environment, based on means, that female students had higher perception than male students. Analysis of the group statistics indicated that the average perception mean on classroom environment for female students (32.30) was higher than the mean of male students (30.63). This finding can be interpreted that girls perceived on their classroom learning environments more positively than boys did.

In comparing the means of male and female perceptions on classroom environment and their academic achievement, it was found that these two variables are related. In other words, the academic achievement scores of female students became high when their perceptions on the classroom environment were favorable. On the other hand, the males' achievement scores became low when their perceptions on the classroom environment were unsatisfied (see Table 3).

Table 3Mean Comparison of Students' Perceptions on Classroom Environment and their Academic Achievement

Student	Perceptions on Classroom Environment	Academic Achievement
Male	30.63	186.85
Female	32.30	195.12

In order to determine whether there was any significance in Grade Nine students' perceptions on their classroom environment in terms of school, sample analysis of variance (ANOVA) was used to analyze the data.

Table 4 ANOVA Results of Students' Perceptions on Classroom Environment in terms of School

Component		Sum of Squares	df	Mean Square	F	Sig.
SC	Between Groups	63.158	5	12.632	1.056	.384
	Within Groups	4232.840	354	11.957		
	Total	4295.997	359	44.877		
C	Between Groups	224.387	5	44.877	2.374	.039*
	Within Groups	6693.069	354	18.907		
	Total	6917.456	359			
TP	Between Groups	35.277	5	7.145	.513	.767
	Within Groups	4934.048	354	13.983		
	Total	4969.775	359			
CM	Between Groups	83.404	5	16.681	1.011	.411
	Within Groups	5840.585	354	16.499		
	Total	5923.989	359			
OL	Between Groups	239.810	5	47.962	1.790	.114
	Within Groups	9486.190	354	26.797		
	Total	9726.000	359			
Total	Between Groups	1006.817	5	201.363	.937	.457
	Within Groups	76093.672	354	214.954		
	Total	77100.489	359			

Note: *$p<.05$

The result of Table 4 indicated that students' perceptions on classroom environment did not differ significantly, except for the component of communication. It meant that communication behaviors are different among the schools. Generally, it can be interpreted that the classroom environments of the six schools differed a little but had no significance.

Relationship between Classroom Environment and Students' Academic Achievement

After examining students' perceptions on the classroom environment, it was continued to investigate the relationship between classroom environment and the academic achievement of Grade Nine students. Pearson product moment correlation was also calculated to know this relationship.

Table 6 Relationship between Classroom Environment and Students' Academic Achievement

Variable	Classroom Environment	AcademicAchievement
Classroom Environment	1	.191**
Academic Achievement	.191**	1

**. Correlation is significant at the .01 level (2-tailed).

The result showed that the students' perceptions on classroom environment were significantly related to their academic achievement at the 0.01 level. The strength of correlation coefficient was low (r=.191). However, there was a positive relationship between students' perceptions on their classroom environment and their academic achievement. This meant that if students' perceptions on their classroom environment are favorable, their academic achievement will be high. In other words, the two variables were positively correlated. Therefore, it can be concluded that the good and favorable classroom environments are likely to have higher students' academic achievement.

Conclusion

Discussion

The main purpose of the present study was to investigate the relationship between the classroom environment and the students' academic achievement within a theoretical framework of classroom environment. The academic achievement scores of Grade Nine students from October first semester examination were used as the criterion measure of students' academic achievement in the present study. This study explored to examine the male and female students' perceptions on their classroom environment. Moreover, this study focused on the comparison of students' perceptions on their classroom environment in terms of school.

According to the results of descriptive statistics, it was found that the students' perceptions on their classroom environment were satisfactory. By comparing the means related to each component of classroom environment, the students' perceptions related to school climate was the highest because it had the highest mean among the five components of classroom environment. However, students' perceptions related to the opportunity for learning was the lowest because it had the lowest mean among the five components. It pointed out that the physical environment of the selected schools was favorable and satisfactory for students.

Secondly, independent samples *t*-test was used to examine the gender differences in students' perceptions on their classroom environment. According to the results of *t*-test, there was a significant difference in male and female students' perceptions on overall components of classroom environment. However, there was no significant difference in male and female students' perceptions on the component of teachers' performance. It can be interpreted that teachers performed their actions fairly for both male and female students. So, it can be generally seen that female students more positively perceived their classroom environment than male students did. This finding was in consistent with the results of Goh& Fraser (1996) which indicated that girls perceived their classroom learning environments more positively than boys did. Girls were more involved, more affiliated and more cooperative with classmates than boys were. Therefore, gender is a key predictor of learning environment.

Finally, it was found that the Grade Nine students' perceptions on their classroom environment did not differ significantly among the six schools. And then, it was continued to investigate the relationship between the classroom environment and the students' academic achievement. Therefore, Pearson product moment correlation was used to analyze this relationship. Consequently, it was found that students' perceptions on their classroom environment had the significant relationship with their academic achievement. It can be concluded that the more favorable school climate, communication, effective teachers' performance, systematic classroom management and much opportunity students receive, the higher academic achievement they tend to get. This finding was in agreement with the results of Fraser & Fisher (1982) which indicated that students' perceptions on the learning environment appears to correlate to student outcomes and also the classroom environment had the predictive ability for students' cognitive and affective learning outcomes.

Suggestions

According to the results of the present study, female students more positively perceived their classroom environment than male students did. It is because girls are more likely to participate whereas boys tend to respond more often if they feel the class is interesting and less often if the class is perceived as boring. So, the teachers should utilize different techniques for male students to enhance their perceptions of feeling as a class participant. Therefore, the classroom teachers should place importance on the entire school performance to demonstrate school success in terms of annual academic progress of students. Parents should involve in the progress of classroom environment and should work in contact with the school authorities for the welfare of the students. Furthermore, teachers should determine which environments are most suitable for positive impact on students' achievement because higher academic achievement is influenced by positive and favorable classroom environments. Based on the results of the study, the following suggestions were made:

- Parents should involve actively in school activities not only for the better development of classroom environment but also for the improvement their children's achievement.
- As there are still many other variables affecting on classroom environment, the developmental history of each member of the group, age, personality variables, affective variables, socio-economic status, parents' educational status of the children should be taken into account in further studies.
- Further research is needed to determine whether there is a similarity or a difference between the actual classroom environments and that preferred by the students in preschool, primary and middle schools, college and university students in various areas.

Conclusion

The classroom has become an important place for educational research because most learning takes places there. The importance of classroom learning environment has been increasingly recognized all over the world. Classroom learning environment is a place where learners and teachers interact each other and use a variety of tools and information resources in the pursuit of learning activities. According to the results of findings, classroom environment is closely related to students' academic achievement and it had a positive influence on their achievement. Therefore, it is needed to create good and favorable classroom environments for students so as to improve their learning outcomes.

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INTEGRATION OF EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD) INTO MIDDLE SCHOOL SCIENCE TEACHING THROUGH LESSON STUDY

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Abstract

The purpose of this study was to introduce the integration of Education for Sustainable Development (ESD) concept into middle school science lessons through lesson study. Four teacher educators from Sagaing University of Education and Sixteen middle school teachers from four basic education schools in Sagaing Township participated in this study. Using adapted Dudley (2014)'s lesson study cycle process, lesson study of science lessons from Grade Six science textbooks was conducted. Both Qualitative and Quantitative methods were used and data collecting instruments were semi-structured interview, observation and achievement test. Results of the initiated lesson study significantly indicated that there are improvements of science teaching learning process in terms of teachers' content knowledge, teaching methodology, and student achievement. As part of participating in interactive lesson study cycles, teachers became more aware of ESD concepts in science lessons and began openly reflecting on students' participation around science activities during their post-lesson discussions. Although lesson study improves teachers' professional development with teacher collaboration and student achievement, on the other hand, the teachers are still unfamiliar with ESD themes and they need to understand ESD concepts more clearly. Therefore integration of ESD concepts into science lessons is a difficult task for teachers and there are many challenges for implementing the integration of ESD into science teaching.

Keywords: education for sustainable development, middle school teachers, lesson study

Introduction

Education is an essential tool for achieving sustainable development and the role of teachers, in turn, is central to implement Education for Sustainable Development (ESD). The teachers therefore need to understand the ESD concepts and have ESD practices. With regards to ESD concept, there is a difference between education about sustainable development and education for sustainable development. The former is an awareness lesson or theoretical discussion and the latter is the use of education as a tool to achieve sustainability (Mckeown, 2002). Development is a holistic approach in which people systematically enhance their capacity to solve their own problems while promoting their cultural, social and economic well-being. Sustainable development occurs when this process is conducted in a manner that can be sustained over a long term (Wiltshire, 2008). Young people are the future and teachers play a key role in the appropriate socialization of young people for sustainable development. To equip teachers to function effectively for the appropriate socialization of young people, they have to understand what ESD is and how it can be implemented. ESD is a complex and evolving concept. It is therefore impossible to attempt to understand ESD by providing a simple definition. Moreover, different cultures and societies perceive sustainable development in many different ways. A more meaningful way to understand ESD is to examine its rules, principles and value, and methods used in its delivery (NZAID, 2009). ESD is already a part of the formal education. Depending on each country's historical background and educational perspectives, various approaches or strategies exist around the world to integrate ESD into formal education. Approaches vary from

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more conventional, for example integrating ESD concept and SD issues in existing school subjects, to more innovative one, for example adopting a whole school approach to ESD and SD issues (Wals, 2009). According to the previous baseline survey research, the teachers still require to understand more ESD concepts and to do ESD practice with ESD teaching approaches. Therefore this study aimed at introducing the conventional approach, i.e. integrating ESD into existing middle school science subject.

Aim and Objectives of the Research

The aim of this study is to introduce the integration of ESD concepts into teaching middle school science teaching and specific objectives are:

- To integrate ESD concepts into existing middle school science topics through Lesson Study
- To investigate the middle school science teachers' teaching skills addressing ESD
- To investigate the improvement of students' science achievement
- To suggest the teachers to use Lesson Study in their science teaching

Definition of Key Terms

Sustainable Development - development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UNESCO, 2012)

Education for Sustainable Development - the process that seeks to integrate values and perceptions of sustainability into not only education systems but one's everyday personal and professional life (Wals, 2009)

Lesson Study - An approach in which groups of teachers collaboratively plan, teach/observe and analyze their teaching (Dudley, 2014)

Review of Related Literature

Sustainable Development and Sustainability

In 1987, the Bruntland Commission Report described the concept of sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The sustainability is a paradigm for thinking about a future in which environmental, social and economic considerations are balanced in the pursuit of development and an improved quality of life (UNESCO, 2012).

The New Zealand Parliamentary Commission for the Environment (UNESCO, 2010) explains that: Sustainability is the goal of sustainable development and it is an unending quest to improve the quality of people's lives and surroundings, and to prosper without destroying the life-supporting systems on which current and future generations of humans depend. Like other important concepts, such as equity and justice, sustainability can be thought of as both a destination and a journey. To live sustainably means finding ways of developing which will improve everyone's quality of life without damaging the environment and without storing up problems for future generations or transferring them to people in other parts of the world. It requires an understanding that inaction has consequences and we must find ways to innovate and change at all levels within society.

Concepts of Sustainable Development

UNESCO has also described the concepts of sustainable development which are important concepts to include in education systems oriented towards sustainable development as follows:

Interdependence: People are an inseparable part of the environment. We are part of a system that connects individuals, their culture, their social and economic activities and their natural surroundings.

Diversity: The Earth and all its inhabitants are characterized by great variety – biologically, culturally, linguistically, socially and economically. We need to understand the importance and value of each of these forms of diversity to the quality of human life and the health of ecosystems.

Human rights: Everyone has an inalienable human right to freedom of beliefs, speech, assembly and protection under the law, as well as to the conflicts that enable them to act on these rights such as access to basic education, food, shelter, health and equal opportunity.

Global equity and justice: This principle is called intra-generational equity and emphasizes that the rights and needs of others are met so that a fair and abundant quality of life is provided for everyone around the world.

Rights of future generations: This principle is called inter-generational equity. It emphasizes that the lifestyle choices we make today always affect the capacity of future generations to have the same range of choices we have.

Conservation: The natural world contains a range of renewable and finite resources that humans can develop to satisfy their needs. The lifestyle choices we make need to respect the long-term sustainability of these resources, and the need for conservation of nature for its intrinsic worth, not only its utilitarian value.

Economic vitality: Economic growth depends upon a dynamic state of economic vitality in which everyone has the opportunity and skills to access the resources required for a satisfying quality of life, within a framework of sustainable development.

Values and lifestyle choices: Values that reflect concern for human well-being, economic vitality and the quality of the environment are required to ensure that we make lifestyle choices that contribute to a sustainable future for everyone.

Democracy and civic participation: People are more inclined to care for others and the environment when they have the right, the motivation and the skills to participate in the decisions that affect their lives.

Precautionary principle: Sustainable development issues are complex, and scientific advice on an issue is often incomplete or divided. In situations of such uncertainty, there is a need to act judiciously and with an awareness of potential unintended consequences.

Therefore the role of Education for Sustainable Development is to integrate these concepts and abilities into education, training and public awareness systems at all levels and in all sectors of society.

Education for Sustainable Development

According to the many reports on ESD providing a variety of definitions which share common elements but are subtly different, Wals (2009) defined ESD as:

- a means of empowering people with new knowledge and skills to help resolve common issues that challenge global society's collective life now and in the future;
- a holistic approach to achieve economic and social justice and respect to all life;
- a means to improve the quality of basic education, to reorient existing educational programmes and to raise awareness.

In 1992, the United Nations Conference on Environment and Development, held in Rio de Janeiro, resulted in a publication Agenda 21. Chapter 36 of Agenda 21 on education identifies four major thrusts: Improving quality of education;Reorienting existing curriculum to address sustainability; Increasing public understanding and awareness of sustainability; Providing training to all sectors of the workforce towards sustainability (Mckeown, 2002).

Components of ESD

ESD is more than a knowledge base related to environment, economy, and society. It also addresses learning skills, perspectives, and values that guide and motivate people to seek sustainable livelihoods, participate in a democratic society, and live in a sustainable manner. ESD also involves studying local and, when appropriate, global issues.

Knowledge: Sustainable development encompasses environment, economics, and society. Therefore, people need basic knowledge from the natural sciences, social sciences, and humanities to understand the principles of sustainable development, how they can be implemented, the values involved, and ramifications of their implementation. Some basic knowledge people need to have:

- Rates of use of renewable resources do not exceed their rates of regeneration.
- Rates of use of nonrenewable resources do not exceed the rate at which sustainable renewable substitutes are developed.
- Rates of pollution emission do not exceed the assimilative capacity of the environment.
- Minimize the use of nonrenewable resources.
- Prevent erosion of renewable resources and so on.

Issues: ESD focuses largely on the major social, economic, and environmental issues that threaten the sustainability of the planet. Earth Summit in Rio de Janeiro identified the key issues in Agenda 21. Some are:

- Population and sustainability, Protecting and promoting human health, Changing consumption patterns,
- Combating deforestation, Protecting the atmosphere, Conservation of biological diversity,
- Strengthening the role of farmers and so on.

Skills: To be successful, ESD must give people practical skills that will enable to continue learning after they leave school, to have a sustainable livelihood, and to live sustainable lives. The types of skills pupils need as adults are:

- The ability to communicate effectively (both orally and in writing).
- The ability to think about systems (both natural and social sciences).
- The ability to think critically about value issues.
- The capacity to move from awareness to knowledge to action.
- The ability to work cooperatively with other people (McClaren, 1989, as cited in Mckeown, 2002).

Perspectives: ESD carries with it perspectives that are important for understanding global issues as well as local issues in a global context. Every issue has a history and a future. Looking at the roots of an issue and forecasting possible futures based on different scenarios are part of ESD. Some of the perspectives associated with ESD students understand are:

- Social and environmental problems change through time and have a history and a future.
- Contemporary global environmental issues are linked and interrelated between and among them.
- Humans have universal attributes (e.g., they love their children).
- Considering differing views before reaching a decision or judgment is necessary.
- Technology and science alone cannot solve all of our problems, etc.

Values: Values are also an integral part of ESD. Understanding values is an essential part of understanding one's own worldview and other people's viewpoints. Understanding one's own values, the values of the society he lives in, and the values of others around the world is a central part of educating for a sustainable future. For example, Respect and care for the community of life, Ecological integrity, Social and economic justice, etc.

Therefore, these five must all be addressed in a formal curriculum that has been reoriented to address sustainability (Mckeown, 2002).

Integrating ESD in Teacher Education

The guide book (UNESCO, 2018) describes that ESD empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, and is an integral part of quality education. ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy and the learning environment. It achieves its purpose by transforming society. To integrate ESD,

Learning content: Integrating critical issues, such as climate change, biodiversity, disaster risk reduction (DRR) and sustainable consumption and production (SCP), into the curriculum;

Learning outcomes: Stimulating learning and promoting core competencies, such as critical and systemic thinking, collaborative decision-making, and taking responsibility for present and future generations;

Pedagogy and learning environments: Designing teaching and learning in an interactive, learner-centered way that enables exploratory, action oriented and transformative learning. Rethinking learning environments – physical as well as virtual and online – to inspire learners to act for sustainability;

Societal transformation: Empowering learners of any age, in any education setting, to transform themselves and the society they live in:

- Enabling a transition to greener economies and societies, i.e., equipping learners with skills for green jobs and motivating people to adopt sustainable lifestyles.
- Empowering people to be global citizens who engage and assume active roles, both locally and globally, to face and to resolve global challenges and ultimately to become proactive contributors to creating a more just, peaceful, tolerant, inclusive, secure and sustainable world.

In UNESCO guide book, the earlier attempts at integrating ESD in schools and educational instructions at all levels have been described.

Examples of current curriculum mainstreaming practices are:

- Creating a standalone ESD-specific subject;
- Embedding ESD in existing subjects or across the curriculum;
- Adopting a thematic, issue or problem-based approach like climate change, air pollution,
- deforestation etc., based on the local realities;
- Incorporating the use of teaching and learning methodologies consistent with ESD principles of learner-centered and participatory approaches, such as field trip;
- Conducting ESD-based co-curricular or extra-curricular activities, such as the use of student clubs and associations and activities;
- Engaging with the local community, often through project-based learning opportunities.

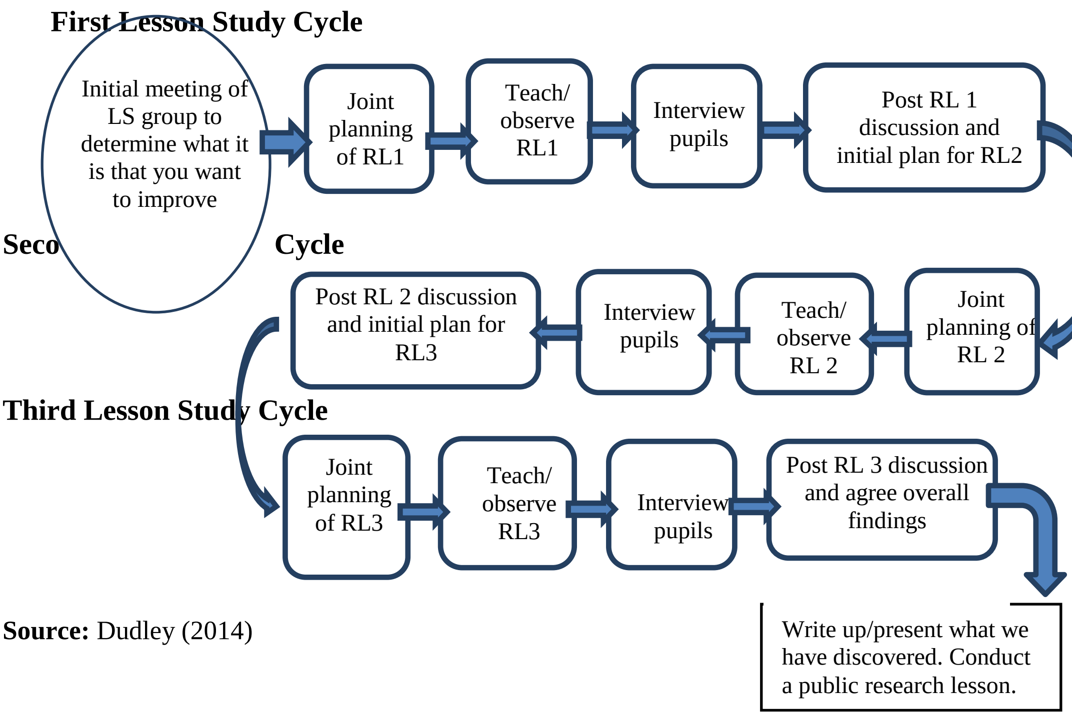
In this study, integrating ESD into middle school science topics was implemented through Lesson Study.

Lesson Study (LS)

Lesson Study is a highly specified form of classroom action research focusing on the development of teacher practice knowledge. Lesson Study involves groups of teachers collaborative planning, teaching/observing and analyzing teaching and learning in research lessons. It blends all the features of professional learning that improve learning and teaching: the professional learning takes place over time; it happens in real classrooms with real group; it involves an element of collaborative enquiry or experiment between teachers who are trying to solve a problem or improve an approach (Dudley, 2014). He also argues that lesson study helps teachers to:

- See pupil learning occurring in much sharper detail than is usually possible.
- See the gaps between what they had assumed was happening when pupils learned and what it is actually happening.
- Find out how to plan learning which is better matched to the pupils' needs as a result.
- Do all this in the context of a supportive teaching learning community which is strongly committed to helping pupils to learn and to the professional learning of the members of the group.
- Change their teaching to better support learning as a result.

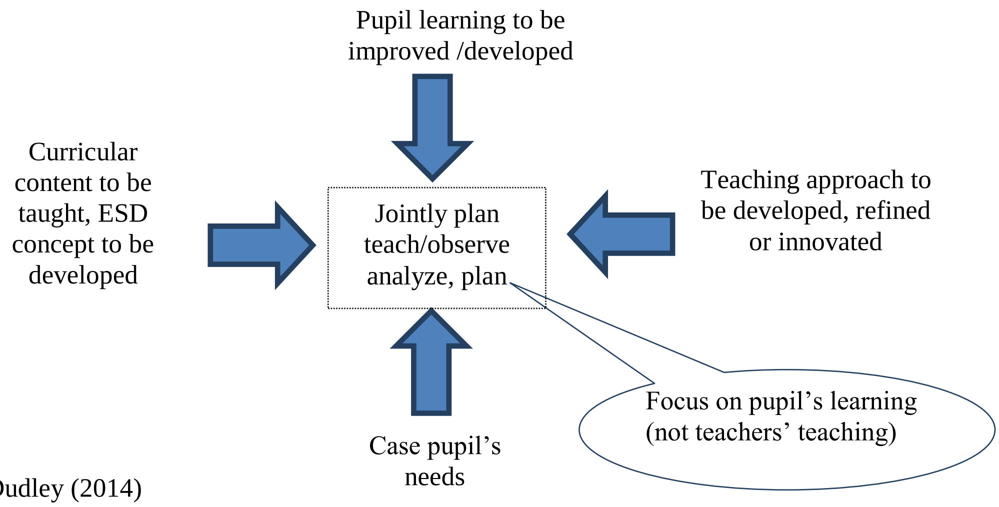
A Lesson Study consists of a cycle of at least three research lessons that are jointly planned, taught/observed and analyzed by a Lesson Study group as shown in Figure 1.



Source: Dudley (2014)

Figure1 The Lesson Study Process

Although Dudley' Lesson Study process consists of three research lessons, this study was conducted with two research lessons. Using the following adapted balanced focus on pupil learning research lesson, Lesson Study groups jointly plan, teach /observe and analyze the science lessons.



Source: Dudley (2014)

Figure 2 The adapted balanced focus on pupil learning in ESD research lesson

Materials and Method

Method

In this study, Qualitative (Case study) and Quantitative methods were used.

Participants

Four teacher educators from Sagaing University of Education and sixteen junior teachers from four basic education schools in Sagaing Township participated voluntarily in this study.

Instruments

Data collecting instruments were semi-structured interview, observation and achievements test items. Four semi-structured interview questions were for focus group teachers and two questions for post lesson interview with the case pupils. Three questions were for observation in the classrooms and 20 items for grade six students' academic achievement.

Procedure

The relevant literatures were studied and referred to explain ESD concepts, to introduce examples of good practices on ESD, and to help in preparing lesson study activities which the teachers can use to enhance their understanding of the topics in ESD such as the importance of trees/plants for survival, interdependence, renewable energy, and environmental pollution, etc. Lesson Study group consisted of four teacher trainers from Sagaing University of Education, and sixteen junior teachers from four basic education schools. Among them, four teachers did not participate in observing the classroom teaching because they had to teach primary classes in parallel. In conducting lesson study, Dudley (2013, as cited in Dudley, 2014)' lesson study cycle process: Plan;Teach; Observe and Reflect/ Post lesson discussion, was used. In planning step, teacher educators facilitate the participants in formulating goals to be achieved or identifying problems to be solved, selecting science lesson topics, identifying lesson objectives, preparing teaching learning materials and creating learning activities, constructing post-test questions, observation sheets. Lesson study group members selected two model teachers to teach the research lessons and the rests were observers, and also identified the case pupils who were might typify different groups of learners in the class (pupils who are making good, average or below average progress in academic achievement). The case pupils were interviewed at the end of lesson. Finally, the lesson study group members conducted post lesson discussion and reviewed the research lesson, refined it and taught as lesson study cycle 2 to the next class. The lesson study group members agreed to conduct the lesson study by the following schedule as in Table 1.

Table 1: Lesson Study Program for Middle School Science Lessons integrating with ESD

Learning objectives: The teachers will be able to plan and teach the science lessons integrating with ESD	
Day 1	1)Reflecting workshop experiences: ESD themes; knowledge, attitude, skills, perspective and value and identifying issues to be concerned in their teaching-learning situation 2)Selecting science topics based on the monthly plan prescribed in teacher' manual 3)Diving the participants into two groups
Day 2	1)Identifying learning objectives for science contents and as well as for ESD 2)Constructing items for student assessment at the end of the lesson 3)Identifying teaching/learning materials and activities to be used during the lesson 4)Preparing observation checklist
Day 3&4	1)Preparing teaching/learning materials 2)Reviewing to the learning objectives, materials, activities, assessments worksheets
3rd& 4th week	Implementing research lessons in two classes by each group

Findings

Research results are presented in four parts: results for lesson study planning, student academic achievement, post lesson focus group discussion, and post lesson case pupil interview.

Lesson Study Planning Step

Teachers in the schools involved in this study were deeply concerned about the issues such as lack of student interest in learning, lack of creating learning activities which encourage student participation and being not enough teacher questions that prompt student's critical thinking. Therefore, as their overall goal for Lesson Study, the teachers identified the following:

> "*To create learning activities and materials which stimulate student interest, and help the improvement of student participation*"

The teachers noted that their traditional teaching techniques: explain the text content orally; ask students to read the text, and then give the exercises already existed in the textbook need to be changed. One teacher said that they never ask any questions that evoke the student thinking. Within the meeting, teachers agreed on the following over-arching goal:

> "*To make questions that prompt student critical thinking"*

Keeping these goals in their mind, the teachers planned their research lesson of the topics which have been selected in accordance with their monthly plan for this academic year. They identified the learning objectives for each science lesson integrating with ESD. The selected topics and the respective learning objectives are described in Table 2.

Table 2 Selected topics of Middle School science lessons integrating with ESD

Grade/Topic	Learning Objectives
Grade six Malleability and Ductility of Matters	- Students understand the concepts by experimenting themselves and reflect on how these properties of metals can be utilized in their daily lives.

The lesson Study groups referred to the suggested questions(Shuilleabhain, 2015) to be used for observation and for post lesson case pupil interview and the posttest questions.

Questions for focus group discussion at the end of the research lesson

1. Was the flow of the lesson coherent and did it support student's learning of the concept?
2. Were the activities and the materials helpful in achieving the goal of the lesson?
3. Did the group discussion help promote student understanding?
4. Did the teacher's questions engage and facilitate student thinking?

Questions for post lesson interview with the case pupils

1. What did you enjoy most about that lesson?
2. What did you learn? (What can you do now that you could not do? What can you do better? How is it better?)

Post-test items were based on the textbook exercises.

During the lesson (physical properties of metals: malleable and ductile), three main activities were provided Grade six students to:

1) Study the physical properties of objects by hammering and identify them metal or non-metal
2) Experiment on the concepts 'malleable and ductile' with metals such as Copper wire (which is pulled into thin and longer one), and a piece of Lead (which is hammered into thin sheet).
3) Classify the given objects into metals and non-metals and then students had to give things made of metals which are used in their daily lives (e.g., Gold, Silver, Copper, Brass, etc.).

Student Achievement

After the lesson, post-test (Grade six) was administered immediately.

The students' learning outcomes from the post-test are as indicated in Table 3.

Table 3 Evaluation of student learning outcomes for Grade six

Student Achievement	Day 1 (N=35)	Day 2 (N=48)
Mean (Total)	68.9%	76.4%
Case pupils (High achiever)	92.5%	90%
Case pupils (Average)	75%	76%
Case pupils (Low achiever)	62.5%	82.5%

As indicated in Table 3, average students' academic achievement being immediate assessment, are above 65% in cycle 1, and in cycle 2 their achievement improved to over 75%.

These achievement values were the worth of Lesson Study, collaborative planning, teaching/ observing and freely, productive suggestions. In particular, Pupils in low learning groups were discovered to be making an academic success even above the level of average groups in cycle 2 (Day 2).

Post Lesson Focus Group Discussion

During the lesson, each teacher had to observe each case pupil to get information about three events on the questions: (1) How many times did the case pupil ask questions to their teacher or themselves? (2) How many times did the case pupil answer their teacher's questions? (3) How did they participate in the group activity?

From the teacher's observation, it was found that some pupils asked questions to their teacher. For example, one common question is *"Sayagyi, what is this?"* (Given materials) They then answered themselves what they thought. And the teachers observed that there is no pupil who did not answer their teacher's question although the numbers of time are not the same.

The common utterance of the observer teachers was,

> *"They measure the length of wire themselves…stretch it with plier…then they measure the wire again…I can see their satisfaction on conceptual understanding of the science concept 'ductility of metal' themselves."*

The teachers interpreted that they could make their students interested in learning experiences and participated in activities. One of the observer teacher said that almost all students answered their teacher's questions.

In post lesson discussion, one of the teacher, less experienced junior teacher commented,

> *"Collaborative planning makes me more confident in and satisfied with teaching and learning situation."*

One experienced teacher, who was selected as a model teacher said,

> *"We usually teach the content as prescribed by the textbook… and rarely prepare science activities… this is because I thought it would be time consuming…Now I realize that planning, collaborative planning is worth."*

Also he said openly,

> *"I don't know some chemicals and simple laboratory apparatus, and I've never seen them"*

These results indicated that the middle school science teachers' content knowledge and pedagogical knowledge need to be improved.

Post Lesson Pupil Interview

The post lesson pupil interview was conducted at the end of the lesson individually. It took about five minutes. For the question, *"what did you enjoy most about that lesson?"*

Generally the students answered that they enjoyed learning the lesson because they had opportunities to do practical. This means that they learned actively because of hands on activity (learning by doing).

Specifically, one case pupil replied,

> *"I am very excited in pulling the wire because I think it will be cut, but it become longer."*

Another common response was that "I did answer all questions correctly without doing homework." Another question, "What did you learn? (What can you do now that you could not do? What can you do better and how is it better?)" Every student replied that they had learned a lot of and they want to do like this next time. However, they could not give the answers clearly on the question of how it is better.

Discussion

In group work, allowing the student time to examine the materials using their senses and to brainstorm ideas of what they find out about the attributes of the materials and asking them to write the properties of the materials, lead to the improvement of student's critical thinking skill and make the students feel the result of group accomplishment. Critical thinking competency is one of the key competencies for sustainability: the ability to question norms, practices and opinions; to reflect on one's own values, perceptions and actions; and to take a position in the sustainability discourse. Moreover the student gets collaborative competency. It is also the key competency for sustainability the student must possess. Collaboration competency is the ability to learn from others; to understand and respect the needs, perspectives and actions of others (empathy); to understand, relate to and be sensitive to others (empathic leadership); to deal with conflicts in a group; and to facilitate collaborative and participatory problem solving (UNESCO, 2017).

From case pupil post discussion, the case pupil's responses (particularly, low achiever but not slow learner) indicated that he could participate in the activities, share his ideas with others in the discussion and do successfully group work. It was found that he was satisfied with his achievement. As a consequence, the students have a sense of self-worth combined with a respect for other individuals and cultures. This quality is also essential for the student who is educated for sustainability (NZAID, 2009).

The teachers participated in this study become realized that they need to help their students have qualities for being a sustainable person. This is because the student who is educated for sustainability has such qualities as a sense of responsibility to the environment, to other people and to the future of both; the will, knowledge and skills to translate this responsibility into action in both personal and public life and a capacity to see the links between individual and group actions and external events (NZAID, 2009). They become understood how ESD teaching strategies (learner-centered) are different from their traditional methods (teacher-centered) and rote learning. Generally, the learning objectives and the overall goals identified during the planning have been achieved. The teachers accepted that they could create the lively learning environment where students discover new things (students did not know before), share ideas, etc. The teachers observed the student interest in learning science

Conclusion

In science teaching, there are many topics related to ESD themes. In this study, the topic, the properties of metals is not directly related to ESD. Even though the topic selected in this study is not directly related to ESD themes such as ecology, health, water, pollution, etc., the teachers could make research lesson for improving students' competencies for sustainability. The aim of this study is to introduce how teachers can integrate ESD concepts into science teaching. It is therefore impossible for the expectation that the teachers will have sufficient teaching competency for sustainability. It would be challenged to implement ESD practices, reorienting education towards quality education. The challenges that Myanmar education system is facing are multi-dimensional, and most of them deal with key concepts in education reform, such as access, quality and equity (MOE, 2016). However, the result of this study was evidence that the teachers could make the science lesson plans which improve the students' competencies for sustainability and that ESD concepts can be integrated into science teaching through Lesson Study. Accordingly, the students will develop key competencies for sustainability which are the essential skills for developing citizens of 21st century.

Acknowledgements

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A STUDY OF THE ACADEMIC SELF-CONCEPT OF HIGH SCHOOL STUDENTS AND ITS EFFECTS ON THEIR ACHIEVEMENT

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Abstract

The purpose of this research was to determine the academic self-concept of high school students and its effects on their achievement. Quantitative research design was chosen for this study. In this study, (600) Grade Ten students from five Basic Education High Schools in Urban and five Basic Education High Schools in Rural were involved. A questionnaire based on the dimensions of Reynolds' Academic Self-concept Scale was used to find the academic self-concept in English, Mathematics and Physics. Independent Samples *t*-test was used to investigate whether there were significant differences in the academic self-concept and achievement of high school students in terms of gender and location of school. The results revealed that there were significant differences in the academic self-concept and achievement of high school students in terms of gender. And there were significant differences in the academic self-concept of high school students in Physics but not in English and Mathematics in terms of location. Then, there were significant differences in the achievement of high school students in terms of location. Pearson Product Moment Correlation was used to investigate the relationship between the academic self-concept of high school students and their corresponding achievement. The result revealed that there was a significant correlation between the academic self-concept and achievement. In addition simple regression was used to find out the effect of the academic self-concept of high school students on their achievement. The result of simple regression (R^2 = .11) revealed that there was a positive small effect of the academic self-concept of high school students on their achievement. Although there was a small effect, the academic self-concept was one of the important factors for increasing the achievement of students. Therefore, teachers and parents need to know the ways of improving the academic self-concept and should create an environment that allow for successive approximations leading toward the end goal.

Keywords: academic self-concept, achievement, effect

Introduction

The future of a nation depends largely on the quality of the citizens. If the citizens of a country are educated, they can easily grow up the national growth and development. Therefore, there must be cultivated educated and successful people for the national growth and development. To become the successful and educated persons, the teachers and parents must be cultivated the students to become all round developed persons since they were in high schools. Academic achievement plays a vital role in all round development. Academic achievement is important because it directly decides the positive outcomes of the students after graduating. Therefore, it is necessary to find out the factors increasing the academic achievement of students.

Statement of the Problem

Students' academic achievement plays a significant role in producing the best quality graduates who will become grate leader and manpower for the country thus responsible for the country's economic and social development. Academic self-concept, broadly defined, can be thought of as a student's self-perception of academic ability formed through individual experiences and interactions with the environment (Valentine, DuBois& Cooper, 2004).

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Academic self-concept, on the other hand, refers to mental representations of one's abilities within school or academic settings, or in relation to one's academic progress.

Many researchers have conducted research and offered explanations as to increase the academic performance and achievement of students. Several factors impact the educational achievement of students, including school curriculum, student learning style, and teacher expectations (Kunjufu, 1989). Therefore, it is necessary to study the level of academic self-concept of Myanmar high school students in terms of gender and location of school and whether there is a relationship between academic self-concept and achievement of students. And it is needed to study whether the academic self-concept of students effect on their achievement and to what extent that effect on their achievement.

Purposes of the Study

The main purpose of the research was to study the academic self-concept of high school students and its effects on their achievement.

The specific objectives of the research were:

1. To explore the academic self-concept and achievement of high school students in English, Mathematics and Physics
2. To compare the academic self-concept and achievement of high school students in terms of gender and location of school
3. To find out the relationship between the academic self-concept of high school students and their corresponding achievement
4. To investigate the effects of academic self-concept of high school students on their corresponding achievement
5. To give suggestions for improving students' academic self-concept and achievement.

Research Questions

1. To what extent do high school students have academic self-concept and achievement in English, Mathematics and Physics?
2. Is there any difference in the academic self-concept and achievement of high school students in terms of gender and location of school?
3. Is there any relationship between the academic self-concept of high school students and their corresponding achievement?
4. Is there any effect of the academic self-concept of high school students on their corresponding achievement?

Significance of the Study

This study will provide the classroom teacher and educators with knowledge of the relationship between the academic self-concept and achievement of high school students. Knowing the correlation between academic self-concept and achievement, they will try ways to improving students' academic self-concept and appropriate teaching methods suitable for their students.

And this study will provide the effects of academic self-concept on achievement of high school students and the findings will be of value to parents, teachers, educators and responsible persons in identifying possible causes of poor academic achievement. Supporting a student's academic self-concept is important to improve academic achievement because the beliefs and feeling that students have are the key components of academic success.

Definition of Key Terms

Academic self-concept	**:**	Academic self-concept is defined as the degree of an individual's perception of his or her own proficiency in academic subjects (Bong &Skaalvik, 2003).
Academic Achievement	**:**	Academic achievement may be defined as the performance of the students in the subjects they study in the school (Pandey, 2008).
Effect	**:**	A change that is caused by an event, action etc.

Scope

This research is geographically restricted to Kalay Township, Sagaing Region. Participants were chosen from Grade Ten Students from the five Basic Education High Schools in urban and five Basic Education High Schools in rural. This research mainly focused on the dimensions of academic self-concept as academic confidence, academic interest, academic effort, and self-evaluation. In this research, academic self-concept was identified with self-concept in Mathematics, English and Physics.

Review of Related Literature

Theoretical Background of the Study

According to Rogers (as cited in Mangal, 2010),every individual possesses the desire to become a perfect human by means of self-control and with his own autonomy. In this respect, he is also endowed with intrinsic motivation to allow him to move towards the direction of achieving self-perfectness and excellence. Furthers, experiences and knowledge acquired from the environment will enable him to form his own self- concept, whether positive or negative, depends on the characteristics of elements which affect the environment. However, every behavior which has been exhibited by an individual usually reflects his self-concept as well as his own beliefs. An individual's personal experience is unique and distinctive, as well as different from other individuals. Such experience is also, to a large extent, affected by the environment which he interacts.

Valentine, DuBois and Cooper (2004) described a positive academic self-concept should lead to gains in academic achievement. Specifically, students with positive views of their academic abilities are likely to engage in more achievement-related behaviors, which might include completing homework, studying for tests, and participating in class activities. Guilford (1966, as cited in Shavelson, Hubner& Stanton, 1976) stated four aspects of self-concepts: (1) how a person perceives himself, (2) what he thinks of himself, (3) how he values himself and (4) how he attempts through various actions to enhance or defend himself.

Academic confidence is the student's belief about performing a task at a particular level in order to attain a specific academic goal. It reflects a strong belief or sure expectation of success in an academic field. Generally, students perform those task and activities in which they feel competent. And then, they who perceive himself confident has a high level of academic achievement (Shaukat& Bashir, 2004).

However, academic interest is also a valence linked to a specific topic, task, or activity which as a driving force. Schiefele and Csikszentmibalys (1994) described that there was a relationship between academic interest and academis achievement (as cited in Corbiere, Fraccaroli & Mbekou, 2006).

Besides, student's effort is strongly related to students learning. The results achieved by the learner through a process of learning depend heavily upon his basic potential. A learner's readiness and power to learn is a great deciding factor of his results in learning. Certainly, if he has a will to learn a thing, then automatically, he will himself find ways for effective learning. The effort and results, which provid a success experience to an individual (Mangal, 2010).

Self-evaluation is also the principal method of assessing progress or success. Self-evaluation is one of the characteristics of Roger's experiential learning. The learner himself is interested in evaluating the results and outcomes of such learning by applying it to the realization of learning objectives (Mangal, 2010).

The Model Used in the Study

The theoretical underpinning of the notion self-concept as used in this study is based on the hierarchical model of Shavelson, Hubner and Stanton (1976) who were the first researchers to create an empirically testable hierarchical self-concept model (Byrne, 1996). The model has been expanded and changed, although the basic structure has stayed similar. The hierarchical model, as represented in Figure 1 can be described as a pyramid with a global self-concept at the apex. Intermediate level self-concepts, such as academic self-concept and social self-concept, follow beneath the apex. Beneath each of the intermediate level self-concepts, further specific self-concepts are found, such as subject-specific academic self-concepts like mathematics and first language self-concepts. Although the components of hierarchical models can differ, the pyramidal description applies for all hierarchical models. The self-concepts are found increasingly differentiated from the top to the bottom in the model.

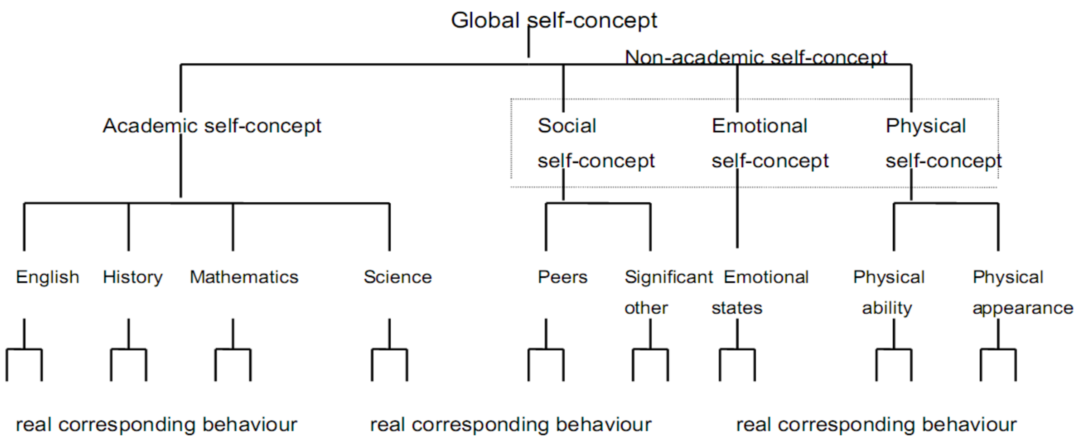

Figure1 The hierarchical model (Shavelson, Hubner& Stanton, 1976).

Academic Self-concept and Academic Achievement

According to Marsh (2003), the major research question in the study of academic self-concept is: whether academic self-concept causes academic achievement or academic achievement causes academic self-concept. In the voluminous literature on self-concept, there are three major theoretical models regarding the causal ordering between academic self-concept and academic achievement: the self-enhancement model, the skill development model, and the reciprocal effects model.

The self-enhancement model posits that the primary causal path is from academic self-concept to academic achievement. It maintains that as improvement in self-concept will lead to improve academic performance and that achievement does not influence self-concept. In the skill development model, academic self-concept is a consequence of prior achievement. The skill development model maintains that past achievement whether successful or unsuccessful influences the formation of self-concept but self-concept does not influence achievement. The reciprocal effects model assumes self-beliefs predicts increase in academic achievement (i.e. later achievement, after controlling for prior achievement), and, conversely, higher levels of achievement predict improvements in self-beliefs.

Many researchers have suggested that the causal direction of academic self-concept and achievement vary with age. The academic self-concept of younger students is more likely to be influenced by school performance. As they enter higher grades, academic self-concept and achievement are more likely to influence each other. Although most researchers concur that the relation between the two variables is reciprocal, there is still a lack of a conclusive answer on when the effect is stronger in one direction or the other or whether the effects one variable on the other is stronger (Liu, 2009). Based on the above literature, this study was conducted.

Research Method

A quantitative research design was chosen for this study. The sample of this study was (600) Grade Ten students from ten Basic Education High Schools in Kalay Township. The participants were selected by using a simple random sampling method.A questionnaire was developed on the basis of the dimensions of Academic Self-concept Scale of Reynolds (1988) to explore the academic self-concept of students in English, Mathematics and Physics. A questionnaire was comprised of four dimensions as academic confidence, academic interest, academic effort and self-evaluation. There were 5 items for each dimension. Therefore, there were 60 items for three subjects. There were five possible responses to each question to indicate the responses of “Strongly Disagree” (1), “Disagree” (2), “Undecided” (3), “Agree” (4), “Strongly Agree” (5). After preparing the instrument, validity was determined by the expert judgments. And then, pilot study was conducted with (60) Grade Ten students in BEHS (Branch) No. (23) BEMS, Pyi Gyi Tagon Township, Mandalay Region. And achievement in each subject was taken from October monthly test scores by teacher made tests. Finally, the obtained data were analyzed. The researcher computed descriptive statistics such as mean and standard deviation for each subscale to investigate academic self-concept and achievement. After that Independent Samples *t*-test was computed to find out the differences in the academic self-concept and achievement of students in terms of gender and location of school. Then, the Pearson Product Moment Correlation was computed to find out the relationship between the academic self-concept and achievement. Finally, simple regression was computed to investigate the effect of academic self-concept on the achievement.

Research Findings

Findings of the Academic Self-concept of High School Students in Each Subject

In order to examine the academic self-concept of high school students in English, Mathematics and Physics, a statistical descriptive procedure was used. The mean and standard deviation for students' academic self-concept in each subject was shown in Table 1.

Table 1 Means and Standard Deviations of Students' Academic Self-concept in Each Subject

Variable	*N*	*M*	*SD*	Mini	Max
English Self-concept	600	70.38	10.647	30	100
Mathematics Self-concept	600	72.89	12.041	36	100
Physics Self-concept	600	70.68	11.941	32	100

The mean of Mathematics self-concept was highest and the mean of English self-concept was lowest. This result revealed that students had the highest self-concept in Mathematics. Generally, the means of academic self-concept of high school students in Kalay Township were greater than the theoretical mean. Therefore, it was concluded that high school students in Kalay Township were likely to have good academic self-concept.

Findings of the Achievement of High School Students in Each Subject

In order to examine the academic achievement of high school students in English, Mathematics and Physics, a statistical descriptive procedure was used. The means and standard deviations for students' achievement in each subject were shown in Table 2.

Table 2Means and Standard Deviations of Students' Achievement in Each Subject

Variable	*N*	*M*	*SD*	Mini	Max
English Achievement	600	15.51	5.735	0	25
Mathematics Achievement	600	17.70	5.501	0	25
Physics Achievement	600	17.56	6.409	0	25

According to Table 2, mathematics achievement had the highest mean and the lowest standard deviation. Therefore, it was concluded that high school students in Kalay Township were likely to have better achievement in Mathematics than English and Physics.

Findings of the Academic Self-concept of High School Students in terms of Dimension

To explore the differences in students' English self-concept, Mathematics self-concept and Physics self-concept in each dimension, descriptive statistics was used. In Table 3, the means and standard deviations for students' Academic self-concept in each dimension were shown.

Table 3 Means and Standard Deviations of Students' Academic Self-concept in terms of Dimension

Subject	Dimension	*N*	*M*	*SD*	Mini	Max
English	Academic Confidence	600	16.63	3.474	5	25
	Academic Interest	600	18.51	2.980	10	25
	Academic Effort	600	16.56	3.379	7	25
	Self-evaluation	600	18.68	3.085	7	25
Mathematics	Academic Confidence	600	16.93	3.943	6	25
	Academic Interest	600	18.70	3.459	7	25
	Academic Effort	600	18.31	3.528	5	25
	Self-evaluation	600	18.96	3.228	5	25
Physics	Academic Confidence	600	16.94	4.047	5	25
	Academic Interest	600	17.87	3.175	10	25
	Academic Effort	600	17.34	3.492	5	25
	Self-evaluation	600	18.53	3.264	5	25

According to the means of students' academic self-concept in terms of dimension, it was found that academic effort in English, academic confidence in Mathematics and Physics had the lowest mean and self-evaluation in three subjects had the highest mean. Therefore, it was concluded that high school students in Kalay Township were good at self-evaluation in each subject and weak in effort in English, weak in confidence in Mathematics and Physics.

Findings of the Academic Self-concept of High School Students in terms of Gender

Independent samples *t* test was used to compare the differences in the academic self-concept of students in terms of gender. The results of *t* test which showed the comparison of means between male and female students were shown in Table 4.

Table 4 Means, Standard Deviations and t Value of Students' Academic Self-concept in terms of Gender

Variable	Gender	*N*	*M*	*SD*	*MD*	*t*	*df*	*p*
English Self-concept	Male	240	67.18	10.240	-5.336	-6.199	598	.000***
	Female	360	72.51	10.388				
Mathematics Self-concept	Male	240	70.62	12.406	-3.787	-3.817	598	.000***
	Female	360	74.41	11.563				
Physics Self-concept	Male	240	68.18	12.122	-4.164	-4.243	598	.000***
	Female	360	72.35	11.538				

Note: ****p*<.001

Table 4 showed that there were significant differences in academic self-concept between male and female students among the selected schools at .001 level. This means that female students had higher academic self-concept than male students in English, Mathematics and Physics in Kalay Township.

Findings of the Academic Self-concept of High School Students in terms of Location

Independent samples *t* test was used to compare the differences in the academic self-concept of students in terms of location. The results of *t* test which showed the comparison of means between urban and rural students were shown in Table 5.

Table 5 Means, Standard Deviations and t Value of Students' Academic Self-concept in terms of Location

Variable	Location	*N*	*M*	*SD*	*MD*	*t*	*df*	*p*
English Self-concept	Urban	300	70.45	10.180	.153	.176	598	.860
	Rural	300	70.30	11.111				
Mathematics Self-concept	Urban	300	73.04	11.625	.293	.298	598	.766
	Rural	300	72.75	12.461				
Physics Self-concept	Urban	300	69.71	11.899	-1.950	-2.005	598	.045*
	Rural	300	71.66	11.923				

Note: $^*p<.05$

Table 5 showed that there were no significant differences in English self-concept and Mathematics self-concept but Physics self-concept had significant difference between urban and rural schools at .05 level. This means that urban and rural students had nearly the same academic self-concept in English and Mathematics, and rural students had better self-concept than urban students in Physics.

Findings of the Achievement of High School Students in terms of Gender

Independent samples *t* test was used to compare the differences in the achievement of students in terms of gender. The results of *t* test which showed the comparison of means between male and female students were shown in Table 6.

Table 6 Means, Standard Deviations and t Value of Students' Achievement in terms of Gender

Variable	Gender	*N*	*M*	*SD*	*MD*	*t*	*df*	*p*
English Achievement	Male	240	14.38	5.672	-1.892	-4.007	598	.000***
	Female	360	16.27	5.660				
Mathematics Achievement	Male	240	16.54	6.335	-1.936	-3.663	598	.000***
	Female	360	18.48	6.349				
Physics Achievement	Male	240	16.65	5.438	-1.519	-3.343	598	.001**
	Female	360	18.17	5.466				

Note: $^{**}p<.01$, $^{***}p<.001$

Table 6 showed that there were significant differences in English achievement and Mathematics achievement at .001 level and Physics achievement at .01 level between male and female students. This means that female students had better achievement than male students in all three subjects in Kalay Township.

Findings of the Achievement of High School Students in terms of Location

Independent samples *t* test was used to compare the differences in the achievement of students in terms of location. The results of *t* test which showed the comparison of means between urban and rural students were shown in Table 7.

Table 7 Means, Standard Deviations and t Value of Students' Achievement in terms of Location

Variable	Location	*N*	*M*	*SD*	*MD*	*t*	*df*	*p*
English Achievement	Urban	300	16.89	4.680	2.753	6.052	598	.000***
	Rural	300	14.13	6.340				
Mathematics Achievement	Urban	300	20.27	5.143	5.140	10.72	598	.000***
	Rural	300	15.13	6.525				
Physics Achievement	Urban	300	18.57	5.319	2.017	4.564	598	.000***
	Rural	300	16.55	5.503				

Note: ****p<.001*

Table 7 showed that there were significant differences in English achievement, Mathematics achievement and Physics achievement between urban and rural students at .001 level. In detail, urban students had higher academic achievement than rural students in all three subjects in Kalay Township.

Findings of the Relationship between Academic Self-concept and their Corresponding Achievement

To investigate the relationship between academic self-concept and their corresponding achievement, Pearson product-moment correlation coefficient between two variables was calculated. The result of correlation between academic self-concept and their corresponding achievement was mentioned as follow in Table 8.

Table 8 Correlation between Academic Self-concept and their Corresponding Achievement

Variable		EA	MA	PA	A
ESC	Pearson Correlation	.392**			
	Sig (2-tailed)	.000			
MSC	Pearson Correlation		.292**		
	Sig (2-tailed)		.000		
PSC	Pearson Correlation			.203**	
	Sig (2-tailed)			.000	
ASC	Pearson Correlation				.334**
	Sig (2-tailed)				.000

** Correlation is significant at the .01 level (2- tailed). N=600

Note: ESC = English Self-concept EA = English Achievement
MSC = Mathematics Self-concept MA = Mathematics Achievement
PSC = Physics Self-concept PA = Physics Achievement
ASC = Academic Self-concept A = Achievement

There was a significant correlation between English self-concept and English achievement, Mathematics self-concept and Mathematics achievement, Physics self-concept and Physics achievement, and total academic self-concept and achievement at the .01level (r =.334). The result shows that the direction of correlation was positive. This means that if the academic self-concept is good, the achievement of students will be high or if the academic self-concept is bad, the achievement of students will be low.

Findings of the Effects of Academic Self-concept on their Corresponding Achievement

In order to investigate the effect of academic self-concept of students on their corresponding achievement, simple regression was calculated. Table 9 presented the results of simple regression for academic self-concept and their corresponding achievement.

Table 9 Simple Regression for Students' Academic Self-concept and their Corresponding Achievement

Variable	R	R square	Adjusted R square	*F*	*p*	B	Beta
ESC EA	.392	.153	.152	108.3	.000***	.665 .211	.392
MSC MA	.292	.085	.084	55.71	.000***	6.38 .155	.292
PSC PA	.203	.041	.040	25.83	.000***	10.9 .094	.203
ASC A	.334	.112	.110	75.23	.000***	15.5 .165	.334

Note: ****P*<.001

ESC = English Self-concept EA = English Achievement
MSC = Mathematics Self-concept MA = Mathematics Achievement
PSC = Physics Self-concept PA = Physics Achievement
ASC = Academic Self-concept A = Achievement

Table 9 showed that there was an effect by English self-concept on English achievement, Mathematics self-concept on Mathematics achievement, Physics self-concept on Physics achievement. The results were statistically significant ($F = 75.229$, $p<.001$) for academic self-concept and achievement. The adjusted R square value was .11. This indicated that 11% of the variance in achievement was explained by academic self-concept. According to Cohen (1988), this is a small effect. Therefore, it was interpreted that high school students' academic self-concept had slightly positive effect on their achievement.

Discussion

As Mathematics self-concept had the highest mean in three subjects, high school students were likely to have better academic self-concept in Mathematics than English and Physics. Mathematics achievement had the highest mean in three subjects. Therefore, it can be concluded that high school students had better achievement in Mathematics than English and Physics. Generally, students are familiar with Mathematics than English and Physics since they were young, easier to use in daily life and have little memorizing in learning. Therefore, they are active and more interest in learning Mathematics, so they had positive self-concept and better achievement in Mathematics than English and Physics.

According to the results, the high school students had the highest mean in self-evaluation in three subjects and the lowest mean in effort in English, confidence in Mathematics and Physics. Generally, high school students are happy to learn three subjects, well-prepared to take these exams and satisfied with their effort in learning these subjects. So, they had the highest self-evaluation in English, Mathematics and Physics. And they should give more time to study English than Mathematics and Physics; because they are weak in effort in English. Then, they are weak confidence in solving problems in Mathematics and Physics although they are interest and take effort in these subjects.

Moreover, there was significant difference in the academic self-concept of high school students in three subjects in terms of gender. Female students had higher academic self-concept in three subjects than male students. Rosenberg and Simmons (1975) noted that adolescence girls are more concerned about being well-liked, more affected by others' opinion of them, and more eager to avoid behavior that elicits negative reaction and Lau and Leung (1997) commented that girls are higher in their need for affection and affiliation (cited in Liu & Wang, 2005). Accordingly, girls will have more willingness to get appraisals from others and to try hardly in academic situations. For these reasons, girls can be assumed to be high effort in academic tasks and then they have high academic confidence, which may result high academic self-concept and achievement.

Besides, there was significant difference in Physics self-concept of high school students in terms of location but not in English and Mathematics. Urban and rural students had nearly the same academic self-concept in English and Mathematics. And, rural students had better academic self-concept than urban students in Physics. This is because of the high level of principal's administration and strong effort of physics teachers.

In addition, there was significant difference in the achievement of high school students in three subjects in terms of gender. Female students had higher achievement in three subjects than male students. Greenfield (1996) discussed that statistically significant differences in achievement were found among students on the basis of gender. In the study of Mirza and Malik (2000), they found that overall performance of girls were better than that of boys at all levels of education starting from primary to college level in Pakistan (cited in Rizwan&Zafar, 2005).

Then, there was significant difference in the achievement of high school students in three subjects in terms of location. A possible explanation for this finding could be the socio-economic status of the parents of the students. Generally, the parents of students in urban had higher education level than parents of the students in rural. According to their level of education, it could be that parents of students in urban high schools were more conscious of the benefits of education, communicated this knowledge to their school going children, and strive to improve the achievement of their children. And, it could be uneven distribution of resources, poor facilities, problem of qualified teachers refusing appointment or not willing to perform well in isolated villages and poor communication.

According to the research findings, there was a significant relationship between academic self-concept of high school students and their corresponding achievement. Therefore, it can be concluded that if the academic self-concept of high school students is high, the achievement of students will be high.

From this research, there is an effect of academic self-concept of high school students on their corresponding achievement. The result revealed that general academic self-concept can explain 11% of the variance in achievement. In the study of Dramanu & Balarabe (2013), academic self-concept can explain 9% of the variance in academic achievement. In the study of Cokley (2000), academic self-concept can explain 21% of the variance in academic achievement. So, this study agreed with the studies of Dramanu & Balarabe (2013) and Cokley (2000).

Many research studies had been developed the factors affecting the academic achievement of students as student's characteristics, parent's characteristics and teacher's characteristics. There were the key factors of student's characteristics as self-efficacy, motivation, attitudes and behavior, academic competency, communication skills, collaboration, academic self-concept, time management and engagement in class activities, and parent's characteristics as the education level of the parent, family income, parent support and educational expectation, and then, teacher's characteristics as teaching experience, qualification, workload, teacher's behavior and personality that affect the students' academic achievement. Therefore, the academic self-concept of students affects 11% on their achievement. So, teachers and parents should try to improve the academic confidence, interest, effort and self-evaluation of children in order to increase their achievement.

Suggestions

Gender difference in the academic self-concept and achievement of high school students was found in the study. This finding by implication is that, male and female students differed in the views they hold about their academic competence and capabilities. Therefore, to increase the level of the academic self-concept and achievement of male students, the teachers and parents should try the male students take more effort and interest in the academic subjects and feel confident in their abilities and capabilities.

From the results, urban and rural students had nearly the same academic self-concept in English and Mathematics. This finding by implication is that, both urban and rural students in Myanmar high schools did not differ in the views they hold about their academic competence and capabilities in English and Mathematics. But, rural students had higher academic self-concept in Physics than urban students. So, the physics teachers in urban schools should do the students feel confident in their abilities and capabilities by praising even their small successes in order to increase the academic self-concept in Physics.

According to the research findings, urban students had better achievement than rural students. So, it is recommended that the Government should bridge the gap between the rural and urban locations by providing adequate learning resources, facilities and good communication. Then, adequate incentives provided to rural area teachers to encourage them to put their effort in teaching.

The results of the study showed there was a positive effect of academic self-concept of high school students on their achievement. This finding suggests that the views that students hold about their academic competence and capabilities are valuable variables that have the potential to facilitate the realization of students' goals in a range of settings including the school. This finding underscores the importance of how students feel about their competence and ability to be successful in their educational programs. Students who are convinced that they are good and have the ability to succeed or control their educational experiences are likely to make efforts to excel in school works.

Therefore, it was important to increase the academic self-concept of students in order to increase the achievement. The role of teachers is significant to improving students' academic self-concept. Sang (2003) discussed that the formation of self-concept is based on perceptions of one's self and others towards him. He also stated that school influences and changes an individual's behavior through aspirations and interactions of peers group and teachers. According to him, the important role of classroom teachers can be seen in the formation of academic self-concept. Others' perceptions towards a person also impact his self-perceptions. Teachers' behavior, attitudes, words and values shape the self-concept students because they are role models for students. So, teachers should care their words and behavior in treating students.

Marsh and Craven (1997) discussed that academic achievement is substantially affected by academic component of self-concept (cited in Rizwan & Zafer, 2005). Because academic self-concept is students' perceptions of their own strengths and weaknesses in academic situation themselves, it may be one of the most important things in learning. A student who perceives himself as a person who always needs help in mathematics class always feels not to solve problems in mathematics and he does not try to solve any problem, and then gets help from others accordingly, his skill of mathematics will decline and his mathematics achievement will be low gradually. Again, a students who perceives himself as a learner who enjoys studying for mathematics will try to solve every problem in mathematics class and he feels happy in solving mathematics problems if so, he will get high skills at mathematics and high achievement. According to this, it can be assumed that a change in academic self-concept will impact on a change in achievement. So, the class teachers need to improve students' self-concept in specific subjects in every class time.

And, teachers should create an environment that is rich with successful opportunities, and allow for successive approximations leading toward the end goal. As students acquire confidence that they can successfully complete the range of individual steps leading to the end goal, the more confident they will feel. So, teachers should train the students feel academically capable in easy tasks and, it sure that they have academic self-concept, then teachers should go to the difficult tasks.

Then, teacher should avoid blaming the students for their weaknesses by comparing with the abilities of others and should give appraisal words to them in their successful tasks. If so, students develop satisfaction and confidence in their abilities and competencies and then they put more effort in their learning process. As a result, academic achievement will increase.

In summary, the results of the present study prove academic self-concept is significantly correlated with academic achievement. Many empirical studies support this relationship. So, teachers and educators need to emphasize academic self-concept of learners and need to strive to help them to build up high positive academic self-concept.

Conclusion

Academic self-concept is the perception of an individual about his or her ability and capability in academic subjects they study in the school. Students' self-perceptions about their academic capabilities form an important part of their adjustment in school. These perceptions play a significant role in directing students' efforts towards their academic work.

The result of the study showed that there was a positive effect of academic self-concept of high school students on their achievement. Individuals with high academic self-concepts are more likely than those with low academic self-concept to study hard in order to perform well academically. The actions and reactions of teachers, parents and significant others towards students should be such they are intended to encourage, suggest, assure and reinforce students that they are academically capable and can do well if they work harder. These words of encouragement are likely to have an impact on the self-belief of the students making them see themselves as academically competent and capable, and thus strive to study hard in order to perform well academically.

Therefore, it is indispensable to take efforts to improve the academic self-concept of students. Academic self-concept is an important factor in improving a student's achievement. Teachers and parents should be offered adequate and sufficient training in the areas of children's personal and social competence (self-concept, self-esteem, social abilities, personal development, etc.,) as an avenue to improve academic performance as well as achievement of learners.

This study is provided the effects of academic self-concept on achievement of high school students and the findings are valuable to parents, teachers, educators and responsible persons in identifying possible causes of poor academic achievement. And, this research is provided the ways of improving the academic self-concept of children to teachers and parents. Therefore, this paper is expected to give a support for increasing the academic self-concept and achievement of high school students.

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A STUDY OF THE PERSPECTIVE OF STUDENT TEACHERSON THE TEACHING PRACTICE

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Abstract

The aim of the research is to study the perspective of student teachers on teaching practice. It was intended to study the perspective of student teachers on teaching practice in Sagaing University of Education. In this research, questionnaire survey method which is one of the descriptive methods was used. The participants in this study were (340) fourth year (second semester) student teachers from Sagaing University of Education. Descriptive statistics was used for the analysis of obtained data. The mean score for the perspective of student teachers on teaching practice in planning was 93.1, the mean score for the perspective of student teachers on teaching practice in instruction was 43.02, the mean score for the perspective of student teachers on teaching practice in assessment was 41.66 and the mean score for the perspective of student teacher on teaching practice in classroom environment was 41.40. The result showed that the mean score for the perspective of student teachers on teaching practice in planning was the highest and the mean score for the perspective of student teachers on teaching practice in classroom environment was the lowest. According to the result, the majority of student teachers possessed moderate level of perspective in their teaching practice. And then, descriptive statistics (percentage) was used to examine the perspective level of the student teachers who had the perspective high, moderate and low. The number of student teachers who possessed high, moderate and low level of perspective were (55), (234) and (51), respectively, in planning. The numbers of students who possessed high, moderate and low level of perspective were (71), (228) and (41), respectively, in instruction. The numbers of student teachers who possessed high, moderate and low level of perspective were (61), (228) and (51), respectively in assessment. The number of student teachers who possessed high, moderate and low level of perspective were (62), (236) and (42), respectively, in classroom environment.

Keywords: perspective, student teacher, teaching practice

Introduction

Khin Zaw (2001) proposed that no educational system can be better than its teachers. Achievement of educational aims and objectives cannot be met unless teacher have necessary training where they are adequately equipped with teaching skills and competences Rao (2007, cited in Ajileye, 2013). The teacher is the most important element in any educational program. It is the teacher who is mainly responsible for implementation of the educational process at any stage (Kilpatric, 2009). Teaching practice provides: an opportunity to gain confidence; chance to put theories into practice; an opportunity to learn the skills and attitudes of a competent and effective teacher; the chance to learn about children in real life; an opportunity to improve the knowledge of subject matter; the chance to gain from the benefits of constructive criticism; an opportunity for self-evaluation and to discover strengths and weaknesses; an opportunity for the teaching institutions to evaluate it (Brown & Brown, 1990, cited in Bashir, Malik & Fatima, 2014).

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Objectives of the Study

1. To study the perspective of student teachers on the teaching practice
2. To investigate the perspective of student teachers on the teaching practice in planning, instruction, assessment and classroom environment
3. To give suggestions for the improvement of teaching practice based on the result of the study

Research Questions

1. What are the perspective of student teachers on the teaching practice?
2. What are the perspective of student teachers on the teaching practice in planning?
3. What are the perspective of student teachers on the teaching practice in instruction?
4. What are the perspective of student teachers on the teaching practice in assessment?
5. What are the perspective of student teachers on the teaching practice in classroom environment?

Review of Related Literature

Philosophical Perspectives in Education

Philosophy means "love of wisdom". Philosophy help teachers to reflect on key issues and concepts in education, usually through such questions as: What is being educated? What is the good life? What is knowledge? What is the nature of learning? And what is teaching? As teacher, educational philosophy is his beliefs about why, what and how the teachers, whom he teaches, and about the nature of learning. It is a set of principles that guides professional action through the events and issues teachers face daily, sources for his educational philosophy are his life experienced, his values, the environment in which he lives, interactions with others and awareness of philosophical approaches (Carson, 2005).

Pragmatism

Pragmatism, is the only one that originated in the United States. Pragmatism, sometimes called experimentalism or instrumentalism, was developed in opposition to the principles of idealism. Ideas alone are not sufficient for reality, said the original pragmatists; action on these ideas is necessary to determine their value. For the pragmatists, the only test of truth is what works best and what ideas can be used to solve problems satisfactorily. The pragmatists were oriented more toward the present than toward the past, which is prominent in idealism and realism. They grounded their thinking in present actualities and used the scientific method to solve present problems. If the idea "works" and the problem is solved, then the truth has been revealed. Truth then, is relative to present conditions and circumstances, not an absolute as the idealists and realists believed. For pragmatists, "experience" was the medium in which thought ideas and action mix. They formulated the principles of interaction and continuity of experience. Americans are a very pragmatic people who like to learn by doing, engage in practical tasks, and determine the truth in each problem situation as it comes along. The pragmatists believed that change is the only thing that is permanent and that truth, reality, and values are all relevant to circumstances. Further-more, the pragmatists did not believe in absolutes and tended to doubt that rules can be generalized over many specific situations. For the pragmatists, society and the social aspects of culture were also very important.

What are the educational principles of current pragmatists? Pragmatists see education as the reconstruction and reorganization of human experience. Educators should provide conditions that allow students to grow. They see the student as an organism capable of solving problems. The teacher, for the pragmatist, is also a continuous learner who aids and guides others in the learning process without pretending to be the only source of knowledge. Teachers do not abdicate their responsibilities, they arrange conditions for learning related to students' needs and interests (Hessong, 1991).

According to professional ethics for education, Education, or pedagogy, or teaching or whatever one chooses is a profession for may obvious reasons. For many teachers the realization that their work is in a profession comes too late, if at all. This is a very unfortunate state of affairs. The realization must develop early, in the preteaching or preparatory years. Teaching is an important calling must come right at the start of teacher education or one's preparation for it (Khin Zaw, 2017).

Importance of Teaching Practice

Teaching practice is important as it provides uptiming condition under which prospective teachers can learn to analyse, evaluate and modify their behaviours in order to accomplish pre-determined educational objectives (Adeniran, 1996, cited in Jekayinfa, 2001). Teaching practice allows student teachers to have ample chance and the real life situations to apply theories and principles of education they have been taught in their institutions. It helps student teachers to identify objectives of teaching and see the relationship of a day's lesson to the long-range load for a week or term (Olaitan & Agusiobo, 1981, cited in Jekayinfa, 2001). Teaching practice is to be very important in teacher education programmes at university into an ability to actually teach in real classrooms (Barasa, 2005, cited in Tuimur, Role, & Makewa, 2012).

Adelaide (1996, cited in Jekayinfa, 2001) and Adekunle (1996, cited in Jekayinfa, 2001) also gave the significance of teaching practice by saying that it enables student teachers to organize syllabus contents around major concepts and generalizations in the development of sequential learning in a unit or course of study. It enables student teachers to become more familiar with variety of instructional materials and resources, evaluate, and select those appropriate for the objectives in a teaching unit or lesson. While teaching practice provided the trainee an opportunity to acquire practical skills through direct experience, it also provides the trainer the opportunity of both assessing and guiding the trainee for both formative and summative evaluation purpose (Afolabi, 1996, cited in Jekayinfa, 2001). Teaching practice enables the teacher educators to develop a degree of experience in understanding the student teachers, their techniques and procedure of teaching, which they put into practice under professional guidance and supervision of the teacher educator (Jekayinfa, 2001).

Teaching practice is important to prospective teachers for many reasons. First, it is a vital avenue for developing the skills, attitudes and understanding of the teaching profession (Adeniran, 1996, cited in Jekayinfa, 2001). Teaching practice offers and opportunity to test the theoretical ideas which the student teachers have learnt and to determine what procedures are appropriate for what categories of students and under what classroom conditions. Hence, teaching practice is conceived by some teacher educators as a necessary laboratory experience (Grim & Michealis, 1953, cited in Jekayinfa, 2001), an apprenticeship or internship (Martins & Westcott, 1963, cited in Jekayinfa, 2001), which gives the student teacher an opportunity to gain insight into teaching. This helps him/her to increase his/her professional competence and to test the applicability of his/her theoretical experience in classroom situation. Shaplin (1962, cited in Jekayinfa, 2001) gave a number of reasons to justify the inclusion of teaching practice in the teacher education programme. These reasons include: teaching and learning being complete processes, student teachers need some basic skills and understanding to analyze and appreciate the difficulties of teaching (Jekayinfa, 2001).

It is therefore very necessary that a conducive educational environment be established for student teachers to enable them gain confidence in themselves and to work effectively with fellow students and the school personnel. In such an environment, student teachers will have the opportunity to engage in profitable experiences in observing, sharing and in teaching with the guidance and supervision of the students' supervisors or tutors. Teaching practice is a co-operative venture involving the student teachers and their supervisors on one hand, and the staff and pupils on the other hand. The programme includes teaching, demonstration, participation in co-curricular activities and evaluation which is the final assessment of the student teachers. Being as important as it is in the curriculum of the teacher training institutions, there are certain things, which the student teachers should take cognizance of when preparing for teaching practice (Jekayinfa, 2001).

Teaching practice is a situation where a student teacher is given the opportunity to try the act of teaching before actually getting into the real world of the teaching profession (Njidi & Sikaya, 2003, cited in Godwin & Issac, 2015). The new trends in teacher education programs focus on the investigation of the problems associated with the training of student-teachers (Vick, 2006, cited in Hamaidi, Al-Shara, Arouri & Awwad, 2014). So, the study programs of teacher education in the university level should include interesting activities that provide students with a realistic experience for future teaching (Jusoh, 2011, cited in Hamaidi et al., 2014).

It is an important course undergone by students who are about entering the teaching profession where they are expected to exhibit the theorietical skills obtained during the course in the institution into practical situation in real life (Godwin & Issac, 2015). McNamara (1992, cited in Hamaidi et al., 2014) noted that 80% of the teaching practice experience took place in the school environment. This gives students the chance to act and make the right decision at the right time. Consequently, teaching practice has a positive effect on student-teachers' attitudes towards teaching profession (Hamaidi et al., 2014).

According to Dreeben (1970, cited in Andabai, 2013), this phase of training contributes not only to the development of occupational norms but also to reducing anxiety about teaching and to learning classroom techniques. It also seems to contribute most of discover workable conduct, where "workable" becomes characteristically defined as classroom management, following fixed schedules of instructions, simplifying lesson plans, getting through the material and cutting back on the breadth and richness of the material presented.

Ajoku (2003, cite din Andabai, 2013) asserted that, performance during practice teaching provide some basis for predicting the future success of the teacher outgoing popularity and centrality of practice teaching is an important contributing factor towards the quality of teacher education programmed. Edem (2003, cited in Andabai, 2013) confirmed that, during practice teaching, working with students in schools provide a high degree of emotional involvement of a mostly positive nature. Students teachers feel themselves grow through experience and they being to link to a culture of teaching. It is an essential aspect of teacher education because it prepares teachers for their future teaching roles and assignment. The main agents who implement educational policies have to be properly organized and teaching practice also help in this function (Hyon, 1999, cite din Andabai, 2013).

The opportunities provided by teaching practice are as follow:

1. An opportunity to gain confidence.
2. Chance to put theories into practice.
3. An opportunity to learn the skills and attitudes of a competent and affective teacher.
4. The chance to learn about children in real life.
5. An opportunity to improve the knowledge of subject matter.
6. The chance to gain from the benefits of constructive criticism.
7. An opportunity for self-evaluation and to discover strengths and weaknesses.
8. An opportunity for the teaching institutions to evaluate itself (Brown & Brown, 1990, cited in Azeem, 2011).

Research Method

(i) Design

In this research, questionnaire survey method which is one of the descriptive methods was used.

(ii)Subject

This research is intended to study the perspective of student teachers on the teaching practice. Due to the limitations of time and resources, the research was conducted from Sagaing University of Education. The subjects were 340 fourth year (second semester) student teachers from the Sagaing University of Education within (2017-2018) academic year. This research is comprised of four dimensions, namely planning, instruction, assessment and classroom environment.

(iii)Instruments

As for the instrument, a questionnaire for the perspective of student teachers on the teaching practice that would be attractive, brief and easy to respond as possible was constructed on the basic of student teachers' perspective questionnaire of Koross (2016) and Danielson (2013). The questionnaire was divided into two parts. The first part of the questionnaire included demographic data which sought to ascertain among student teachers such as gender and specialization. The second part of the questionnaire included five points Likert-type items for four dimensions: Planning, Instruction, Assessment and Classroom environment.

There were forty Likert-type items in this instrument including items 1 to 10 for first dimension, 11 to 20 for second dimension, 21 to 30 for third dimension and 31 to 40 for the last dimension. The questionnaire was prepared having five alternate options for each statement. Student teachers' perceptions were rated from strongly disagree to strongly agree. The score closer to 1 indicated strongly disagree and strongly agree was indicated by the score closer to 5 for positive questions.

In order to get validation, the copies of questionnaire were distributed to five experts from Yangon University of Education in the field of Education. List of these experts was presented.

And then, these experts' opinions were obtained. After that, items were modified again in accordance with the advice of five experts.

(iv) Data Analysis

To analyze the quantitative data, the Statistical Package for the Social Sciences (SPSS) version 21 was used. The data were analyzed by using descriptive statistics. The responded rate of perspective of student teachers were analyzed by descriptive statistics (percentage) for each question.

Findings

I. Descriptive Statistics for the Perspective of Student Teachers in Teaching Practice on each Dimension

In order to determine the mean scores and standard deviation of the perspective of student teachers in teaching practice on each dimension, descriptive statistics was calculated. The results are described in Table 1.

Table 1Mean Scores of the Perspectives of Student Teachers on each Dimension

Dimension	No. of Participants	Mean	Std. Deviation	Minimum	Maximum
Planning	340	43.16	3.790	27	50
Instruction	340	43.02	3.359	32	50
Assessment	340	41.66	3.798	31	50
Classroom Environment	340	41.40	3.858	29	50

Table 1 shows that the mean scores of the perspective of student teachers on teaching practice. There are 10 items for each dimension. The mean score for perspective of student teachers on planning is 43.16, the mean score for perspective of student teachers on instruction is 43.02, the mean score for perspective of student teachers on assessment is 41.66 and the mean score for perspective of student teachers on classroom environment is 41.40. Among them, it can be observed that the mean scores for perspective of student teachers in planning is the highest and that of student teachers on classroom environment is the lowest.

As the mean scores for each dimension are greater than the median score 30, it shows that student teachers have positive view in teaching practice on each dimension. Medium score can be obtained by the multiplication of the number of items and neutral score 3. Therefore, it can be concluded that the student teachers from Sagaing University of Education have positive view in teaching practice.

The comparison of mean scores on each dimension is shown in Figure 1.

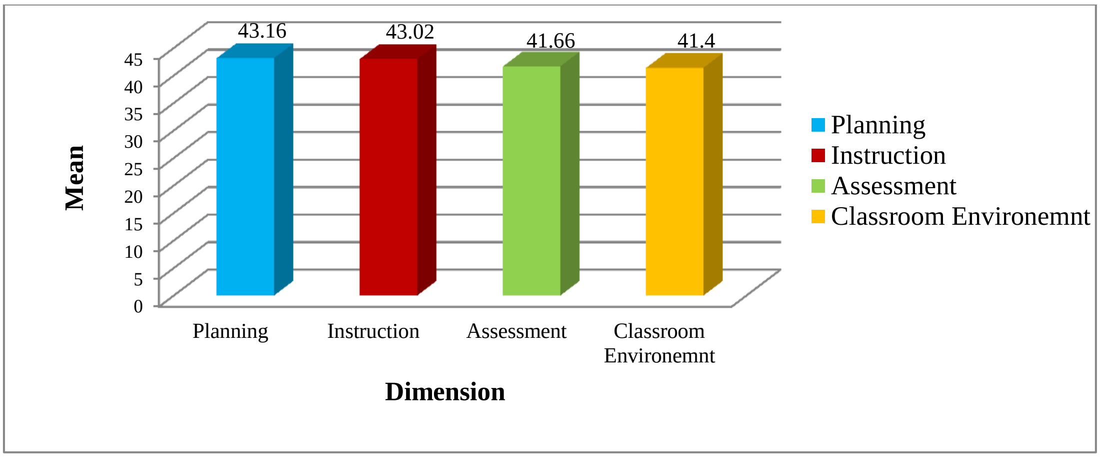

Figure 1 Comparison of mean scores of student teachers' perspective for each dimension

II. Percentage of Student Teachers' Perspective on each and Overall Dimension

The student teachers' perspective level on teaching practice based on the mean scores of their perspective is presented in Table 2. It is divided into three groups, namely, high, moderate and low. The full score of student teachers' perspective on teaching practice is 200. The average mean score and standard deviation is 169.24 and 12.059, respectively. If the average mean score of student teachers is higher than 181.299, it would be defined as high perspective group. If the average mean score is between 157.181 and 181.299, it would be defined as moderate perspective group. If the mean score is below 157.181, it would be defined as low perspective group.

The perceptive level of the student teachers based on the mean scores of teaching practice was presented in Table 2. Therefore, descriptive statistics (percentage) was used to examine the percentage of student teachers who had the perspective high, moderate and low. The numbers of students who possessed high, moderate and low level of perspective were 55, 234 and 51, respectively (see Table 2).

Table 2 Percentage of Student Teachers' Perspective on Teaching Practice

Perspective Level	No. of Participant	Percentage (%)
High	55	16.2
Moderate	234	68.8
Low	51	15.0
Total	340	100.0

The result shows that the percentages of perspective level of student teachers on teaching practice are 16.2 %, 68.8 % and 15.0%, respectively. The following pie chart shows the percentage of student teachers' perspective on teaching practice for each dimension.

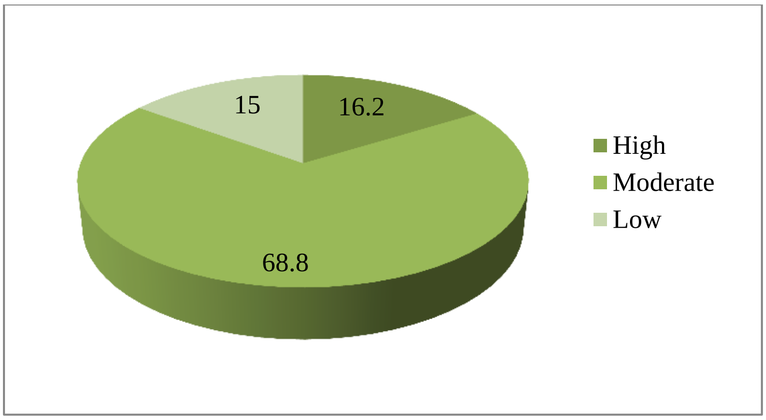

Figure 2 Percentage of student teachers' perspective on teaching practice for each dimension

Finding of the Total Individual Response within each Dimension on Perspective of Student Teacher on Teaching Practice

Descriptive statistics analyses were calculated to determine the percentages of total individual responses.

SD=Strongly Disagree; D=Disagree; UD=Undecided; A=Agree; SA=Strongly Agree

The first dimension deals with the perspective of student teacher on planning. It consists of ten items. The responses of student teacher for each item are as follows:

Table 3The Responses of Student Teachers' Perspective on Teaching Practice in Planning

Item No.	Item	Percentage (%)				
		SD	D	UD	A	SA
1.	Through practice teaching, it came to know that it is an effective preparation for our real-time teaching.	.3	.9	1.2	45.6	52.1
2.	It helps us understand how to plan our lessons as students' different learning styles are encountered during practice teaching.	.3	2.4	3.5	69.1	24.7
3.	Using teaching aids make our teaching process easier to understand.	0	.3	1.8	55.9	42.1
4.	I realized which teaching methods should be used depending on the class size, number of students, etc… (e.g. group discussion,..)	0	1.2	6.5	62.1	30.3
5.	Practice teaching introduces us to students' different learning styles.	.3	1.8	2.9	64.1	30.9
6.	The teaching process will be effective if lesson plans are made before the actual teaching.	0	2.1	6.2	55.6	36.2
7.	Lesson plans that would be accordance with each student's learning abilities should be prepared	0	1.8	5.3	61.2	31.8
8.	The questions that would cover learning objectives should be prepared in the lesson planning.	0	.3	2.1	55.0	42.6
9.	Time management should be taken care in the teaching steps.	0	.6	3.5	56.2	39.7
10.	The teaching aids and materials should be cheap and easy to be used during the teaching- learning processes.	.3	.6	2.6	47.9	48.5

The second dimension deals with the perspective of student teacher on instruction. It consists of ten items. The responses of student teacher for each item are as follows:

Table 4The Responses of Student Teachers' Perspective on Teaching Practice in Instruction

Item No.	Item	Percentage (%) SD	D	UD	A	SA
11.	It is assumed that a good relationship between teachers and students make an effective teaching learning process.	0	0	.3	39.4	60.3
12.	It is known that a teacher should guide his/her students, to have the sense to apply the subject matters being taught in their daily lives.	0	.6	1.2	45.0	53.2
13.	It is assumed that group discussion is the best method of teaching students as it gives students a chance to share their knowledge during the discussion time.	.3	1.8	11.2	66.8	20.0
14.	It is realized that asking students some questions help to get their attention to the subject.	0	1.8	3.8	60.0	34.4
15.	It is thought that different teaching method should be used in order to achieve the learning objective.	0	1.5	2.9	51.5	44.1
16.	It is assumed that encouraging the students to become involved in the lesson being taught makes them to remember the lesson longer.	0	.3	.6	46.8	52.4
17.	Teaching aids should not be used all the time expect when necessary.	0	5.6	8.8	51.2	34.4
18.	Some important points should be noted down on the whiteboard before starting to teach.	.6	6.8	7.1	52.1	33.5
19.	A teacher should give focus to no student and must treat all students in the same way.	.3	2.1	.9	45.9	50.9
20.	A teacher must follow the lesson plan in order to complete each teaching-learning process.	.9	5.3	9.4	62.4	22.1

The third dimension deals with the perspective of student teacher on assessment. It consists of ten items. The responses of student teacher for each item are as follows:

Table 5 The Responses of Student Teachers' Perspective on Teaching Practice in Assessment

Item No.	Item	Percentage (%) SD	D	UD	A	SA
21.	An assessment must be done every after teaching learning process in order to test the achievement of the learning objectives.	0	1.2	2.1	65.3	31.5
22.	Assessing the students' prior knowledge or background knowledge about the topic is an effective way of teaching.	0	.3	2.4	54.7	42.6
23.	Some questions concerning the important points of the subject matter must be asked orally during the process of teaching learning process.	.3	.3	3.2	59.4	36.8
24.	When asking for the questions, selecting certain students by calling their names make the other students less interested in the questions are noticed.	2.1	14.4	15.3	45.0	23.2
25.	Setting all students listen to the questions first and then selecting the certain students is the best.	0	3.5	5.9	37.9	52.6
26.	Giving enough time for the answer to the questions is better than asking for the respond immediately.	0	4.4	8.2	49.1	38.2
27.	Correcting the students' exercises and giving feedback without fail is also essential.	.3	.3	2.6	52.1	44.7
28.	Both kinds of subjective and objective questions must be asked at the end of the class.	0	1.8	7.6	60.0	30.6
29.	Peer correction helps to reduce the amount of class time that is needed to spend on correcting the written test (or) question.	2.1	17.4	18.2	47.6	14.7
30.	The questions being asked must be appear in accordance with the objectives in order to get a good result.	0	2.6	3.5	67.6	26.2

The fourth dimension deals with the perspective of student teacher on classroom environment. It consists of ten items. The responses of student teacher for each item are as follows:

Table 6 The Responses of Student Teachers' Perspective on Teaching Practice in Classroom Environment

Item No.	Item	Percentage (%)				
		SD	D	UD	A	SA
31.	A good relationship is built between our students and us through teaching practice.	0	1.2	4.7	59.4	34.7
32.	Other duties like registration should be done with our teaching in the classroom.	.6	3.8	7.1	63.8	24.7
33.	If the students understand lesson well, then it can go on to the new lesson.	0	0	3.8	47.6	48.5
34.	Clear and rigid explanation is needed in correcting students' bad habits and behaviours (eg., not doing homework)	0	.9	.9	54.4	43.8
35.	Classroom environment should be the place where students can learn peacefully and safely. (eg., not near the market)	.3	.3	2.4	46.2	50.9
36.	A teacher should train students to do the classwork individually or in group or by cooperating with others.	0	0	.6	53.5	45.9
37.	The school that I practice teaching practice has a good classroom environment.	4.1	15.3	3.5	49.7	27.4
38.	The school that I practice teaching practice provides all kinds of teaching aids necessary for teaching learning process.	9.1	48.2	5.6	27.6	9.4
39.	The school that I practice teaching practice supports all kinds of facilities needed for the classroom (eg., table, desks, charis,…)	.3	6.8	2.9	62.4	27.6
40.	It is necessary to praise the students who work hard.	0	.6	.6	42.4	56.5

Conclusion

This chapter consists of three parts. The first part is concerned with discussion in the second part, suggestions are presented. At last conclusion is presented in the third part.

Discussion

The purpose of this study is to explore the student teachers' perspective on teaching practice. This research was descriptive in nature. A questionnaire for the perspective of student teachers in teaching practice was constructed on the basis of Koross (2016) and Danielson (2013). The questionnaire included 40 Likert-type items for four dimensions: planning, instruction, assessment and classroom environment. The sample of this study was 340 fourth year (second semester) student teachers from Sagaing University of Education (2017-2018) academic year. Descriptive statistics (percentage) was applied to analyze each dimension.

When statistical analysis of the data has been conducted, it shows that the mean scores of perspective of student teachers in each dimension are 43.1, 43.02, 41.66 and 41.40, respectively. Among them, it was found that the mean score for perspective of student teachers in planning is the highest and that of student teachers in classroom environment is the lowest. As the mean scores for each dimension are greater than the median score 30, it shows that student teachers have positive view in teaching practice on each dimension. Medium score can be obtained by the multiplication of the number of items and neutral score 3. Therefore, it can be concluded that the student teachers from Sagaing University of Education have positive view in teaching practice.

On the basis of these research findings, the following conclusions were drawn.

1. According to mean comparison, the mean score of the perspective of student teachers in planning was the highest and that of student teachers in classroom environment was the lowest among four dimensions.
2. It was found that the perspective of 71 student teachers was at the high level on planning, 228 student teachers had the moderate level on planning and 41 student teachers had the low level on planning. The percentages of high, moderate and low level of student teachers' perspective on planning were 20.9%, 67.1% and 12.1%, respectively.
3. It was found that the perspective of 61 student teachers was at the high level on instruction, 228 student teachers had the moderate level on planning and 51 student teachers had the low level on instruction. The percentages of high, moderate and low level of student teachers' perspective on instruction were 17.9%, 67.1% and 15.0 %, respectively.
4. It was found that the perspective of 62 student teachers was at the high level on assessment, 236 student teachers had the moderate level on assessment and 42 student teachers had the low level on assessment. The percentages of high, moderate and low level of student teachers' perspective on assessment were 18.2%, 69.4% and 12.4%, respectively.
5. It was found that the perspective of 54 student teachers was at the high level on classroom environment, 237 student teachers had the moderate level on planning and 49 student teachers had the low level on classroom environment. The percentages of high, moderate and low level of student teachers' perspective on classroom environment were 15.9%, 69.7% and 14.4%, respectively.

The result of open-ended questions pointed the student teachers state that the practice duration is very short. They suggest that –the duration of teaching practice time should be taken at least one month or more. Some of the teachers who they come teaching practice are like them and some of the teachers are not. Some of the student teachers express that they have more confidence for their profession. Some of the student teachers show that they know advantages and disadvantages of their teaching skills from teaching practice. Some of the student teachers state that they had good relationship between them.

According to the first dimension, planning, most student teachers agree that they came to know practice teaching is an effective preparation for their real-time teaching. More than half of student teachers agree that they understand how to plan their lessons as students' different learning styles are encountered during practice teaching. A few student teachers cannot decide which teaching methods should be used depending on the class size, number of students, etc...(e.g group discussion).

According to the second dimension, instruction, most student teachers agree that a good relationship between teachers and students make an effective teaching learning process. More than half of teachers agree that group discussion is suitable method of teaching students as it gives students a chance to share their knowledge during the discussion time. A few teachers disagree that some important points should be noted down on the blackboard (or) whiteboard before starting to teach.

According to the third dimension, assessment, most of the student teachers agree that setting all students listen to the questions first and then selecting the certain students is the best. More than half of student teachers agree that the questions being asked must be appear in avoidance with the instructional objective in order to get a good result. A few teachers cannot decide that peer correction helps to reduce the amount of class time that is needed to spend on correcting the exercise in the classroom.

According to the last dimension, classroom environment, most student teachers agree that it is necessary to praise (or) reward those students who are trying. More than half of student teachers agree that other duties like registration should be done with our teaching in the classroom. Less than half of student teachers disagree that the school they practice teaching provides all kinds of teaching aids necessary for teaching learning process.

Pre-service teachers should be given more time to do teaching practice and less time on content, as they need the application skills more than they need the content (Major & Tiro, 2012). To become efficient and effective teaching practice in Universities of Education, the above discussion should be taken into account by teacher educators.

To sum up, the result of this study state that the perspective of student teachers from Sagaing University of Education is mostly positive. This result is consistent with the findings of Koross (2016) who investigated the student teachers' experiences during teaching practice and its impact on their perception of the teaching profession.

Suggestions

To raise the quality of education with efficient and effective teaching practice, teacher educators should try to promote the teaching practice programme by implementing the above discussions. This research studied the student teachers' perspective on teaching practice from Sagaing University of Education. It can be seen that the majority of student teachers in this study had positive view on teaching practice that it can benefit them in planning, instruction, assessment and managing classroom environment when they create a teaching-learning process. This is probably one of the reasons why teaching practice should be continued to regard as an essential part of a teacher education programme. Interestingly, it should be noted that most school could not provide all kinds of teaching aids for teaching-learning process. Nevertheless, regardless of the supporting of the Ministry of Education and the school itself, a teacher (a student teacher in this case) is responsible for effective teaching-learning process by using creative teaching aids which are not costly.

Furthermore, as the saying goes "Experience is the best teacher", student teachers should be employed in their teaching practice at least one month or more.

Moreover, the Department of Methodology, which takes all the responsibilities of teaching practice for student teachers, should emphasize more on the teaching practice for the benefits of student teachers as well as the education system. It is also suggested that the limitations of the process should be noted and refined them for better outcomes.

However, research is not an ending process and every research work provides bases for further research studies. With this view, some recommendations were provided for further research.

- The research should also be conducted to study the student teachers' perspective in teaching practice from Yangon University of Education.
- A comparative study of student teachers' perspective in teaching practice from all the Education Colleges should be carried out.
- A comparative study of student teachers' perspective in teaching practice from Sagaing University of Education and Yangon University of Education should be conducted.

Conclusion

In this research, the researcher investigated the perspective of student teachers on teaching practice from Sagaing University of Education. A five-point Likert scale was used to respond the perspective questionnaires. The sample of this study was 340 fourth year (second semester) student teachers from Sagaing University of Education (2017-2018) academic year. Descriptive statistics (percentage) was applied to analyze each dimension.

The purpose of this study is to explore the student teachers' perspective on teaching practice. This research was descriptive in nature. A questionnaire for the perspective of student teachers in teaching practice was constructed on the basis of Koross (2016) and Danielson (2013). The questionnaire included 40 Likert-type items for four dimensions: planning, instruction, assessment and classroom environment. The sample of this study was 340 fourth year (second semester) student teachers from Sagaing University of Education (2017-2018) academic year. Descriptive statistics (percentage) was applied to analyze each dimension.

And then, the collected data were analyzed in order to get the accurate results. The perspective of student teachers in planning is the highest and that of student teachers in classroom environment is the lowest. As the mean scores for each dimension are greater than the median score 30, it shows that student teachers have positive view in teaching practice on each dimension. Medium score can be obtained by the multiplication of the number of items and neutral score 3. Therefore, it can be concluded that the student teachers from Sagaing University of Education have positive view in teaching practice. The results showed that most of the student teachers chose neutral score 3 in expressing their perspective of teaching practice. Therefore, it may be assumed that the obtained results were deviated from the real teaching perspective of student teachers in the classroom. In order to get more accurate information for the research, the researcher should use four-point Likert scale instead of five-point Likert scale and should also employ qualitative research.

Kasanda, (1995) indicates that during teaching practice, a student teacher is given the opportunity to try the art of teaching before actually getting into the real world of the teaching profession. Osuala, (2004) established that, teaching practice exposes the trainee teacher to the realities of effective teaching and helps them to try out methods of teaching and gain practical classroom experience under experts. According to Tuli File (2009) teaching practice allows student teachers to discover their abilities and creativities that help them in their future teaching processes. Marais and Meier (2004) argue that teaching practice is a challenging but important part of teacher training, especially in developing countries. As it is commonly said that "theory without practice is empty; practice without theory is blind" (Morrison & Werf, 2012, p.1). Teaching practice enables student teachers to understand the real world of teaching and let them know about problems and difficulties of teaching that may face them in the future.

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A STUDY OF THE ATTITUDE OF PRE-SERVICE TEACHERS IN EDUCATION COLLEGES TOWARDS THEIR TEACHING PROFESSION

Bawi Kee[1] and San Aye[2]

Abstract

The purpose of this research was to investigate the attitude of pre-service teachers in Education Colleges towards their teaching profession. A sample was comprised of 1000 pre-service teachers from selected Education Colleges. A descriptive survey method was used in this study. To get the data for the attitude towards teaching profession, the questionnaire having the demographic data, (40) five-point Likert items, was developed. Pre-service teachers' attitude towards their teaching profession was examined by five dimensions: attitude towards choosing teaching career, attitude towards professional development during training period, attitude towards professional commitment, attitude toward professional status/pride and attitude towards professional expectation. The data were analyzed using descriptive statistics and independent samples *t* test. The findings showed that most of pre-service teachers chose teaching as career accordance with their own desire. They got fond of teaching during their training period due to their teachers' guidance and practical teaching. They have a strong commitment as well as a high willingness towards teaching profession. They also believe teaching profession as a noble job and that it will bring a venerable position in society. According to gender, female pre-service teachers have more positive attitude than males. On comparing teaching programs, the pre-service teachers who attend pre-service primary teachers training program have more positive attitude than those who attend diploma in teacher education program. However, pre-service teachers who are specialized in both of arts and sciences subject combination have the same attitude towards teaching profession. Therefore, it can be concluded that all of pre-service teachers have positive attitude towards teaching profession although there was difference in the attitude in terms of gender and teaching program.

Keywords: attitude, teaching profession, pre-service teacher

Introduction

Education is the background of any progressing nation and also the teachers are the pivot in any system of education as she has a key role to perform in the whole progress. Teachers are pillars of society. Moreover, they play a major role in serving society via manpower training, providing peace of mind and social peace in society, culture, and values of society to be transferred to young generations. If a teacher is committed and has a positive attitude, then it is sure that his/her performance will be better her environment (Jain, 2012). Attitudes towards profession are typically connected with enjoying the profession, complete dedication to their profession, and being aware that profession is socially helpful and believing that they have to enhance the profession (Shakir & Parvez, 2013). As well, teachers' attitudes towards teaching play a significant role in shaping the attitudes of students towards learning (Bichi & Musa, 2015). As Myanmar raises the quality of the education system, it needs teachers with the right values, skills, and knowledge to be effective practitioners. That is to say, teachers' positive attitudes towards their profession have great importance in fulfilling the requirements of the profession and bringing along professional contentment. Therefore, Myanmar needs a strong system of teacher education, with programs that provide the theoretical foundations to produce graduates

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with the kinds of professional knowledge, understanding, and skills associated with the role of the teacher and the process of teaching (Aye Aye Myint & Myo Win, 2016).

Statements of the Problem

In Myanmar, the entrance system of university and college is only based on the students' matriculation examination marks from high school. The entrance system is encouraging merely getting high marks and overlooking the attitudes towards their teaching profession. There is a challenge to consider changes in the entrance system of the universities because most of the students wanted to join popular university and joined the institutions to study particular subjects with the force of parents and societies without being much interested in those fields. As the result, human resources are not in the right place(Mya Oo, 2013).

In Education College, there are two different types of pre-service teacher training programs. The first one is a Diploma in Teacher Education (DTEd) program for those who passed the matriculation examination with high marks. This program is accepted the candidates not only with high marks in their matriculation examination but also the entrance selection board for teacher training at Teacher Education Institution (MOE, 2017). The next program is Pre-service Primary Teacher Training (PPTT) for those who are the first-degree holder and passed the written entrance test. Accordingly, prospective teachers are selected in accordance with their academic qualifications and without considering much about their attitudes toward the teaching profession. This means that most of the admission system in a teacher training program focused on students' academic qualification and placed very little emphasis on the importance of the attitude development of pre-service teachers.

However, most of the developed European countries, prospective teachers are selected in accordance with the criteria for selection. The main choice criteria area unit are those the performance in higher educational activity, satisfactory performance in an examination specifically for admission to teacher training, and interviews during which candidates are asked regarding their reasons for embarking on coaching and desire to become teachers (Delhaxhe, Forsthuber, García & Decoster, 2002). In Myanmar, however, the pre-service teachers' attitudes and wishes are ignored while choosing prospective teachers in Education Colleges.

Investigation of the pre-service teachers' attitudes towards their teaching profession is so important because student teachers in education colleges are trained to potentially take teaching responsibilities after completion of their course. Therefore, the present study aimed at investigation the attitudes of the pre-service teachers towards teaching profession who are studying in Education Colleges.

Purposes of the Study

The main purpose of the research is to investigate the attitude of pre-service teachers in Education Colleges towards their teaching profession. The specific objectives of the research are as follows:

1. To find out the attitude of pre-service teachers towards their teaching profession
2. To explore the attitude of pre-service teachers toward their teaching profession in terms of gender
3. To investigate the attitude of pre-service teachers towards their teaching profession in terms of subject combination

4. To examine the attitude of pre-service teachers toward their teaching profession in terms of teaching program
5. To give suggestions and recommendations on the attitudes of pre-service teachers towards teaching profession based on the results of the study

Research Questions

1. What are the attitudes of pre-service teachers toward their teaching profession?
2. Is there any significant difference in the attitude of pre-service teachers toward their teaching profession in terms of gender?
3. Is there any significant difference in the attitude of pre-service teachers towards their teaching profession in terms of subject combination?
4. Is there any significant difference in the attitude of pre-service teachers towards their teaching profession in terms of teaching program?

Definition of Key Terms

Attitude

Attitude is a mental and neural state of readiness, organized through experience, exerting a directive influence upon the individual's response to all objects and situations with it is related (Allport, 1935).Attitude for this study is defined as the inclinations and feelings of the pre-service teachers towards their teaching profession.

Teaching Profession

Teaching profession is an occupation which requires specialized intellectual study and training, the purpose of which is to supply skilled service or advice to others for a definite fee or salary (Manjula & Manichander, 2001).

Pre-service Teacher

The pre-service teachers are those who are getting in a training course to become teachers and they have not undertaken any teaching.

Review of Related Literature

The Importance of Attitude towards Teaching Profession

Attitude is that the broad coverage of virtually all the educational, social science and psychological fields. The importance of perspective within the lifetime of a teacher is universally well recognized. Teacher success within the teaching profession and in any work of life depends on two things-his aptitudes and perspective without a positive perspective, he tends to stay an inactive, dormant and sluggish state, despite all his capacities he achieves very little. The positive perspective might evoke sensible and effective results whereas negative might convey the diametrically opposite (Arjunan, 2014). Attitude towards teaching is a permanent sensory activity organization of the teacher's belief and learned tendency to react favorably or unfavorably in several degrees that determines his response towards teaching.

The teachers play a very vital role in a society or community, because of their role in social and individual upliftment that the teachers are referred to a professional and teaching as a profession. Teachers are considered as professional because they have been trained to teach and have acquired teaching skills (Manjula & Manichander, 2001).Attitude towards profession means a person's feelings, behaviors, and commitment to the profession or job. Thus, the attitudes of teacher are important to determine the level of commitment towards the profession. It is a pivotal quality that determines a teacher's willingness to develop and grow as a professional. The performances as well as commitment to their role and responsibilities are depended on the attitude of teacher's towards their profession. The attitude towards teaching profession was explored by the following five dimensions.

Teaching Career

Teaching career is an opportunity for teachers to study a far better understanding of students and their environments as a teaching profession is incredibly complex, and demanding. Pre-service teachers' attitudes towards choosing teaching career relate to their orderly and consistent manner of thinking, feeling, hoping and reacting with relation to their future profession. Moreover, some folks or family have a bit influence on the schooling and career choices of their children (Low, Hui & Cai, 2017). Gao (2008) expressed that parents play a vital role in shaping students' perspective toward schooling generally and better education in specific. Students with folks who had school experiences and powerfully encourage the student to attend school are additional seemingly to be progressing to attend college. Of course, parental knowledge and expectations will be effective provided that the student will profit of this. Before coming into education colleges, most of pre-service academics would have already got positive attitudes towards teaching career which would are created by direct expertise or by implicitly experience. Several researchers have investigated the attitudes of pre-service teachers towards choosing teaching career with the understanding that their attitudes towards the teaching career have a control on their subsequent professional development, commitment and quality of their work when they become teachers. The research studied by Took (2012); Kaur & Gill (2017) and Phargava & Pathy (2014) claim that having positive attitudes towards choosing teaching profession is as necessary as developing knowledge, skills and value required in teaching.

Professional Development

Professional development is that the enrichment training provided to teachers over a period of time to promote their development altogether subjects of content and pedagogy. It is not merely a time-bound activity or series of events, however a continual process. Professional development includes formal experiences (such as attending workshops and professional conferences, mentoring, etc.) and informal experiences (such as reading professional publications, observation television documentaries associated with an educational discipline, etc.). It may have a positive impact on teachers' pedagogic content knowledge as many teachers feel challenged with the teaching of curricular subjects because of the dearth of interest to amass the resources required to make applicable learning environments and lack of confidence (Manjula & Manichander, 2001). It is a medium for teachers to develop their knowledge and skills in teaching. It additionally suggests that to a process wherever teachers review, renew, and extend their commitment as modification agents to the ethical functions of teaching, yet as acquire and develop the information, skills, plan, and observe with kids, children, and colleagues through every part of their teaching lives with ideas of learning, engagement, and improved apply (Day, 1999; Bredeson, 2002, as cited in Adnyani, 2015).

Teacher professional development ought to aim at enhancing the knowledge and skills of teachers by suggests that of orientation, training, and support that contribute to the advance of the standard of the educational and teaching method and that specialize in teacher core competencies like improving teacher proficiency, understanding the scholars, managing observe of teaching skills, comprehending the opposite branches of knowledge as well as knowing and appreciating the teaching profession.

Professional Commitment

Professional commitment is defined as the degree of positive, effective bond between the teacher and the institution. Professional commitment is the feeling of dedication among the individuals of a group towards their profession. This commitment area involves two essential components: namely, pride in one's being in the teaching profession; and a strong desire for professional development (Shashi, 2014). Professional commitment also indicates (1) the belief and acceptance of goals and values of the profession, (2) the willingness to exert considerable effort on behalf of the profession and (3) a definite desire to maintain membership in the profession (Kaur& Gill, 2017).It is the feeling of dedication among the individuals of a group towards their profession.

The Status of Teaching Profession

Teaching is actually one of the oldest professions. A profession is a high status and high prestige occupation. Hoyle (2001) has proposed that the generic term 'status', as applied here, is made up of three components - occupational prestige, occupational status, and occupational esteem. Prestige relates to the public perception of the standing an occupation has in comparison to others; status refers to how knowledgeable groups refer to an occupation (e.g. as a profession); and esteem refers to the regard in which an occupation is held by the public due to the attributes that members of that group are perceived to bring to the job. Guerriero (2017) stated that the status or social standing of the teaching profession is difficult to define could be due to teaching being placed more along the lines of a semi-profession than a profession. However, in Myanmar society,teachers have traditionally been regarded as one of the "five gems" and considered on the same plane as the Buddha (who himself was a teacher), the scriptures, monks and parents(Han Tin, 2010). He also pointed out that the teaching profession has inadequate remuneration and that leads many teachers in Myanmar to operate outside the formal public education system. The status of teaching and the teaching profession is linked to the respect accord to the teachers and the value ascribe to the teaching profession. If a society does not respect or value teachers, it will not be able to attract and retain their best talents within the teaching profession, and teachers will not be able to do their job in the classrooms.In many Asian societies, teachers are held in high regards and have often been equated to the status of a "guru", a "child's first guide" or even a father (Low et al., 2017).

Professional Expectation

All pre-service teachers are expected to demonstrate progressive development within the domains of professional knowledge, practice and commitment. Because pre-service teachers are expected to exhibit on going professional growth as they progress through their training programs. They are expected to observe and involved in the whole activities when undertaking professional experience. They also trust that they will enjoy and satisfy from teaching despite a low paid job. They also believed that teaching profession has job security that can guarantee their future life and it will bring a chance to supply the wellbeing of society.

Research Method

In this study, descriptive research design was used. Dada were collected through questionnaires.

Subjects

This study was concerned to investigate the professional attitude of pre-service teachers who are trained in Pakokku Education College, Monywa Education College, Sagaing Education College, Mandalay Education College, and Meiktila Education College. The subjects were confined to Diploma in Teacher Education (DTEd) second year and Pre-service Primary Teacher Training (PPTT) trainees in 2018-2019 Academic Year. A sample of 1000 pre-service teachers was selected for this study. Table 1 shows the simple size of the study.

Table 1 The Sample Size of the Study

No.	Colleges	PPTT		DTEd		Total
		Male	Female	Male	Female	
1.	C1	50	50	50	50	200
2.	C2	50	50	50	50	200
3.	C3	50	50	50	50	200
4.	C4	50	50	50	50	200
5.	C5	50	50	50	50	200
	Total	250	250	250	250	1000

Note: PPTT = Pre-service Primary Teacher Training, DTEd = Diploma in Teacher Education

Instrument

The Attitude Scale towards Teaching Profession (ASTP) developed by Malsawmi & Renthlei (2015) and Tezci & Terzi (2010) was used in this study. The instrument used for the data collection contained two sections: section A and B. Section A was used to obtain the demographic information of pre-service teachers: gender, program, subject stream and college. Section B contained (40) items related to five subscales, namely, choosing teaching career, professional development, professional commitment, professional pride/status and professional expectation. There are 8 items of each subscale. Each subscale was coded by using a five-point Likert scale, with 1 = "strongly disagree" to 5 = "strongly agree". The scoring was reversed for negatively stated items. ASTP questionnaire developed in English was translated into Myanmar version.

Procedure

First of all, the literature review was explored in this study. Secondly, in order to get the required data, the researcher constructed an instrument under the guidance of the supervisor. For the validation of the instruments, the questionnaires were distributed to three experienced teacher educators. The instrument was modified before the pilot survey according to the advice and guidance of three experienced teacher educators. After that, the pilot survey was conducted on the 25th of October, 2018. The pilot test was held with (100) pre-service teachers from Pakokku Education College. Internal consistency reliability of the whole scale of ASTP revealed as .855. This Cronbach's alpha value indicated that the attitude scale towards teaching profession has high reliability to measure pre-service teachers' attitude towards teaching profession.

After administering the pilot, the instrument was revised according to the results of the pilot. And then, the major survey was conducted on 5th December 2018. It was held with (1000) subjects. The attitude questionnaires and demographic data were distributed to the pre-service teachers with a request to complete and return as soon as possible. The respondents were asked to decide about their agreement with the statements and mark the relevant response category honestly. The questionnaire was returned (100%) from the pre-service teachers in five Education Colleges under the research work. Then, the obtained data were analyzed.

Analysis of the Data

After data collection, the data were analyzed by using descriptive statistics (means and standard deviations) and independent samples *t* test. A mean score of 3 and above was regarded as agreement with the item statement while 2.99 and below was regarded as disagreement. For example, for the case of analysis the research questions 1, a mean of 3 and above was regarded as a positive attitude while 2.99 and below was regarded as a negative attitude. Independent samples *t* test was used to compare the pre-service teachers' attitude towards teaching profession in terms of gender, subject combination, teaching program and college.

Findings

The findings was based on the data resulted from the research study. The demographic information of the participants is presented in Table 2. It comprises of 500 (50%) males and 500 (50%) female pre-service teachers. 500 (50%) PPTT pre-service teachers who had held a first degree from universities and the rest 500 (50%) DTEd second-year pre-service teachers those are direct intake program and they had passed matriculation examination with high marks. The participants of the subject combination included 500 (50%) Arts and 500 (50%) Sciences pre-service teachers. It comprises of 200 (25%) pre-service teachers from each college.

Table 2 Demographic Information of Participants

Gender	Male	500 (50%)
	Female	500 (50%)
	Total	**1000 (100%)**
TeachingProgram	DTEd	500 (50%)
	PPTT	500 (50%)
	Total	**1000 (100%)**
SubjectCombination	Arts	500 (50%)
	Sciences	500 (50%)
	Total	**1000 (100%)**
Colleges	College 1	200 (25%)
	College 2	200 (25%)
	College 3	200 (25%)
	College 4	200 (25%)
	College 5	200 (25%)
	Total	**1000 (100%)**

As shown in Table 3, the values of all items other than that of item 7 are positive. Most of pre-service teachers have entered into teaching profession not because they have little options to choose other professions but because they love children and teaching. Furthermore, they chose the teaching profession not because it was easily available and low marks in matriculation examination. Similarly, the mean of the attitude towards choosing teaching career is 3.75 and the standard deviation is 0.571. Therefore, it can be interpreted that the attitude of pre-service teachers towards teaching profession is moderately positive.

Table 3 Attitude towards Choosing Teaching Career

No	Item	Mean	SD
1	I chose teaching profession owing to the compulsion of my relatives or persuasion of my friends.	3.53	1.272
2	I chose teaching profession because I love children and teaching them makes me feel pleased.	4.19	.753
3	I made a firm decision to be a teacher since my childhood.	3.48	1.255
4	*I chose to teach as my career because it is easily available.	3.68	1.167
5	I chose teaching profession because teaching is a respected profession like Medicine and Engineer.	4.03	.922
6	*I had to choose teaching as my career because I had low marks in matriculation examination.	4.12	.974
7	*I chose teaching career as my last resort.	2.96	1.320
8	I voluntarily choose teaching program I am currently attending.	3.89	1.069
	Attitude towards Choosing Teaching Career	3.75	.571

Note: Negative items are marked with (*)

According to Table 4, the value of all items ranges from 4.12 to 4.41 which indicates that pre-service teachers' attitude towards professional development is strongly positive. Most pre-service teachers are interested in and enjoy their training courses. Moreover, they believe that knowledge and skills which they learned from the training will help them to become effective teachers. As well, teacher educators' supervision and practical teaching make them be a more positive attitude towards teaching profession.

Table 4 Attitude towards Professional Development during training period

No.	Item	Mean	SD
9	When I become a teacher, I will apply professional teaching knowledge and skill gained through the teacher training courses.	4.41	.595
10	It makes me happy to think that I will become a school teacher.	4.34	.678
11	I became fond of teaching profession after micro-teaching or practicum.	4.38	.673
12	When I become a teacher, I will equip myself with the latest technology of teaching.	4.12	.653
13	I got fond of teaching because of teacher educators' guidance and instruction.	4.25	.696
14	*I don't think I will be able to apply pedagogic and academic knowledge I gained from teacher training courses.	4.17	.821
15	I believe I will be a professional teacher.	4.18	.640
16	*I neither like nor interested in the teacher training courses offered.	4.23	.738
	Attitude towards professional development	4.26	.445

Note: Negative items are marked with (*)

Pre-service teachers' attitude towardsprofessional commitments is shown in Table 5. The value of all items is positive. Most of pre-service teachers' attitude is favorable regarding professional obligation. Moreover, most of pre-service teachers' attitude is positive and they want to work as a teacher anywhere, anyplace and any situation. According to the mean of professional commitment, pre-service teachers dedicated themselves to become a good and qualified teacher. Therefore, it can be said that pre-service teachers in education colleges had strong commitment towards teaching profession.

Table 5 Pre-service Teachers' Attitude towards Professional Commitment

No.	Item	Mean	SD
17	I will try to be an honest and outstanding teacher when I become a teacher.	4.48	.549
18	When I become a teacher, I'll try not only to improve my students' academic achievement but also to enhance their lives.	4.49	.550
19	I would like to keep working as a teacher even under any difficult conditions.	4.20	.689
20	I will try to improve the education of underdeveloped areas especially bordered and remote areas when I become a teacher.	4.13	.699
21	*I will look for a highly remunerative job if teaching career does not satisfy me.	4.05	.868
22	I would like to work in any place when I become a teacher.	4.17	.739
23	I believe I will be a learned and qualified teacher.	4.43	.539
24	I find it honorable to guide people's lives by working as a teacher.	4.58	.575
	Attitude towards professional commitment	4.31	.431

Note: Negative items are marked with (*)

Table 6 showed that the value of all items is positive. Most pre-service teachers feel proud to be a teacher and they also accepted that teaching as a noble and prestige profession. Moreover, they do not regret entering into the teaching profession and they recommend that teaching is a suitable job to choose as a profession.

Table 6 Attitude towards Professional Status/pride

No.	Item	Mean	SD
25	Teaching is one of the most social prestigious profession	4.58	.573
26	*The teaching profession is a boring job.	4.27	.800
27	*I feel shy to identify myself as a teacher among my friends and colleagues.	4.52	.746
28	Teaching is a noble job.	4.69	.520
29	*I regret having chosen the teaching profession.	4.44	.757
30	I am proud of my future job as a teacher.	4.37	.609
31	I think teaching is a suitable profession for me.	4.17	.731
32	I would recommend teaching to those who are to choose a profession	3.91	.853
	Attitude towards professional status/pride	4.37	.421

Note: Negative items are marked with (*)

According to table 7, pre-service teachers' attitudes towards professional expectation, the statement in all items except that of item 38 are positive. Most pre-service teachers believe that they will be treated respectfully by society. They also trust that they will enjoy and satisfy from teaching despite a low paid job. They also believed that teaching profession has job security that can guarantee their future life and it will bring a chance to supply the wellbeing of society.

Besides, they hope that their personality and character will be developed through teaching. Moreover, the descriptive analysis showed that the mean score of professional expectation is 4.06. Thus, it can be concluded that the attitude of the pre-service teachers' towards teaching profession is favorable.

Table 7 Pre-service Teachers' Attitude towards Professional Expectation

No.	Item	Mean	SD
33	I believe teaching profession will bring me a prestigious status in society.	4.32	.599
34	I believe that working as a teacher can guarantee my future life.	4.24	.730
35	*I don't think I will derive satisfaction from teaching.	3.98	1.03
36	Teaching profession will develop my personality and character.	4.41	.553
37	I believe that the teaching profession will bring me a venerable position in society	4.26	.582
38	*Low rates of remuneration for teachers will make me remain financially depressed	3.00	1.23
39	I think teaching will provide me with opportunities to be productive and creative	4.20	.604
40	I believe I will be sufficiently esteemed by society when I become a teacher.	4.07	.736
	Attitude towards professional expectation	4.06	.424

Note: Negative items are marked with (*)

As shown in figure, the mean score of 3.75 for " Choosing Teaching Career", 4.26 for "Professional Development", 4.31 for "Professional Commitment", 4.37 for "Professional Status/Pride" and 4.06 for "Professional Expectation" indicated that pre-service teachers' attitude was positive in all subscales. While comparing all subscales, the mean score for "Professional Status/Pride" was found to be the highest and "Choosing Teaching Career" was the lowest.

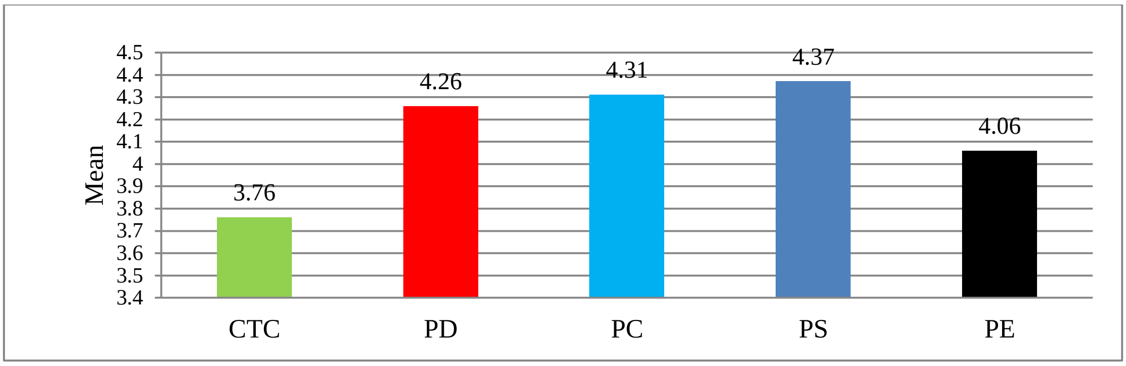

Figure 1 Mean scores of pre-service teachers' attitude towards teaching profession

Note: CTC = Choosing Teaching Career PS = Professional Status/Pride
PD = Professional Development, PE = Professional Expectation
PC = Professional Commitment

Table 8 reveals the mean scores for attitude of pre-service teachers towards the teaching profession to be 4.14 out of a total score of 5 subscales. The minimum mean score rated by the pre-service teachers is 3 and the maximum is 5. Based on the descriptive analysis, it can be concluded that the pre-service teachers' attitude towards teaching profession is positive.

Table 8 Overall Pre-service Teachers' Attitude towards Teaching Profession

Variables	N	Mean	SD	Minimum	Maximum
Attitude	1000	4.14	.363	3	5

Table 9 shows that the mean of female pre-service teachers are greater than that of male pre-service teachers in their attitude towards teaching profession. According to the findings, there was a significant difference in the attitude of male and female. It can be said that the female pre-service teachers have a more positive attitude than male pre-service teachers towards teaching profession.

Table 9 Pre-service Teachers' Attitude towards Teaching Profession by Gender

Dimension	Mean		SD		t	df	p
	Male	Female	Male	Female			
CTC	3.669	3.801	.5950	.5383	-3.692	998	.000***
PD	4.175	4.341	.4743	.3972	-6.027	998	.000***
PC	4.262	4.365	.4470	.4083	-3.814	998	.000***
PS	4.290	4.445	.4416	.4037	-5.793	998	.000***
PE	3.988	4.132	..4232	.4133	-5.476	998	.000***

Note: *** $p < .001$

Table 10 shows that there was a statistically significant difference in the attitude of pre-service teachers towards choosing teaching career subscale. However, there was no significant difference in the attitude of pre-service teachers towards teaching profession between the arts and sciences on the other four subscales of professional development, professional commitment, professional status/pride and professional expectation.

In overall, the finding shows that there was no significant difference in the attitude of pre-service teachers' towards their teaching profession in terms of their subject combination.

Table 10 Pre-service Teachers' Attitude towards Teaching Profession by Subject Combination

Dimension	Mean		SD		t	df	p
	Arts	Sciences	Arts	Sciences			
CTC	3.789	3.680	.5636	.5737	3.031	998	.003**
PD	4.273	4.243	.4400	.4501	1.092	998	.275 (ns)
PC	4.322	4.305	.4227	.4393	.633	998	.527(ns)
PS	4.380	4.356	.4353	.4246	.883	998	.378(ns)
PE	4.065	4.055	.4255	.4235	.396	998	.692(ns)
Overall	4.17	4.13	.372	.361	1.654	998	.098(ns)

Note: ** $p < .01$, ns = not significant

According to Table 11, the findings indicate that there was a statistically significant difference between the attitude of the DTEd and that of PPTT pre-service teachers in terms of teaching program. It can be interpreted that the PPTT pre-service teachers have a more positive attitude than DTEd pre-service teachers towards teaching profession. On the other hand, it can be said that the pre-service teachers of PPTT chose the teaching profession, not because of the force of their parents and relatives but because they chose according to their own desire and wish.

Table 11 Pre-service Teachers' Attitude towards Teaching Profession by Teaching Program

Dimension	Mean		SD		t	df	p
	DTEd	PPTT	DTEd	PPTT			
CTC	3.582	3.887	.6199	.4710	-8.761	998	.000***
PD	4.185	4.331	.4671	.4098	-5.245	998	.000***
PC	4.266	4.361	.4474	.4087	-3.533	998	.000***
PS	4.309	4.427	.4617	.3873	-4.360	998	.000***
PE	4.017	4.106	.4351	.4084	-3.453	998	.001**

Note: ** p <.01, *** p <.001

Discussion

In general, pre-service teachers in education colleges have a moderate positive attitude towards their teaching profession. Regarding choosing teaching career, most pre-service teachers chose teaching profession not only they love children and teaching but also they believed that teaching is a respected profession. They chose teaching profession not because it was easily available and low marks in matriculation. On the other hand, most of pre-service teachers supposed their courses were interesting and enjoyable during their training period. They also believed that the pedagogic and academic knowledge they received from the training course will become beneficial to their teaching profession.

Moreover, most of pre-service teachers' attitude was favorable regarding professional commitment. They have a strong commitment on teaching profession. As the results, most pre-service teachers want to work as a teacher anywhere, anyplace and any situation. The finding supports U Han Tin's interpretation that although pre-service teachers have to work under very difficult circumstances with little remuneration or reward, most teachers do good work (Han Tin, 2010). They felt proud to be a teacher as a teaching profession was considered to be a noble job and social prestigious profession.

In this studied, female pre-service teachers have significantly higher attitude than male pre-service teachers towards teaching profession. This result might be consistent with that women are seen as being responsible for home care and when a profession is taken into consideration, teaching profession is seen as suitable since it involves taking care of young children (Bademcioglu, Karatas & Alci, 2014; Shaheen et al., 2016; Ali & Ahmad, 2016). Min ZawSoe et al. (2017) have also pointed out that, in teaching profession, because of disincentives such as lower salaries, and insufficient accommodation and facilities, most male pre-service teachers do not prefer teaching as their profession. It is not a surprising result since the teaching profession is known as a more female dominant occupation as well as society orients females to choose occupations that can help itself like the teaching profession (Lall et al., 2013). Therefore, most of the researches show that the teaching profession is dominated by females.

The second component of this study was the attitudes of pre-service teachers towards teaching profession in terms of subject combination. Pre-service teachers of arts subject combination have significantly higher attitude than those of science subject combination in choosing teaching career. It may be possible that pre-service teachers of science subject combination might have more expectation on options to choose other professions like Medicine, Technology, Computer sciences etc. than those of arts subject combination according to University Entry Guidebook which was consistent with Han Tin (2010)'s results. However, there was no statistically significant difference in the other subscales such as professional development, professional commitment, professional status/pride and professional expectation. Therefore, in general, there was no significant difference in the attitude of pre-service teachers towards teaching profession in terms of their subject combination.

In third component of the attitude of pre-service teachers towards teaching profession in terms of teaching program, PPTT pre-service teachers have a more positive attitude than DTEd pre-service teachers towards teaching profession. PPTT pre-service teachers had more experiences than DTEd pre-service teachers in other universities about four years. These experiences may lead to developing a positive attitude towards teaching profession.

Suggestions

Positive attitudes not only promote learning but also create the climate which stimulates effective learning. Therefore, the following points would be suggested with respect to this study.

- Selection of pre-service teacher candidates should be based on the consideration of not only high marks in the matriculation exam but also interview process. The personal interview can support the admission system to select the candidates who possess a positive attitude towards teaching profession. This process can reduce the shortage of teacher at primary level as well as for retention pre-service teachers from dropout during their training period.
- The government needs to improve the salaries of teachers to the level where they will be in harmony with the current economic trends in order to reduce the wastage of primary teachers. This is because salary leads to a high level of job satisfaction and influences on teachers' attitude towards their teaching profession.
- Teacher educators should observe practical teaching and give student teachers feedback from their weak point and good point on the practical teaching and the student teachers can correct their weakness. It can help the pre-service teachers' professional development effectively and to support effective teachers for their teaching profession.

Recommendations for further Studies

Following are some of the recommendations for further research studies in the area of professional attitude.

1. A longitudinal study that would measure the attitudes of pre-service teachers towards teaching profession at the entry purpose and at the time when these students reach their final year of study would be acceptable. This study would investigate whether or not pre-service initiate teachers’ attitude towards teaching changes as they undergo the teacher education course.

2. A comparative study should be concluded with both pre-service teachers and in-service teachers’ attitudes towards teaching profession whether or not they could be differences in attitudes towards teaching between those preparing to join the teaching profession and those already in the teaching profession.

3. The study may be replicated using other standards instruments and other variables like socio-economic status, residence, and level of satisfaction for choosing teaching profession as a career.

Conclusion

The quality of education depends on the quality and effectiveness of its teachers. Teachers' proficiency depends on the attitude they possess for his or her profession. The positive attitude helps the teacher to develop a conductive learner-friendly atmosphere in the classroom (Bhargava & Pathy, 2014). Today, the requirements of the teaching profession are progressively changing. In contrast to different professions, teachers are generally loaded with many expectations from society. Moreover, teachers are assigned as one of the "five gems" in Myanmar society (Han Tin, 2010). The world is rapidly changing and information and communication are developing splendidly. However, no machine or mechanism will replace the role of teachers as a result of their own temperament is an academic model for students. In order to achieve success within the teaching profession, one needs to love the profession and perform it volitionally or enthusiastically.

For that reason, the teachers' attitudes that are formed within the teacher training programs towards the teaching profession should be organized in order to get a positive attitude towards the teaching profession. This research may support the admission system of teacher education program as well as education colleges to developing a positive professional attitude of pre-service teachers. It may be helpful for policymakers, administrators and teacher educators to enhance teacher training programs.

To conclude, the findings and results of this study indicate that the attitude of pre-service teachers in education colleges towards teaching profession is moderately positive, however, there is a pressing problem need to review the status of teachers in terms of remuneration like salaries and fringe benefits, and also the admission system that can keep retention of pre-service teachers throughout their training course.

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AN ANALYTICAL STUDY OF GRADE ELEVEN MYANMAR TEXTBOOKS FOCUSING ON THEIR OBJECTIVES, CONTENTS AND CONTRIBUTIONS TO MYANMAR LITERATURE

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Abstract

The purpose of this research is to analyse the Grade Eleven Myanmar textbooks (Selected Myanmar Prose and Selected Myanmar Poetry) focusing on their objectives, contents and contributions to Myanmar literature, and to explore the perception of the teachers who teach Myanmar on these textbooks. The triangulation design, one of the mixed methods designs, was used for this study. The researcher conducted content analysis plus survey questionnaires which can be used to evaluate textbooks from the perspective of teachers, ensuring a higher level of objectivity of the results and less subjective judgements. The checklists were developed for both textbooks, in accordance with the nature of Grade Eleven Myanmar textbooks and the survey questionnaires for the perception of teachers who teach Myanmar, were developed in order to gain both qualitative and quantitative data. All senior Myanmar language teachers (totally 70) from the Basic Education High Schools and Sub-high Schools in Hsalingyi, Yinmarbin and Pale Townships, were chosen as participants in this study. Results from the qualitative content analysis showed that both textbooks can fulfil the goals and objectives of teaching Myanmar and Grade Eleven Myanmar Syllabus though objectives themselves seem to be updated. Similarly, according to the results of the quantitative data, the teachers satisfied the objectives. The researcher found that both textbooks need to be updated in terms of contents. Despite the major satisfaction in contents, the results described that the Myanmar language teachers did not satisfy the textbooks in terms of exercises. It is found that both textbooks can highlight the brief history of Myanmar literature and make several contributions to it. The teachers who used those textbooks also confessed that statement. The findings of this study reveal the strengths and limitations of Grade Eleven Myanmar textbooks designed for use in a Myanmar context.

Keywords: textbooks, analysis, perception

Introduction

According to Richards (2000, p. 125), “While the roles of teachers, teaching, and learners have been the focus of a vast body of discussion and research over the years, much less attention has been given to textbooks”. Being crucial materials in the teaching-learning process, textbooks need to be written carefully and then, they also need to be analysed, evaluated and wisely chosen to reach its great effectiveness. In some settings, teachers have a chance to choose the book which they want to use in their classes. But in other settings, textbooks are prescribed by administrators or committees of teachers. In Myanmar, it can also be seen that all the decisions about curriculum and school textbooks taught at the basic education level are made by the Ministry of Education. An analytical study of textbooks is, therefore, an educational necessity in order to sure that those textbooks reflect the aims and objectives of the teaching programme, fulfil the needs of intended students, and to reveal their strengths and limitations. Consequently, how a textbook can be improved or adapted can be shown by such analysis.

The textbooks that are chosen to analyse are two of the Grade Eleven Myanmar textbooks (Selected Myanmar Prose and Selected Myanmar Poetry) published by Basic Education Curriculum, Syllabus and Textbook Committee adopted for use in Myanmar Basic Education

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Schools. It is an undeniable fact that systematic analysis of the prescribed textbooks for Grade Eleven students plus surveying perception of teachers who currently use these textbooks in their classes is of great importance for effective teaching of Myanmar.

Objectives of the Study

(1) To analyse the objectives, contents and contributions to Myanmar literature of the Grade Eleven Myanmar textbooks based on predetermined checklists

(2) To examine the suitability of the Grade Eleven Myanmar textbooks for the high school students

(3) To highlight the strengths and limitations of the Grade Eleven Myanmar textbooks

(4) To evaluate the Grade Eleven Myanmar textbooks from the perspective of Myanmar language teachers

(5) To be helpful in current curriculum reform

Research Questions

1. To what extent do Grade Eleven Myanmar textbooks meet the characteristics of a good textbook in terms of objectives, contents and contributions to Myanmar literature?
2. Are Grade Eleven Myanmar textbooks appropriate to be studied at the high school level?
3. What are the strengths and limitations of Grade Eleven Myanmar textbooks?
4. What is the overall perception of Myanmar language teachers on these textbooks?

Definition of Key Terms

Textbook : Textbooks are important medium of instruction throughout the world. They are designed to communicate information by means of printed words, numbers, pictures, diagrams and maps. They are a useful tool for teaching students of any age how to acquire and use information. Textbooks indicate what a teacher must teach and what the students have to learn (Department of Methodology, 2017).

Analysis : The detailed study or examination of something in order to understand more about it; the result of the study (Oxford advanced learner's dictionary, 2015).

Operational Definition

Grade Eleven Myanmar Textbooks : The Grade Eleven (Standard Ten) Myanmar Readers published by the Basic Education Curriculum, Syllabus and Textbook Committee (2018-2019 Academic Year).

Literature Review

Role of Textbooks in Education

Textbooks are crucially important in most education systems. The role of textbooks is certainly recognized by both learners and teachers. Hutchinson & Torres (1994) stated that learners see the textbook as a 'framework' or 'guide' that helps them to organize their learning both inside and outside the classroom. Most teachers consider that using textbooks means saving time, giving directions to lessons, guiding discussions, facilitating in giving homework, making teaching easier, better organized, more convenient, learning easier, faster, better, and most of all, it provides confidence and security.

Richards (2010) also described that textbooks are a key component in most language programmes. The textbook may provide the major source of contact for learners apart from input provided by the teacher. In the case of inexperienced teachers, textbooks may also serve as a form of teacher training, suggesting ideas on how to plan and teach lessons as well as formats that teachers can use. He added that language teaching through the world today are not likely to occur without the extensive use of commercial textbooks and that is why learning how to use and adapt textbooks is an important part of a teacher's professional knowledge.

However, no textbook will be totally suited to a particular teaching situation. Cunnings worth (1984) mentioned that textbooks are only an aid to the language-teaching process, which also depends upon individuals, their needs and their relationships in the classroom. Teachers and students find their own ways of using a textbook to suit these circumstances, and to suit their methods of learning.

The Importance of Textbook Analysis

Teaching is a kind of partnership between teacher and materials such as textbooks. Partnerships work best when each partner knows the strengths and weaknesses of the other and is able to complement them (Hutchinson & Torres, 1994). Textbooks play a crucial role in students' success or failure and that is why particular attention must be paid to analyse such materials based on valid and reliable instruments.

There are many features of textbooks which have a significant impact on their target audience. Such features can have positive or negative impacts on learning. Textbook analysis is a means by which these features can be identified and the effectiveness of textbooks can be established (Okeeffe, 2013). Textbook analysis and evaluation, moreover, is useful in teacher development and helps teachers to gain good and useful insights into the nature of the material (Cunningsworth, 1995).

A variety of methods regarding textbook analysis are used in practice and there are two main categories of textbook analysis methods: qualitative and quantitative. These methods can be used both independently from each other, as well as together, depending on the objective of the analysis. A combined approach that involves both qualitative and quantitative data is frequently used which ensures a higher level of objectivity of the results (Pingel, 1999 as cited in Musteaţă, 2011). However, selecting an appropriate textbook is not a wholly objective process. While many guidelines are suggested, the individual subjective judgments of the teachers are central to it.

Textbook Analysis Criteria

The main purpose of textbook analysis is to identify its strengths and limitations, and to eliminate negative features. "In evaluating any new book of a scholarly or technical nature, one have to consider the purpose for which it was written, for it is all too easy to attack it for not being something else" (Verhave& Sherman, 1967, p. 641).

Cunningsworth (1995) proposed four guidelines which underlie many of the specific criteria for textbook analysis and evaluation. The first guideline is that textbooks should correspond to learners' needs and they should match the aims and objectives of the language-learning programme. The second is that textbooks should reflect the uses which learners will make of the language. The third guideline is to ensure that textbooks facilitate learning processes. The last guideline is that textbooks should have a clear role as a support for learning. These above-mentioned guidelines need to be considered in analysing and evaluating textbooks which will be used, which are currently used, or which had been used in any teaching programme.

Harmer (2001) suggested that whether assessing or evaluating textbooks, student opinion and comment should also be considered. He described the three-stage procedure which can help teachers analyse and assess books on the basis of their own beliefs and their assessment of their students' needs and circumstances. The first stage is selecting areas for assessment in which the desired features in textbooks are listed under consideration. This list can be reduced or expanded according to the focused criteria in the light of teachers' teaching situation. The second one is to state belief statements about any or all of the areas that have been decided to concentrate on. This can be done by a group of teachers writing their individual beliefs and then combining them into an agreed set. The last stage is using statements for assessment in which the statements of beliefs from the previous stage are ready to use as assessment items. Then, the predetermined list and statements can be judged by using a simple tick and cross system to compare different books.

Research Method

(i) Design

The triangulation design, one of the mixed methods designs, was used for this study. Mixed methods research combines quantitative and qualitative approaches by including both quantitative and qualitative data in a single study (Gay & Airasian, 2012). In this study, the researcher used the mixed methods research design; content analysis plus survey questionnaires which can be used to evaluate textbooks from the perspective of teachers, ensuring a higher level of objectivity of the results.

(ii) Subjects

The Grade Eleven Myanmar textbooks, Selected Myanmar Prose and Selected Myanmar Poetry, published by the Ministry of Education, Basic Education Curriculum, Syllabus and Textbook Committee, 2018-2019 Academic Year, were chosen as the subjects for this study.

The predetermined checklists of textbook analysis based on a number of criteria for textbook analysis and evaluation set by some researchers (Cunningsworth, 1995, Daoud&Celce-Murcia, 1979, Williams, 1983) were developed, for qualitative data, in accordance with the nature of the Grade Eleven Myanmar textbooks.

In addition, the questionnaires targeted to all senior teachers who teach Myanmar from the Basic Education High Schools and Sub-high Schools in Hsalingyi, Yinmarbin and Pale Townships, Sagaing Region, were developed, for quantitative data, based on the above predetermined checklists for each textbook. The total number of the study population is 70.

(iii) Instruments

As this research employed a mixed methods design, the predetermined checklists for textbook analysis for content analysis and the survey questionnaires for the perception of teachers who teach Myanmar, were developed in order to gain both qualitative and quantitative data. The materials were composed of the following.

(a) The Grade Eleven Myanmar Textbooks; Selected Myanmar Prose and Selected Myanmar Poetry, published by the Ministry of Education, Basic Education Curriculum, Syllabus and Textbook Committee, 2018-2019 Academic Year.

(b) The predetermined checklists of textbook analysis were based on a number of criteria for textbook analysis and evaluation set by some researchers (Cunningsworth, 1995, Daoud&Celce-Murcia, 1979, Williams, 1983). The checklists were developed for both textbooks; in accordance with the nature of Grade Eleven Myanmar textbooks.

(iv) Procedure

First of all, the researcher studied the relevant literature concerned with the research and the research methodology in order to establish the most suitable research design. Second, instruments were constructed under the guidance of the supervisor. These instruments were distributed for validation to those who have special knowledge, two educators from Sagaing University of Education and two senior teachers who have more than 30 years of experience of teaching of Grade Eleven Myanmar. Next, the checklists and questionnaires were modified according to their opinions. And then, pilot testing was administered followed by revising the instruments according to the results of the pilot test. After that, major survey was conducted, analysing the textbooks qualitatively at the same time as this study employed the triangulation design. Finally, the obtained data were collected, analysed and presented.

(v) Data Analysis

Content analysis was used for qualitative data and descriptive statistics was used for quantitative data. Content analysis is a method of data analysis and it is labelled as data collection method (Mayring, 2014). It is a method of analysing written, verbal or visual communication messages (Colc, 1988 as cited in Elo & Kyngäs, 2008). The textbooks were analysed by this method in order to get their in-depth information.

In analysing survey data, a five-point Likert scale was used and the rating scales were numerically coded as 1 - strongly disagree, 2 - disagree, 3 - undecided, 4 - agree, and 5 - strongly disagree, which greatly facilitated the statistical analysis. The Statistical Package for the Social Sciences (SPSS) version 21 was used to analyse the survey data.

Findings

I. Qualitative Content Analysis of the Textbook: Selected Myanmar Prose

(က)Objectives (ရည်ရွယ်ချက်များ)

ဒသမတန်း ပင်ရင်းမြန်မာစကားပြေလက်ရွေးစင်စာအုပ်သည် အခြေခံပညာအထက်တန်းမြန်မာစာသင်ကြားခြင်း၏ ရည်ရွယ်ချက်များကို အောင်မြင်ပေါက်မြောက်စေကြောင်း တွေ့ရှိရသည်။ ထိုရည်ရွယ်ချက် များသည်စာအရေးအသား အကြောင်းကိုအဓိကဦးတည်ထားကြောင်း တွေ့ရပါသည်။ စာအရေးအသားဆိုင်ရာ လိုအပ်ချက်များကို ဖြည့်ဆည်း ပေးနိုင်သည်။ ရည်ရွယ်ချက်ပေါက်မြောက်မှု ရှိ၊ မရှိကိုလည်း လက်တွေ့တိုင်းတာစစ်ဆေးနိုင်ပါသည်။

(ခ) Contents(ပါဝင်သော အကြောင်းအရာများ)

ပြဋ္ဌာန်းစာအုပ်တွင် ပင်းယခေတ်နှင့်အင်းဝခေတ်မှလွဲ၍ ခေတ်အမျိုးမျိုး၊ အကြောင်းအရာအမျိုးအစား စုံသော စကားပြေများဖြစ်သည်။ လက်တွေ့ဘဝတွင် ပြန်လည်အသုံးချနိုင်သည်ကိုတွေ့ရပါသည်။ ဗလငါးတန်တွင် ဘောဂဗလ အကြောင်း အားနည်းသည်။ တချို့ခက်ဆစ်အဓိပ္ပာယ်များသည်မြန်မာအဘိဓာန်နှင့်ကွဲလွဲနေသည်များကို တွေ့ရှိရပါ သည်။ ပါဝင်သောစကားပြေများသည် လူမှုရေးနှင့်ယဉ်ကျေးမှုဆိုင်ရာအကြောင်းအရာများနှင့် ညီညွတ်သော ဆက်နွှယ်မှု ရှိပါသည်။

(ဂ)Contributions to Myanmar literature (မြန်မာစာပေကိုအကျိုးပြုပုံ)

မြန်မာစာပေသမိုင်းကိုအကျဉ်းမျှသိစေရန်အထောက်အကူပြုပါသည်။ စာရေးဆရာများ၏ အကြောင်းကို ပိုမိုစိတ်ဝင်စားမှုရှိစေနိုင်ပါသည်။ မြန်မာစာပေကိုလေးစားတန်ဖိုးထားစိတ်များ ဖြစ်ပေါ်လာစေနိုင်ပါသည်။ မြန်မာစာပေအကြောင်း ဆက်လက်လေ့လာလိုစိတ်ကိုတိုးပွားစေနိုင်ပါသည်။

(ဃ)Other considerations

ပင်ရင်းမြန်မာစကားပြေလက်ရွေးစင်စာအုပ်ကို လေ့လာရာ၌ဆရာ၊ ဆရာမ၏ လမ်းညွှန်သင်ကြားမှု အတော်အသင့်သာလိုအပ်သည်။ သင်ခန်းစာပြင်ဆင်ရာတွင်အချိန်ကုန်သက်သာစေသည်။ စကားပြေအများစုကိုကျောင်းသား၊ ကျောင်းသများ ကိုယ်တိုင်ဖတ်၍နားလည်နိုင်သည်။ ထို့ကြောင့်စကားပြေပြဋ္ဌာန်းစာအုပ်မှ သင်ခန်းစာအများစုကို ကျောင်းသား၊ ကျောင်းသူများကိုယ်တိုင်လေ့လာဆည်းပူးနိုင်သည်ဟု ဆိုရမည်ဖြစ်သည်။ ပင်ရင်းမြန်မာစာဆရာလက်စွဲစာအုပ်သည်သင်ကြားရေးတွင်အထောက်အကူဖြစ်သည်ကိုတွေ့ရပါသည်။ ဆရာ၊ ဆရာမသည် မြန်မာစာနှင့်ပတ်သက်၍ ဗဟုသုတကြွယ်ဝရန်၊ စာများများဖတ်ထားရန်အထူးလိုအပ်သည်။ မြန်မာစာပေကို အကဲဖြတ်ရာတွင် မှတ်ကျောက်များအဖြစ်အသုံးပြုနိုင်သော ဂုဏ်၊ အလင်္ကာ၊ ရသတို့အကြောင်းကိုလည်း သင်ကြားပေးသင့်ပါသည်။

II. Quantitative Findings: Selected Myanmar Prose

The Results of the Per Statement Analysis

(i) Objectives

Table 1Percentage of Teachers' Perceptions on Objectives

No.	Statement	SD	D	U	A	SA
1	The textbook fulfils the objectives of teaching Myanmar at the high school level.	0%	1.4%	4.3%	90%	4.3%
2	The objectives meet the needs of Grade Eleven students.	1.4%	14.3%	22.9%	55.7%	5.7%
3	The objectives are systematically organized in the textbook.	0%	0%	4.3%	77.1%	18.6%
4	The objectives are clear and precise.	1.4%	8.6%	10%	68.6%	11.4%
5	The objectives are measurable.	2.9%	15.7%	27.1%	51.4%	2.9%

(ii) Contents

Table 2Percentage of Teachers' Perceptions on Contents

No.	Statement	SD	D	U	A	SA
1	The selection of topics is appropriate for Grade Eleven students.	0%	4.3%	5.7%	77.1%	12.9%
2	The sequence of topics according to their era in which they were written is appropriate.	1.4%	2.9%	2.9%	70%	22.8%
3	There is a wide variety of topics in the textbook.	1.4%	5.7%	1.4%	80%	11.5%
4	The topics interest Grade Eleven students.	0%	8.6%	7.1%	65.7%	18.6%
5	The topics are applicable in real life situations.	0%	5.7%	18.6%	61.6%	14.1%
6	There are topics which can improve the five strengths (Physical, Intellectual, Moral, Friendship and Wealth) of Grade Eleven students.	1.4%	24.3%	7.1%	64.3%	2.9%
7	Background information and summaries of each topic are helpful for both teacher and students.	0%	2.9%	4.3%	68.6%	24.2%
8	There are enough glossaries for unfamiliar words.	4.3%	20%	15.7%	55.7%	4.3%
9	There are enough exercises to be practised for fulfilling the objectives of each topic.	2.9%	40%	12.9%	37.1%	7.1%
10	The textbook is compatible with the social and cultural contexts.	0%	5.7%	14.3%	67.1%	12.9%

(iii) Contributions to Myanmar literature

Table 3 Percentage of Teachers' Perception on Contributions to Myanmar Literature

No.	Statement	SD	D	U	A	SA
1	The textbook is useful to see the brief history of Myanmar literature.	1.4%	8.6%	0%	67.1%	22.9%
2	The textbook raises the students' interests in Myanmar authors who are the main contributors to Myanmar literature.	0%	8.6%	7.1%	62.9%	21.4%
3	The textbook encourages students to respect and value Myanmar literature.	0%	2.9%	11.4%	65.7%	20%
4	The textbook is helpful for students to be aware of the relationship between literature and history.	0%	4.3%	5.7%	78.6%	11.4%
5	The textbook enhances students' further studies about Myanmar literature.	0%	12.9%	22.9%	51.4%	12.8%

The Results of the Per Category Analysis

Table 4Mean Comparison for each Category

No.	Main Categories	No. of Items	N	Mean	Standard Deviation
1	Objectives	5	70	18.77	1.965
2	Contents	10	70	38.24	5.622
3	Contributions to Myanmar Literature	5	70	19.63	2.391

On the per-category analysis, the observed means are more than the theoretical means, respectively, in all categories. Accordingly, it is probable to assume that all the participants satisfied the textbook.

Other considerations

Table 5 Percentage of Teachers' Perception on Other Considerations

No.	Statements	Options			
1	How much degree of teacher input does the textbook require?	Much (75.7%)	Not too much (24.3%)	A little (0%)	No input at all (0%)
2	Does the textbook aid teachers to minimize their preparation time?	Yes (74.3%)		No (25.7%)	
3	Is the textbook almost self-sufficient for self-study?	Yes (40%)		No (60%)	
4	Is the teacher's guide helpful in teaching?	Yes (84.3%)		No (15.7%)	
5	Does the textbook require the teacher to have mastery of Myanmar language and literature?	A through study is required (100%)	Only the areas related with the topics should be studied(0%)	No need to study at all (0%)	
6	In addition to the text in the textbook, what else should be taught?	Literary quality (34%)	Figures of speech (100%)	Aesthetic (100%)	
7	Which portions of the textbook should be improved?	Contents (68.6%)	Physical appearance (60%)	Paper quality (30%)	Binding (30%)

III. Qualitative Content Analysis of the Textbook: Selected Myanmar Poetry

(က)Objectives (ရည်ရွယ်ချက်များ)

ဒသမတန်း ပင်ရင်းမြန်မာကဗျာလက်ရွေးစင်စာအုပ်သည် အခြေခံပညာအထက်တန်းမြန်မာစာသင်ကြားခြင်း၏ ရည်ရွယ်ချက်များကို အောင်မြင်ပေါက်မြောက်စေကြောင်း တွေ့ရှိရသည်။ ထိုရည်ရွယ်ချက် များသည်စာအရေးအသား အကြောင်းကိုအဓိကဦးတည်ထားကြောင်း တွေ့ရပါသည်။ စာအရေးအသားဆိုင်ရာလိုအပ်ချက် များကိုဖြည့်ဆည်း ပေးနိုင်သည်။ ရည်ရွယ်ချက်ပေါက်မြောက်မှု ရှိ၊ မရှိကိုလည်း လက်တွေ့တိုင်းတာစစ်ဆေးနိုင်ပါသည်။

(ခ)Contents(ပါဝင်သော အကြောင်းအရာများ)

ပြဋ္ဌာန်းစာအုပ်တွင်တောင်ငူခေတ်မှလွဲ၍ခေတ်အမျိုးမျိုး၊ အကြောင်းအရာအမျိုးအစားစုံသောကဗျာများ ဖြစ်သည်။ လက်တွေ့ဘဝတွင် ပြန်လည်အသုံးချနိုင်သည်ကိုတွေ့ရပါသည်။ ဗလငါးတန်တွင်ဘောဂဗလ အကြောင်း အားနည်း သည်။ တချို့ခက်ဆစ်အဓိပ္ပာယ်များသည်မြန်မာအဘိဓာန်နှင့်ကွဲလွဲနေသည်များကို တွေ့ရှိရပါသည်။ ပါဝင်သော ကဗျာများသည် လူမှုရေးနှင့်ယဉ်ကျေးမှုဆိုင်ရာအကြောင်းအရာများနှင့်ညီညွတ်သောဆက်နွှယ်မှုရှိပါသည်။

(ဂ)Contributions to Myanmar literature (မြန်မာစာပေကိုအကျိုးပြုပုံ)

မြန်မာစာပေသမိုင်းကိုအကျဉ်းမျှသိစေရန်အထောက်အကူပြုပါသည်။ စာရေးဆရာများ၏ အကြောင်းကို ပိုမို စိတ်ဝင်စားမှုရှိစေနိုင်ပါသည်။ မြန်မာစာပေကိုလေးစားတန်ဖိုးထားစိတ်များ ဖြစ်ပေါ်လာစေနိုင်ပါသည်။ မြန်မာစာပေ အကြောင်း ဆက်လက်လေ့လာလိုစိတ်ကိုတိုးပွားစေနိုင်ပါသည်။

(ဃ)Other considerations

မြန်မာကဗျာပြေလက်ရွေးစင်စာအုပ်ကိုလေ့လာရာ၌ဆရာ၊ ဆရာမ၏ လမ်းညွှန်သင်ကြားမှု အတန်အသင့် လိုအပ်ပါသည်။ ကျောင်းသား၊ ကျောင်းသူများ ကိုယ်တိုင်အားထုတ်လေ့လာဆည်းပူးနိုင်သည်ဟု ဆိုရမည်ဖြစ်ပါသည်။ ပင်ရင်းမြန်မာစာဆရာ လက်စွဲစာအုပ်သည်သင်ကြားရေးတွင် အထောက်အကူဖြစ်သည်ကို တွေ့ရပါသည်။ ဆရာ၊ ဆရာမသည်မြန်မာစာ၊ မြန်မာကဗျာနှင့်ပတ်သက်၍ ဗဟုသုတကြွယ်ဝရန်၊ စာများများ ဖတ်ထားရန်အထူးလိုအပ်သည်။ မြန်မာစာပေကိုအကဲဖြတ်ရာတွင်မှတ်ကျောက်များအဖြစ်အသုံးပြုနိုင်သော ဂုဏ်၊ အလင်္ကာ၊ ရသတို့အကြောင်းကိုလည်း သင်ကြားပေးသင့်ပါသည်။

IV. Quantitative Findings: Selected Myanmar Poetry

The Results of the Per Statement Analysis

(i) Objectives

Table 6Percentage of Teachers' Perception on Objectives

No.	Statement	SD	D	U	A	SA
1	The textbook fulfils the objectives of teaching Myanmar at the high school level.	0%	4.3%	7.1%	82.9%	5.7%
2	The objectives meet the needs of Grade Eleven students.	0%	15.7%	28.6%	48.6%	7.1%
3	The objectives are systematically organized in the textbook.	0%	2.9%	4.3%	81.4%	11.4%
4	The objectives are clear and precise.	0%	5.7%	8.6%	74.3%	11.4%
5	The objectives are measurable.	2.9%	12.9%	28.6%	52.9%	2.7%

(ii) Contents

Table 7Percentage of Teachers' Perception on Contents

No.	Statement	SD	D	U	A	SA
1	The selection of poems is appropriate for Grade Eleven students.	0%	4.3%	10%	75.7%	10%
2	The sequence of poems according to their era in which they were written is appropriate.	0%	1.4%	5.7%	74.3%	18.6%
3	There is a wide variety of topics in the textbook.	0%	7.1%	2.9%	74.3%	15.7%
4	The poems interest Grade Eleven students.	0%	8.6%	5.7%	64.3%	21.4%
5	The topics are applicable in real life situations.	1.4%	8.6%	21.4%	54.3%	14.3%
6	There are poems which can improve the five strengths (Physical, Intellectual, Moral, Friendship and Wealth) of Grade Eleven students.	0%	35.7%	7.1%	50%	7.2%
7	Background information and summaries of each topic are helpful for both teacher and students.	0%	4.3%	1.4%	75.7%	18.6%
8	There are enough glossaries for unfamiliar words.	2.9%	30%	8.6%	52.9%	5.6%
9	There are enough exercises to be practised for fulfilling the objectives of each topic.	2.9%	45.7%	8.6%	38.6%	4.2%
10	The textbook is compatible with the social and cultural contexts.	0%	1.5%	17.1%	71.4%	10%

(iii) Contributions to Myanmar Literature

Table 8Percentage of Teachers' Perception on Contributions to Myanmar Literature

No.	Statement	SD	D	U	A	SA
1	The textbook is useful to see the brief history of Myanmar literature.	1.4%	4.3%	4.3%	81.4%	8.6%
2	The textbook raises the students' interests in Myanmar authors who are the main contributors to Myanmar literature.	0%	4.3%	10%	68.6%	17.1%
3	The textbook encourages students to respect and value Myanmar literature.	0%	5.7%	5.7%	68.6%	20%
4	The textbook is helpful for students to be aware of the relationship between literature and history.	0%	2.9%	4.3%	84.3%	8.5%
5	The textbook enhances students' further studies about Myanmar literature.	0%	11.4%	20%	52.9%	15.7%

The Results of the Per Category Analysis

Table 9Mean Comparison for each Category

No.	Main Categories	No. of Items	N	Mean	Standard Deviation
1	Objectives	5	70	18.70	2.038
2	Contents	10	70	37.21	3.867
3	Contributions to Myanmar Literature	5	70	19.64	2.420

Other considerations

Table 10Percentage of Teachers' Perception on Other Considerations

No.	Statements	Options			
1	How much degree of teacher input does the textbook require?	Much (84.3%)	Not too much (15.7%)	A little (0%)	No input at all (0%)
2	Does the textbook aid teachers to minimize their preparation time?	Yes (71.4%)		No (28.6%)	
3	Is the textbook almost self-sufficient for self-study?	Yes (34.3%)		No (65.7%)	
4	Is the teacher's guide helpful in teaching?	Yes (84.3%)		No (15.7%)	
5	Does the textbook require the teacher to have mastery of Myanmar language and literature?	A through study is required (100%)	Only the areas related with the topics should be studied(0%)	No need to study at all (0%)	
6	In addition to the text in the textbook, what else should be taught?	Literary quality (34%)	Figures of speech (100%)	Aesthetic (100%)	
7	Which portions of the textbook should be improved?	Contents (80%)	Physical appearance (57.1%)	Paper quality (34.3%)	Binding (34.3%)

Conclusion

Discussion

Objectives (ရည်ရွယ်ချက်များ)

အထက်တန်းဆင့်မြန်မာစာသင်ကြားခြင်း၏ ရည်ရွယ်ချက်များသည် စကားပြေနှင့်ကဗျာအကြောင်း၊ စကားအသုံးအနှုန်းနှင့်စာရေးတတ်ရန် ဦးတည်သည့်ရည်ရွယ်ချက်များသာ အဓိကပါဝင်သည်ကို တွေ့ရပါသည်။ ရည်ရွယ်ချက်များသည် ဒသမတန်းကျောင်းသား၊ ကျောင်းသူများ၏ စာအရေးအသားဆိုင်ရာ လိုအပ်ချက်များကို ဖြည့်ဆည်းပေးနိုင်ပြီး အကျင့်စာရိတ္တနှင့်၊ ရသခံစားမှုဆိုင်ရာလိုအပ်ချက်များကို ဖြည့်ဆည်းပေးနိုင်မည့် ရည်ရွယ်ချက်မျိုးမပါဝင်ပါ။ ရည်ရွယ်ချက်များကို စနစ်တကျစီစဉ်ထားပြီး ရှင်းလင်းတိကျသည်ကို တွေ့ရှိရပါသည်။ ရည်ရွယ်ချက်များ ပေါက်မြောက်မှု ရှိ၊ မရှိကိုလည်း လက်တွေ့တိုင်းတာစစ်ဆေးနိုင်ပါသည်။ ဤအချက်များသည် အားသာချက်များဖြစ်ပါသည်။ကျောင်းသား၊ ကျောင်းသူများ ဘက်စုံဖွံ့ဖြိုးတိုးတက်စေမည့်ရည်ရွယ်ချက်များဖြစ်စေရန် မွမ်းမံပြင်ဆင်သင့်ပါသည်။

Contents (**ပါဝင်သော အကြောင်းအရာများ**)

ဒသမတန်းပင်ရင်းမြန်မာစကားပြေလက်ရွေးစင်စာအုပ်၏ အားသာချက်မှာခေတ်အသီးသီးမှစကားပြေများ ကိုရွေးချယ်ထည့်သွင်းထားခြင်းဖြစ်ပြီး အားနည်းချက်မှာ ခေတ်အစုံမပါနိုင်ခြင်း ဖြစ်ပါသည်။ ပြဋ္ဌာန်း စာအုပ်တွင် ပင်းယခေတ်နှင့်အင်းဝခေတ်စကားပြေများ မပါဝင်သည်ကို တွေ့ရှိရပါသည်။

ပြဋ္ဌာန်းစာအုပ်တွင် '**သိဃ်သူ့သမီး**'နှင့် '**မိဖုရားဖွားစော**'ဟူ၍ပုဂံခေတ်ကျောက်စာနှစ်ပုဒ်ကိုပြဋ္ဌာန်းထားရာ ထိုကျောက်စာနှစ်ပုဒ်တွင်ပုဂံခေတ်တစ်ပုဒ်၊ ပင်းယခေတ်တစ်ပုဒ်ပြဋ္ဌာန်းလျှင်ပိုမိုသင့်လျော်နိုင်ပါသည်။ ခေတ်နှစ်ခေတ်၏ ကျောက်စာရေးဖွဲ့ပုံအကြောင်းအရာချင်း သိပ်မကွာခြားသော်လည်း ပင်းယခေတ်တွင် ဝါကျရှည်များကို ရေးသားလာကြကြောင်းတွေ့ရသည် ဟုဆိုသည် (ဖေမောင်တင်၊ ၂၀၁၃)။ ထို့ကြောင့်ပုဂံခေတ်ကျောက်စာတစ်ပုဒ်၊ ပင်းယခေတ်ကျောက်စာတစ်ပုဒ်ပြဋ္ဌာန်းလျှင်ထိုနှစ်ခေတ်၏ ကျောက်စာအရေး အသားများကိုနှိုင်းယှဉ်လေ့လာနိုင်မည်ဖြစ်ပါသည်။

အင်း၀ခေတ်စကားပြေ မပါ၀င်သော်လည်း အထူးဆိုဖွယ်ရာမရှိပေ။ ထိုခေတ်တွင်ပျို့ကဗျာများသာအထူးခေတ်စားပြီး စကားပြေအရေးအသားကလည်း အနည်းငယ်ပင် ရှိသည်။

မြန်မာကဗျာလက်ရွေးစင်စာအုပ်၏ အားသာချက်မှာခေတ်အသီးသီးမှကဗျာများကို ရွေးချယ်ထည့်သွင်း ထားခြင်းဖြစ်ပြီး အားနည်းချက်မှာ ခေတအစုံမပါ၀င်နိုင်ခြင်းဖြစ်ပါသည်။ ကဗျာများကိုခေတ်အလိုက်စီစဉ်ထားပြီး တောင်ငူခေတ်ကဗျာ မပါ၀င်သည်ကိုတွေ့ရပါသည်။ မြန်မာစာပေသမိုင်းကိုကြည့်လျှင် ချန်လှပ်ထား၍မဖြစ်သော အလွန်ထင်ရှားသည့် တောင်ငူခေတ်မှကဗျာများကိုလည်း ပြဋ္ဌာန်းစာအုပ်တွင်ထည့်သွင်းပြဋ္ဌာန်းသင့်ပါသည်။ ကဗျာ (၁၆)ပုဒ်တွင် ကုန်းဘောင်ခေတ်ကဗျာ (၇)ပုဒ်ဖြင့် အများဆုံးပါ၀င်သည်ကို တွေ့ရသည်။ စာပေအမျိုးအစား၊ ကဗျာ အမျိုးအစား စုံလင်စွာ ပေါ်ပေါက်ထွန်းကားခဲ့သော ခေတ်ဖြစ်ပြီး ပြဋ္ဌာန်းစာအုပ်တွင်အကြောင်းအရာစုံ၊ ကဗျာအမျိုးအစား အစုံပါ၀င်နိုင်ရန် ရည်ရွယ်ထား၍ ကုန်းဘောင်ခေတ်မှကဗျာများ ပိုမိုများပြားစွာ ပါ၀င်နေခြင်းဖြစ်နိုင်ပါသည်။

ပြဋ္ဌာန်းစာအုပ်နှစ်အုပ်လုံးတွင်ပုဂံခေတ်မှလွတ်လပ်ရေးခေတ်အထိ ရေးသားခဲ့ကြသောစကားပြေ၊ ကဗျာ အမျိုးမျိုး ပါ၀င်သည်ဖြစ်ရာ အကြောင်းအရာအမျိုးအစားစုံလင်ခြင်းသည် ၄င်းတို့၏အားသာချက်ဖြစ်ပါသည်။ သို့သော် အားနည်းချက်မှာ ယနေ့ခေတ်အကြောင်းအရာ၊ အရေးအဖွဲ့ မပါ၀င်ခြင်း ဖြစ်ပါသည်။ လက်ရှိ (၂၁) ရာစုမျက်မှောက်ကာလမှ အကြောင်းအရာ၊ အရေးအသားများလည်း ပါ၀င်သင့်သည်။ သို့မှသာခေတ်အဆက်ဆက်စကားပြေများ၊ ကဗျာများနှင့်မိတ်ဆက်ပေးနိုင်ပြီး မျက်မှောက်ကာလစကားပြေအရေး အသားများ၊ ကဗျာအရေးအဖွဲ့များနှင် ရင်းနှီးစေနိုင်ပါသည်။

ရွေးချယ်ပြဋ္ဌာန်းထားသောအကြောင်းအရာ၊ အရေးအသားများသည်အခြေခံပညာအထက်တန်း အဆင့် ဆယ်ကျော်သက်အရွယ် ကျောင်းသား၊ ကျောင်းသူများ စိတ်ဝင်စားဖွယ်ကောင်းနိုင်သော စာပေများဖြစ်လျှင် ပိုမို ကောင်းမွန်ပါမည်။

ပြဋ္ဌာန်းစာအုပ်များတွင် အကြောင်းအရာအမျိုးမျိုး၊ အရေးအသားပုံစံအမျိုးမျိုးပါ၀င်သဖြင့် ဒသမတန်းကျောင်းသား၊ ကျောင်းသူတို့အတွက် စိတ်ဝင်စားဖွယ်ကောင်းနိုင်သည်။ ဤသည်မှာအားသာချက်ဖြစ်ပါသည်။ သို့သော် ထိုအချက်သည်သင်ကြားပေးသူဆရာနှင့်စာမေးပွဲစနစ်အပေါ်တွင်မူတည်နေသည်။

ပြဋ္ဌာန်းစာအုပ်များတွင်ကျောင်းသား၊ ကျောင်းသူများ၏ ဗလငါးတန်လုံးကိုဖွံ့ဖြိုးစေမည့်သင်ခန်းစာများ ထည့်သွင်းနိုင်လျှင်ပကောင်းမည်ဖြစ်ပါသည်။ ပြဋ္ဌာန်းစာအုပ်များ၏ နောက်ထပ်အားသာချက် တစ်ခုမှာမိတ်ဆက်နိဒါန်းနှင့် သင်ခန်းစာအကျဉ်းသည်ဆရာ၊ ဆရာမနှင့်ကျောင်းသား၊ ကျောင်းသူများအတွက် အထောက်အကပြုခြင်းဖြစ်ပါသည်။ သို့သော်မိတ်ဆက်နိဒါန်းတွင် ဖော်ပြထားသည်မှာ အကျဉ်းမျှသာ ဖြစ်သောကြောင့်ဆရာ၊ ဆရာမမားသည် ဖော်ပြထားသောမူရင်းစာအုပ်များ၊ အညွှန်းစာအုပ်များကို ရှာဖွေဖတ်ရှုထားရန် လိုအပ်မည်ဟု ထင်ပါသည်။

သက်ဆိုင်ရာသင်ခန်းစာအလိုက်ခက်ဆစ်အဖွင့်များကို လုံလောက်မှုရှိစေရန် ထည့်သွင်းဖော်ပြထားသည်ကို တွေ့ရပါသည်။ ခက်ဆစ်အဖွင့်အချို့သည်မြန်မာအဘိဓာန်မှအဓိပ္ပာယ်ဖွင့်ဆိုချက်နင့်ကွဲလွဲနေသည်များ ရှိပါသည်။

ပြဋ္ဌာန်းစာအုပ်တစ်အုပ်လုံးခြုံကြည့်လျှင်သင်ခန်းစာ၏ ရည်ရွယ်ချက်ပေါက်မြောက်မှုကို စစ်ဆေးရန် လေ့ကျင့်ခန်းများ အတော်အသင့်ပြည့်စုံမှုရှိသည်ဟု ဆိုနိုင်သည်။ သို့သော် ပြဋ္ဌာန်းစာအုပ်ရှိ လေ့ကျင့်ခန်း များကို ထပ်မံဖြည့်စွက်ထည့်သွင်းရန်လိုအပ်ပါသည်။ အလင်္ကာနှင့်ပတ်သက်သောလေ့ကျင့်ခန်းလည်း အနည်းငယ်သာပါ၀င်သည်။ ဝေဖန်ပိုင်းခြားနိုင်မှု၊ အတွေးအခေါ်နှင့် အရေးအသားများကိုစစ်ဆေးရန်လေ့ကျင့်ရန်မေးခွန်းများ ထပ်မဖြည့်ဆည်း ပေးနိုင်လျှင်ပိုကောင်းမည်ဖြစ်ပါသည်။

ပြဋ္ဌာန်းစာအုပ်နှစ်အုပ်လုံး၏အားသာချက်တစ်ခုမှာ ပါ၀င်သောစကားပြေများ၊ ကဗျာများသည် ထင်ရှားသော မြန်မာစာရေးဆရာများ၊ စာဆိုများ၏ စကားပြေ၊ ကဗျာလက်ရာကောင်းများဖြစ်သောကြောင့်အတွေး အခေါ်အားဖြင့် သော်လည်းကောင်း၊ အရေးအဖွဲ့အားဖြင့်သော်လည်းကောင်း ကျောင်းသား၊ ကျောင်းသူများ အတွက်မှတ်သားလိုက်နာဖွယ်ဖြစ်သည်။ မြန်မာနိုင်ငံ၏ လူမှုရေးနှင့်ယဉ်ကျေးမှုဆိုင်ရာအကြောင်းအရာများနှင့်လည်း ညီညွတ်သော ဆက်နွယ်မှုရှိပါသည်။

သို့သော်ပင်ရင်း မြန်မာစကားပြေလက်ရွေးစင်ပြဋ္ဌာန်းစာအုပ်၏ အားနည်းချက်တစ်ခုမှာ ပုဂံခေတ်ကျောက်စာနှစ်ချပ်မှ လွဲ၍ကျန်စကားပြေများသည်အမျိုးသားစာရေးဆရာတို့၏ စာပေလက်ရာများသာဖြစ်နေသည်။ အမျိုးသမီးစာရေးဆရာများ၏ စကားပြေကောင်းများကိုလည်း ရွေးချယ်ထည့်သွင်းသင့်ပါသည်။ ထို့အတူတိုင်းရင်းသားစာပေအနေဖြင့်လည်း မွန်ဝန်ကြီးဗညားဒလ၏ **'စီးချင်းတိုက်ပွဲ'**တစ်ပုဒ်ကိုသာ တွေ့ရှိရသည်။ တိုင်းရင်းသားလူမျိုးများအကြောင်း ကောင်းနိုးရာရာစကားပြေများကိုလည်း ထုတ်ဖော်ပြဋ္ဌာန်း သင့်သည်ဟုယူဆပါသည်။

ထို့အတူ မြန်မာကဗျာလက်ရွေးစင်ပြဋ္ဌာန်းစာအုပ်၏ အားနည်းချက်တစ်ခုမှာအမျိုးသမီးစာဆိုဟူ၍ ရှင်ငြိမ်းမယ်နှင့်ငွေတာရီ (၂) ဦးသာပါဝင်သည်ကို တွေ့ရသည်။ အမျိုးသမီးစာဆိုများ၏ ကဗျာလက်ရာ ကောင်းများကိုလည်း ရွေးချယ်ပြဋ္ဌာန်းသင့်ပါသည်။ ထို့အတူကျေးလက်ရိုးရာတေး တစ်ပုဒ် **(အကျွန်ုပ်တို့ လယ်ကောက်စိုက်တုန်းက)** ပါဝင်သော်လည်း တိုင်းရင်းသားကဗျာမပါဝင်ပေ။ တိုင်းရင်းသားလူမျိုးများ၏ ကောင်းနိုးရာရာကဗျာများကိုလည်း ထုတ်ဖော်ပြဋ္ဌာန်းသင့်သည်ဟုယူဆမိပါသည်။

Contributions to Myanmar Literature (မြန်မာစာပေကိုအကျိုးပြုပုံ)

ဒသမတန်းပင်ရင်းမြန်မာစကားပြေလက်ရွေးစင်စာအုပ်တွင် သင်ခန်းစာများကိုပုဂံခေတ်မှလွတ်လပ်ရေးခေတ်အထိခေတ်အစဉ်အတိုင်း စီစဉ်ထားသော်လည်း ပင်းယခေတ်နှင့်အင်းဝခေတ် စကားပြေများမပါဝင်သဖြင့် ခေတ်အစဉ်ပေါ်လွင်မှုအားနည်းနိုင်ပါသည်။

မြန်မာကဗျာလက်ရွေးစင်စာအုပ်တွင်လည်း သင်ခန်းစာများကို ပုဂံခေတ်မှ လွတ်လပ်ရေးခေတ်အထိ ခေတ်အစဉ်အတိုင်းစီစဉ်ထားသည်။ သို့သော်တောင်ငူခေတ်ကဗျာ မပါဝင်သဖြင့် ခေတ်အစဉ်ပေါ်လွင်မှု အားနည်းနိုင်ပါသည်။

သင်ခန်းစာအားလုံးတွင် မိတ်ဆက်နိဒါန်းပါဝင်သဖြင့် ပင်ရင်းစကားပြေနှင့် ကဗျာကိုလေ့လာသင်ယူရန် ပိုမိုလွယ်ကူစေနိုင်သည့်အပြင်မြန်မာစာရေးဆရာများအကြောင်း ပိုမိုစိတ်ဝင်စားမှုရရှိ စေနိုင်သည်။ ပြဋ္ဌာန်း စာအုပ်တွင် မြန်မာစာရေးဆရာအကျော်အမော်များ၏ စကားပြေများ၊ ကဗျာနှင့်မူရင်းစာအုပ်များကိုပါ ဖော်ပြထားသောကြောင့်စာဖတ်ရာတွင် စာကောင်းပေကောင်းကိုရွေးချယ်ဖတ်နိုင် စေမည်ဖြစ်ပါသည်။ ၎င်းသည် ပြဋ္ဌာန်းစာအုပ်၏ အားသာချက်ဖြစ်ပါသည်။ ထို့ပြင်ထိုစာရေးဆရာများ၏ မူရင်းစာအုပ်များ၊ ရည်ညွှန်းကိုးကားစရာစာအုပ်များကို ကျောင်းစာကြည့်တိုက်များတွင် အလွယ်တကူဖတ်ရှုနိုင်ရန် စီစဉ်ပေးထားနိုင်လျှင်ပိုမိုထိရောက်မည်ဟု ထင်ပါသည်။

မြန်မာစာပေကိုလေးစားတန်ဖိုးထားတတ်လာပြီး မြန်မာဘာသာစကားနှင့် မြန်မာစာလေ့လာမှုဆိုင်ရာအရည်အသွေးများ တိုးတက်လာစေရန်သင်ကြားပေးသူဆရာ၏ အခန်းကဏ္ဍသည်အလွန် အရေးကြီးပါသည်။ ပြဋ္ဌာန်းစာအုပ်၏ အားသာချက်များအနက်တစ်ခုမှာခေတ်နှင့်အတူစာပေအသစ်များ ထွန်းကားပေါ်ပေါက်လာပုံ၊ ခေတ်ကာလ နိုင်ငံရေး အခြေအနေနှင့်တကွထွန်းကားသောစာပေများ ဆက်နွှယ်မှုရှုပုံကို သတိပြုမိစေခြင်း ဖြစ်ပါသည်။

ထို့ပြင်ကောက်နုတ်ထားသောမူရင်းစာများ၊ အခြားထင်ရှားသော စာများအကြောင်းကိုလည်း ဖော်ပြထား သဖြင့် မြန်မာစာပေအကြောင်း ဆက်လက်လေ့လာလိုစိတ်ကိုတိုးပွားစေနိုင်ပါသည်။ သို့သော်ထိုအချက်သည်လည်း သင်ကြားပေးသူ ဆရာအပေါ်တွင်များစွာမူတည်နေပါသည်။ စာမေးပွဲတစ်ခုတည်းကိုသာ ဦးတည်သင်ကြားခြင်းမပြုဘဲမြန်မာစာပေအကြောင်း ဆက်လက်လေ့လာဖတ်ရှုချင်အောင်၊ ဏာဖတ်သော အလေ့အကျင့်ရသွားအောင် သင်ကြားပေးရန် အရေးကြီးပါသည်။

ယေဘုယျအားဖြင့်ဆိုရလျှင် ပင်ရင်းမြန်မာစကားပြေလက်ရွေးစင်စာအုပ်ကို လေ့လာရာ၌ဆရာ၊ ဆရာမ၏ လမ်းညွှန်သင်ကြားမှုအပေါ် အလွန်အမင်းမှီခိုနေရန်မလိုအပ်ပါ။ စကားပြေအများစုသည်ကျောင်းသား၊ ကျောင်းသူများကိုယ်တိုင်ဖတ်ပြီးလေ့လာလျှင်လည်း နားလည်နိုင်ပါသည်။ တပည့်များ၏ အခြေအနေပေါ် မူတည်၍ဆရာ၊ ဆရာမ၏အခန်းကဏ္ဍ များလွန်းလျှင်သော်လည်းကောင်း၊ နည်းလွန်းလျှင်သော်လည်းကောင်း သင်ကြားသင်ယူမှုဖြစ်စဉ် မထိရောက်နိုင်သဖြင့်မိမိအတန်း၏ အခြေအနေအလိုက်ဆရာ၊ ဆရာမ၏ လမ်းညွှန်သင်ကြားမှု အတန်အသင့်လိုအပ်ပါသည်။ စကားပြေအများစုမှာစိတ်ပါလက်ပါ၊ ပေါ့ပေါ့ပါးပါး ဖတ်သွားစရာ ပုံဝတ္ထုစာမျိုးဖြစ်၍ ဆရာမပါဘဲ တပည့်တို့ကိုယ်တိုင်ဖတ်သွားနိုင်ပါသည်။ သို့သော်ပထမဆုံး ကျောင်းသား၊ ကျောင်းသူများ ကိုယ်တိုင် စကားပြေ

များကိုဖတ်ရှုကာ သိလာသောအချက်များနှင့်မသိသေးသောအချက်များကိုဆရာ၊ ဆရာမနှင့်ဆွေးနွေးနိုင်လျှင် အကောင်းဆုံးပင်ဖြစ်ပါသည်။

ကဗျာဆိုသည်မှာဘာသာစကားကိုအကောင်းဆုံး၊ အထူးခြားဆုံးဖန်တီးထားသော စာပေလက်ရာဖြစ်သောကြောင့် ကဗျာ့အဓိပ္ပာယ်ကိုကျောင်းသား၊ ကျောင်းသူများကိုယ်တိုင်ဖော်ထုတ်ရာတွင်အခက်အခဲ ရှိနိုင်ပါသည်။ ဒသမတန်း မြန်မာကဗျာလက်ရွေးစင်စာအုပ်ကို ကျောင်းသား၊ ကျောင်းသူများသည်ဆရာ၊ ဆရာမ၏ လမ်းညွှန်သင်ကြားမှု အကူအညီဖြင့်သာ ကောင်းစွာလေ့လာသင်ယူနိုင်ပါသည်။ သို့သော်ဆရာ၊ ဆရာမကချည်း အကြောင်းစုံ ရှင်းပြပေးခြင်းမျိုးမဟုတ်ဘဲကျောင်းသား၊ ကျောင်းသူများ ကိုယ်တိုင်ကဗျာကို ဖတ်ရှုကာ ဇာတ်ဆောင်၊ ကာလဒေသ၊ အကြောင်းအရာနှင့်ရည်ရွယ်ချက်များကိုဖော်ထုတ်စေကာ သိလာသောအချက်များနှင့်မသိသေးသောအချက်များကိုဆရာ၊ ဆရာမနှင့်ဆွေးနွေးနိုင်လျှင်အကောင်းဆုံးပင်ဖြစ်ပါသည်။

Perceptions of Teachers on the Textbooks

According to the results of the study, the books satisfied the teachers' expectations regarding to its objectives, contents and contributions to Myanmar literature.

Interestingly, there is only one statement that the teachers did not such satisfy, which concerned exercises in the textbooks. They thought that the exercises in the textbooks are not enough. Therefore, it would be noted that this section of the textbooks should be improved.

Furthermore, most of the teachers thought that the textbooks require a high degree of teacher input. They admitted that the textbooks aid them to minimize their preparation time. Next, they assumed that the textbooks are not self-sufficient for self-study. These reveal the quality of the textbooks and current situations the teachers face these days. Most of the teachers might consider that they are vital and they might not teach students with interactive teaching methods. Or it may be because of the abilities of the students the teachers had to deal with.

Almost all of the teachers in this study confessed that they use teachers' guide and it was helpful. But some teachers mentioned that their school did not provide teachers' guide and they could not use it. Some said they have never seen it. Therefore, it may be suggested to sure that all the teaching materials are provided to all schools.

Undoubtedly, all the teachers accepted that a teacher needs to study Myanmar language and literature thoroughly in teaching with the textbooks. Besides, they assumed that figures of speech and aesthetic should be taught to students while literary quality was not yet necessary at the high school level. It is probable that the teachers did not want to go deeply about the fields of writing techniques in teaching young learners.

Surprisingly, despite the major satisfaction, the teachers also suggested that the contents and physical appearance of the textbooks should be improved. A fairy number of teachers advised to improve paper quality and binding of the textbooks. Therefore, it may be seen that the teachers wanted the textbooks to be excellent ones.

Suggestions

Based on the results of the study, there are several recommendations for future research. First, some of the limitations outlined in this study may be minimized or eliminated in a revised analysis of textbooks. A qualitative content analysis of textbooks by a group of experts should be done in order to avoid subjective judgments. Next, in future research, it is necessary to implement a larger sample size in surveying teachers' perceptions. With a larger sample size, it would be more likely to arrive at a more comprehensive evaluation result. Second, this study did not include students' perceptions on the textbooks. Harmer (2001) suggested that whether assessing or evaluating textbooks, student opinion and comment should also be considered. Future studies should employ a student survey or interviewing procedure to explore students' perceptions on the textbooks. Finally, this study only focused on objectives, contents and contributions to Myanmar literature of the textbooks. Future studies should be carried out in other dimensions concerning the textbook evaluation beyond the scope of this research.

Conclusion

Interestingly, a critical finding from the qualitative analysis shows that both textbooks can fulfil the goals and objectives of teaching Myanmar and Grade Eleven Myanmar Syllabus though objectives themselves seem to be updated. Similarly, according to the results of the quantitative data, the teachers satisfied the objectives. It can then be concluded that the textbooks are good in terms of objectives.

From the analyzed data, it is evident that both textbooks need to be updated in terms of contents. Although the textbooks consist of authentic writings of famous Myanmar authors, they should also include the contemporary writings. Despite the major satisfaction, the teachers who teach Grade Eleven Myanmar did not satisfy the textbooks in terms of exercises. They thought that there are not enough exercises in the textbooks. In addition, the entire context in the textbook should be up-to-date and no mistake is accepted. The textbook, as far as possible, should be the latest edition.

Obviously, describing the authentic writings of famous Myanmar authors, both textbooks can highlight the brief history of Myanmar literature and make several contributions to it. The teachers who used these textbooks also confessed that statement.

The findings of this study reveal the strengths and limitations of Grade Eleven Myanmar textbooks designed for use in a Myanmar context. It is important for textbook writers and developers to be aware of the perceptions of teachers towards the use of Myanmar textbooks so that they can help the teachers to use them more effectively. Textbook analysis and evaluation, moreover, is useful in teacher development and helps teachers to gain good and useful insights into the nature of the material (Cunningsworth, 1995).

The results of this study also provide useful information for policy makers. The Ministry of Education is redesigning the basic education curriculum, and new curricula and new textbooks are being written during these years. This study will be useful in producing excellent textbooks based on the feedback and results about the current textbooks.

To sum up, it should also be noted that the quality of a textbook is dependent on the quality and attitude of the people involved in the process. Textbooks are only an aid to the teaching-learning process, which also depends upon individual teachers and students, their needs and their relationships in the classroom (Cunningsworth, 1984). To avoid the deskilling effect for textbooks, Richards (2000) suggested that teachers must be trained to have knowledge and skills needed to evaluate and adapt textbooks. In this way, the potential negative effect of using textbooks can be reduced and they are still in their right place in the educational system as resources to support and facilitate teaching.

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ဖေမောင်တင်၊ **ဦး**၊ (ပါမောက္ခ–)။ (၂၀၁၃)။ ***မြန်မာစာပေသမိုင်း*** (ဧကာဒသမအကြိမ်)။ ရန်ကုန်၊ ရာပြည့်။

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A STUDY OF THE RELATIONSHIP BETWEEN SCHOOL CLIMATE AND TEACHERS' PERFORMANCEIN HIGH SCHOOLS

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Abstract

The purpose of this research is to examine the relationship between school climate and teachers' performance in high schools. Descriptive survey method was applied for this study. There are nine Basic Education High Schools in Pale Township. In this study, the samples were (9) principals, (236) teachers and (712) students from all Basic Education High Schools. The questionnaires were used as instruments to collect the appropriate data. There is one instrument for principals and students and two instruments for teachers. The first instrument for teachers (Q1) includes Organizational Climate Description Questionnaire (OCDQ) developed by Haplin and Croft (1963, cited in Chen, 1990). The second instrument for principals, students and teachers (Q2) is to measure teachers' performance developed by Raza (2010) in order to obtain information for the study. In order to analyze the data obtained, Pearson-product moment correlation coefficient and descriptive statistics were computed. The result of the study indicated that the perception of the teachers on school climate was at high level. With regard to teachers' performance, the perception of principals, students and teachers were also high level. According to ANOVA result, there was significant difference between principals, students and teachers' perception on teachers' performance. It was found that there was significant relationship between school climate and teachers' performance with Pearson r of .658 at 0.001 level. The effect size of r = .658 was considered large effect size. According to simple linear regression, it can be concluded that 43% of teachers' performance can be predicted from school climate. These results indicate that school climate is one factor that increases teachers' performance in high schools.

Keywords: relationship, school climate, teachers' performance

Introduction

Development of nation is primarily dependent on the education system available in the country. Teachers are essential for the effective functioning of education system and for improving the quality of learning process. The quality of educational process and its product is unquestionably influencing by teachers' performance. The entire edifice of education is shaky if the performance of teachers is weak and ineffective. Therefore effective performance of teachers is a must for educational improvement, which we are striving hard to bring about. School climate is one of the most powerful and significant factor that contributes to effective teacher performance. Teacher plays a pivotal role in ensuring achievement in school (Selamat, Semsu & Kamaly, 2013). School organizational climate is well known to be a factor that affected teachers' performance. In an organization with a high extent of humanistic relationship, collegiality, and participation, the teaching effectiveness is high, triggering a higher success of education (Babu, 2013). Thus a positive school climate of a school is not only an important predictor of teachers' performance but also a crucial factor in instruction.

Objectives of the Study

(1) To study the perceptions of teachers on school climate at Basic Education High Schools

(2) To explore the levels of teachers' performance rated by principal at Basic Education High Schools

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(3) To investigate the levels of teachers' performance rated by students at Basic Education High Schools
(4) To explore the levels of teachers' performance rated by teachers themselves at Basic Education High Schools
(5) To find out the relationship between school climate and teachers' performance at Basic Education High Schools, Pale Township, Sagaing Region

Scope

This study was confined to principals, teachers and students at basic education high schools in Pale Township, Sagaing Region. The number of participants included in the study was (9) principals, (284) teachers and (712) students. In this study, eight dimensions of school climate questionnaires (aloofness, production emphasis, consideration, thrust, disengagement, hindrance, intimacy and esprit) with (48) items were limited to inquire the perceptions of teachers on school climate. For teachers' performance questionnaires with (30) items were limited to inquire the levels of performance for teachers.

Definitions of Key terms

Relationship : Relationship is the way in which two or more people or things are connected, or the state of being connected (Oxford Dictionary).

School Climate: School climate refers to the result of the reciprocal effects of the teachers' behavior patterns as a group and the principal's behavior pattern as a leader (Halpin& Croft, 1963).

Teacher Performance: Teachers' performance could be described as the duties performed by a teacher at a particular period in the school system in achieving organizational goals (Obilade, 1999, cited in Adeyemi, 2010).

Literature Review

School Climate and Teachers' Performance

Halpin and Croft (1963) identified eight dimensions of the school climate such as disengagement, hindrance, espirit and intimacy as reflected in the behavior of teacher and aloofness, production emphasis, thrust and consideration as reflected in the behavior of the principals. They reduced these eight dimensions to six broad and more comprehensive dimensions or types of climates i.e. open, autonomous, controlled, familiar, parental and closed, defining each of these with reference to the degree of presence or absence of the eight elements or dimensions of the climate. They developed a tool OCDQ (Organizational Climate Description Questionnaire) to measure these dimensions and types of the climate. The rationale underlying OCDQ was first assumed that something actually exists which can properly be called organizational climate. Further, it was also assumed that organizational climate is closely related to the perceived behavior of teachers and principals.

The teachers are the most important factor of the teaching-learning process. The school's most important influence is the teachers. He sets the tone of the classroom and establishes the mood of the group. He is the authority figure providing the direction for behavior. He is a model and is consciously imitated (Bernard, 1972, cited in Akram, 2010).

The teacher performance is the most crucial input in the field of education. Whatever policies may be laid down, in the ultimate analysis these have to be interpreted and implemented by the teachers, as much as through their personal examples as through teaching-learning processes. Performance refers to an act of accomplishing or executing a given task (Lindsay, 1995; Griffin, 1997; Owei, 1999, cited in Adejumobi, 2013).

The term teaching performance is referring to the conduct of instruction: posing questions, providing explanations, giving directions, showing approval, engaging in the myriad instructional acts that a teacher performs in the classroom. The term is not meant to encompass the effects or products of instruction, such as student achievement or personal growth. Neither is it meant to encompass such teacher characteristic as attitudes and expectations. Rather, teaching performance is concerned, to use Dunkin and Biddle's terms, with process variable rather than presage or product variables. (cited in Raza, 2010)

Research Method

Design

In this study, questionnaire survey method which is one of the descriptive methods was used to collect the information about school climate and teachers' performance in high schools. A questionnaire survey method and a descriptive research design were used. Descriptive research involves collecting data in order to test hypotheses or answer questions concerning the current status of the subjects of the study (Gay, 1987).

Subjects

This study was carried out among principals, teachers and students in Pale Township, Sagaing Region. There are nine basic education high schools. These schools were included in the sample. So, principals, teachers and students from nine basic education high schools in Pale Township were selected as the sample subjects in this study. The total number of principals in this study was (9). The total number of teachers was (284) and the total number of students was (712). Table 1 showed the number of sample schools and sample size in this study.

Table 1 The Sample Schools and Sample Size

No.	Name of Schools	Number of Participants		
		(Principals)	(Teachers)	(Students)
1.	BEHS Pale	1	45	100
2.	BEHS Let TaungGyi	1	26	70
3.	BEHS Pan Ywa	1	26	82
4.	BEHS Mindaingpin	1	68	200
5.	BEHS Chinpyit	1	25	50
6.	BEHS Kandaung	1	26	100
7.	BEHS PadaukKone (S)	1	22	50
8.	BEHS Kyetyin	1	14	30
9.	BEHS Wet Kya	1	17	30
Total		9	269	712

Instruments

In this study, the researcher used four questionnaires for school climate and teacher performance in order to obtain data from principals, teachers and students. The questionnaire for school climate was constructed on the basis of the questionnaire of Halpin and Croft (1963, cited in Chen, 1990). The questionnaire for teacher performance was constructed on the basis of the questionnaire of Raza (2010). The demographic variables such as gender, age, teaching experience and qualification were firstly asked teachers before asking the items on school climate and teacher performance.

Questionnaire for school climate included five-point Likert scale items for eight dimensions: aloofness, production emphasis, consideration, thrust, disengagement, hindrance, intimacy and esprit. There were 48 Likert scale items in this instrument including 6 items for each dimension. The possible responses to each item to measure the perceptions of school climate of teachers were ranged according to responses of “Never Occurs” (1), “Rarely Occurs” (2), “Sometimes Occurs” (3), “Often Occurs” (4), and “Always Occurs” (5). Each individual’s score was determined by adding the responses of each item on school climate. The higher scores the teachers got, school climate is a positive climate.

Questionnaire for teacher performance included five-point rating-scale items. There are 30 items for principals, teachers and students. The possible responses to each item to measure the performance of teachers were ranged according to responses of “Never” (1), “Rarely” (2), “Sometimes” (3), “Often” (4), and “Always” (5). Each individual’s score was determined by adding the responses of each item on teacher performance. The higher scores the teacher got, the higher performance they had.

Instrument Validity

To get for questionnaire validation, the copies of questionnaires were distributed to the experienced teachers in the field of education in Sagaing University of Education on 11st, September, 2018. For the suitability of each item, the correctness of the key, the clarity of the language and the suggestions for improvement of the questionnaires, those teachers were requested. After that, items were modified again according to their advice and guidance.

Pilot Survey

On 25th, September, 2018, a pilot survey was carried out with (37) teachers and (100) students in BEHS – Ohm Taw, Sagaing Township. The main objective of the pilot study was to determine the reliability of the main survey. The pilot questionnaire was prepared in the same format as envisaged for the main survey; the same instructions were included as for the main survey. Based on the finding of the pilot survey, internal consistency reliability of the questionnaire is determined by Cronbach’s alpha. The Cronbach’s alpha internal consistency reliability of school climate questionnaire was 0.90 and the Cronbach’s alpha internal consistency reliability of teachers’ performance questionnaire was 0.847.

Procedure

First and foremost the researcher collected relevant data and information from several available books, reports, theses and the Internet. Secondly, in order to get the required data, the researcher constructed the instruments under the guidance of the supervisor. Thirdly, content validity will be determined by experienced teachers. After the instruments had been validated, a pilot testing was conducted. For the internal consistency reliability, Cronbach's alpha coefficient was used.

After the pilot survey, the main survey was conducted in Basic Education High Schools in Pale Township. The questionnaire and demographic data were distributed to principals, teachers and students with the request to complete and return as soon as possible. All participants were asked to decide their agreement with the statements and mark the relevant response category honestly. A hundred percent of the questionnaires from principals and students, and 87.73 percent of the questionnaires from teachers were returned in the sample schools under study. Finally, the obtained data were analyzed.

Analysis of the Data

After collecting the required data, a quantitative data analysis was made by using the Statistical Package for the Social Science (SPSS) version 20. The data were analyzed by using descriptive statistics, one-way ANOVA and Pearson-product moment correlation. In order to know mean and standard deviation for school climate and teachers' performance by principals, teachers and students, descriptive analyses were used. One-way ANOVA was used to compare teachers' performance in terms of principals, teachers and students. Then, Pearson-product moment correlation was used to determine whether any relationship exists between school climate and teachers' performance in high schools. To examine how school climate can predict teachers' performance in high schools, simple linear regression was calculated.

Data Analysis and Findings

After the instrument had been developed for the research and applied for the data collection, school climate and teachers' performance were investigated. Data were analyzed by using the Statistical Package for Social Science (SPSS) software. Descriptive statistics, One-way ANOVA, Pearson-product moment correlation and simple linear regression were applied to discuss findings and results.

Perceptions of Teachers on School Climate at Basic Education High Schools

Mean Comparison for Each Dimension of School Climate

The mean and standard deviations of each dimension of school climate were described in Table 2.

Table 2 Comparison of Mean and Standard Deviation for Each Dimension of School Climate for All Teachers in Nine Basic Education High Schools

Dimension of School Climate		A (n=35)	B (n=21)	C (n=25)	D (n=55)	E (n=21)	F (n=26)	G (n=22)	H (n=14)	I (n=17)	Total (n=236)
Aloofness	Mean	3.96	3.93	3.75	3.65	3.86	3.39	3.87	3.87	3.8	3.79
	SD	0.48	0.43	0.56	0.46	0.24	0.48	0.39	0.35	0.35	0.42
Production Emphasis	Mean	4.44	4.11	4.20	3.99	4.62	3.96	4.49	4.74	4.73	4.36
	SD	0.48	0.63	0.71	0.7	0.39	0.69	0.43	0.31	0.39	0.53
Thrust	Mean	4.64	4.01	3.89	4.11	4.69	3.46	4.55	4.77	4.62	4.30
	SD	0.47	0.91	0.70	0.67	0.45	0.74	0.35	0.21	0.55	0.56
Consideration	Mean	4.27	3.29	3.71	3.85	4.21	3.11	3.87	4.33	4.09	3.86
	SD	0.71	0.83	0.79	0.73	0.45	0.79	0.55	0.46	0.66	0.66
Disengagement	Mean	2.92	2.71	2.97	3.13	2.76	3.00	3.00	3.15	2.96	2.96
	SD	0.43	0.39	0.38	0.35	0.43	0.29	0.34	0.39	0.25	0.36

Dimension of Climate	School	A (n=35)	B (n=21)	C (n=25)	D (n=55)	E (n=21)	F (n=26)	G (n=22)	H (n=14)	I (n=17)	Total (n=236)
Hindrance	Mean	2.10	2.10	2.14	2.65	2.26	2.71	2.57	2.33	2.14	2.33
	SD	0.75	0.71	0.58	0.68	0.71	0.48	0.65	1.01	0.66	0.69
Esprit	Mean	4.10	3.76	4.23	3.96	4.48	4.10	4.23	4.36	4.45	4.19
	SD	0.64	0.62	0.52	0.56	0.37	0.59	0.27	0.35	0.41	0.48
Intimacy	Mean	3.92	4.1	3.39	3.88	4.29	3.97	4.25	4.20	4.32	4.04
	SD	0.71	0.71	0.57	0.57	0.51	0.64	0.41	0.68	0.47	0.59
Total	Mean	3.79	3.50	3.60	3.65	3.89	3.46	3.85	3.98	3.89	3.73
	SD	0.58	0.65	0.60	0.59	0.44	0.58	0.42	0.47	0.46	0.53

Note: 1-2.33 = Low, 2.34-3.67 = Moderate and 3.68-5 = High

Table 2 shows descriptive statistics for dimensions of school climate in Nine Basic Education High Schools in Pale Township. According to the teachers' perspectives, Aloofness was mostly practiced by principal from School A, Production Emphasis was mostly practiced by principal from School H, Thrust was mostly practiced by principal from School H, Consideration was mostly practiced by principal from School H, Disengagement was mostly practiced by teacher from School H, Hindrance was mostly practiced by principal from School F, Esprit was mostly practiced by principal from School E and Intimacy was mostly practiced by principal from School E. Among Nine Basic Education High Schools, School H is the highest used of eight dimensions of school climate and School F is the lowest used of eight dimensions of school climate on the perspectives of teachers.

Descriptive Statistics for Teachers' Performance

The mean and standard deviations of teachers' performance were described in the following tables.

Table 3 Mean and Standard Deviation of Principals' Perceptions on Teachers' Performance in Nine Basic Education High Schools

		Nine Basic Education High Schools (n=9)
Teachers' Performance	Mean	4.18
	SD	0.29

Note: 1-2.33 = Low, 2.34-3.67 = Moderate and 3.68-5 = High

According to Table 3 shows that all teachers from Nine Basic Education High Schools perceived by their principals as high level.

Table 4 Mean and Standard Deviation of Students' Perceptions on Teachers' Performance in Nine Basic Education High Schools

		A (n=100)	B (n=70)	C (n=82)	D (n=200)	E (n=50)	F (n=100)	G (n=50)	H (n=30)	I (n=30)	Total (n=712)
Teachers' Performance	Mean	3.96	4.18	3.86	4.04	4.16	3.88	4.41	4.01	3.77	4.02
	SD	0.52	0.62	0.534	0.57	0.34	0.44	0.33	0.46	0.37	0.46

Note: 1-2.33 = Low, 2.34-3.67 = Moderate and 3.68-5 = High

According to Table 4 shows that all teachers from Nine Basic Education High Schools perceived by their students as high level; School A ($\bar{X}$=3.96), School B ($\bar{X}$=4.18), School C ($\bar{X}$=3.86), School D ($\bar{X}$=4.04), School E ($\bar{X}$=4.16), School F ($\bar{X}$=3.88), School G ($\bar{X}$=4.41), School H ($\bar{X}$=4.01) and School I ($\bar{X}$=3.77).

Table 5 Mean and Standard Deviation of Teachers' Perceptions on Teachers' Performance in Nine Basic Education High Schools

		A (n=35)	B (n=21)	C (n=25)	D (n=55)	E (n=21)	F (n=26)	G (n=22)	H (n=14)	I (n=17)	Total (n=236)
Teachers'	Mean	4.31	4.35	4.28	4.05	4.59	4.22	4.47	4.38	4.53	4.3
Performance	*SD*	0.68	0.68	0.5	0.5	0.38	0.57	0.37	0.3	0.37	0.48

Note: 1-2.33 = Low, 2.34-3.67 = Moderate and 3.68-5 = High

According to Table 5 shows that all teachers from Nine Basic Education High Schools perceived by themselves as high level; School A ($\bar{X}$=4.31), School B ($\bar{X}$=4.35), School C ($\bar{X}$=4.28), School D ($\bar{X}$=4.05), School E ($\bar{X}$=4.59), School F ($\bar{X}$=4.22), School G ($\bar{X}$=4.47), School H ($\bar{X}$=4.38) and School I ($\bar{X}$=4.53).

Comparison of Teachers' Performance by Principals, Teachers and Students

There are Nine Basic Education High Schools in this variable. To compare teachers' performance by principals, teachers and students, descriptive statistics was first used. Table 15 displayed mean and standard deviations for teachers' performance from principals, teachers and students.

Table 6 Comparison of Mean and Standard Deviations for Teachers' Performance by Principals, Teachers and Students

Variable	Types of Person	*N*	Mean	*SD*
Teachers' Performance	Principals	9	4.18	0.29
	Teachers	236	4.3	0.48
	Students	700	4.02	0.46
	Total	945	4.19	0.41

According to table 6, teachers had the highest mean ($\bar{X}$=4.3) on teachers' performance and students had the lowest mean ($\bar{X}$=4.02) on teachers' performance.

In order to determine where there is a significant difference between the perceptions of principals, teachers and students, the collected data were analyzed by using one way analysis of variance (ANOVA). The results of ANOVA are presented in Table 7.

Table 7 ANOVA Results of Principals, Teachers and Students' Perceptions for Teachers' Performance

		Sum of Squares	*df*	Mean Square	*F*	*p*
Teachers' Performance	Between Groups	14.062	2	7.031	24.623	.000***
	Within Groups	272.413	954	.286		
	Total	286.476	956			

Note: *** The mean difference is significant at 0.001 level

Table 7 indicated that a statistically significant difference in teachers' performance was found among principals, teachers and students at 0.001 level.

To investigate more specifically how teachers' performance differed in relation to principals, teachers and students, the Post Hoc Test was carried out. The results were shown in Table 8.

Table 8 The Result of Post Hoc Test Multiple Comparison for Teachers' Performance

Variable	Types of Person *(I)*	Position of Person *(J)*	Mean Difference *(I-J)*	*p*
Teachers' Performance	Principals	Teachers	-.123	.480
		Students	.157	.291
	Teachers	Principals	.123	.48
		Students	.281	.000***
	Students	Principals	-.157	.297
		Teachers	-.281	.000***

Note: *** The mean difference is significant at 0.001 level

Post Hoc Test revealed that the mean difference between Teachers and Students was .281 and it was significantly different at p = 0.000. So, the teachers' perception had higher teachers' performance levels than the students' perception.

Pearson-product moment correlation between School Climate and Teachers' Performance

The Pearson-product moment correlation was utilized to find out the relationship between school climate (independent variables) and teachers' performance (dependent variables). Table 9 shows correlations between school climate and teachers' performance of teachers perceived by teachers in Nine Basic Education High Schools in Pale Township, Sagaing Division.

Table 9 Pearson-product Moment Correlation between School Climate and Teachers' Performance Perceived by Teachers in Nine Basic Education High Schools

	School Climate	Teachers' Performance
School Climate	1	.658
P		.000***
Teachers' Performance	.658	1
P	.000***	

Note: *** Correlation is significant at the 0.001 level (2-tailed)

Table 9 depicts that the two variables were significantly correlated. The direction of correlation was positively correlated with a Pearson r = .658 at 0.001 level. According to Cohen's guideline, the effect size of r = .658 was considered large effect size.

Simple Linear Regression on School Climate and Teachers' Performance in High Schools

To examine how school climate can predict teachers' performance in high schools, simple linear regression was calculated. By using the results of simple linear regression, school climate significantly predicted to teachers' performance F (1, 234) = 178.498. To see vividly, the explanation was presented in Table 19.

Table 10Model Summary for School Climate and Teachers' Performance

Model	*R*	R^2	Adjusted R^2	Std. Error of the Estimate
1	.658	.433	.430	12.547

According to Table 10, the simple linear regression coefficient (R) = .658 and adjusted R square was .430. It can be concluded that 43% of teachers' performance can be predicted from school climate. To get more exact information, the results can be seen in the following Table 11.

Table 11 Results of Simple Linear Regression on School Climate and Teachers' Performance

Variables	Unstandardized Coefficient		Standardized	*t*	*p*
	B	Std. Error	Coefficient β		
Teachers' Performance (TP)	11.141	8.865		1.257	.210
School Climate (SC)	.663	.050	.658	13.360	.000***

Note:*** The mean difference is significant at the 0.001 level

From the Table 11, it was found that the predictor teachers' performance significantly predicted school climate. Therefore, the model can be expressed as the following equation.

Teachers' Performance = 11.141+.663School Climate

Conclusion

Discussion

This study was conducted to find out the relationship between school climate and teachers' performance. A total number of (9) principals, (269) teachers and (712) students from Basic Education High Schools in Pale Township were chosen as the sample. The school climate questionnaire was composed of 78 items in the form of five-point Likert Scale based on Organizational Climate Description Questionnaire (OCDQ) constructed by Halpin and Croft (1963, cited in Chen, 1990) and the teachers' performance questionnaire was composed of 30 items in the form of five-point Likert Scale constructed by Raza (2010). Based on the findings of this study, the following were discussed.

To find out the mean and standard deviation of school climate, descriptive analysis was carried out. The results showed that all teachers from Basic Education High Schools in Pale Township rated school climate to be moderate level on disengagement ($\bar{X}$=2.96) and low level on hindrance ($\bar{X}$=2.33). Besides, all teachers from Basic Education High Schools perceived aloofness ($\bar{X}$=3.79), production emphasis ($\bar{X}$=4.36), thrust ($\bar{X}$=4.3), consideration ($\bar{X}$=3.86), esprit ($\bar{X}$=4.19) and intimacy ($\bar{X}$=4.04) to be high level. As discussed in literature, school climate consists of two aspects: principal's leadership behavior and teachers' behavior. The dimensions of principal's leadership behavior are aloofness, production emphasis, thrust and consideration and the dimensions of teachers' behavior are disengagement, hindrance, esprit and intimacy.

Therefore, in term of principal's leadership behavior aspects, it could be inferred that the principals practice aloofness highly that is the extent to which some principals keep social distance from the teachers, give excessive rules and regulations. Some principals are seen as unfriendly; they do not show human feelings as they relate to the staff. And, the principals practice production emphasis highly that is the behavior by the principal which is characterized by close supervision of the staff. He is highly directive and task-oriented. Then, the principals emphasize thrust to be highly that is behavior marked not by close supervision of the teacher, but by the principal's attempt to motivate the teachers through the example which he personally sets. He does not ask the teachers to give of themselves anything more than he willingly gives of himself; his behavior, though starkly task-oriented, is nonetheless viewed favorably by the teachers. Hence thrust is an important factor in enhancing the effectiveness of an organization. Next, the principals used consideration as highly practice that is the behavior by the principal which is characterized by an inclination to treat the teachers "humanly," to try to do a little something extra for them in human terms.

Another behavior, the teachers practice disengagement to be moderately that is the principal's negative behavior does not prevent the teachers from doing and enjoying their work. Thus, these teachers are productive regardless of the principal's weak autocratic leadership. Disengagement indicates that the teachers do not work well together. They pull in different directions with respect to the task; they gripe and bicker among themselves. Besides, the teachers practice hindrance to be lowly level that is the teachers' feeling that the principal relieve them with routine duties, committee demands and other requirements which the teachers construe as unnecessary busy-work. Moreover, teachers practice esprit as to be highly effective that is describes "teachers' satisfaction with their social and professional needs." In an institution characterized by high esprit and accomplishments, teachers help, support and work with each other. As a team, they like and respect each other. They enjoy each other's company and they are committed to their work. They are enthusiastic, innovative and they willingly work reluctantly. They do not derive satisfaction from their work. Thus, they work just to earn a living without any devotion. Another aspect, the teachers practice intimacy highly in their schools that is characterized by high intimacy knows each other well and share personal issues with each other. This kind of relationship does not end at school; they socialize on a regular in school and outside school. They provide strong support for each other, that is, they exchange visits, know each other's family members, they are always there for each other even in difficult situations. They find their closest friends among their colleagues.

The study findings showed that teachers perceived by principals to be highly practiced on their performance ($\bar{X}$=4.18). The study findings showed that teachers perceived by students to be highly practiced on their performance ($\bar{X}$=4.02). The study findings showed that teachers perceived themselves to be highly practiced on their performance ($\bar{X}$=4.3). This implies that the teachers' performance is very crucial in child's development. The identification and nurturing of talents is one of the main responsibilities of a teacher. Riley (1994, cited in Raza, 2010) has stated "as an interpreter, the teacher has to place new knowledge and new experience with in the context of what is already known and understood by the students." If the teachers highly practice in their duties and responsibilities, it can improve school environment, students' achievement, development in their life-long time.

According to the ANOVA results, there were significant differences among principals, teachers and students' perception on teachers' performance. The teachers' perception from all schools had the highest mean scores among them. However, the principals and students' perception were also high levels on teachers' performance. Among these, teachers' perceptions were slightly distinct on teachers' performance. It may be because teachers ranked themselves their own performance.

Pearson-product moment correlation showed that there was a significant relationship between the school climate and teachers' performance basing on the evaluation done by the teachers from basic education high schools in Pale Township (r=.658, p<0.001). This implies that the school climate have significant implication on their level of performance in their teaching job. And then, the finding of regression analysis showed that the approximately 43% of the variance in school climate could be explained. This implies that school climate is one of the most powerful and significant factor that contributes to effective teacher performance.

Suggestions

This study was concerned with the teachers' performance in relation with to their school climate. The performance of employees can be improved by providing on job relevant training, seminars, conferences, departmental meetings and supervision. The climates environment may be ensured through administrative policy measures and performance can be improved by allowing controlled climates rather than closed climates (Raza, 2010). In the school organization, it is common for the principals and teachers to discuss and interact with each other concerning schools matters and issues. According to Raza (2010), the interaction between the principals and teachers influence the atmosphere of the school organization. Organizational climate assessment might help in finding the obstacles to teachers' job performance. Moreover, the principals need to know why and how their instructional leadership behaviors can bring into existence of a particular type of school climate. It will help them to take the necessary steps to improve the climate in their schools. The principal must create a quality workplace for teachers and increase the opportunities for quality teaching in each classroom through instructional leadership. The principal should create a climate of high expectations in schools by communicating with teachers, supporting and participating in staff development activities. A positive school climate affects everyone associated with the school; students, staff, parents and the community.

As the research is an endless process and every research work provides the way for further research studies, some suggestions are provided.

1. As the present study was limited geographically, the future studies should include other townships, divisions, regions or even nationwide if possible.
2. It is suggested that longitudinal study should be undertaken to confirm and validate the findings of this study.
3. Further research needs to find out other factors that improve the performance of teachers.
4. Moreover, the research should be conducted that is factors affecting on school climate and teachers' performance.
5. And then one research, school climate, teachers' job satisfaction and teachers' performance should be made because job satisfaction can influence teachers' job performance.
6. If the current investigation for school climate can be made, we may know that it may play a role in reducing negative outcomes.

Conclusion

Nowadays, education is more important for human resources to meet the challenges in the world's development. It must be the type of education that fulfills individual, social, national, and international needs. It means all-round development of a person who is self-aware and self-development, one who can make a better self, better surroundings and who can carve out a better history of humanity. In raising the standard of education, the teachers who are the main inputs of the educational process, play a vital role. Therefore, teachers require expert knowledge, wide range of skills, abilities (personal, social and methodological abilities or attitudes), competences and qualities in order to carry out teaching tasks and to cope with the current educational technologies and advancement in the changing world. In addition, the school climate of schools requires being positive climate and staff in this climate requires being possessive willingness to go above and beyond the call of duty to promote the effective functioning of organization. So, the researcher get examined school climate and teachers' performance in high schools in Pale Township, Sagaing Region in the present study.

Education is now universally recognized to be the prime key to moral, cultural, political and socio-economic development of a nation. School climate or environment of a workplace is one of the factors that explicitly or implicitly influence the level of performance of teachers. This climate affects the behavior of the individual living and working in the environment which in turns influences their performance. Thus the environment of a school is an important factor, which influences the behavior and activities of the role participants. The climate is quite vital because it shapes the social and environmental structure organizational improvement and to bring change and promote individual skills and performance outcomes. So, principals and teachers should be able to apply effectively organizational climate which include aloofness, production emphasis, consideration, thrust, disengagement, hindrance, esprit and intimacy that can shapes social and environmental structure of organization.

This research points out the relationship between school climate and teachers' performance in high schools in Pale Township, Sagaing Region. It was found that there was a significant relationship between school climate and teachers' performance. This study supply all principals and teachers to better understand how they communicate each other to improve their school outcomes. To conclude, if the school climate is positive, the teachers' performance and school may be at high level. Hence, it is expected that this research will be able to provide paramount benefits for principals and teachers. And, this study may provide basis for further research studies.

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AN INVESTIGATION INTO THE EFFECTS OF THE USE OF DIAGRAMS IN TEACHING AND LEARNING BIOLOGYAT THE HIGH SCHOOL LEVEL

Htet Wai Aung[1] and Wutyi Htway[2]

Abstract

The purpose of the study is to investigate the effects of the use of diagrams in teaching and learning biology at the high school level. Mix-Method Research: QUAN-qual Model was used in the study. Two Basic Education High Schools were selected from Yesagyo Township, Magway Region by using simple random sampling method. The sample size was (176) Grade Ten biology students of 2018-2019 Academic Year. Pretest and posttest, questionnaire items, and interviews were used as instruments to measure the effects of the study. The two intact groups in each school were assigned into experimental and control groups. Before the treatment, both groups were administered by the pretest to determine group equivalence between experimental and control groups. According to the *t* value, it was found that the students in both schools were essentially the same before the treatment. In each school, the experimental group was given a treatment by using extensive diagrams while the control group was taught only with textbook. Independent samples*t*-test was used to analyze the quantitative data (t = 7.515, df= 84, p< .001) at BEHS, Yesagyo and (t = 7.950, df= 78.995, p< .001) at BEHS, Ma-U-Out-Seik. The result indicated that the students who were taught by using diagrams performed significantly better than those who were not on the overall posttest achievement scores in both schools. Based on the findings of interviews and questionnaires, it can be interpreted that the students had good perception on using diagrams in teaching and learning biology and they enjoyed teaching with diagrams. Therefore, diagrams are essential to support teaching and learning process. Teaching biology can be effective through the use of diagrams, which helps students have a meaningful learning.

Keywords: biology, visual representations, diagram

Introduction

At the beginning of the last century, children were taught in a rigidly formal and stereotyped way. Education was then conceived as a process of transmission of factual knowledge only. The teacher adopted an authoritarian attitude. The facts learnt by rote by children were tested from time to time but such tests were neither concerned with conceptual understanding nor effective performance. The main emphasis was on testing memory. The teacher very often used the verbal method. The teacher had little or no sensory or other visual material to supplement his/her oral teaching.

The science of biology concerns itself with living system from cellular to the biosphere. Biology is developing more rapidly today than in any period of past. The teaching matters of biology are always changed because of the changing nature of biological sciences. The new information is observed from time to time. Teaching strategies and the teaching styles are needed to develop to encourage thinking and enquiry process in teachers. Thus, the teacher should emphasize to develop effective teaching and learning by using proper resources.

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Importance of the Research

Biology is a science of living things. Science is a methodology for learning about the world. It involves the application of knowledge. Scientists create, share, and negotiate the meanings of representations – notes, reports, tables, graphs, drawings, diagrams (Anderson, 1999). In such a case, representations play a central role in explaining scientific concepts to enhance students' learning and understanding and facilitate learners' conceptual learning processes. Ainsworth (2006) argued that the use of representations as an aid to the transmission of scientific ideas is proving to be one of several theoretical accounts relevant to classroom use of representations to support science teaching and learning. Therefore, in order to learn science effectively students must understand different modes of representations demonstrating scientific concepts and processes, and be able to translate the knowledge learnt from one representation to another, as well as realize the co-ordinated relations in representing expertise (Ainsworth, 2006).

Studies on multiple external representations have shown that representations can provide unique benefits when students are learning complex concepts (Ainsworth, 1999, 2006). When learners are interacting with multiple forms of representations to learn complex scientific concepts, representations such as diagrams, graphs and written text can provide learners with visualizations of phenomena that are difficult to achieve without such representations. Scientific ideas cannot be separated from their representation, and the learning process implies the need for students to harness the representational usage and to develop their own skills of interpreting scientific phenomena.

Representational learning environments require careful handling because different representations have different implications. Ainsworth (2006) insisted that multiple external representations can play many cognitive roles in learning complex material and these different roles fall into three distinct categories: to complement, constrain and construct. This design, functions and tasks framework for learning with multiple representations provides some insights into considering how multi-representational systems might be designed to support learning.

Some biology concepts are complex and abstract to comprehend and understand for students. Teaching of biology is a challenging work for the biology teacher, while teaching the biology concepts in classroom, teachers faced many difficulties. Thus, biologists use several types of visual representations, including graphs, photographs and drawings as well as diagrams. By using diagrams, students can understand some biology concepts that are abstract and difficult. Therefore, it is necessary to investigate the effects of the use of diagrams in teaching and learning biology at the high school level.

Purpose

The purpose of the study is to investigate the effects of the use of diagrams in teaching and learning biology at the high school level.

Objectives

The objectives of the research are as follows:

1. To examine the improvement of students' achievement in teaching and learning biology with the use of diagrams.
2. To compare the achievement between the students who are taught by using diagrams and those who are not.

Research Hypotheses

The research hypotheses of the study are as follows:

1. There is a difference between the students who are taught by using diagrams and those who are not.
2. Students will have good perception on using diagrams in teaching and learning biology.

Definition of Key Terms

Biology	:	Biology is the science of life and the study of the structure, function, growth, origin, evolution and distribution of living organisms. Its name is derived from the Greek words ‘bios’ (life) and ‘logos’ (study) (Bagley, 2017).
Visual Representation	:	Visual representations translate data into a visible form that highlights important features, including commonalities and anomalies (Szent-Gyorgyi, 2005).
Diagram	:	A diagram is a simplified drawing designed to show inter-relationship primarily by means of lines and symbols. Diagrams are used in the teaching of almost all subjects (Kochhar, 1981).

Review of Related Literature

Biology is the science that studies living organisms and how they interact with one another and with their environment. Biology is the science of life. Science employs both deductive reasoning and inductive reasoning (Raven, Johnson, Losos& Singer, 2005). Some biology concepts are complex and abstract to comprehend and understand for students. So, many educationists agree that instructional materials bring about improvement in the teaching/learning process as well as permit teachers and students to interact as human beings in a climate where people control their environment for their own best purposes. Also, most educators generally and equally agree that the creative use of variety of instructional materials will increase the probability that student would learn more, retain better and bring about the skills they are expected to perform. The instructional materials also offer real experiences in giving the teacher basis for thinking and understanding. They supply concrete basis for conceptual thinking and therefore reduce meaningless responses of students (Kamal-deen, 2013).

Visual-aids are items that are designed (most by teachers) to support written or spoken information so that it can be understood more easily. Visual-aids have the ability to arouse and maintain students’ interest, simplify teaching, accelerate learning and improve the retention of learned information. Visual-aids bring the real thing closer to the student. They make learning experiences more natural more realistic. Learning is faster and therefore more effective when students are interested to learn when visual-aids make it easier for them to see patterns and relationships. Visual-aids make it easy for students to form mental images of abstract ideas (Foliaki, 2012).

Therefore, teachers should use the visual materials such as diagrams because visual representations play a very important role in the communication of science concepts (Ametller& Pinto, 2002, cited in Cook, 2011). Among visual representations, diagrams are important tools for biologists (Perini, 2013).

Visual Media

Visual-aids are items that are designed (most by teachers) to support written or spoken information so that it can be understood more easily. Visual-aids have the ability to arouse and maintain students' interest, simplify teaching, accelerate learning and improve the retention of learned information. Visual-aids bring the real thing closer to the student. They make learning experiences more natural more realistic. Learning is faster and therefore more effective when students are interested to learn when visual-aids make it easier for them to see patterns and relationships. Visual-aids make it easy for students to form mental images of abstract ideas (Foliaki, 2012).

Visual media may provide the chance to learn visually and are more effective and easy for human beings. During teaching with visual media and models, students try to recognize it, or know its functions and try to have its interpretation, to understand its use. They compare it with their pre-concepts, assimilating the new phenomenon and seeking to know about it. Hence, it is good to activate the students or keep them active for eliciting in teaching and learning process (Baser, 2013).

When visual aids are used as teaching aid, it is one of the factors which cause involvement of students in the lesson because when students look at visual aid or model, it is considered as a kind of involvement. Also the uses of visual aids encourage the body movement and it may strengthen the control. So, visual aids, then, is mutually beneficial to the students and teacher. Visual aids increase the interest of students and teacher to the subject matter. Visual senses contribute to about 90 percent to all students or human learning. It means other senses have only 10 % contribution to learning. Clear pictures and diagrams increase the student's level of understanding of the material presented, and its use facilitate learning, reinforce the sayings, clarify ideas, and create excitement (Rautrao, 2012, cited in Baser, 2013).

Diagram

A diagram is a simplified drawing designed to show inter-relationship primarily by means of lines and symbols (Kochhar, 1981). Diagrams being of an abstract character require a careful foundation work before they can be used effectively with a class of pupils. Diagrams are used in the teaching of almost all subjects. They are indispensable in geometry and science. Diagrams are very helpful to show arrangements and relations. In biology teaching, the diagrams are used to explain the abstract biology concepts.

Diagram could be used to explain many facts easily using a variety of symbols and labels. Diagrams can explain facts more easily than charts. Teachers use diagrams every day and in many subjects. A diagram must be as simple as possible. Diagrams should be used along with the other aids. A good diagram must approximate two standards:

(i) It must be technically correct and neatly drawn in paper proportions well-labeled and explained.

(ii) It should be so prepared that it can be moved and seen from all angles (Kochhar, 1981).

Advantages and Disadvantages of Diagrams

According to Bhaavani, Khimani and Kinger (n.d.), the followings are the advantages of diagrams.

- The information gathering stage on most projects produces a substantial amount of data. This information, sometimes may not give the essence of data and hence misunderstanding create a chaos on the mind of viewer. But, good diagrams turn chaos into clarity. The essence of data becomes clear on the mind of the viewer. The diagram translates all the information and helps us to plan for the next.
- The amount of information can be overwhelming sometimes. The initial diagrams are always a good reference point – a good reminder of the most important aspects on a project. These diagrams act like a roadmap which guides the viewer.
- The data collected may require to be communicated with different persons. These persons may come from different castes and may have different mother tongue. This can lead to misunderstandings between them as these different persons are not mind-readers. To remove this misconception, the data can be communicated with diagrams and hence, a common plan of action could be carried out.
- The huge amount of data collected may not be grasped in mind within a short period of time. Also, the characteristic of the variables of data may not be revealed easily. But, all the difficulties while grasping data can be removed with diagrams. Diagrams provide an effective way to summarize the whole data. This summarized data could be grasped up easily and be remembered for a sufficiently long time. The characteristic of the variables of data are easily revealed. Hence, learning data through diagrams saves time.

Bhaavani, Khimani and Kinger (n.d.) also pointed out the disadvantages of diagrams. The disadvantages are:

- There is a loss of accuracy of data while representing data through diagrams. It is obvious that there will be loss of data as it is the summarization of the whole data.
- Sometimes the illusionary effect creates a wrong impression on the mind of viewer.

Research Method

In the research, "the effects of the use of diagrams in teaching and learning biology at the high school level", Mix-Method Research: QUAN–qual model, also known as the explanatory mixed methods design was used.

Table 1 Population and Sample Size

Name of School	Population Size (Student)	Sample Size (Student)
BEHS, Yesagyo	235	86
BEHS, Ma-U-Out-Seik	124	90
Total	**359**	**176**

Instruments

Pretest and posttest, questionnaire and interviews were used as instruments to measure the effects of the study.

Data Analysis

The pretest was used to see if the groups were essentially the same before the treatment. To be able to determine whether there are significant differences between the experimental group and control group, the posttest scores of the groups were used. Because of this procedure, it is most appropriate to use the *t*-test for independent samples. The Statistical Package for Social Scientists (SPSS) version 23 was used to analyze the quantitative data. Descriptive statistics showing mean, standard deviation and independent samples *t*-test are commonly presented. For qualitative study, after data are collected, qualitative data analysis is conducted by a multistage process of organizing, categorizing, synthesizing, analyzing, and writing about the data (Gay, Mills &Airasian, 2012). The following table shows that there is no significant difference between the means of the experimental and control groups in both schools before they are treated.

Table 2Analysis of Means on Pretest

School	*N*		*M*		*SD*		*t*	*df*	*Sig.(2-tailed)*
	E	C	E	C	E	C			
BEHS, Yesagyo	43	43	32.84	32.47	3.988	3.954	.434	84	.665**(ns)**
BEHS, Ma-U-Out-Seik	45	45	39.51	39.07	4.879	5.227	.417	88	.678**(ns)**

Note: E = Experimental, C = Control, ns = not significant

Procedure

For studying the effects of the use of diagrams in teaching and learning biology at the high school level, two Basic Education High Schools were selected from Yesagyo Township.

First of all, the researcher requested and discussed the headmasters and two teachers who teach Grade Ten biology to cooperate in the study and to assign the content area. Two classes from each school were assigned as experimental and control groups to receive the treatment. The pretest was administered to both groups. The mean scores of the two groups were compared by using the independent samples *t*-test to determine group equivalence between experimental and control groups at the beginning of the study.

In each school, the experimental group was given a treatment by using diagrams. The researcher prepared the lesson plans for the content assigned for this study with the help of supervisor before teaching for the class of experimental groups. During instruction, the researcher used many diagrams. On the other hand, the control group was taught only with textbook. The researcher wrote the lesson plans for the content assigned for the study with the help of supervisor before teaching for the class of control group.

The researcher taught both the experimental and the control groups. The treatment period was four weeks. One period per day was taken for each group in each school. One period was lasted 45 minutes. At the end of the treatment period, the posttest was conducted for both groups. The allocated time for the posttest was 1:30 hours and the given marks were 50 marks. And then, questionnaire on perception of students towards using the diagrams was administered to experimental groups, followed by the interview given to all students who had been exposed to the treatment with the diagrams at the conclusion of the study. Then, the findings were presented based on experimental and control groups' scores, the students' perception to the questionnaire and the interview data.

Findings

This section describes quantitative and qualitative findings.

Quantitative Findings

This section deals with the findings of the experimental study andperception of students towards using diagrams. Data obtained from the posttest were analyzed by using independent samples *t*-test to compare the differences between the experimental and control groups of each school.

Analysis on Overall Posttest Achievement Scores

Table 3Analysis on Overall Posttest Achievement Scores

School	*N*		*M*		*SD*		*t*	*df*	*Sig.(2-tailed)*
	E	C	E	C	E	C			
BEHS, Yesagyo	43	43	43.16	35.86	4.359	4.647	7.515	84	.000***
BEHS, Ma-U-Out-Seik	45	45	42.67	36.07	3.205	4.555	7.950	78.995	.000***
Total	88	88	42.91	35.97	3.798	4.575	10.954	168.310	.000***

Note: E = Experimental, C = Control, ****p*< .001

The means of experimental group were significantly higher than those of control group in both schools. It indicated that there was a significant difference between experimental and control groups on overall posttest biology achievement scores. It can be seen in following Figure.

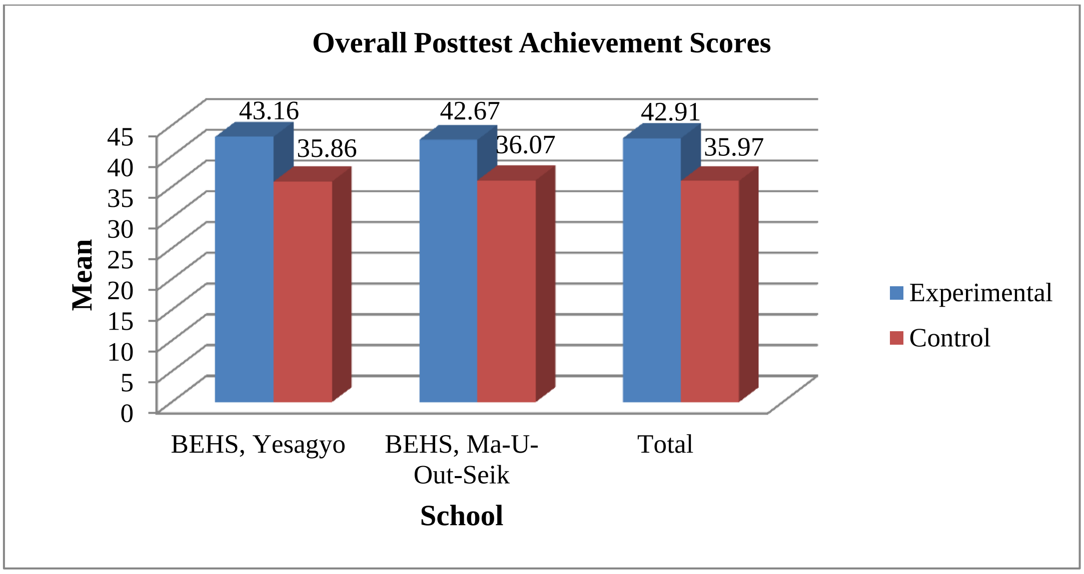

Figure Comparison of means for overall posttest achievement scores.

Based on the above findings, it can be interpreted that the use of diagrams has significant effect on biology achievement scores. Hence, the use of diagrams has a positive effect on biology teaching at the Basic Education High School level. Using the diagrams can make effective learning in the students' cognition.

Perception of Students towards Using Diagrams

Responses from questionnaire on perception of students towards using diagrams were used to see if there was consensus of opinion about the use of diagrams.

From the questionnaire data, it was observed that all of the students (100%) from the experimental groups agreed with the following facts that the diagrams help them in:

- understanding the meaning of the lesson better,
- promoting learning and retention of new lessons,
- making biology class interesting and
- knowing the links between new knowledge and previously obtained knowledge.

Motivation of learners is one of the most important factors in teaching. It was observed that teaching by using the diagrams improved the students' motivation to learn the lesson and made the class more interesting. So, they understood the meaning of the lesson better and could know the links between new knowledge and previously obtained knowledge. Therefore, they improved their learning and retention of new lessons.

Over 90% of the students agreed with the following items:

- Diagrams stimulate the students to learn biology.
- The use of diagrams has improved the students' learning in biology.
- Using the diagrams makes the students feel comfortable in learning biology.
- The student would like to learn biology with extensive diagrams in addition to those in textbook.
- When the students can explain a biology concept with different types of diagrams, the students feel more confident about their learning.

It was observed that teaching by using the diagrams could stimulate the students to learn the lesson and helped them to learn the lesson easily. So, they felt comfortable in learning and improved their learning in biology. Therefore, they are likely to learn biology with the diagrams.

Eighty six percent (86%) of the students agreed that the diagrams help me to contribute in class discussion.

It was observed that because the diagrams helped the students to contribute in class discussion, the students could share the ideas with each other, they participated actively in learning activities, they are interested the lesson and improved their interpersonal skills. It can also be interpreted that students enjoyed teaching with the diagrams and they had good perception on using the diagrams in teaching biology.

Qualitative Findings

For this section, semi-structured interview was conducted in order to make quantitative findings more reliable.

Analysis on Students' Interview

Interview was given to six experimental students, three from each school, to find out students' perceptions about the use of diagrams in the classroom. Interviews were semi-structured type and in face to face format. Responses were recorded by audio-taping and they were transcribed. Interview questions can be found in below. The interview was given at the conclusion of the study; after all students had been exposed to the treatment with the diagrams. The answers to each question varied. Answers to each interview question are summarized as follow.

1. Do you think that diagrams play an important role in teaching and learning biology?

Student 1: Yes, I do. This is because teaching and learning biology with the help of diagrams make it easier to understand the content more quickly and more exactly than the words alone.

Student 2: Yes, I do. This is because I can learn the lessons more easily with the help of diagrams than the words alone. That is why I think diagrams play an important role.

Student 3: Yes, I do. This is because I can remember the lessons more easily with the help of diagrams than the words alone.

Student 4: Yes, I do. This is because we have to learn biology in English. If we learn it through the diagrams, we can understand it more easily. That is why diagramsare important.

Student 5: Yes, I do. This is because in learning biology, we can learn it more easily withthe help of diagrams than the words alone. That is why diagrams are important.

Student 6: Yes, I do. This is because it is difficult to learn the words alone, and it is easy to learn the lessons with the help of diagrams.

From this question, all students indicated that they think that diagrams play an important role in teaching and learning biology.

2. Do you like being taught by using diagrams in biology?

Student 1: Yes, I do. This is because learning the lessons with the help of diagrams makeme remember it more easily.

Student 2: Yes, I do. I can learn the lessons more quickly and easily with the help of diagram.

Student 3: Yes, I do. This is because I like drawing and it also makes me feel relaxed. That’s why I like it.

Student 4: Yes, I do. I can learn the lessons more quickly in a short period of time with the help of diagrams.

Student 5: Yes, I do. Studying the lessons with the help of diagrams not only makes me easyto learn, but also makes me feel relaxed. So, I can learn a lot.

Student 6: Yes, I do. This is because studying diagrams is easier than studying the lessonsalone.

All six students like being taught by using diagrams in biology.

2. What are the difficulties during learning with diagrams?

Student 1: I have some difficulties in drawing.

Student 2: The difficulty is that drawing takes a long time.

Student 3: We have to draw the portraits of living things. It takes some time to do so. That’sthe difficulty.

Student 4: I like drawing but it is time-consuming. It is also difficult when we don't know how to draw.

Student 5: Yes, I have difficulties in drawing the portraits of plants and animals and incorrect labeling and spelling.

Student 6: The difficulty is that I have to draw diagrams that I have not seen before.

Four of the six students indicated that they have some difficulties in drawing because drawing takes a long time. Two of the six said that they have difficulties in drawing the portraits of plants and animals and in correct labeling and spelling.

3. When you were taught biology concepts by using diagrams, do you think it would help you learn better?

Student 1: Yes, I do. When the teacher explains to us the lessons by using diagrams, I can remember almost all the lessons. Even when I can't recall the lessons, I canrecall the lessons with the help of diagrams.

Student 2: Yes, I do. This is because even if we can't remember the lessons we have leanedby heart, we can write it our own words since we remember the diagrams.

Student 3: Yes, I do. Learning the lessons with the help of diagrams can save times and make us learn it more quickly than the rote learning with only text.

Student 4: Yes, I do. Since I learn the lessons with the help of diagrams, it is easy toremember the lessons. In the exam, we can get clue to answer the questions fromthe diagrams even if we forget the lessons.

Student 5: Yes, I do. I can not only draw the diagram but also retain the lessons longer. I can also label the diagrams wit correct spellings. That's why I think it is an improvement.

Student 6: Yes, I do. Leaning with diagrams is helpful to remember the lessons.

All students indicate that they feel the diagrams have been most helpful.

4. Tell me your feelings about learning biology with the help of diagram.

Student 1: I like it very much. This is because those are the diagrams of plants and animals, which can be seen in our environment.

Student 2: I like it. This is because we can learn animals and plants with the help of diagams.

Student 3: I am happy because I like drawing.

Student 4: I feel satisfied because I have become better at drawing.

Student 5: I like it. This is because I can learn the lessons more easily with the help of diagrams.

Student 6: I am happy. I love drawing.

Three of the six students indicated that they like diagrams, and three of the six said that they love drawing.

5. Do you have a long retention of biological concepts taught with the help of diagrams?

Student 1: Yes, I do. I listen carefully to the teacher's teaching as I like diagrams. That's why I can retain them longer.

Student 2: Yes, I do. This is because I can focus on the lessons as I love learning through diagrams.

Student 3: Yes, I do. This is because I can study eagerly.

Student 4: Yes, I do. As learning the lessons through diagrams look like watching a movie, I can retain it longer.

Student 5: Yes, I do. In biology, learning with text alone is easy to forget but through diagrams, I have a long retention of it.

Student 6: Yes, I do. Learning the lessons with the help of diagrams helps me remember the lessons and it is also helpful in the exam in a way that by just thinking about the diagrams, I can answer the questions.

Three of the students indicated that they have a long retention of biological concepts taught with the help of diagrams because learning the lesson alone is easy to forget but through diagrams they have a long retention of it and the lessons through the diagrams helps them remember the lessons and is also helpful in the exam even they can't recall the lessons. Three of the six students said that they also have a long retention because they can focus on the lessons as they love learning through the diagrams.

6. Teaching with the use of diagrams makes the classroom an interesting place.

Do you agree with this statement?

Student 1: Yes, I do. Most students including me like diagrams and listen carefully to theteacher's explanations of how to draw diagrams and how to explain by using diagrams.

Student 2: Yes, I do. Most students like the teacher's teaching in which he uses diagrams. So,they can play attention to the teacher.

Student 3: Yes, I do. This is because studying the lessons with diagrams is very interesting and knowledgeable.

Student 4: Students are interested in diagrams. If they are taught through them, the classroom will be a happy and interesting place.

Student 5: Yes, I do. This is because diagrams can be both the plants and animals that we have seen and the ones we haven't seen, students are interested in that.

Student 6: Yes, I do. This is because teaching students by using diagrams can make themhappy and they like drawing.

Three of the six felt that the diagrams were specifically shown during the study helped them learn concepts. All six felt the diagrams made class more interesting.

7. Can teacher's teaching with the use of diagrams from many sources (Google, Facebook, Internet and Website etc.,) besides textbook make conducive learning? Why or why not?

Student 1: There are not only the lessons with diagrams but also the lessons with nodiagrams. If we can make a text with diagrams, it can be understood easily.

Student 2: If we can teach the lessons with the help of diagrams, it will be more effective.

Student 3: The lessons with the help of diagrams can be memorized more easily than the lessons without diagrams.

Student 4: Yes, I do. This is because we can learn the plants and animals extensively. Diagrams should be used because they can raise the speed of studying.

Student 5: Yes, I do. In biology textbook, there are not only the lessons with diagrams butalso the lessons with no diagrams. If we can learn the lessons through thediagrams, we can understand them.

Student 6: Yes, I do. It is beneficial.

Four of the students indicated that diagrams are beneficial to them because there are not only the lessons with diagrams but also the lessons with no diagrams in biology textbook. So, learning the lessons through the diagrams makes students easier to understand the concepts. Two of the six students said that the lessons with the diagrams can be memorized more easily than the lessons without diagrams and it will be less time consuming.

To sum up, students indicated in the interview that diagrams were useful and made class more interesting. Thus, students had good perception on using diagrams in teaching and learning biology.

Conclusion

Discussion

The following points are discussed as the results of the study.

Discussion for Hypothesis 1

The posttest means of experimental group was significantly higher than the means of control group for overall posttest achievement scores in each school. The finding revealed that there was a significant difference between the students who are taught by using diagrams and those who are not. As a result, experimental groups performed more effectively than the control groups for overall posttest achievement scores. Baser (2013) believed that the use of visual media is good to activate the students or keep them active for eliciting in teaching and learning process. Visual media is mutually beneficial to the students and teachers. Visual media increase the interest of students and teacher to the subject matter (Rautrao, 2012, cited in Baser, 2013). According to Foliaki (2012), visual-aids have the ability to arouse and maintain students' interest, simplify teaching, accelerate learning and improve the retention of learned information. It was found that diagrams facilitate and promote in teaching and learning biology. Furthermore, when properly combined and appropriately used, the diagrams could help the teacher to teach more efficiently and effectively and learners to earn faster, better retain longer and transfer learned material more effectively. There is a link between attitude and achievement. If students are more engaged and more motivated to learn, then achievement is likely to increase. When students have a more positive attitude towards class and the content learned, then achievement could follow. This implies that the use of diagram was successful and boosted students' achievement.

Discussion for Hypothesis 2

When analyzing data for the student surveys, it was observed that all of the students (100%) from the experimental groups agreed with the statement that teaching by using the diagrams improved the students' motivation to learn the lesson and made the class more interesting. So, they understood the meaning of the lesson better and could know the links between new knowledge and previously obtained knowledge. Therefore, they improved their learning and retention of new lessons. Over 90% of the students agreed that teaching by using the diagrams could stimulate the students to learn the lesson and helped them to learn the lesson easily. So, they felt comfortable in learning and improved their learning in biology. Therefore, they are likely to learn biology with the diagrams. Eighty six percent (86%) of the students agreed that the diagrams helped the students to contribute in class discussion, the students could share the ideas with each other, they participated actively in learning activities, they are interested the lesson and improved their interpersonal skills. It can be interpreted that students enjoyed teaching with the diagrams and they had good perception on using the diagrams in teaching biology.

The responses to interview questions were also useful in this study. The six students indicated that the use of diagrams make biology class interesting and comfortable in learning, stimulate to learn and improve learning in biology. And then, diagrams helped them to see links, summarize concepts, contribute in class discussion, and understand the lesson better. So, if students feel positively about using extensive diagrams in teaching, then diagrams could still be used in teaching of biology. In teaching, many strategies can be used. The use of diagrams can help students to pay attention more. Students also showed that they had opportunity to interact with their classmates, enjoyed the use of diagrams and wished it to be used in other lessons. Therefore, the students had good perception on using the diagrams in teaching biology.

Recommendations for Further Research

The major findings in the study have prompted the researcher to make the following recommendations so as to facilitate further improvement in the effective utilization of diagrams in teaching and learning biology.

1. Further studies should be conducted to investigate the teachers' attitudes towards the effectiveness of using diagrams in teaching biology.
2. Further research should be extended with a larger sample and a longer term of study in order to obtain more reliable and valid results.
3. This study deals with biology students at the high school level. Therefore, similar studies should be investigated on the teaching of other various subject areas at different grade levels to determine whether similar or different result could be obtained.
4. The study should be replicated in other districts and regions in Myanmar.
5. Teachers should always try their best to make use of available diagrams which make their lessons more interesting.
6. Government and school principals should provide biology teachers with enabling environment for the use of available diagrams in order to make learning more meaningful. Government and school principals should also supply finance for biology teachers to make teaching and learning easier, practical, appealing and enjoyable and promote academic standard.
7. Workshops, conferences and seminars should be organized for teachers where they would be taught how to use the diagrams effectively for the achievement of educational goals and how to incorporate into main stream of pedagogy in teaching various subject areas at different grade levels.

Conclusion

The major purpose of the study was to investigate the effects of the use of diagrams in teaching and learning biology at the high school level. Mix-Method Research: QUAN-qual Model was used to compare students' biology achievement between Grade Ten biology students from two selected schools. It was conducted in Yesagyo Township, Magway Region. The instruments for this study were pretest and posttest, questionnaire and interview. In order to get the validation and expert opinions, the sets of pretest and posttest questions, making schemes and questionnaire items were distributed to the five educators from Sagaing University of Education.

Before the treatment, pretest was used to check the equivalence of the two groups. These two intact groups were assigned as experimental and control groups. According to the *t* value, it was found that the students in both schools were essentially the same before the treatment. In each school, the experimental group was taught by using extensive diagrams and textbook while the control group was taught by using textbook only. After treatment period, the posttest was administered to both groups. Independent samples *t*-test was used to examine whether there were significant differences according to Revised Bloom's taxonomy levels of cognitive domain. And then, the questionnaire was administered to the experimental groups in order to investigate students' perception on using the diagrams. And then, the six students were interviewed to delve into their ideas about the use of diagrams in the classroom.

On these overall achievement scores, there were significant differences between the two groups for all selected schools. According to the questionnaire and interviews, students had good perception on using the diagrams in learning biology and the students felt the diagrams that were specifically shown during the study helped them learn concepts and made class more interesting.

Based on the findings of the study, it can be concluded that the diagrams are essential to support teaching-learning process. The students taught with diagrams have excellent achievement scores compared with those who were not. It is clear that to achieve effectiveness and efficiency in teaching-learning process, the diagrams should be incorporated. The diagrams could facilitate teaching-learning process between teachers, learners and subject matter. Students could pay attention and focus better in class if the teachers used the diagrams in teaching biology. Teaching at any level requires that the students be exposed some form of simulation. Using a variety of diagrams can enliven a class, encourage student participation, and help students grasp difficult concepts. Therefore, teaching biology can be effective through the use of diagrams, which helps students have a meaningful learning.

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DEVELOPING THE READING SKILL OF EFL STUDENTS THROUGH COOPERATIVE LANGUAGE LEARNING

Kyaw Zin Oo[1] and Wai Wai Oo[2]

Abstract

The purpose of this study was to investigate the development of the reading skill of EFL students design through cooperative language learning. The quasi-experimental design, viz, non-equivalent control group was used to develop the reading skill of EFL students. The students from the experimental group received the cooperative learning methods (Jigsaw method and Think-Pair-Share method) but the control group was not taught by these methods. The subjects, (106) students from No.(1) Basic Education High School, Kyaukse and (125) students from No.(2) Basic Education High School, Kyaukse, Kyaukse Township, were chosen by using a random sampling method. The instruments used in this research were a pretest and a posttest. The independent samples *t* test was used to analyze whether there was a significant difference between the two groups. Examination of the means and *t* test for the posttest were (t=4.176, df=104, MD=5.151, p<.001) at No. (1) BEHS, Kyaukse (t=3.415, df=123, MD=3.433, p<.001) at N0. (2) BEHS, Kyaukse. The results showed that the students who received a treatment by using cooperative learning method were significantly better than those who did not receive it. Thus, it can be interpreted that the cooperative learning methods (Jigsaw method and Think-Pair-Share method) can develop the reading skill of EFL students and a suggestion was made for teachers to use the cooperative learning methods in teaching reading in English.

Keywords: cooperative learning, language, skill, reading, reading skill

Introduction

The education system plays a crucial role in every society. It is necessary to focus the education efforts on preparing students to enter the modern life of the twenty-first century. There is no doubt that English is a universal language. It is used for international communication in various fields such as education, science, business, society, and technology. There is an increasing demand for effective teaching and learning of English in many contexts. Effective English language skills are seen as vital for the countries which seek to participate actively in the global economy and want to have access to the information that forms the basis of social, educational, and economic development.

All teachers know that language plays a crucial role in education. It is a way for communication and expression, and also the medium of thought and a precious tool for learning. Teachers also know that English is the most useful language in the world and it has four skills namely reading, writing, listening and speaking. In fact, listening, speaking, reading and writing need equal attention if the new communicative skills now acquired are to be attained (Savigon, 1983). In order to teach the language called English, they need to promote the skills of language teaching efficiently and effectively.

Because of the recent spread of information technology, English is more essential in non-English speaking countries which have undergone extreme changes recently. So, the English teachers have to develop and be experts in approaches or methods suitable for the students who

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come from different backgrounds and have different proficiencies in English. But now, almost every student can have the chance to learn English in the basic education schools.

This study mentions about the reading skill of the English language. Reading skill is one of the basic English skills which should be proficient by the students. It is a way of transferring information from the writer to the reader. The only main aim of teaching reading skills is to achieve comprehension. Without comprehension the meanings of the text, reading will be useless. In order to make the teaching learning process more interesting and reach the goals of the process, the teacher needs to apply a special technique, strategy and method. Using a suitable method in teaching reading skills to students makes the teaching learning process more effective and the students more active. There are so many methods to develop the reading skill of the students. Among these methods, Cooperative Language Learning (CLL) is one of the most special methods used in developing the reading skill of EFL students as mentioned in this study.

Hence, unlike the traditional teaching methods which focused on reading skills of English, only cooperative language learning is to apply cooperative learning techniques to the language learning either for the native or foreign language. Cooperative learning is a generic term for various small group interactive instructional procedures. It can be an effective method to motivate students, encourage active learning, and develop key critical-thinking, communication, and decision-making skills.

For language contexts, CLL is broadly defined as an approach to organize classroom activities so that students are able to learn from and interact with one another as well as from the teacher (Olsen &Kagan, 1992).

Purposes of the Research

The main purpose of this study is to study the development of the reading skill of EFL students through cooperative language learning. The specific purposes are as follows:

- to differentiate the reading skill of EFL students taught by cooperative learning from those who did not receive it in the posttest reading skill achievement.
- to differentiate the reading skill of EFL students taught by cooperative learning from those who did not receive it in components of reading skill.
- to provide related discussion and recommendations based on the findings.

Research Questions

1. Is there any significant difference in the reading skill achievement between the students taught by cooperative learning and those who are not?
2. Is there any significant difference in the reading skill achievement between the students taught by cooperative learning and those who are not taught to scanning?
3. Is there any significant difference in the reading skill achievement between the students taught by cooperative learning and those who are not to synonyms and antonyms?
4. Is there any significant difference in the reading skill achievement between the students taught by cooperative learning and those who are not to true/false?
5. Is there any significant difference in the reading skill achievement between the students taught by cooperative learning and those who are not in relation to cloze procedures?

6. Is there any significant difference in the reading skill achievement between the students taught by cooperative learning and those who are not in relation to skimming?
7. Is there any significant difference in the reading skill achievement between the students taught by cooperative learning and those who are not in relation to matching?

Definition of Key Terms

Cooperative Learning: A group learning activity organized so that learning is dependent on the socially structured exchange of information between learners in a group in which each learner is held accountable for his or her own learning and is motivated to increase the learning of others (Richards& Rodgers, 2001).

Reading: Reading is the processes by which the meaning of a written text is understood(Richards & Schmidt, 2010).

Skill: Skill is an acquired ability to perform an activity well, usually one that is made up of a number of coordinated processes and actions. Many aspects of language learning are traditionally regarded as the learning of skills, such as learning to speak, or read fluently (Richards & Schmidt, 2010).

Reading Skill: A reading skill is a cognitive ability which a person is able to use when interacting with the written text (Bojovic, 2010).

Language: Language is a system that connects thoughts, which cannot be heard, seen, or touched, with sounds, letters, manual signs, or tactile symbols (Delahunty& Garvey, 2010).

Review of Related Literature

Cooperative Language Learning (CLL) is part of a more general instructional approach known as Collaborative Learning. “Cooperative learning is group learning activity organized so that learning is dependent on the socially structured exchange of information between learners in groups and in which each learner is held accountable for his or her own learning and is motivated to increase the learning of others”(Olsen &Kagan 1992). Cooperative learning has examples in proposals for peer-tutoring and peer-monitoring. Some students were left behind higher-achieving ones in this learning area but cooperative learning required to do the followings:

- raise the achievement of all students,
- help the teacher build positive relationships among students
- give students the experiences they need for healthy social, psychological, and cognitive development.
- replace the competitive organizational structure of most classrooms and schools

In second language teaching, CL (where it is often referred to as Cooperative Language Learning-CLL) has been defined as a way of promoting communicative interaction in the classroom and it is also the extension of Communication Language Teaching. It is also assumed as the learner-centered approach to teaching rather than teacher-centered classroom methods. Therefore, CLL is an approach that crosses the education and second and foreign language teaching.

Cooperative Learning and Second Language Acquisition

Student participation in groups and small-group work following cooperative principles facilitates second language acquisition along with the subject matter mastery (McGroarty, 1991). According to Aronson, (2000)modern methods of Cooperative Learning includes: Jigsaw, Think-Pair-Share, Group investigation, Constructive Controversy,Student Teams-Achievement Divisions (STAD), and so on.

(a) Jigsaw

Aronson (2012) describes how he and a group of graduate students developed jigsaw in 1971 as a means of reducing the interracial hostility among students and they were able to reduce racial conflict, raise the self-esteem of students, improve their academic performance and increase their enthusiasm for learning.

In the jigsaw approach, the teacher divides the learning materials into manageable pieces and each learner initially concentrates on mastering a small portion of the material. The learners then share their understanding and integrate all the pieces into a meaningful whole to complete the jigsaw.

(b) Think-Pair-Share

Think-pair-share is a relatively low-risk and shortcooperative learning technique, and is ideally suited for instructors and studentswho are new to cooperative learning. Defined by Ledlow (2001), Think-pair-share is a low-risk strategy to get many students actively involved in classes of any size. Ledlow (2001) also declared that think-pair-share (TPS) technique ineducation is also about:

1) Think: Students think independently about the question that has been posed, forming ideas of their own.
2) Pair: Students are grouped in pairs to discuss their thoughts. This step allows students to articulate their ideas and to consider those of others.
3) Share: Each student pair shares their ideas with a larger group, such as the whole class.

Think-Pair-Share is a collaborative discussion strategy designed to provide students with time to think and formulate their individual thoughts and ideas about a given topic or concept before forming a pair with a peer to share their thinking(Lyman, 1981).

Research Method

Participants

This study took place in Kyaukse Township and the required sample schools were selected by using a simple random sampling method. They were No.1 Basic Education High School and No.2 Basic Education High School in Kyaukse. Participants in this research were Grade Ten students from the selected high schools (see Table1).

Table Population and Sample Size

Name of the School	Number of Population	Number of participants
No.1 BEHS, Kyaukse	604	106
No.1 BEHS, Kyaukse	233	125

Research Design

One of the quasi-experimental designs, viz. non-equivalent control group designwas adopted in this research.

Table 2Experimental Research Design

Group	No. of Students		Pretest	Treatment	Posttest
	BEHS 1	BEHS 2			
Experimental	53	64	ERSA	CLL	ERSA
Control	53	61	ERSA	Formal Teaching	ERSA

Note: CLL = Cooperative Language LearningERSA=English Reading Skill Achievement

Instruments

The instruments used in this research were a pretest, a posttest, and sample lesson plans.

Pretest

The pretest was constructed to measure the basic English knowledge of the students. It consists of short question items, same meaning items, true or false items, opposite meaning items, reference items, cloze procedure, multiple choice items, match items, the cause and effect items, and answer questions items. Test items were constructed based on the Units from 1 to 8 of Grade Ten English textbook and intermediate stories for reproduction 2by Hill (1977). Then, the test items were validated by a professor from the Department of English, two professors and two lecturers from the Department of Methodology, Sagaing University of Education. According to the suggestions of these teachers, the test items were modified again. On 29th October, 2018, the pilot test was held with (60) Grade Ten students from No.5 Basic Education High School, Mandalay. The allocated time for this test was (120) minutes and the given marks were (50) marks. On 1st November, 2018, the pretests were held at No.(1)BEHS and No.(2)BEHS in Kyaukse Township.

Posttest

The posttest was administered to investigate if there is any significant difference between the students from the experimental group and those from the control group in terms of their English reading skills achievement. The construction of the test items was made on the Unitsfrom 1 to 10 of Grade Ten English textbook and intermediate stories for reproduction 2 by Hill (1977). For validations, the copied papers of the test items were distributed to the four experienced teachers from Sagaing University of Education. The allocated time for the test was (120) minutes and the given marks were (50) marks. On the basis of the suggestions of those experienced teachers, the test items were modified again. Then, the pilot test was held with 60 Grade Ten Students from Minn Myanmar Private High School, Mandalay. After the treatment was given, the posttests were administered at the selected high schools on 17th December, 2018.

Analysis of the Data

In order to find out whether there is a significant difference between the experimental group and the control group, the posttest scores of the two groups were compared by calculating means, standard deviations and using the independent samples*t*test. The pretest was conducted to ensure that the background English knowledge of the two groups were equivalent. The results of the posttest were analyzed to investigate the development of the reading skill of EFL students through cooperative language learning.

Research Findings

Findings for Pretest

This study was designed to explore the development of the reading skill of EFL students in high schools through cooperative language learning. One of the true experimental designs, the randomized pretest-posttest control group design was used and it involved two groups such as experimental group and control group. Both groups were formed by random assignment. Before the treatment was given, a pretest was administered and the results of the *t* value, the mean, standard deviations, and mean differences of both groups are presented as follows:

Table 3 t Values for Pretest Reading Skill Achievement Scores

School	Group	*N*	*M*	*SD*	*MD*	*t*	*df*	Sig. (2-tailed)
	Experimental	53	19.74	4.382				0.216
BEHS 1	Control	53	21.02	6.100	-1.283	-1.244	104	(ns)
	Experimental	64	27.81	4.105				0.217
BEHS 2	Control	61	29.36	5.834	-1.283	-1.244	94.376	(ns)

Note: ns = not significant BEHS 1 = No.1 BEHS, Kyaukse BEHS 2 = No.2 BEHS, Kyaukse

The means of the experimental groups and control groups were slightly different (see Table 3). It showed that there was no significant difference between the experimental group and control group for the scores on the pretest in each school (see Figure 1).

After a pretest, the experimental group was taught by cooperative language learning but the control group was not taught by it. A posttest was administered to both groups after eight weeks. The posttest scores could be compared by using the independent samples *t* test.

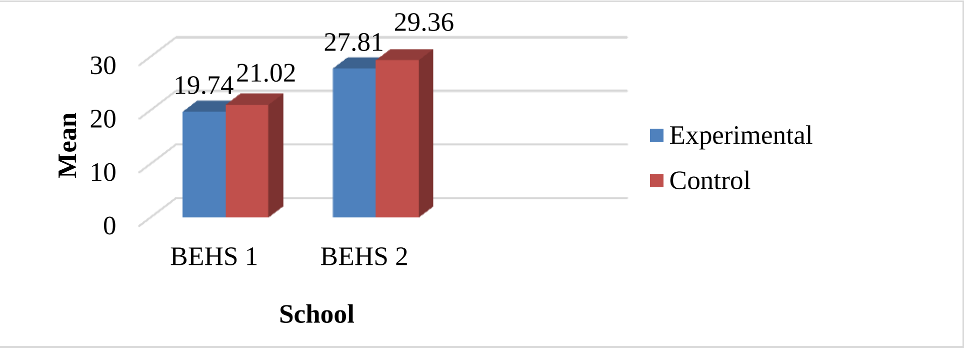

Figure 1 Comparison of means for pretest

Findings for Posttest

Examining the Results for Research Question (1)

To examine this question, means, standard deviations and mean differences of the experimental group and the control group for the posttest reading skill achievement were computed. The independent samples *t*test was used to measure the significant difference.

Table 4 t Values of Posttest Reading Skill Achievement Scores

School	Group	*N*	*M*	*SD*	*MD*	*t*	*df*	Sig. (2-tailed)
BEHS 1	Experimental	53	29.43	3.592	5.151	4.176	104	0.000***
	Control	53	24.28	8.231				
BEHS 2	Experimental	64	30.86	3.558	3.433	3.415	123	0.001***
	Control	61	27.43	7.170				

Note: ****p*< .001

According to table 4, the results showed that there was a significant difference between the overall reading skill achievement scores of the experimental and control groups in each school (see Figure 2).

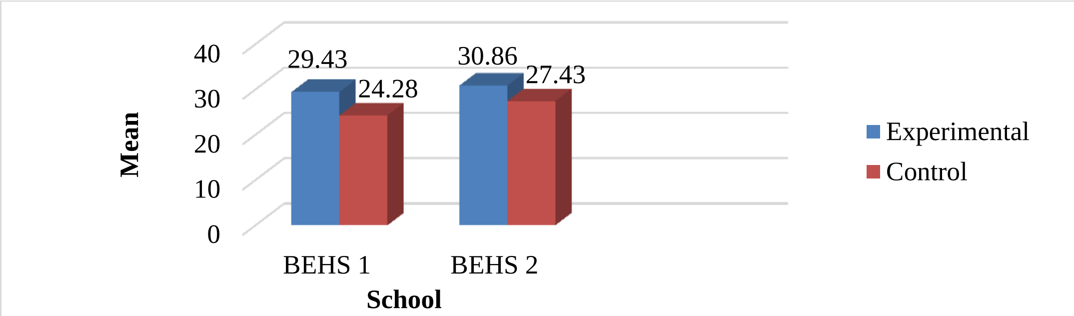

Figure 2 Comparison of means for posttest

According to the findings, it can be interpreted that the use of cooperative language learning has a significant effect on the reading skill of EFL students from high schools. It positively contributed to the teaching of reading skill of students at the high school level.

Examining the Results for Research Question (2)

In this study, scanning includes short answer question (5 items). To examine this question, means, standard deviations and mean differences of the experimental group and the control group for recognition type items were computed. The independent samples *t* test was used to measure the significant differences.

Table 5t Values for Scores scanning

School	Group	*N*	*M*	*SD*	*MD*	*T*	*df*	Sig. (2-tailed)
BEHS 1	Experimental	53	4.28	1.274				
	Control	53	3.15	1.535	1.13	2.431	104	0.010*
	Experimental	64	4.01	0.112				
BEHS 2	Control	61	3.24	1.542	0.77	1.063	123	0.031*

Note. * *p*< .05

According to the table 5, it showed that there were significant differences between the results of the experimental groups and the control groups in both schools (see Figure 3). Therefore, it can be interpreted that cooperative learning can improve the achievement of the students with regard to the scanning.

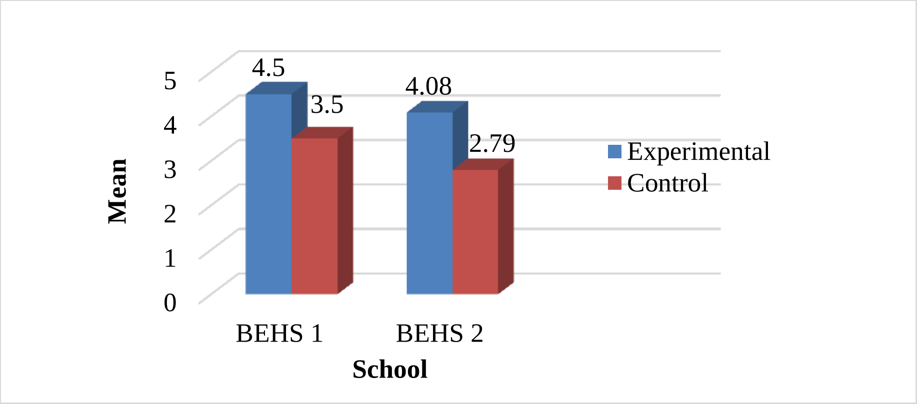

Figure 3 Comparison of means for scanning

Examining the Results for Research Question (3)

In this study, synonyms and antonyms include same meanings (5 items), opposite meanings (5 items) and suitable words (5 items). To examine this question, means, standard deviations and mean differences of the experimental groups and the control groups for recognition type items were computed. The independent samples *t*test was used to measure the significant differences.

Table 6 t Values for Scores on Synonyms and Antonyms

School	**Group**	***N***	***M***	***SD***	***MD***	***t***	***df***	**Sig. (2-tailed)**
BEHS 1	Experimental	53	17.18	3.410	3.86	2.257	104	0.000***
	Control	53	13.32	2.127				
BEHS 2	Experimental	64	15.75	3.056	6.31	3.525	123	0.000***
	Control	61	9.44	3.043				

Note: *** $p< .001$

According to table 6, it showed that there were significant differences between the results of the experimental groups and the control groups in both schools (see Figure 4). Therefore, it can be interpreted that cooperative learning can improve the achievement of the students with regard to the synonyms and antonyms.

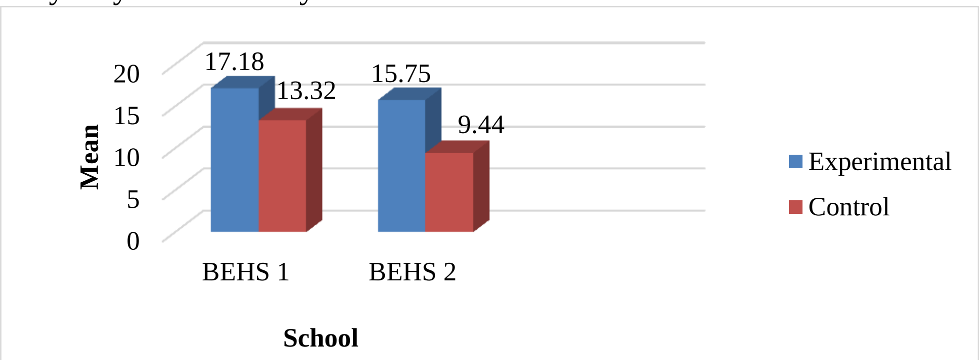

Figure 4 Comparison of means for synonyms and antonyms

Examining the Results for Research Question (4)

To examine this question, means, standard deviations and mean differences of the experimental groups and the control groups for true/false were computed. The independent samples *t* test was used to measure the significant difference.

Table 7t Values for Mean Scores on True/False

School	Group	*N*	*M*	*SD*	*MD*	*t*	*df*	Sig. (2-tailed)
BEHS 1	Experimental	53	4.5	1.284	1	4.076	104	0.000***
	Control	53	3.5	2.935				
BEHS 2	Experimental	64	4.08	0.721	1.29	2.744	123	0.007**
	Control	61	2.79	2.327				

Note:*** $p < .001$** $p < .01$

According to the table 7, it showed that there were significant differences between the results of the experimental groups and the control groups in both schools (see Figure 5). Therefore, it can be interpreted that cooperative learning can bring about the significant effect on the achievement of the students with regard to the true/false.

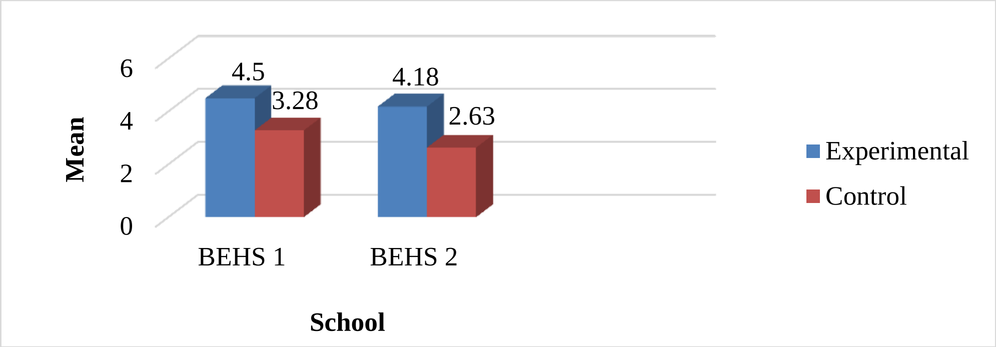

Figure 5 Comparison of means for true/false type

Examining the Results for Research Question (5)

To examine this question, means, standard deviation and mean differences of the experimental groups and the control groups for cloze procedures were computed. The independent samples *t* test was used to measure the significant differences.

Table 8*t Values for Scores on Cloze Procedures*

School	**Group**	***N***	***M***	***SD***	***MD***	***t***	***df***	**Sig. (2-tailed)**
BEHS 1	Experimental	53	15.28	3.510	2.98	2.327	104	0.022*
	Control	53	12.30	5.109				
BEHS 2	Experimental	64	14.95	2.050	2.31	4.845	123	0.000***
	Control	61	12.64	5.053				

Note:* $p< .05$*** $p< .001$

According to the table 8, it showed that there were significant differences between the results of the experimental groups and the control groups in both schools (see Figure 6). Therefore, it can be interpreted that cooperative learning can improve the achievement of the students with regard to the cloze procedures.

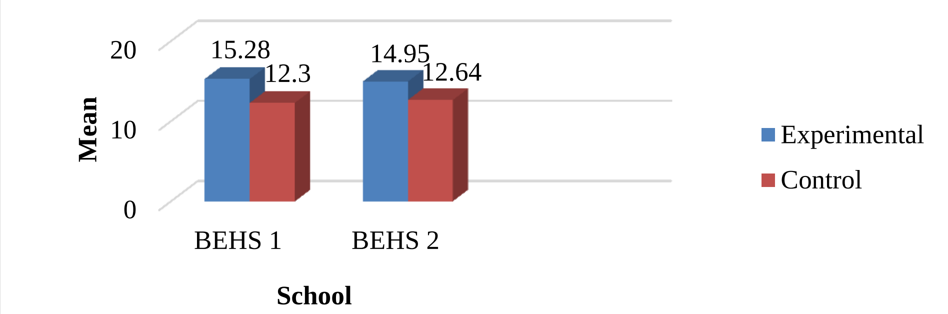

Figure 6 Comparison of means for cloze procedures

Examining the Results for Research Question (6)

In this study, skimming includes choose the right answer (5 items). To examine this question, means, standard deviation and mean differences of the experimental group and the control group for skimming were computed. The independent samples *t* test was used to measure the significant differences.

Table 9t Values for Scores on Skimming

School	Group	*N*	*M*	*SD*	*MD*	*t*	*df*	Sig. (2-tailed)
BEHS 1	Experimental	53	4.5	1.164	1.22	3.006	104	0.038*
	Control	53	3.28	1.435				
BEHS 2	Experimental	64	4.18	0.511	1.55	2.112	123	0.000***
	Control	61	2.63	2.127				

Note:* $p < .05$*** $p < .001$

According to the table 9, it showed that there were significant differences between the results of the experimental groups and the control groups in both schools (see Figure 7). Therefore, it can be interpreted that cooperative learning can improve the achievement of the students with regard to skimming.

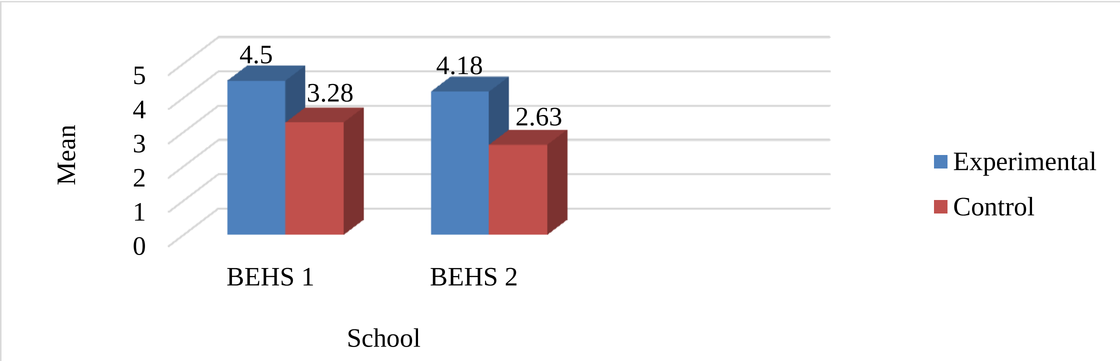

Figure 7 Comparison of means for skimming

Examining the Results for Research Question (7)

In this study, matching includes match cause with effect (5 items). To examine this question, means, standard deviations and mean differences of the experimental groups and the control groups for matching were computed. The independent samples *t* test was used to measure the significant differences.

Table 10t Values for Scores on Matching

School	Group	*N*	*M*	*SD*	*MD*	*t*	*df*	Sig. (2-tailed)
BEHS 1	Experimental	53	4.48	0.184	0.8	2.112	104	0.042*
	Control	53	3.68	1.135				
BEHS 2	Experimental	64	4.01	0.211	0.4	1.173	123	0.021*
	Control	61	3.61	1.107				

Note: * $p < .05$

According to the table 10, it showed that there were significant differences between the results of the experimental groups and the control groups in both schools (see Figure 8). Therefore, it can be interpreted that cooperative learning can improve the achievement of the students with regard to the matching.

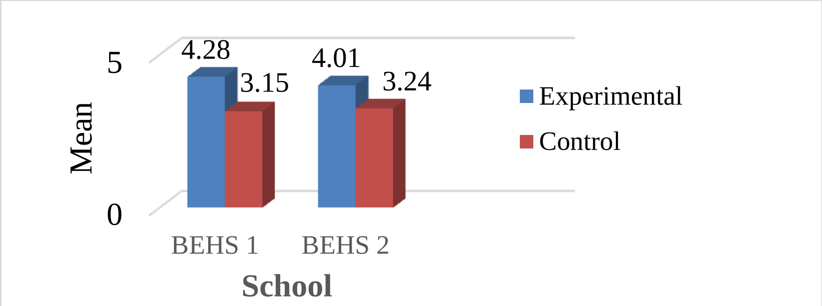

Figure 8 Comparison of means for matching

Conclusion

Discussion

In this study, the results relating on the posttest indicated that there was a significant difference at $p< .001$, between the performances of the two groups. The means of the control groups were 24.28 and 27.43, the means of the experimental groups were 29.43 and 30.86. This showed that there was a significant difference between the overall reading skill achievement scores of the experimental group and those of the control group in each school.

In addition, the finding concerning to scanning indicated there was a significant difference at $p< .05$, between the performance of the students from both schools. Whereas the means of the control groups were 3.15 and 3.24, the means of the experimental groups were 4.28 and 4.01. This showed that there was a significant difference between the reading skill achievement of the students from the experimental groups and the control groups in relation to the short answer type items.

Moreover, the results relating to the synonym and antonym type items showed that there was a significantly difference at $p< .001$, between the performance of the students from both schools. While the means of the control groups were 13.32 and 9.44, the means of the experimental groups were 17.18 and 15.75. This can be interpreted that there was a significant difference between the reading skill achievement of the students from the experimental groups and the control groups in relation to the synonym and antonym type items.

Furthermore, the comparison of means on true/false showed that there was a significant difference at $p< .001$, between the performances of the students from both schools. While the means of the control groups were 3.5 and 2.79, the means of the experimental groups were 4.5 and 4.08. This revealed that there was a significant difference between the reading skill achievement of the students from the experimental groups and the control groups in relation to the true/false.

Furthermore, the results concerning the cloze type items indicated that there was a significantly difference at $p< .05$, between the performance of the students from both schools. Whereas the means of the control groups were 12.30 and 12.64, the means of the experimental groups were 15.18 and 14.95. This revealed that there was a significant difference between the reading skill achievement of the students from the experimental groups and the control groups in relation to the cloze procedures.

The results concerning to the skimming indicated there was a significantly difference at $p< .05$, between the performance of the students from both schools. The means of the control groups were 3.28 and 2.63, the means of the experimental groups were 4.5 and 4.18. These results showed that there was a significant difference between the reading skill achievement of the students from the experimental groups and the control groups in relation to skimming.

Finally, the results concerning to the matching indicated there was a significantly difference at $p< .05$, between the performance of the students from both schools. The means of the control groups were 3.61 and 3.68, the means of the experimental groups were 4.48 and 4.01. It can be said that there was a significant difference between the reading skill achievement of the students from the experimental groups and the control groups in relation to the matching.

The current study pointed out that the reading skill achievement of the students by cooperative learning is better than that of the students by other learning method. Therefore, cooperative learning especially jigsaw method and think-pair-share method can significantly develop the reading skill of the EFL students.

Recommendations and Suggestions

It is obvious that the reading skill is becoming important in language learning nowadays. A child’s reading skills are important to their success in school as they will allow them to access the breadth of the curriculum and improve their communication and language skills. In addition, reading can be a fun and imaginative time for children, which opens doors to all kinds of new worlds for them.

Ulla (2017) stated that jigsaw method could improve the students’ reading comprehension of narrative text of the eighth grade students of MTS Tarqiatul Himmah Pabelan Semarang district in the academic year 2016/2017. Mutiara and Bugis and Hanapi (2018) pointed that the students were active in the class using Think Pair Share method in terms of sharing ideas, asking and answering questions.

The teachers should use jigsaw method and think-pair-share methods to improve the students’ reading comprehension and should be recognized the advantages of jigsaw method and think-pair-share method. Some of the writers think that jigsaw method and think-pair-share method are the frequently used in learning strategy and the teacher should stimulate the students by conducting jigsaw method and think-pair-share method in learning English. By using these methods, the teachers should develop students’ deeper understanding of the text. On the basis of these findings, recommendations are offered as follows:

i. This study deals with only EFL students at the high school level. As cooperative learning (jigsaw method and think-pair-share method) is suitable to all levels of education, further research therefore should be conducted at other levels, especially at the middle school level or at the university level.

ii. This study was limited at two selected high schools in Kyaukse Township, Mandalay Region. To be more representative, further studies should be done in other states and regions.

iii. In this study, the content area was limited to Unit 9: Earthquakes and Unit 10: Traditional Medicine from Grade Nine Textbook. To get more generalized results, more studies are needed to conduct in other content areas of other Textbook, especially Grade Ten Textbook.

iv. Cooperative learning (jigsaw method and think-pair-share method) is also an effective method for other subjects such as Mathematics, Science, Social studies and so on. Therefore, further research should be extended to investigate in those subjects.

v. For those who are going to conduct the study that will use cooperative learning, are recommended to apply the methods in improving other skills such as writing, listening and speaking.

vi. As students' attitudes are very important in learning English, further studies should be conducted to investigate students' attitudes toward the use of cooperative learning in developing the reading skill.

vii. The current study lasted for 6weeks (6 weeks treatment and 1 week for test). It may be beneficial to conduct the study over a longer period of time as students can become comfortable in incorporating the strategy into their habits.

viii. Moreover, the small sample size limits the extent to which the conclusions can be generalized. Therefore, further studies and research need to use a great number of subjects in order to obtain more reliable results.

Conclusion

The main purpose of the study was to develop the reading skill of EFL students through cooperative language learning. In language teaching, reading was one of the best ways to promote understanding all the facts concerning the whole world. In this study, cooperative learning is one of the best trends in the field of language teaching and learning. Therefore, cooperative learning was selected to develop the reading skill of EFL students. The importance of reading skill was highlighted in the literature review and also the findings of the study showed that students who were taught with cooperative learning methods had better achievement than those who were not. Furthermore, the results of this study revealed that as regard with the teaching to develop the reading skill, using cooperative learning method was better than the conventional teaching.

To sum up, in the context of EFL (English as a Foreign Language), the ultimate aim of the language is to use it as a means of communication. The reading skill is given special status in language teaching as equally as writing skill, listening skill and speaking skill. Therefore, in order to develop the reading skill, the effective language teaching materials and syllabus designed to reflect the theories of language and accompanied with the most suitable teaching methods are vitally needed. In this study, it was found that the achievement of the students taught by Cooperative Learning was better than that of the students who were not taught by it. Therefore, it can be concluded that Cooperative Learning could make them more familiar with each other and also develop their reading skill.

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A STUDY OF DIPLOMA IN TEACHER EDUCATION PROGRAMIN MYANMAR

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Abstract

The main purpose of this paper is to study Diploma in Teacher Education (DTEd) program in Myanmar. Literature survey, one of the descriptive methods, was used in this paper. Literature survey was mainly conducted to collect relevant data for this study. There are 24 Education Colleges and 12 Departments under the Ministry of Education. The necessary data for this study were collected by studying books form libraries, theses, reports, journals and downloading related data from internet besides 3 Education Colleges and Department of Higher Education The obtained data were analyzed, synthesized and presented as the research findings. It was found that there are purpose of DTEd program, management and control, type, level and duration of the program, admission requirements, application and selection procedure, registration fees, daily program, curriculum and credit unit of first year and second year, practice teaching, assessment system of the DTEd program and awards and appointment of the DTEd students. After completion the course, the trainees are awarded Diploma in Teacher Education (DTEd). These results indicate that DTEd program is a two-year diploma course, the longest teacher education course, available for qualifying as a primary school teacher.

Keywords; Education, Teacher Education, Diploma

Introduction

An effective teacher is not just born; they are made over time through training and experience. Teacher education is crucial in this process (Thompson & Power, 2015).Quality training must therefore be assured by teacher education institutions and other training programs sanctioned by the Ministry of Education (Karan &Morren, 2013). Teacher education and teachers themselves are a crucial part of educational change and development (Rehmani, 2006).

In order to build human resources in the field of education, training must be done both at the pre-service and in-service levels. Pre-service training refers to training individuals before they become teachers (Nyuyet & Ha, 2010). To know the efficiency of teacher education programs in our country, we should study teacher education program that is necessary for the improvement of teachers' proficiency and competency. For that reason, a study of the Diploma in Teacher Education (DTEd) program was conducted.

Objectives of the Study

1. to present the DTEd program in Myanmar
2. to offer some suggestions concerning the DTEd program in Myanmar
3. to serve as a useful paper for further research in the field of teacher education

Definition of Key Terms

Education : Education is a system process through which a child or an adult acquires knowledge, experience, skill and sound attitude. It makes an individual civilized, refined cultured and educated(Parankimakil, 2014).

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Teacher Education : Teacher Education is wider than teacher-training in that it includes not simply a teacher's vocational training but also whatever general post-secondary education he has that contributes to his growth as a person regardless of his future profession (Rowntree, 1981).

Diploma : Diploma is a course of study at a college or university. e.g. a two-year diploma course (Oxford Advanced Learner's Dictionary, 2015).

Scope

This research is intended to study the DTEd program offered by Education Colleges in Myanmar. The purposes of DTEd program, management and control, type, level and duration of the program, admission requirements, application and selection procedure, registration fees, daily program, curriculum and credit unit of DTEd course, practice teaching, assessment system of the DTEd program and awards and appointment of the DTEd students are emphasized.

Review of Related Literature

Meaning and Aims of Education

Different educationists' thoughts from both Eastern and Western side have explained the term education. Various educationists have given their views on education. Some important definitions are:

1. **Mahatma Gandhi** – By education mean an all-round drawing out of the best in man – body, mind and spirit.
2. **Rabindranath Tagore** – Education enables the mind to find out the ultimate truth, which gives us the wealth of inner light and love and gives significance to life.
3. **Nelson Mandela** – Education is the most powerful weapon which you can use to change the world (Parankimakil, 2014).

Aims give direction to activities. Aims of education are formulated keeping in view the needs of situation. Human nature is multisided with multiple needs, which are related to life. Educational aims are correlated to ideals of life (Parankimakil, 2014).

1. **Knowledge Aim**. Knowledge is essential for intellectual development, better adjustment in life, social efficiency, character formation and spiritual upliftment.
2. **Vocational Aim.** Self-preservation is the individual's first need. So education should enable one to earn his bread and butter. Most of the parents send their children to school mainly with this aim in mind.
3. **Social Aim.** Social aims of education include creation of the sense of citizenship, development of a sense of community involvement, protection and increase of culture and civilization, increasing consciousness of other cultures, developing national integration and international understanding (Parankimakil, 2014).

Meaning and Nature of Teacher Education

Teacher education encompasses teaching skills, sound pedagogical theory and professional skills.

Teacher Education = Teaching Skills + Pedagogical theory + Professional skills.

Teacher education has become differentiated into stage-specific programmes. This suggests that the knowledge base is adequately specialized and diversified across stages, which should be utilized for developing effective processes of preparing entrant teachers for the functions which a teacher is expected to perform at each stage. It is a system that involves an interdependence of its inputs, processes and outputs (Kilpatric, 2009).

Historical Background of Teacher Education in Myanmar

The teacher education started as the monastic system in Myanmar. The Christian Missionaries introduced the teacher education during the First Anglo-Burmese War (Kaung, 1963, cited in KoKoAung, 2014). During (1853-1885) teacher education was given in the Normal Schools. Most of the Normal Schools were opened by the Christian Missionaries. The first Normal Schools were established at Hinthata (henzata) and Pathein (bassien) to train primary school teachers during the year 1862-63. In 1886-87, there were four Normal Schools which were opened by the government (three for men teachers in Yangon, Sittwe and Mawlamyine; one for women teachers in Yangon), and three Missionary Normal Schools for women teachers (Kaung, 1963, cited in KoKoAung, 2014).

After the establishment of Yangon University in 1920, a separate Education Department came into being and Diploma Classes were conducted beginning from 1921(Han Aye, 2002). In 1925-26, there were six Missionary Normal Schools aided by the Government (Kaung, 1963, cited in KoKoAung, 2014). Short courses for Middle School teachers were also offered during October Holidays (1928). In 1931, a Teacher Training College (TTC) was established with the former Head of Education Department of Yangon University, Dr. Clark as its principal. Normal schools were abolished and all English and Anglo Vernacular teachers (except KG teachers) were trained at the Teachers Training College (TTC) (Han Aye, 2002).

In 1941, all schools of Yangon were closed because of the declaration of War by the Japanese. And then, the schools in Taninthayi Division were closed. Only the schools in Ayeyarwady Delta Region were opened until 31st March, 1942 (Kaung, 1963, cited in KoKoAung, 2014). In the post-war period, the UTTC courses were dropped and were handed over to the State Teacher Training College (STTC) in 1947. Only BEd classes were conducted at the former TTC. Meanwhile, University of Yangon (Yangon University was reorganized on a unitary basis. All the constituent colleges were converted into Faculties under the control of Yangon University. So, the TTC became Faculty of Education in 1946-1947 AY (Han Aye, 2002). The B.A.Ed course was opened in 1950 to those who passed the Intermediate Examination of the Faculty of Education. The reasons for the introduction of this course were

1. to produce trained teachers with a professional degree and
2. to provide more teachers, which was a felt need at the time (Han Aye, 2002).

To meet the urgent need for more teachers created by the expansion of education, a TTC in Mandalay and Teacher Training Schools (TTSs) in Mawlamyine, Pathein, Kyaukphyu, and Meiktila were opened (1955). More TTCs and TTSs totaling 19 have been opened since then to meet the raising demands and needs (Han Aye, 2002). In October 1964, the New System of University Education was implemented according to the new University Education Law (Han Aye, 2002).

Under the new system, the Institute of Education offered a five-year BEd degree course for those who had passed the matriculation examination. At the same time, a one-year Dip.Ed. course for university graduates and a one-year BEd course for those who passed B.A.Ed. or Dip.Ed. continued to be offered until their cessation in 1966-67 and 1969-70 AY respectively. From 1970-71 academic year, MEd courses for deserving in-service teachers with Diplomas in Education (DT/Dip.Ed.) and BEd degree were offered to upgrade the quality of the teaching force (Han Aye, 2002). In 1975-76, a bridge system for Junior Teachers to attend the course beginning from the third year was introduced. Since 1980-81, the duration of the course has been reduced to one-year and the course came to be intended mainly for in-service graduates (Junior Teachers and Senior Teachers) (Han Aye, 2002).

According to a felt need for in-service training of Upper Myanmar, Institute of Education, Mandalay was established in 1992. Beginning from 1998-99 academic year, MEd degree course were also conducted (Han Aye, 2002). In 1998, the TTCs and TTSs have been upgraded to Education Colleges (မြကျော်၊ ၂၀၁၄). According to the Education Promotion Programmes which begin in 1998, (5) Teacher Training Colleges were upgraded to Education Colleges (Level I) and (14) Teacher Training Schools were upgraded to Education Colleges (Level II) (Han Aye, 2002). In 2002, Daewi Education College (Level I) was opened. On January 16, 2004, (14) Education Colleges (Level II) were upgraded to Education Colleges (Level I). During 2013-2016, 5 Education Colleges (Level I) were opened. All Education Colleges became Education Colleges (Level I). Institutes of Education (IOE) were upgraded to Universities of Education on June 5, 2014 (မြကျော်၊ ၂၀၁၄). IOE also offer higher degree courses such as Bachelor of Education, Master and PhD courses (Suzuki, 2007).

Research Method

Design

In order to collect the relevant data for this paper, literature survey which is one of the descriptive methods was used (Gay, 1987).

Procedure

Literature survey was mainly conducted to collect relevant data for this study. The necessary data for this study were collected by studying books, theses, reports and journals form libraries, and downloading related data from internet besides 3 Education Colleges (Mandalay Education College, Taunggyi Education College and Sagaing Education College) and Department of Higher Education (DHE). Then, the obtained data were analyzed, synthesized and presented as the research findings.

Findings

Purposes of the Program

The purposes of the DTEd program is as follows:

1. to get the chances to study primary and middle teacher education for the students who pass the matriculation examination,
2. to fulfill and serve those who pass the diploma in teacher education as necessary primary teachers in basic schools and
3. to get the opportunities for the local youths serving as the primary teachers according to the divisions and states.

Management and Control

According to the education system, the Ministry of Education was organized to manage and supervise all the education sectors. Under the Ministry of Education, there were (10) departments including Department of Educational Planning and Training (DEPT) in 1998. In 2013, there were (7) departments including Department of Teacher Education and Training (DTET) and in 2016, there are (12) departments including Department of Higher Education (DHE). DEPT and DTET were responsible for formulation, implementation, monitoring and evaluation of the education plans, programs and projects as well as supervision and management of teacher education colleges. Nowadays, Department of Higher Education is responsible for teacher education programs (မြကျော်၊ ၂၀၁၈).

Type, Level and Duration of the DTEd Course

Diploma in Teacher Education course in Myanmar is full-time, regular and pre-service one. Education Colleges offer pre-service course leading to diploma. The duration of DTEd course is two academic years. Each academic year is divided into two semesters. The semesters in the academic years are referred to as semester I and semester II. The candidates have to attend and have to sit for a written examination at the end of each semester.

Admission Requirements

1. The applicant must be a Myanmar citizen.
2. The applicants must have passed the Basic Education High School examination with grade ‘A’ from batch 1/98 to batch 3/00 and the matriculation examination from batch 4/00 to batch 23/18.
3. The applicants must be under 24/25 years of age on the fixed date of application from batch 1/98 to batch 10/05 and must be under 22 years of age on the fixed date of application batch 11/06 to batch 23/18.
4. Beginning from batch 1/98, the applicant must give achievement recommendation by the Headmaster/ Headmistress of the school the applicant has been attended, the copy of list of marks and three passports together with application form. From batch 17/12, the copy of list of family members and the copy of identity card are needed. From batch 20/15, a medical certificate is needed. Except from batch 10/05 to batch 19/14, the applicant must give moral recommendation by the commission.
5. From batch 10/05 to batch 19/14, the applicants (woman) must be unmarried. Except batch 10/05 to batch 19/14, the applicants (woman) who are married must not be pregnant. In the admission requirements of Batch 23/18, the applicant (woman) is allowed to rest the course if she can show the pregnant certificate during the training course. If the applicant is either ill or pregnant, he/she must report the medical certificate and he/she is allowed to attend the next academic year with his/her own plan.
6. From batch 12/07, the applicant must attend to the education college which is sent by authority.
7. The applicant must be able to serve anywhere within the country.

Application and Selection Procedure

1. The applicant must send three sets of applications to the respective State/Division Education Office or Joint State/Division (from batch 1/98 to batch 19/14), two sets of applications to the respective State/Division Education Office or Joint State/Division (from batch 20/15 to batch 21/16) and two sets of applications to the respective Education College (from batch 22/17 to batch 23/18) together with each passport as in admission application assigned.
2. From batch 1/98 to batch 9/04, the applicant who can be able to serve anywhere within the country will be selected. From batch 10/05 to batch 23/18, the applicant will be selected by means of their subject wise marks in matriculation examination.
3. From batch 1/98 to batch 9/04, the applicant will be examined at the respective State/Division Education Office on the assigned day. From batch 10/05 to batch 23/18, the candidate must reach to the education college earlier than one or two days before the course starts. There will be a physical examination of student teacher in the respective education college. If the physical character does not find him suitable to the teaching profession, the candidate will be sent back.
4. From batch 1/98 to batch 17/12, a list of applicants to attend will be announced in the respective State/ Division/ Township Education Office.
5. From batch 10/05 to batch 23/18, the order, a list of applicants to attend the course, will be sent to the candidate selected.
6. The candidate to the diploma course must give a medical certificate of the respective township.
7. The candidate must be able to attend the appointed education college together with documents needed.
8. From batch 10/05 to batch 23/18, the candidate must complete the agreement that he can serve anywhere within the country.

Registration Fees for the Course

All of the DTEd students are required to register at the beginning of the academic year (AY). The fees for DTEd course (batch 23/18) is as follows:

Registration fees	100ks
Admission fees	100ks
Hostel fees	300ks
School fees	6000ks
Sport fees	100ks
Laboratory fees (for science)	600ks
Laboratory fees (for art)	300ks
Examination fees	300ks
Library fees	300ks

Curriculum and Credit Unit of DTEd Course

Curriculum and credit unit of DTEd course from 1998-99 AY to 2002-03 AY is described in Table 1.

Table 1: Credit Unit of First Year and Second Year Curriculum (from 1998-99 AY to 2002-03 AY)

Sr. No	Subjects	Credit Unit (first year)		Credit Unit (second year)	
		First semester	Second semester	First semester	Second semester
1	Educational Theory	4		4	
2	Educational Psychology	4		4	
3	Methodology				
	(a) Myanmar	3		3	
	(b) English	3		3	
	(c) Mathematics	3		3	
	Natural Science and Social Science (first year)/General Science (second year)	3		3	
	General Studies and Social Studies (first year)/Geography + History (second year)	3		3	
	Academic Subjects				
	(a) Myanmar				
	(b) English				
4	(c) Mathematics		4		4
	(d) Physics/History		4		4
	(e) Chemistry/Geography		4		4
	(f) Biology/Economic		4		4
	Co-curricular Subjects		4		4
	(a) Physical Education		4		4
	(b) Industrial Arts/				
5	Domestic Science	1	1	1	1
	(c) Agriculture	1	1	1	1
	(d) Fine Arts				
	(e) Music	1	1	1	1
		1	1	1	1
		1	1	1	1
	Total	28	29	28	29

ရင်းမြစ်။ပညာရေးဝန်ကြီးဌာန (၂၀၀၂)

Curriculum and credit unit of DTEd course from 1998-99 AY to 2002-03 AY is described in Table 2.

Table 2Credit Unit of First Year and Second Year Curriculum (from 2003-04 AY to 2018-19 AY)

Sr. No	Subjects	Credit Unit (first year)		Credit Unit (second year)	
		First semester	Second semester	First semester	Second semester
1	Educational Theory	2	2	2	2
2	Educational Psychology	2	2	2	2
3	Methodology				
	(a) Myanmar	2	2	2	2
	(b) English	2	2	2	2
	(c) Mathematics	2	2	2	2
	(d) Natural Science and Basic Science (first year)/Basic Science (second year)	2	2	2	2
	(e) Geography and History (first year)	2	2		
	(f) Geography (second year)			2	2
	(g) History (second year)			2	2
4	Academic Subjects				
	(a) Myanmar	2	2	2	2
	(b) English	2	2	2	2
	(c) Mathematics	2	2	2	2
	(d) Physics/History	2	2	2	2
	(e) Chemistry/Geography	2	2	2	2
	(f) Biology/Economic				
5	Co-curricular Subjects				
	(a) Physical Education	1	1	1	1
	(b) Industrial Arts/ Domestic Science	1	1	1	1
	(c) Agriculture	1	1	1	1
	(d) Fine Arts	1	1	1	1
	(e) Music	1	1	1	1
	ICT	-	-	-	-
	Total	29	29	31	31

ရင်းမြစ်။ပညာရေးစီမံကိန်းနှင့်လေ့ကျင့်ရေးဦးစီးဌာန (၂၀၁၂)

Daily Program for the Trainees of DTEd Course

Daily program for the students is described in Table 3.

Table 3Daily Program for the DTEd Students

Period	Time	Activity
1	5:00 am	Getting up
2	6:00-6:45 am	Taking Physical Exercise
3	7:00-7:45 am	Attending co-curricular classes
4	7:45-8:00 am	Taking bath
5	8:00-9:00 am	Breakfast
6	9:30-12:30 am	Attending morning classes
7	12:30-1:00 pm	Lunch
8	1:00-3:15pm	Attending afternoon classes
9	3:15-4:00 pm	Attending co-curricular classes
10	4:00-5:00 pm	Dinner
11	5:00-7:00 pm	Leisure time
12	7:00-10:00 pm	Night study
13	10:00 pm	Going to bed

Source: From UNICEF (2013)

Practice Teaching

Concerning the teaching practice, the prospective primary school teachers have to do practical teaching in local school or attached school at the end of first year course of education colleges. They conduct their teaching practice in the selected primary, middle and high schools of their township for about two months (ပညာရေးစီမံကိန်းနှင့်လေ့ကျင့်ရေးဦးစီးဌာန၊ ၂၀၁၀). The program of practice teaching is helped and supported by the township education officers and relevant principals of primary, middle and high schools. The placements are designed so each student is supervised and mentored by the class teacher and monitored and assessed by the head teacher and the Township Education Officer (TEO) or Assistant TEO (ATEO). Assessment of the placements is through the TEOs checklist and the student teachers' post-practicum report based on daily journals. At the end of a placement, the teacher educators receive both the checklists and reports.

From 1998-99 AY (batch 1/98) to 2001-02 AY (batch 6/01), the trainees had to take practice teaching at the end of the first semester of the first year for the first time and that of the second year for the second time. From 2002-03 AY (batch 7/02) to 2013-14 AY (batch 18/13), they had to take practice teaching at the end of the first year for the first time and at the end of the first semester of the second year for the second time. From 2014-15 AY (batch 19/14) to 2018-19 AY (batch 23/18), they had to take practice teaching at the end of the first year for the first time and at the end of the second year for the second time. After the completion of practical teaching, the trainees have to send the evaluation records to the respective education college in time(ပညာရေးစီမံကိန်းနှင့်လေ့ကျင့်ရေးဦးစီးဌာန၊၁၉၉၈).

Assessment System

Since the beginning of 1998-99 AY, an attendance of 90% is the requirement for permission to sit for the examination (ပညာရေးစီမံကိန်းနှင့်လေ့ကျင့်ရေးဦးစီးဌာန၊ ၂၀၁၀).From 2017-18 AY, an attendance of 75% is the requirement for permission to sit for the examination (အဆင့်မြင့်ပညာဦးစီးဌာန၊ ၂၀၁၇).From 1998-99 AY to 2016-17 AY, the question papers for tutorial are set up by a group of teacher educators in the respective education college. For mid-term test and final examination of first year and second year, the question papers for all subjects are set up by the educational personnel in the respective Department (DEPT or DTET or DHE). From 2017-18 AY to 2018-19 AY, the question papers for the mid-term test and final examination of first year are set up by teacher educators in the respective education college, and that of second year are set up by Department of Higher Education. The assessment system for assignment is as follow.

1.	Introduction	0.5 marks
2.	Objective	0.5 marks
3.	Presentation	4 marks
4.	Conclusion	0.5 marks
5.	Suggestion	3 marks
6.	References	0.5 marks
7.	Appendix	0.5 marks
8.	Format from 1 to 7	0.5 marks
	Total	**10 marks**

Since the beginning of 1998-99 AY, the credit system with modular approach has been introduced and it is applied to all Education Colleges. The proportion of marks prescribed for each education subject and academic subject are shown in Table 4.

Table 4Proportion of Marks for Assessment of Educational Subjects and Academic Subjects

No	Classification	Percentage	
		1998-99 AY to 2009-2010 AY	**2010-11 AY to 2018-19 AY**
1	Tutorials (first semester + second semester)	30	20
2	Assignments (first semester + second semester)	30	20
3	Final examination (first semester + second semester)	40	60
	Total	**100**	**100**

ရင်းမြစ်။ပညာရေးဝန်ကြီးဌာန (၂၀၀၂) နှင့်ပညာရေးဝန်ကြီးဌာန (၂၀၁၉)

For co-curricular subjects, a hundred marks are mostly based on the daily routine, practical tasks and final examination. Marks allocation for co-curricular subjects from 1998-99 AY to 2018-19 AY is shown in Table 5.

Table 5: Marks Allocation for Co-curricular Subjects

No	Examination	Given Marks	
		PT	**Co-curricular Subjects (expect PT)**
1	Daily routine (first semester + second semester)	40	30
2	Practical (first semester + second semester)	30	40
3	Final examination (first semester + second semester)	(40 x 0.75= 30)	(40 x 0.75= 30)
	Total	**100**	**100**

ရင်းမြစ်။ပညာရေးဝန်ကြီးဌာန (၂၀၁၂)

From 1998-99 AY to 2018-19 AY, assigned credit unit in accordance with the attendance is presented in Table 6.

Table 6Credit Unit with Attendance

No	Percentage of Attendance	Earned Credit Unit	
1	90% - 100%	4	1998-99 AY to
2	85% - 89%	3	2002-03 AY
3	80% - 84%	2	
4	75% - 79%	1	
5	0% - 74%	0	
1	95% - 100%	4	2003-04 AY to
2	90% - 94%	3	2018-19 AY
3	85% - 89%	2	
4	80% - 84%	1	

ရင်းမြစ်။ပညာရေးဝန်ကြီးဌာန (၂၀၀၂) နှင့်ပညာရေးဝန်ကြီးဌာန (၂၀၁၉)

From 1998-99 AY to 2018-19 AY, changing grade number from written, tutorial, assignment and practical marks each subject is presented in Table 7.

Table 7 Changing Grade Number from Written, Tutorial and Assignment Marks

No	Marks range	Grade No. Assigned	Meaning	
1	0-49	0	Fail	
2	50-59	1	Pass	1998-99 AY
3	60-69	2	Good	to
4	70-79	3	Very Good	2007-08 AY
5	80-100	4	Excellent	
1	0-49	1	Resist	
2	50-59	2	Pass	
3	60-64	2.5	Pass	2008-09 AY
4	65-69	3	Pass	to
5	70-74	3.5	Pass	2016-17 AY
6	75-79	4	Pass	
7	80-84	4.5	Pass	
8	85+	5	Qualified	
1	0-34	1	Fail	
2	35-49	2	Moderation	2017-18 AY
3	50-64	3	Pass	to
4	65-74	4	Qualification	2018-19 AY
5	75+	5	Distinction	

ရင်းမြစ်။ပညာရေးဝန်ကြီးဌာန (၂၀၀၂)၊ ပညာရေးဝန်ကြီးဌာန (၂၀၁၂) နှင့်အဆင့်မြင့်ပညာဦးစီးဌာန (၂၀၁၈)

From 1998-99 AY to 2018-19 AY, assigned specification based on grade point average is presented in Table 8.

Table 8 Assigned Specification Based on Grade Point Average

No	GPA	Specification	
1	3.5 - 4.0	Distinctions	
2	2.5 - 3.49	Good	1998-99 AY to
3	1.5 - 2-49	Pass	2002-03 AY
4	1 - 1-49	Conditional Pass	
1	4.5 - 5	Distinctions	
2	3.5 - 4-49	Very Good	2003-04 AY to
3	2.5 - 3.49	Good	2018-19 AY
4	2 - 2.49	Pass	

ရင်းမြစ်။ပညာရေးဝန်ကြီးဌာန (၂၀၀၂) နှင့်ပညာရေးဝန်ကြီးဌာန (၂၀၁၂)

Awards and Appointment

After the completion of the one-year pre-service course, the candidates are awarded Certificate in Education and appointed as Primary Teachers at the same time. Those who pass the first year course must attend the second year course. The candidates who pass the second year course are awarded Diploma in Teacher Educationand appointed as Primary Teachers. Up until 2014 (batch 18/13), ECs also offered a one-year Certificate in Teacher Education, which provided the Y1 diploma curriculum, and qualified new teachers for primary school level only (UNESCO, 2016).

Those who finished the course are obliged to serve anywhere within the country. Concerning the appointment procedure, those who finished the course colleges are obliged to serve as school teachers for a minimum of five years after training. If they are absent, they must compensate 40000 kyats to the country (from batch 1/98 to batch 19/14), 50000 kyats (from batch 20/15 to batch 21/16) and 300000 kyats (from 22/17 to batch 23/18).

From batch 1/98 to batch 16/11, the scholar are obliged to serve as school teachers for a minimum of ten years after training. If they are absent, they must compensate two times of contribution including 40000 kyats (from batch 1/98 to batch 16/11) to the country. Beginning from batch 17/12, the scholarship program stopped (Department of Educational Planning and Training, 2012). From batch 20/15 to batch 23/18, all student teachers get 30000 kyats for the contribution. If the student teachers are absent to serve as school teachers, they must compensate two times of contribution including 50000 kyats (batch 20/15 to batch 21/16) and the contribution including 300000 kyats (batch 22/17 to batch 23/18) to the country. After completion of the two-year course, the qualified students can attend B.Ed. course from third year.

Conclusion

Discussion

The main purpose of this study was to study the DTEd program in Myanmar. Regarding the management and control, there were Department of Educational Planning and Training (1998-99 AY to 2012-13 AY), Department of Teacher Education and Training (2013-14 AY to 2015-16 AY) and Department of Higher Education (2016-17 AY to 2018-19 AY) for the responsibilities for all aspects of teacher education. In the role of duration of training of the course, the student teachers had to attend four months for the first semester and four months for the second semester. Sometimes, they had four months or fifteen days or two months for off-days between two semesters (from 1998-99 AY to 2018-19 AY). Because of four months for off-days, there is gap in time between two semesters. Because of fifteen days or two months for off-days, there is no gap in time between two semesters. It is easy to recall the lesson that learnt the first semester of each academic year.

Regarding the admission requirements for the course, there are changes according to the admission guide-books. Regarding the fees for the course, total fees for science stream is 7800 kyats and 7500 kyats for art stream. In the role of daily program for the DTEd students, the student teachers have to take daily activities regularly. This makes the student teachers' body healthy and fit. Regarding the curriculum, educational subjects, academic subjects and co-curricular subjects are taught together in both semesters (from 2003-04 AY to 2018-19 AY). This makes the student teachers interesting in teaching-learning process.

In the role of practice teaching and curriculum, the student teachers had to take practice teaching at the end of the first semester of each academic year, or sometimes at the end of the whole academic year. Taking practice teaching at the end of first year/second year made the student teachers' practice teaching skill efficient as they learnt the educational subjects and academic subjects within the academic year. It is efficient for practice teaching because the student teachers learnt the educational subjects and academic subjects at the whole academic year. Regarding the change of attendance of 90% to 75%, the student teachers get more opportunities to study other subjects and to carry out the activities.

Regarding awards and appointment of the DTEd students, the trainees who complete first year course are awarded Certificate in Teacher Education until batch 18/13. The teachers can still get job opportunities for their life by offering Certificate in Teacher Education. The candidates who pass the second year course are awarded Diploma in Teacher Education. For those who are awarded Diploma in Teacher Education can become middle school teachers (Junior Teacher, JT) without attending the Correspondence Course in Middle School Teachers Training. By completing the confession, percentage of drop-out of school teachers can reduce. This may contribute as a part in the role of building the modern and developing country with education.

Suggestions

The applicants who have passed the matriculation examination attended DTEd course. After the completion of the course, the candidates are awarded Diploma in Teacher Education and appointed as Primary Teachers. For a primary school teacher (Primary Teacher, PT) to be promoted to a middle school teacher (Junior Teacher, JT), they need to complete a further degree-level course. The majority of teachers seemingly complete a degree-level correspondence course post their diploma through the University of Distance Education (UDE).

Although they studied the academic subjects in the two-year teacher training course, they attend the correspondence course again from first year. As the school that he/she serves as school teacher is far from the location of the University of Distance Education, it is impossible to do the practical task (for science subjects). Thus they choose the art subjects although they studied the science subjects in the training course. Because of the unconformity of the subject specialization, teaching-learning process is not effective. Thus the subject specialization in the DTEd course should be conformable with the subject specialization in the University of Distance Education. The trainee who finished the teacher training course in education college studies for two years at the diploma in teacher education course and for three or four years at the University of Distance Education to promote or become a middle school teacher. Increasing the duration of training and offering the trainees degree in stead of diploma will solve the condition of the unconformity of the subject specialization and the duration that lasts for six years to get degree. Thus the duration of training should be increased and the course should be upgraded.

Student teachers should have the option to study specific subjects. By selecting the subject specialization that the student teachers want to study, this makes them interesting on their specialized subjects and their proficiency with their subject specialization may improve. This proficiency can contribute the improvement of their teaching-learning process. The period of the practice teaching for student teachers matches with the October examination in basic education. This means regular lessons are not being carried out and student teachers are therefore not able to practice teaching. The period of the practice teaching should be changed. Concerning the award and appointment, the student teachers that finished the course are young. Thus, the duration of training should be increased to become qualified and complete teachers.

Conclusion

The aim of this paper is to study the DTEd program in Myanmar. The objectives of this paper are (a) to present the DTEd program in Myanmar, (b) to offer some suggestions concerning the DTEd program in Myanmar, and (c) to serve as a useful paper for further research in the field of teacher education. Regarding the management and control, there were three departments (Department of Educational Planning and Training, Department of Teacher Education and Training and Department of Higher Education) for the responsibilities for all aspects of teacher education. In the role of type, level and duration, diploma in teacher education program is pre-service teacher training course leading to diploma. The course is a two-year training course and there are two semesters in an academic year. The different admission requirements, fees for the course, curriculum and credit unit are described.

In the role of practice teaching, they conduct the practice teaching in the selected primary, middle and high schools of their township for about two months. Regarding the assessment system of the DTEd program, the percentage of attendance that requires for permission to sit for the examination is stated. The assessment system of the DTEd program is stated from 1998-99 AY to 2018-19 AY. Regarding awards and appointment of the DTEd students, the trainees who complete first year course are awarded Certificate in Teacher Education and those who complete the second year course for Diploma in Teacher Education.

The findings of this study contribute that ECs and DTEd program have a key role to play in the reform of teacher education in Myanmar at the pre-service stage. So pre-service teacher education program such as DTEd program is necessary for the improvement of teachers' proficiency and competency. Findings of this study will contribute to a consideration measure for the improvement of the program and for further research concerning the teacher education program.

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ဆရာအတတ်ပညာနှင့်လေ့ကျင့်ရေးဦးစီးဌာန။ (၂၀၁၅)။ ***ဝင်ခွင့်လမ်းညွှန်***။ နေပြည်တော်။

ပညာရေးဝန်ကြီးဌာန။ (၂၀၁၆)။ ***ပညာရေးဝန်ကြီးဌာန၏ (၂၀၁၁ခုနှစ် မှ ၂၀၁၅ခုနှစ်အထိ) လုပ်ငန်းဆောင်ရွက်ချက်မှတ်တမ်း***။ ရန်ကုန်၊ ဇေရာဝဏ်ပုံနှိပ်တိုက်။

ပညာရေးဝန်ကြီးဌာန။ (၂၀၁၃)။ ***ဘက်စုံလွှမ်းခြုံနိုင်သောပညာရေးကဏ္ဍ လေ့လာသုံးသပ်ရေး လုပ်ငန်း အစီရင်ခံစာ၊ အတွဲ–၁***။ရန်ကုန်။

ပညာရေးဝန်ကြီးဌာန။ (၂၀၁၄)။ ***ဘက်စလွှမ်းခြုံနိုင်သောပညာရေးကဏ္ဍလေ့လာသုံးသပ်ရေး လုပ်ငန်း အစီရင်ခံစာ၊ အတွဲ–၂***။ ရန်ကုန်။

ပညာရေးဝန်ကြီးဌာန။ (၂၀၀၅)။ ***အခြေခံပညာကဏ္ဍ ၂၀၀၅ခုနှစ် အမျိုးသားပညာရည်မြင့်မားရေး နှီးနှောဖလှယ်ပွဲသို့ တင်ပြသည့် စာတမ်းများ***။ ရန်ကုန်။

ပညာရေးဝန်ကြီးဌာန။ (၂၀၀၂)။ ***အခြေခံပညာကဏ္ဍ အမျိုးသားပညာရည်မြင့်မားရေး နှီးနှောဖလှယ်ပွဲသို့တင်ပြသည့်စာတမ်းများ***။ရန်ကုန်။

ပညာရေးစီမံကိန်းနှင့်လေ့ကျင့်ရေးဦးစီးဌာန။ (၂၀၁၂)။ ဆရာအတတ်ပညာကဏ္ဍ အဆင့်မြင့်တင်ရေး လုပ်ငန်းဆွေးနွေးပွဲ၊ နေပြည်တော်။

ပညာရေးဝန်ကြီးဌာန။ (၂၀၀၄)။ ***အခြေခံပညာကဏ္ဍ (၂၀၀၃–၂၀၀၄) အကောင်အထည်ဖော်မှုအစီရင်ခံစာ***။ ရန်ကုန်။

ပညာရေးစီမံကိန်းနှင့်လေ့ကျင့်ရေးဦးစီးဌာန။ (၂၀၁၀)။ ပညာရေးကောလိပ်လုပ်ငန်းခွင်အကြို ဆရာအတတ်ပညာသင်တန်းသားများ လက်တွေ့တန်းပြလေ့ကျင့်ရေးလမ်းညွှန်။

ပညာရေးစီမံကိန်းနှင့်လေ့ကျင့်ရေးဦးစီးဌာန။ (၁၉၉၈)။ ***ဝင်ခွင့်လမ်းညွှန်***။ ရန်ကုန်။

ပညာရေးစီမံကိန်းနှင့်လေ့ကျင်ရေးဦးစီးဌာန။ (၂၀၀၄–၂၀၀၇)။ ***ဝင်ခွင့်လမ်းညွှန်***။ရန်ကုန်။

ပညာရေးစီမံကိန်းနှင့်လေ့ကျင့်ရေးဦးစီးဌာန။ (၂၀၁၀–၂၀၁၄)။ ***ဝင်ခွင့်လမ်းညွှန်***။ ရန်ကုန်။

မြကျော်၊မောင်။ (၂၀၁၄)။ ***ပညာရေးခရီး***။ ရန်ကုန်၊ ဆုစာအုပ်တိုက်။

မြကျော်၊မောင်။ (၂၀၁၈)။ ***မြန်မာနိုင်ငံဆရာအတတ်ပညာသမိုင်း***။ ရန်ကုန၊ ဆုစာအုပ်တိုက်။

အဆင့်မြင့်ပညာဦးစီးဌာန။ (၂၀၁၆–၂၀၁၈)။ ***ဝင်ခွင့်လမ်းညွှန်***။ နေပြည်တော်။

အဆင့်မြင့်ပညာဦးစီးဌာန။ (၂၀၁၄)။ သင်တန်းသူသင်တန်းသား စားသောက်စရိတ်ပြင်ဆင်သတ်မှတ်ခြင်းကိစ္စ။ နေပြည်တော်။

အဆင့်မြင့်ပညာဦးစီးဌာန။ (၂၀၁၈)။ ပညာရေးကောလိပ်ကျောင်းအုပ်ကြီးများနှင့်လုပ်ငန်း ညှိနှိုင်း အစည်းအဝေးမှတ်တမ်း။ နေပြည်တော်။

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AN EXPERIMENTAL STUDY OF THE USE OF COMMUNICATIVE APPROACH IN DEVELOPING THE LISTENING SKILL OF HIGH SCHOOL STUDENTS

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Abstract

The main purpose of this study was to study the effect of communicative approach in developing the listening skill of high school students. The design adopted in this study was a quasi-experimental design, viz. non-equivalent control group design. The subjects were 61 Grade Ten students from No. (14) Basic Education High School and 104 Grade Ten students from No.(16) Basic Education High School, Chan Aye Tharsan Township, Mandalay. The instruments for this study were a pretest, teaching materials, lesson plans and a posttest. The subjects were pretested before the treatment. The experimental groups were taught through communicative approach whereas the control groups were not taught using this approach. After five weeks' treatment, a posttest was administered to examine whether there was a positive effect of communicative approach on the students' listening skill. In order to satisfy the research questions, the obtaining data were analyzed by using the independent samples t test and analysis of covariance (ANCOVA) to compare the listening achievement of the students between the experimental and control groups. The findings showed that there was a significant difference between the experimental and control groups for the scores on listening achievement test in HS 14 (p = .008) and HS 16 (p = .000) at the levels of $p < .01$ and $p < .001$ respectively. The result of this study, therefore, indicated that communicative approach has positive effect on developing the listening skill of high school students.

Keywords: approach**,** communicative approach**,** listening skill

Introduction

The trend of modern education directs to the needs of language competency to enhance the demands. Global language, the English, became the first priority many decades ago. TESL (Teaching English as a Second Language) and TEFL (Teaching English as a Foreign Language) programmes were developed all over the world as soon as the acceptance of the significance of English. In order to be proficient in global language, English, all four skills of language must be provided equally and orderly. In most of the Myanmar classrooms, reading and writing skills are the major focus more than the other two skills. Speaking and listening skills are rarely taught in schools since these skills are not assessed in examinations. As a consequence, the proficiency of speaking and listening skills are extremely limited. It, therefore, is a high time to promote these skills. For communicative competence, receptive skill should be given priority to naturally lead to the productive skill. The most widely used teaching in the world today is communicative approach or communicative language teaching (CLT) which is advocated by many applied linguists and English teachers.

Objectives

The objectives of this study are as follows:

- To compare the listening skill achievement of students who were taught by communicative approach and those who were not.

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- To highlight the importance of listening skill in language learning.
- To improve student's listening skill through communication.
- To give some suggestions on the use of communicative approach in English language teaching.

Research Questions

- Does the use of communicative approach have positive effect on improving the listening skill of Grade Ten students?
- Does the use of communicative approach have positive effect on improving the listening for specific information of Grade Ten students?
- Does the use of communicative approach have positive effect on improving the listening for phonemic distinctions of Grade Ten students?
- Does the use of communicative approach have positive effect on improving the listening for sequencing of Grade Ten students?
- Does the use of communicative approach have positive effect on improving the listening for transferring information of Grade Ten students?

Review of Related Literature

According to Richards and Rodgers (2001), at the level of language theory, Communicative Language Teaching has "a rich, if somewhat eclectic, theoretical base". Some of the characteristics of the communicative view of language are as follows:

1. Language is a system for the expression of meaning.
2. The primary function of language is to allow interaction and communication.
3. The structure of language reflects its functional and communicative uses.
4. The primary units of language are not merely its grammatical and structural features, but categories of functional and communicative meaning as exemplified in discourse.

The influential interpretation of Finocchiaro and Brumfit (1983) upon the distinctive features of communicative approach is as follows:

1. Meaning is paramount.
2. Dialogues, if used, center around communicative functions and are not normally memorized.
3. Contextualization is a basic premise.
4. Language learning is learning to communicate.
5. Effective communication is sought.
6. Drilling may occur, but peripherally.
7. Comprehensible pronunciation is sought.
8. Any device that helps the learners is accepted – varying according to their age, interest, etc.
9. Attempts to communicate may be encouraged from the very beginning.
10. Judicious use of native language is accepted where feasible.
11. Translation may be used where students need or benefit from it.
12. Reading and writing can start from the first day, if desired.
13. The target linguistic system will be learned best through the process of struggling to communicate.
14. Communicative competence is the desired goal (i.e., the ability to use the linguistic system effectively and appropriately).

15. Linguistic variation is a central concept in materials and methodology.
16. Sequencing is determined by any consideration of content, function, or meaning that maintains interest.
17. Teachers help learners in any way that motivates them to work with the language.
18. Language is created by the individual, often through trial and error.
19. Fluency and acceptable language is the primary goal: Accuracy is judged not in the abstract but in context.
20. Students are expected to interact with other people, either in the flesh, through pair and group work, or in their writings.
21. The teacher cannot know exactly what language the students will use.
22. Intrinsic motivation will spring from an interest in what is being communicated by the language (Finocchiaro and Brumfit (1983) cited in Brown, 2001).

Moreover, Littlewood (1981) diagrammatically provided a methodological framework for communicative activities as follows:

Pre-communicative activities
- Structural activities
- Quasi-communicative activities

Communicative activities
- Functional communicative activities
- Social interaction activities

Through pre-communicative activities, the teacher isolates specific elements of knowledge or skill which compose communicative ability, and provides the learners with opportunities to practice them separately. The learners are thus being trained in the part-skills of communication rather than practicing the total skill to be acquired. The different types of drill or question-and-answer practice are included. These aim to provide learners with a fluent command of the linguistic system, without actually requiring them to use this system for communicative purposes. Accordingly, the learner’s main purpose is to produce language which is acceptable (i.e. sufficiently accurate or appropriate) rather than to communicate meanings effectively. The activities which attempt to create links between the language forms being practiced and their potential functional meanings can be categorised as ‘quasi-communicative’ because they take account of communicative as well as structural facts about language.

In communicative activities, the learner has to activate and integrate his pre-communicative knowledge and skills, in order to use them for the communication of meaning (Littlewood, 1981).

Research Method

Research Design

The design adopted in this study was a quasi-experimental design, viz. non-equivalent control group design (see Table 1).

Table 1 Experimental Design

Group	Assignment	No. of Students		Pretest	Treatment	Posttest
		HS 1	HS 2			
Control	Intact	30	51	UBLLT	Conventional Methods	PILLT
Experimental	Intact	31	53	UBLLT	Communicative Approach	PILLT

Note: UBLLT = Upper Beginner Level Listening Test HS1 = BEHS (14)
PILLT = Pre-Intermediate Level Listening Test HS2 = BEHS (16)

The independent variable was the use of communicative activities to develop the students' listening skill, and the dependent variable was the student's listening skill. The data collected in this study were the scores of the posttest for quantitative data.

Subjects

Two basic education high schools from Chan Aye Tharsan Township: No. (14) Basic Education High School and No. (16) Basic Education High School, were selected by using a simple random sampling method. A sample of (61) students was selected from a population of (94) Grade Ten students of No. (14) Basic Education High School. A sample of (104) students was selected from a population of (283) Grade Ten students of No. (16) Basic Education High School. Table 2 showed the number of population and sample size used in this study.

Table 2Population and Sample Size

Name of School	No. of Population	No. of Sample
No. (14) BEHS	94	61
No. (16) BEHS	283	104

Instruments

(a) Pretest

The pretest consisted of (50) items for specific information, phonemic distinctions, transferring information and sequencing. The items in the pretest are upper beginner level. The test was constructed according to the advice and guidance of the supervisor. For the validation of the pretest, the test was delivered to three experienced and expert teachers and modified the test according to the suggestions of the experts. A pilot test was administered with (47) Grade Ten students from Basic Education High School, Patheingyi. But due to the inconvenience in playing one audio file, this pilot test was rejected. The second pilot test was administered with (50) Grade Ten students from No. (33) Basic Education High School, Aung Myae Tharsan Township, Mandalay. According to the pilot test, the item responses showed that the estimate of reliability was 0.79. Then, on the 1st November 2018, the pretest was held at No.(14) BEHS and No.(16) BEHS.

(b) Teaching Materials and Lesson Plans

Teaching materials ranging from upper beginner to pre-intermediate levels were compiled into three categories: dialogues and conversations, short stories and various topics which are relevant to the high school level. They were collected from various sources such as English workbooks, graded story books, internet websites. The collected teaching materials were designed for the study under the guidance and suggestions of the experienced and expert teachers. Teaching materials for the listening skills were planned as the following table.

Table 3Teaching Materials

Types of Materials	Listening Skill
Dialogues and conversations	• General idea • Ordering • Specific information • Transferring information
Stories	• Phonemic distinctions • Specific information • Sequencing
Topics	• Phonemic distinctions • Transferring information

As regard with the lesson plan, it was divided into pre-listening, while-listening and post-listening for both groups. The distinction between conventional teaching and communicative approach for teaching listening is focus on form of the language and focus on function of the language. Especially for post-listening section, conventional teaching emphasizes on the analysis of language in the text and on listen and repeat, whereas, communicative approach targets at the examining functional language and inferring vocabulary meaning (Field, 2002). To examine practically and revise as necessary, the lesson plans were pilot tested for one week with (47) Grade Ten students from Basic Education High School, Patheingyi.

(c) Posttest

The posttest consisted of (60) items of pre-intermediate level for specific information, phonemic distinctions, transferring information and sequencing. The posttest was administered to investigate whether the use of communicative approach has positive effect on improving the listening skill of Grade Ten students. The test items were constructed according to the advice and suggestions of the supervisor. The test items were validated by three experienced and expert teachers. The allocated time was (45) minutes and the given marks were 50 marks. The test items were modified again in accordance with the suggestions of those experienced teachers. Then, the posttest was administered at the selected high schools on December 12, 2018.

Analysis of the Data

Statistical Package for Social Science (SPSS) was used to process the results of the groups statistically. The pretest scores of the experimental and control groups were compared by using the independent samples *t* test. According to the *t* test result, the levels of the two groups were not the same before the treatment. Therefore, the posttest scores of the two groups were compared after controlling the pretest scores by using the analysis of covariance (ANCOVA) to find out whether there was a significance difference between the two groups from each selected school.

Procedure

Research methodology was studied to understand the nature of the research and the researcher's ethics. For the theoretical foundation, relevant information were explored and collected through books, educational journals, theses and Internet websites. After that, the literature review was made on the basis of communicative approach and listening skill. At the same time, the research design was chosen and the instruments were constructed under the guidance of the supervisor. In order to carry out the experimental study, quasi-experimental non-equivalent control group design was used. The two high schools, No. (14) Basic Education High School and No. (16) Basic Education High School, Chan Aye Tharsan Township, Mandalay, were selected by using a simple random sampling method. Non-equivalent control group design allows random assignment of intact groups not individuals. "An advantage of this design is that since classes are selected "as is", possible effects from reactive arrangements are minimized. Groups may not even aware that they are involved in a study" (Gay &Airasian, 2003).

The pilot study was carried out for the pretest and lesson plans. Then, the pretest was administered before the treatment was provided. Afterwards, the treatment was given to the experimental groups for five weeks. The posttest was administered to both groups after giving the treatment. The data were analysed by using the independent samples *t* test and analysis of covariance (ANCOVA).

Findings

Findings on the Equivalence of the Intact Groups

The non-equivalent control group design requires to consider whether the groups are equivalent because "the more similar the intact groups are, the stronger the study" (Gay &Airasian, 2003). To examine this question, the pretest scores of the both groups in each school were calculated by using the independent samples *t* test as shown in the following table.

Table 4The Result of t Test for Independent Samples on Pretest Scores

School	Group	*N*	*M*	*SD*	*t*	*df*	*p*
HS 1	C	30	32.33	8.93	-2.37*	59	.021
	E	31	37.16	6.85			
HS 2	C	51	36.39	8.07	-4.43***	79.12	.000
	E	53	42.13	4.63			

***Note*:** $^{*}p < .05$ C = Control Group HS 1 = No. (14) BEHS, Mandalay
$^{***}p < .001$ E = Experimental Group HS 2 = No. (16) BEHS, Mandalay

According to the results as shown in Table 4, it was found that the means of the experimental groups were higher than that of the control groups in both schools. Then, the null hypothesis, 'there is no difference between the groups', was rejected because the *p* values were .021 ($p < .05$) and .000 ($p < .001$) respectively. Therefore, there were significant differences between the control and experimental groups in both schools. Consequently, it can be said that the listening skill of the experimental groups was significantly higher than that of the control groups before the treatment. According to this result, to display the findings on the research questions, the pretest scores were needed to equate statistically in using the analysis of covariance (ANCOVA).

Findings on Research Question (1)

Research question (1) is whether the communicative approach has positive effect on improving the listening skill of Grade Ten students. To examine this question, the pretest and the posttest scores of the experimental groups and control groups in both schools were calculated by using the analysis of covariance as in the following table.

Table 5 The Result of Analysis of Covariance on Posttest Scores Using Pretest Scores as a Covariate

			Unadjusted		*Adjusted*					
School	**Source**	***N***	***M***	***SD***	***M***	***SE***	***df***	***Ms***	***F***	***p***
HS 1	C	30	22.70	7.62	23.54	1.36	1	395.85	7.50**	.008
	E	31	29.69	7.78	28.88	1.34				
	Error						58	52.76		
HS 2	C	51	20.45	8.52	22.72	.98	1	798.22	17.94***	.000
	E	53	30.97	8.21	28.79	.96				
	Error						101	44.51		

Note. $^{**}p < .01$ C = Control Group HS 1 = No. (14) BEHS, Mandalay
$^{***}p < .001$ E = Experimental Group HS 2 = No. (16) BEHS, Mandalay

According to the results as shown in Table 5, after controlling the pretest scores, there was a significant difference between the control and experimental groups in each school, $F(1,58) = 7.50$, $p = .008$ and $F(1,101) = 17.94$, $p = .000$ respectively. Moreover, as it is evident from this table, the adjusted means of the experimental groups are significantly higher than those of the control groups in both schools (see Figure 1).

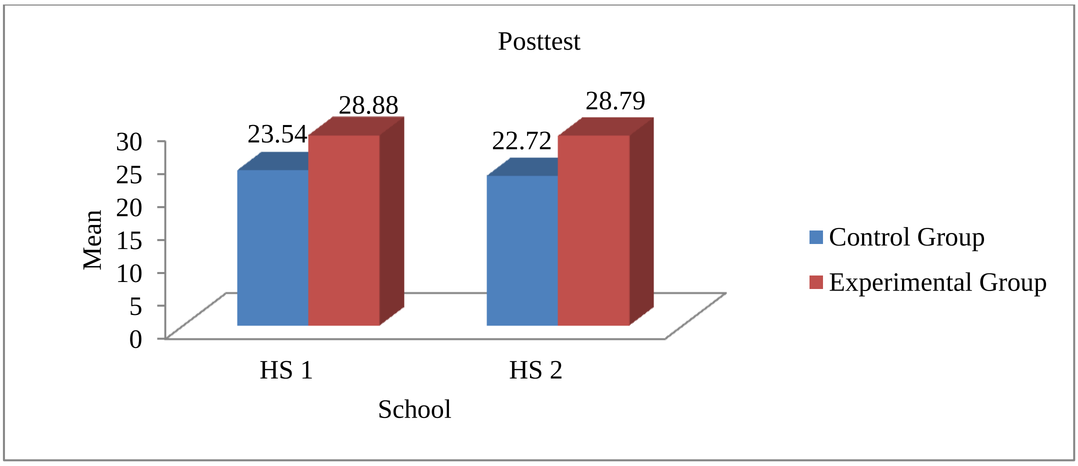

Figure 1 Comparison of means of the two groups on the posttest

These results showed that the use of communicative approach has positive effect on improving the listening skill of Grade Ten students.

Findings on Research Question (2)

Research question (2) is whether the communicative approach has positive effect on improving the listening for specific information of Grade Ten students. To satisfy this question, the overall pretest scores and the posttest scores in relation to the specific information items of the experimental groups and control groups in both schools were analyzed by using the analysis of covariance as shown in the following table.

Table 6 The Result of Analysis of Covariance on Specific Information Items Using Pretest Scores as a Covariate

			Unadjusted		*Adjusted*					
School	**Source**	***N***	***M***	***SD***	***M***	***SE***	***df***	***Ms***	***F***	***p***
HS 1	C	30	2.17	1.05	2.29	.24	1	5.83	3.60	.063
	E	31	3.06	1.55	2.94	.23				
	Error						58	1.62		
HS 2	C	51	2.86	1.90	3.26	.26	1	.08	.26	.613
	E	53	3.83	2.04	3.45	.25				
	Error						101	3.13		

Note: C = Control Group; E = Experimental Group; HS 1 = No. (14) BEHS, Mandalay; HS 2 = No. (16) BEHS, Mandalay

According to the results of the Table 6, after controlling the pretest scores, there were no significant differences between the control groups and experimental groups of the posttest scores on specific information items in both schools, *F*(1,58) = 3.60, *p* = .063 and *F*(1, 101) = .26, *p* = .613 respectively. And the means of the experimental groups and those of the control groups were also almost the same in both schools (see Figure 1).

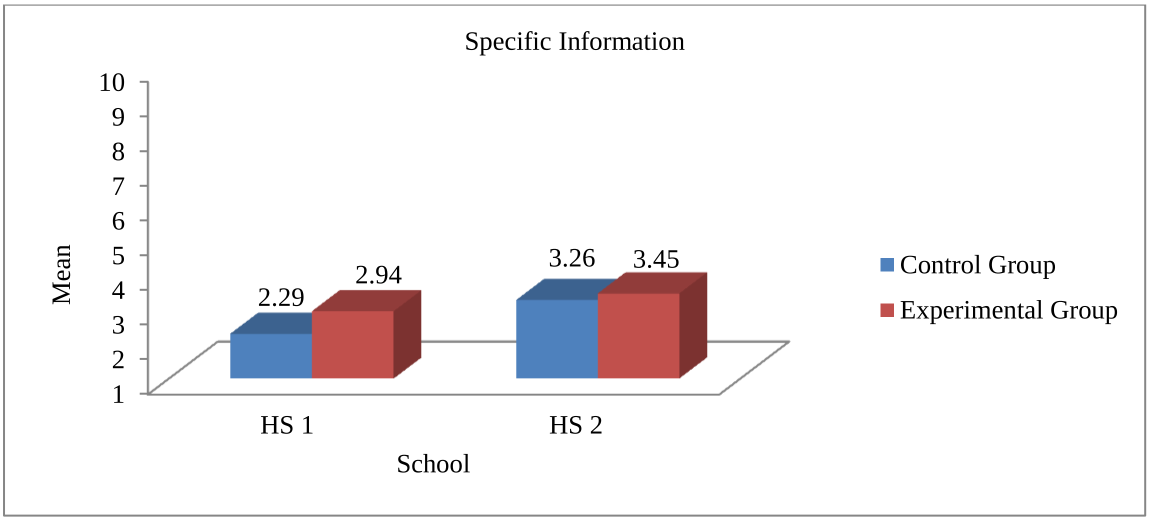

Figure 2 Comparison of means of the two groups on the specific information items

These results lead to the conclusion that the use of communicative approach does not have positive effect on improving the listening skill of Grade Ten students in relation to the specific information.

Findings on Research Question (3)

Research question (3) is whether the communicative approach has positive effect on improving the listening for phonemic distinctions of Grade Ten students. To answer this question, the overall pretest scores and the posttest scores in relation to the phonemic distinctions items of the experimental groups and control groups in both schools were analyzed by using the analysis of covariance as shown in the following table.

Table 7 The Result of Analysis of Covariance on Phonemic Distinctions Items Using Pretest Scores as a Covariate

			Unadjusted		*Adjusted*					
School	**Source**	***N***	***M***	***SD***	***M***	***SE***	***df***	***Ms***	***F***	***p***
HS 1	C	30	8.40	1.33	8.59	.24	1	1.65	1.01	.320
	E	31	8.44	1.49	8.25	.24				
	Error						58	1.64		
HS 2	C	51	7.35	2.26	7.85	.29	1	9.08	2.37	.127
	E	53	8.98	2.23	8.50	.28				
	Error						101	3.83		

Note: C = Control Group HS 1 = No. (14) BEHS, Mandalay
E = Experimental Group HS 2 = No. (16) BEHS, Mandalay

The results in the Table 7 showed that after controlling the pretest scores, there were no significant differences between the control groups and experimental groups of the posttest scores on phonemic distinctions items in both schools, $F(1, 58) = 1.01$, $p = .320$ and $F(1, 101) = 2.37$, $p = .127$ respectively. Also, the adjusted means of the experimental groups and those of the control groups are about the same in both schools (see Figure 3).

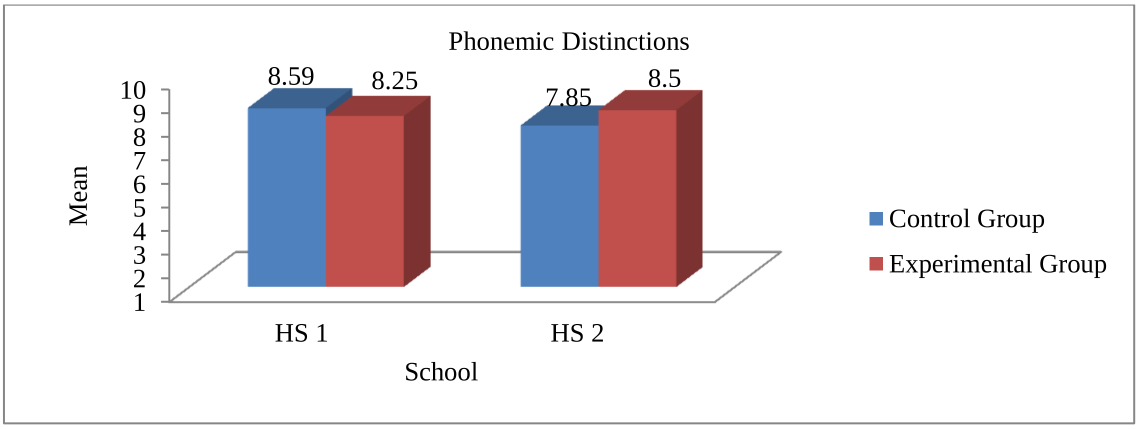

Figure 3 Comparison of means of the two groups on the phonemic distinctions items

This means that the use of communicative approach does not have positive effect on improving the listening skill of Grade Ten students in relation to the phonemic distinctions.

Findings on Research Question (4)

Research question (4) is whether the communicative approach has positive effect on improving the listening for sequencing of Grade Ten students. To examine this question, the overall pretest scores and the posttest scores in relation to the sequencing items of the experimental groups and control groups in both schools were analyzed by using the analysis of covariance as shown in the following table.

Table 8 The Result of Analysis of Covariance on Sequencing Items Using Pretest Scores as a Covariate

			Unadjusted		*Adjusted*					
School	**Source**	***N***	***M***	***SD***	***M***	***SE***	***df***	***Ms***	***F***	***p***
HS 1	C	30	5.00	2.23	5.21	.38	1	18.56	4.52*	.038
	E	31	6.58	2.03	6.37	.37				
	Error						58	4.11		
HS 2	C	51	5.51	3.23	6.07	.39	1	4.05	.57	.454
	E	53	6.17	2.62	5.64	.30				
	Error						101	7.15		

Note: *$p < .05$ C = Control Group HS 1 = No. (14) BEHS, Mandalay
E = Experimental Group HS 2 = No. (16) BEHS, Mandalay

The results in the Table 8 revealed that after controlling the pretest scores, there was a significant difference between the groups in BEHS (14) since $F(58, 4.11) = 4.52$, $p = .038$ ($p < .05$) and the adjusted mean scores of the experimental groups were higher than those of the control groups. For BEHS (16), however, there was no significant difference between the groups, $F(101, 7.15) = .57$, $p = .454$ and the adjusted means were almost the same (see Figure 4).

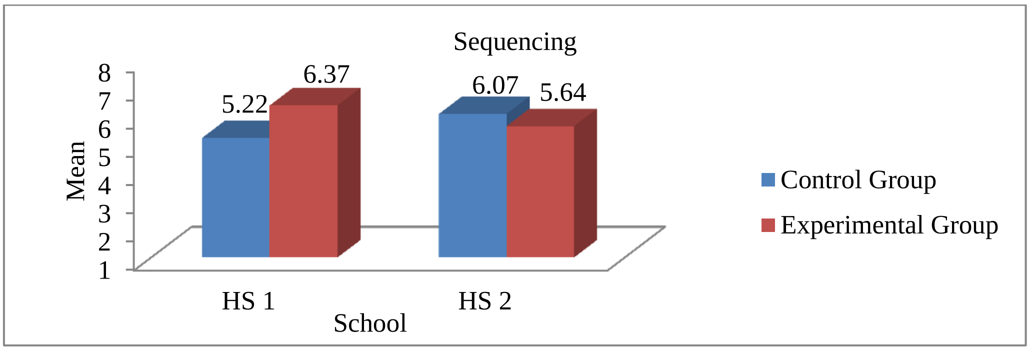

Figure 4 Comparison of means of the two groups on the sequencing items

These results lead to the conclusion that the use of communicative approach has positive effect on improving the listening for sequencing of students in BEHS (14) but not on that of students in BEHS (16).

Findings on Research Question (5)

Research question (5) is whether the communicative approach has positive effect on improving the listening for transferring information of Grade Ten students. To examine this question, the overall pretest scores and the posttest scores in relation to the transferring information items of the experimental groups and control groups in both schools were analyzed by using the analysis of covariance as shown in following table.

Table 9The Result of Analysis of Covariance on Transferring Information Items Using Pretest Scores as a Covariate

			Unadjusted		*Adjusted*					
School	**Source**	***N***	***M***	***SD***	***M***	***SE***	***df***	***Ms***	***F***	***p***
HS 1	C	30	7.13	5.04	7.44	.85	1	205.67	9.98**	.003
	E	31	11.58	4.15	11.28	.83				
	Error						58	20.60		
HS 2	C	51	4.75	3.69	5.57	.49	1	727.39	64.20***	.000
	E	53	12.15	3.95	11.36	.48				
	Error						101	11.33		

Note. $^{**}p < .01$ C = Control Group HS 1 = No. (14) BEHS, Mandalay
$^{***}p < .001$ E = Experimental Group HS 2 = No. (16) BEHS, Mandalay

Table 9 displayed that after controlling the pretest scores, there were significant differences between the control groups and experimental groups in both schools, $F(1, 58) = 9.98$, $p = .003$ and $F(1, 101) = 64.20$, $p = .000$. As it is obvious from this table, the means of the experimental groups are significantly higher than those of the control groups in both schools (see Figure 5).

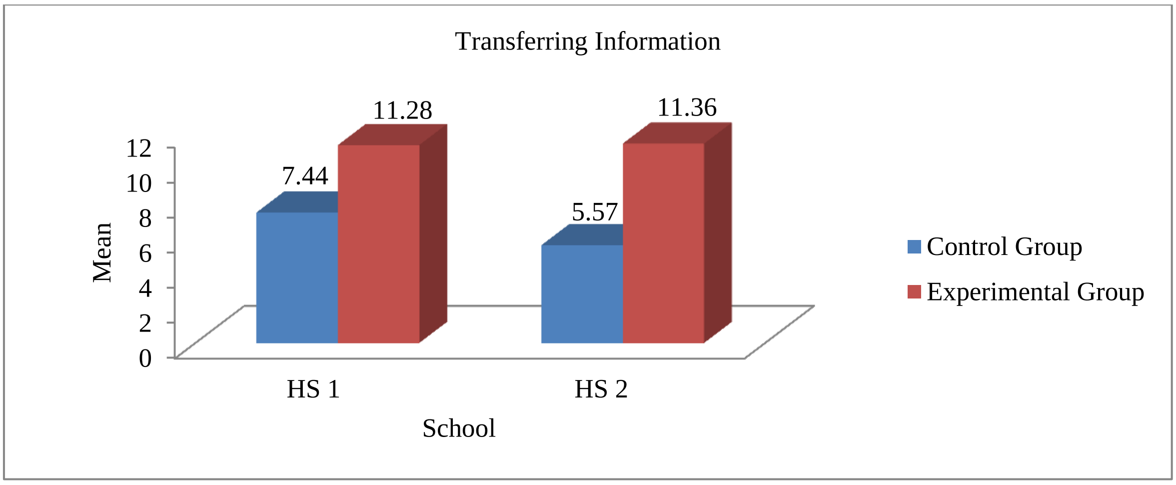

Figure 5 Comparison of means of the two groups on the transferring information items

Therefore, the use of communicative approach has positive effect on improving the listening for transferring information of Grade Ten students.

Conclusion

Discussion

In this study, the achievement test for the listening skill was developed with four sub-skills: listening for specific information, phonemic distinctions, sequencing and transferring information. The data were also analyzed according to each sub-skill to examine if there is a significance difference between the groups.

The sub-skills of listening were arranged in the order of more challenging ones. The results on each listening sub-skill highlighted that the effect of using communicative approach and conventional teaching had no difference in less challenging sub-skills such as specific information and phonemic distinctions. When it came to the more challenging sub-skills as sequencing and transferring information, however, using communicative approach had a relatively positive effect on them.

To examine the effectiveness of communicative approach on developing the listening skill, the overall posttest scores were analyzed statistically. As a result, the experimental groups which were treated by communicative approach had higher means on the listening test than the control groups which were treated by conventional teaching. This result advocated that "the communicative language teaching – the idea the student learns through the act of communication – increased the role of listening" (Helgesen, 2003).

In language teaching, all four skills are equally important and should be prioritized equally in the textbooks and tests. Nevertheless, listening skill is still excluded in the text content. This study, therefore, tried to highlight the importance of listening skill in language teaching.

Through the study, one surprising fact to the researcher was that all students had the listening ability to some extent although listening skill was not practiced in class. If the students were given the opportunity for practice, their listening skill could be developed in no time. Furthermore, owing to the lack of practice, their listening skill was somewhat lower in comparing with their reading and writing skills.

It was also found that the students had lack of confidence in listening and communication during the first week of the study because it was quite unfamiliar to them. But they gradually enjoyed and actively participated in the listening processes; pre-listening, while-listening and post-listening. This proved that even though listening is a receptive skill it is not necessarily a passive one and a listener can either be active or passive (Lindsay & Knight, 2006).

As regard with the communication during the lesson, the researcher could not expect the students could communicate successfully using the target language due to the less significance of speaking section in the textbook and exclusion in the achievement tests. That is why, according to the continuum of communicative approach from pre-communicative to communicative activities (Littlewood, 1981), the researcher could design the lessons only around the pre-communicative activities and the judicious amount of using the mother tongue was allowed (Finocchiaro and Brumfit, 1983, cited in Brown, 2001).

The most time-devoting task in this research was developing the teaching materials. In designing them, the most commercial syllabuses which seemed reflected the communicative approach were studied. The researcher had to consider the background knowledge of students based on the English syllabuses used in Myanmar as well as trying to make the teaching materials including in the communicative continuum. The researcher also had to take the suggestions and help of the expert teachers in designing the materials which is "tailored for a particular group of learners in a particular place, studying for particular purposes in a given amount of time" (Brown, 2001).

The main differences of the lesson plans between conventional teaching and communicative approach were classroom setting, classroom language and different focuses on language. For conventional teaching, the classroom setting remained unchanged as it was and the teacher led the explanation of the language which was emphasized on grammar and new vocabularies. For communicative approach, the students were cooperated in groups and the teacher manipulated the members of the groups during the study. The intervention of the teacher in communicative approach was much less than that of in conventional teaching. The teacher's explanation emphasized mainly on examining functional language and usage of new vocabularies. For classroom language, the teacher used the target language in communicative approach and the students also tried to use the target language as much as they could during the communication with each other, but not in conventional teaching. The findings of the study also statistically approved the relatively positive effect of communicative approach in compared with the conventional teaching.

As regard with the study period, the schools allowed four days per week because the listening skill was excluded in the textbook and the researcher could not substitute the existing period of English subject teachers. The schools had to draw the new timetables that include the period for this research. At the high school level, therefore, only Grade Ten was available for this study owing to the matriculation exam preparation of Grade Eleven.

In addition, the class size of a school was very big, up to (53) students in each classroom. The researcher, therefore, found that it was difficult to give individual attention to each student. In every group, few students who had enough confidence to speak usually led the group to discuss and the others seemed less active in communicating with the whole group. However, their contributions to group performance by taking notes and delivering the ideas were prominent due to the fact that "communicative competence implies a set of strategies for getting messages sent and received and for negotiating meaning as an interactive participant in discourse, whether spoken or written" (Brown, 2001). So, it can be said that those less active students could be more active in communication if the group size was small enough to enhance their confidence and the teacher's attention could be given individually to encourage them.

Moreover, noise was also an important factor to control in listening and communication processes. Although the researcher tried to reduce the noise by choosing the classrooms which was not very close to the others, noise from the other classes was still disturbed the listening process to some extent. Similarly, the noise from the communication of students also disturbed the other classrooms in some ways. Accordingly, rooms like language laboratory become necessity for listening sessions, whereas the language laboratory with the individual seats which prevent communication with each other would also be useless in implementing communicative language teaching.

In this study, only classroom activities and teaching materials for listening could be developed to implement communicative approach. Since communicative approach leads to "re-examination of language teaching goals, syllabuses, materials, and classroom activities" (Richards & Schmidt, 2002), the underlying communicative theories of language should also be reflected in the syllabuses.

To sum up, the listening skill of the students could be developed if the special attention is given to it in the textbooks and syllabuses. As regard with the language teaching methods, the results of this study clearly revealed that using communicative approach is far more effective than using the conventional teaching.

Suggestions for Further Studies

In order to provide the enriched information of the integration of communicative approach to language teaching, suggestions for further studies are as follows:

1. Researchers should use the communicative approach in developing the other skills of language: speaking, reading and writing.
2. Researchers should arrange to get as much study period as possible.
3. Researchers should compare the use of communicative approach not only to conventional teaching but also to other language teaching methods.
4. Researchers should widen the scope of the study by choosing more than two schools.
5. Researchers should study the effectiveness of communicative approach at other school levels such as primary and middle school levels.
6. Researchers should strengthen the experimental study by combining with the study of students' perception on the communicative approach using questionnaires or interviews.

Conclusion

In language teaching, listening was the ignored skill all over the world a long time ago. Nunan (2002), therefore, called it "the Cinderella skill" in second language learning since it was overlooked by "its elder sister, speaking skill". However, listening became fashion in language learning since 1960s and many appropriate approaches were developed. Here, communicative approach is the latest trend in the field of language teaching. In this study, therefore, communicative approach was selected to develop the listening skill which is still ignored in Myanmar with the intention of showing the equal paramount importance of developing language skills and adopting appropriate teaching approach for teachers.

The importance of listening skill was highlighted in the literature review and also the findings of the study showed that although students had lower level in listening skill than their existing level of reading and writing skills, it could develop when great attention was given to it. This means that if the listening skill was integrated in syllabus and given the special attention, this could lead to the significant development of students' listening skill.

Moreover, the results of this study revealed that as regard with the teaching to develop the listening skill, the use of communicative approach was better than the use of conventional teaching. Therefore, when it comes to the language teaching, this study has manifested that communicative approach is the solution.

To sum up, in the context of ESL (English as a Second Language) and EFL (English as a Foreign Language), the ultimate aim of the language is to use it as a means of communication for learning. The listening and speaking skills are given special status in language teaching as equally as reading and writing skills which have never been ignored in teaching language. Therefore, in order to enhance the development of all four skills of language in students, effective language teaching materials and syllabuses should be designed to reflect the theories of language and to accompany with the most suitable teaching methods.

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A STUDY OF THE FACTORS INFLUENCING STUDENTS' PARTICIPATION IN CO-CURRICULAR ACTIVITIES AT THE MIDDLE SCHOOL LEVEL

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Abstract

The main aim of this research is to investigate the factors influencing students' participation in co-curricular activities at the Middle School Level. This study sought four possible factors influencing students' participation in co-curricular activities such as the roles of teachers, infrastructures, funding and parental involvement. Descriptive survey design was used and the respondents included (13) principals, (42) co-curricular teachers and (471) middle school students from (13) schools within Kyauktaga Township of Bago Region. (526) respondents were selected by using stratified sampling and simple random sampling methods. Data was collected by using attitude questionnaires for three different types of respondents and a set of participation questionnaire for students only. So, students are asked by two questionnaires. Principals and teachers' attitude questionnaires consist of (10) items for each factor. Students' attitude questionnaire contains (6) items for each factor. Students' participation questionnaires contain (10) Likert-type items. Moreover, researcher conducted interview with (13) principals to enhance the credibility of current research findings. All questionnaires are self-structured. Data analysis included both quantitative and qualitative methodologies. The quantitative results indicated that these four factors have significant and positive relationship towards students' participation in co-curricular activities (the role of teacher $r(471) = .407^{***}$, $p< .001$, infrastructures $r\ (471) = .310^{***}$, $p< .001$, funding $r(471) = .199^{***}$, $p< .001$ and parental involvement $r(471) = .292^{***}$, $p< .001$). Teachers' role factors is the most influent factor among them and 22% of the combination of four predictor variables can be predicted from the influencing factors. It can be concluded that these factors are necessary to become more participation of students in co-curricular activities at the middle school level.

Keywords: activities, participation, co-curricular activities

Introduction

Modern education aims at the wholesome development of children. In fact all-round development is the key theme of education. Today, when a child comes to school, he comes in his totality and, so education should help him to develop his total personality. To fulfill these purposes, varieties of educative experiences are to be provided in the school programs which may contribute to a long, happy and normal life of the child. The function of the education is to bring change in child behavior and personality in a more desirable form. So, modern approach of education emphasizes on all-round development of the child.

In this modern world, our nation needs citizens, dynamics and excellent leaders. The schools are where the molding should begin, and thus the importance of students' participation in co-curricular activities, which has proven to turn out better and successful students, as leaders and responsible citizens of tomorrow. Co-curricular activities and extra-curricular activities play a significant role in the lives of the students. Therefore, participating in these activities has been linked to greater school attachment and sense of belonging, better academic achievement, and higher academic aspirations. There are many factors which affect students' participation in co-curricular activities. In order to fulfill some requirements for more participation of students in

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co-curricular activities, this study aimed at investigating the influencing factors on students' participation in co-curricular activities.

Purposes

The main purpose of this study is to investigate the factors influencing students' participation in co-curricular activities at the Middle School Level. The specific objectives are as follows:

- To study the assumptions of participants about the factors influencing students' participation in co-curricular activities.
- To explore the relationship between the influencing factors and students' participation in co-curricular activities.
- To explain the extent of the influence of the roles of teachers, infrastructural facilities, funding, and parents' involvement on students' participation in co-curricular activities.
- To find out the most influential factors on students' participation in co-curricular activities.
- To give suggestions for the improvement of students' participation in co-curricular activities according to the results of the study.

Research Hypothesis

There is a relationship between the influencing factors and students' participation in co-curricular activities.

Scope of the Study

The subjects were confined to the principals, middle school co-curricular teachers and middle school students at the three basic education middle schools, five basic education high schools (branch) and five basic education high schools in Kyauktaga Township, Bago Region of Lower Myanmar. The total number of schools was (13) and the total participants were (526). This study was delimited into the four factors such as teachers' role, funding, infrastructural facilities and parents' involvement.

Definition of Key Term

Co-curricular Activities

Co-curricular activities mean the programs of educational activities, which are systematically organized in or out of the school compounds together with the teaching of subject matters in order to implement the educational objectives for the purpose of students' all-round development (Basic Education Law, 1973).

Review of Related Literature

All-round, Balanced Development and Co-curricular Activities

Students must be nurtured with focus on all-round, balanced development especially in terms of intellectual, physical, social, moral, emotional and aesthetic dimensions (National Education Law, 2014). The all-round development or holistic development of an individual is only possible through balanced development of scholastic or academic as well as non-scholastic or non-academic aspects in the formal, in-formal and non-formal educational setting in the society. The co-curricular or extracurricular activities help the student to overcome the stress of stunts and allow the holistic development of individual. Holistic Development is basically the development of everyone's intellectual, emotional, social, physical, artistic, creative, religious values and feelings. It is pretty much just the development of the entire brain's thoughts and feelings. Co-curricular activities such as academic or special interest clubs, theatre and music groups, and internal sports teams have traditionally enhanced students' sense of school membership by providing them with a special position in the school community. Students involved in these kinds of co-curricular activities find opportunities to shine and are less likely to become disengaged from school. Many studies have indicated an association between co-curricular activities in general and positive academic outcomes. Co-curricular activities promote enthusiasm, vitality, positive thinking and team spirit which in turn, contribute to personality development. Co-curricular activities facilitate the development of various domains of mind and personality such as intellectual development, emotional development, social development, moral development and aesthetic development (Kisango, 2016).

Teachers' Role and Students' Participation in Co-curricular Activities

The importance in education does not only lie in academic but also in all other fields which are required in educating students , which include skills and co- curriculum. Fostering a sense of school co-curricular engagement in a personalized environment requires an expanded role for teachers. In this expanded role, teachers seek to influence students' social and personal development, as well as their intellectual growth. The new school has considerably modified the status, duties and privileges of the teacher. In the new school, the teacher goes beyond the classroom (Kochhar, 1985).

Teaching is a broad occupation and teachers may range far beyond their specialization in their reading, writing, and the enjoyment of the arts. They may range over every type of composition from biography, fiction, travel, adventure, science, poetry, to journalism. Their interest in music, drama, and the fine arts may be just as catholic. Such interests tend to "elevate and liberate the human spirit" (Alcorn, Kinder, & Schunert, 1964).

The Influence of Infrastructural Facilities and Funding on Students' Participation in Co-curricular Activities

Education is very important to the economic development of Myanmar. Only when the education system is good enough will the workers needed for the country's manufacturing and services sectors that support the development of the economy be improved. For that kind of quality education, the level of expenditure plays a major role. In Myanmar, education expenditure, the curriculum, infrastructure, learning materials and the attractiveness of the teaching profession are related. If those elements, and specially the budget allocation, are limited, the education environment will not be conducive to effective teaching and learning. Limited budget allocations cause significant difficulties for education reform. Most graduates are not interested in being teachers because the low salaries offered to them are not attractive. According to a survey conducted by Comprehensive Education Sector Review, teachers reported that most schools do not have enough desks and chairs for classrooms, the classroom size is inadequate, and there are no toilets in the schools. Moreover, many classes are crowded into the same room without any walls or partitions between them. These kinds of problems are mostly the result of inadequate budget allocation (Min ZawSoe, Aye MyaSwe, Nan Khin Moe Aye, & Nan Htet Mon, 2017).

School's physical facilities provide and maintain safety, cleanness, and creativity learning environments to the students which encourage students to perceive high achievements and outcome. Physical facilities strive to give students a comfortable learning environment in which they work and learn. In developing countries, low quality of learning among students can partly be attributed to poor or physical facilities of the schools. School physical facilities are fundamental factors for better learning environment and achievements, and outcome of the students (Saeed&Wain, 2011, cited in Nepal &Maharjan, 2015).

Parental Involvement and Students' Participation in Co-curricular Activities

The modern educator seeks the active interest and co-operation of parents in the education of their children. In the new school, every week is "Education Week" when the school doors are open to visitors. The new school realizes that home and school share a mutual interest and school, there cannot be full success in educating the child. The result is that parents and teachers meet in small or large groups to discuss their common problems. In some schools, parents assist in the office and classrooms, they participate in trips and many other social and community undertakings (Kochhar, 1985).

Effective schools also tend to have high levels of parental involvement. Parents are key individuals whose support can make important contributions to a school's effort to accomplish its educational missions. There is strong evidence that, when parents show a strong interest in school, their children have a more positive attitude about school and do better in their academic tasks (Armstrong, Henson, & Savage,1989).

Research Method

Descriptive survey design, both quantitative and qualitative method is used to carry out the study. As a quantitative research method, data were collected by surveys from the principals, teachers and middle school students to investigate how the various factors influenced students' participation in co-curricular activities at the Middle School Level. As a qualitative research method, the researcher conducted interview by meeting headmasters or headmistress in the selected schools. Descriptive research involves collecting data in order to test hypothesis or to answer questions concerning the current status of the subjects of the study (Gay, 1987).

Population and Sample Size

The sample of the subjects was principals, junior teachers; particularly co-curricular teachers, and middle school students from the thirteen schools in Kyauktaga Township and they were selected by using stratified sampling and simple random sampling methods. The total numbers of principals, junior teachers and students participated in this study were (526).

Table 1The Sample Schools and Sample Size

No	Schools	Numbers of participants		
		Principals	Teachers	Students
1	B.E.H.S, Kyauktaga	1	6	78
2	B.E.H.S, Thamin Inn Kone	1	2	26
3	B.E.H.S, In Kone	1	4	20
4	B.E.M.S, 14-Ywa	1	2	28
5	B.E.H.S(Branch), Htain Tall	1	2	16
6	B.E.M.S, KoneLalYoe	1	2	16
7	B.E.H.S, PaeNweKone	1	4	45
8	B.E.H.S, Pha do	1	6	72
9	B.E.H.S(Branch), 2-Yat Quat	1	2	36
10	B.E.M.S, Myot Ma	1	2	30
11	B.E.H.S(Branch), HmanChaung	1	3	32
12	B.E.H.S(Branch), Say YoeKhin	1	3	32
13	B.E.H.S(Branch), AnaukYat	1	4	40
Total		13	42	471

Note: B.E.H.S = Basic Education High School, B.E.H.S(Branch) = Basic Education High School, Branch, B.E.M.S = Basic Education Middle School

Instrument

As the instrumentation, three questionnaires for the factors influencing students' participation in co-curricular activities were self-structured. Each questionnaire included demographic data and items deal with the influencing factors, such as, the role of teachers, infrastructural facilities of schools, funding condition, and involvement of parents in education.

Questionnaires for principals and teachers consist of 10 items for each factor and totally 40 items were contained. And one set of interview question for the principals is prepared. Questionnaires for students consist of 6 items of each factor and totally 24 items were contained. Another one set of participation question for students contains 10 items. Each item in attitude questionnaires is constructed with five-point Likert scales (1- Strongly Disagree, 2- Disagree, 3- Moderately agree, 4- Agree, and 5- Strongly Agree). Each item in participation questionnaire for students is constructed with five-point Likert scales (1-Never, 2-Seldom, 3-Sometimes. 4- Often, 5- Always).

Procedure

First of all, the researcher found out the relevant literature concerning with the research. Secondly, in order to the required data, the researcher constructed the instruments under the guidance of the supervisor. For the validation of the instrument, the questionnaires for the factors influencing students' participation in co-curricular activities were distributed to three experts from the Department of Methodology, Sagaing University of Education. The instrument was modified according to the advices and guidance of the experts. Content validity was determined by expert judgment. After that, a pilot testing was conducted in 3rd October, 2018. Based on the findings of the pilot test, internal consistency reliability of the questionnaires are determined by Cronbach's alpha. The Cronbach' alpha internal consistency reliability of the students' questionnaire was (0.674) and the Cronbach' alpha internal consistency reliability of the teacher's questionnaire was (0.876). So these items were used for the final test.

And then, the main study was conducted from 9th November, 2018 to 28th November, 2018. The questionnaires were distributed to the subjects with the request to complete and return as soon as possible. At the same time, the researcher interviewed to the principals. The respondents were asked to decide about the questionnaire statements and marked the relevant response category honestly. So the response rate was (100)%. After the questionnaires were returned, the obtained data were entered into a computer file and were analyzed using the Statistical Package for the Social Sciences (SPSS) version 20.

Analysis of Data

The data were analyzed by using descriptive (means, standard deviations) and inferential (correlation) statistics. Pearson product-moment correlation was used to assess whether there were relationship between students' participation in co-curricular activities and the influencing factors. Multiple regressions were used to calculate the extent of influencing factors on students' participation in co-curricular activities. To interpret the interview response, constant comparison method was used.

Findings

Findings of the Quantitative Results

Table 2 Percentages of Assumptions of the Factors Influencing Students' Participation in Co-curricular Activities by the Participants

Factors	Numbers of Participants	Disagree		Normal		Agree	
		N	%	N	%	N	%
The Role of Teachers	526	2	0.4%	46	8.7%	478	90.9%
The Role of Infrastructures	526	29	5.5%	266	50.6%	231	43.9%
The Role of Funding	526	14	2.7%	245	46.6%	267	50.7%
The Role of Parental Involvement	526	5	1%	56	10.6%	465	88.4%

Table 3 Means, Standard Deviations, and Intercorrelations for Students' Participation in Co-curricular Activities and Predictors Variables (N=471)

Variable	*M*	*SD*	Teachers' Role	Infrastructural Role	Funding Role	Parents' Involvement
Students' Participation in Co-curricular Activities	3.53	.547	.407***	.310***	.199***	.292***
Predictor variable						
Teachers' Role	4.05	.435	--	.448***	.144***	.384***
Infrastructural Role	3.46	.581		--	-.095*	.282***
Funding Role	3.57	.490			--	.244***
Parents' Involvement	4.10	.481				--

Note:.**p*<.05; ****p*<.001.

The correlation coefficient indicates the size and the direction of a relationship. As it can be seen in Table 3, there is a positive correlation between students' participation in co-curricular activities and the four factors.

Table 4 Simultaneous Multiple Regression Analysis Summary for Teachers' Role, Infrastructural Role, Funding Role, and Parents' Involvement Predicting Students' Participation in Co-curricular Activities (N=471)

Variable	*B*	*SE B*	β	*t*	Sig.
Teachers' Role	.335	.061	.267	5.516***	.000
Infrastructural Role	.165	.044	.175	3.721***	.000
Funding Role	.169	.048	.152	3.513***	.000
Parents' Involvement	.117	.052	.103	2.250*	.025
Constant	.519	.271		1.918	.056

Note: R^2= .223 ;$F(4,466)$ = 33.46, ***p <.001, *p<.05

According to the result, the adjusted R^2 value is .216. So the predictors are particularly good at predicting students' participation in co-curricular activities and it can be assumed that the model is a particularly modest fit one. The combination of variables to predict students' participation in co-curricular activities from the role of teachers, the role of infrastructural facilities, the role of funding, and the role of parental involvement was statistically significant, F(4,466) = 33.46, p < .001. This indicates that approximately 22 % of the variance in students' participation in co-curricular activities can be predicted from the influencing factors.

The model equation to predict students' participation in co-curricular activities is;

$$SPCA = .519 + .335\ TR + .165\ IR + .169\ FR + .117\ PI$$

*Note.*SPCA = Students' Participation in Co-curricular Activities, TR = Role of Teacher, IR = Role of Infrastructure Facilities, FR = Role of Funding, PI = Parental Involvement.

From the regression analysis, among four variables, the best predicting factors of the influencing factors for students' participation in co-curricular activities were found to be role of teacher (β = .269), role of infrastructure facilities (β = .175), role of funding (β = .152), and parental involvement (β = .117). According to the results, the role of teacher appeared to be the strongest predictor of students' participation in co-curricular activities. These findings support that the students' participation in co-curricular activities was closely related with the influencing factors such as their teachers' role, schools' infrastructures, funding role and their parents' involvement. So it may be interpreted that the better the role of teachers in co-curricular teaching, the higher the students' participation in co-curricular learning would be. The following model is constructed to predict students' participation in co-curricular activities.

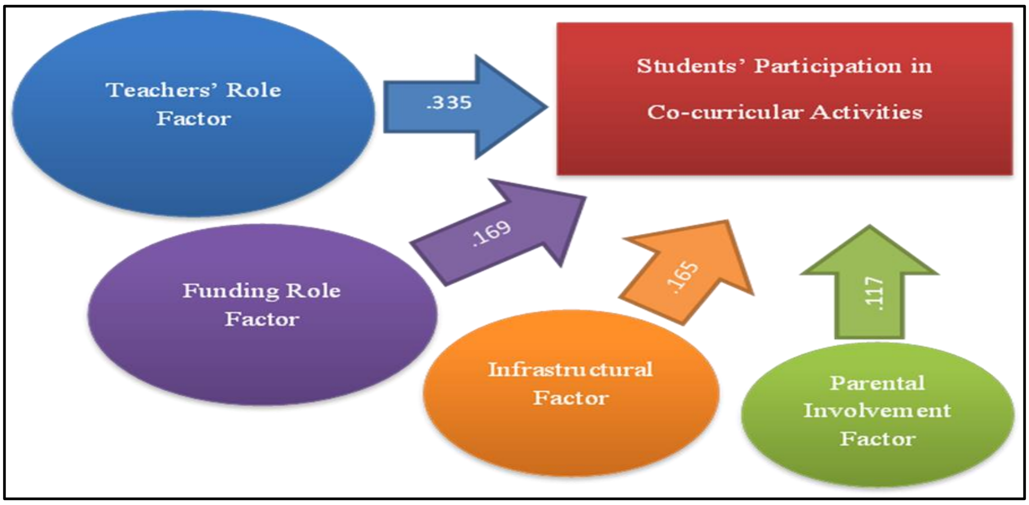

Figure 1 Summary model of the results

Findings of Qualitative Results

In dealing with the influencing factors on students' participation in co-curricular activities such as the role of teacher, infrastructural facilities, funding and parental involvement, the representative responses of the principals are as follows:

- All principals have basic general concepts of co-curricular activities.
- Most of the principals perceived co-curricular activities have advantages for students.
- There is little effectiveness of co-curricular teaching in today schools.
- Barriers of Co-curricular Teaching in Schools (principals' responses)
  1. There are little competent teachers in all co-curricular teachings.
  2. Since no adequate teachers in schools, there are more burdens on teachers to teach co-curricular activities.
  3. Insufficiency of teaching aids for some co-curricular activities.
  4. Lack of appropriate space or playground in schools.
  5. Some activities cost appropriate funds to carry out and there is no particular fund allotment for co-curricular activities in the school grants given by the government.
  6. Most parents are less interested in school activities and in their children education.
  7. Some teachers and students are less interested and little focused in co-curricular activities because these activities have no examination.
  8. Since most of the parents did not know the importance and benefits of these activities, they do not encourage their children to participate in.
- Suggestions of Principals to Become More Participation of Students in Co-curricular Activities
  1. It should be fulfilled more adequate teachers in schools.
  2. It should be appointed specialized teachers for each co-curricular activity or subject.
  3. It should be trained in-service teachers about how to teach these activities.
  4. If possibility, particular fund for all co-curricular activities are assigned by the government.

5. It should be supplied adequate infrastructures, facilities, and equipment for co-curricular teaching.
6. It should be distributed knowledge of co-curricular activities to the students' parents by any way.

Discussion

The main purpose of this study is to investigate the factors on middle school students' participation in co-curricular activities. The researcher assigned the possible four factors previously, such as, the teachers' role factor, infrastructural role factor, funding role factor and parental involvement role factor, and then prepared three sets of questionnaires dealing with these factors for three strata, such as students, teachers and principals.

In order to assess the assumptions of participants on the factors influencing students' participation in co-curricular activities, three groups such as disagree, normal and agree are classified as presented in Table 2. the percentages of disagree populations of the study on each factor are relatively small to the comparison of agree populations, so the assumptions of the participants in respect of the four factors were the same as the researcher that these four factors would be influenced to the students' participation in co-curricular activities.

In the part of relationship between students' participation in co-curricular activities and the four factors, by applying Pearson correlation analysis, the results showed that the four factors such as the role of teachers [$r(471) = .407^{***}$, $p < .001$], infrastructures [$r(471) = .310^{***}$, $p < .001$], funding [$r(471) = .199^{***}$, $p < .001$] and parental involvement [$r(471) = .292^{***}$, $p < .001$] were positively and significantly correlated.

The results of the role of teachers revealed that the correlation was positive correlation. This means that if the performance of teachers in co-curricular teaching is high, the participation of students in co-curricular activities is likely to be high, or if the performance of teachers in co-curricular teaching is low, the participation of students in co-curricular activities is likely to be low. In other word, students who are teached by more enthusiastic teachers were more eager to participate in co-curricular activities than who are teached by less enthusiastic teachers. Therefore the role of teachers significantly affects students' participation in co-curricular activities.

Based on the result of infrastructural facilities, it shows the direction of correlation was positive. This means that if the role of infrastructural facilities in the schools is high, the participation of students in co-curricular activities is likely to be high, or if the role of infrastructural facilities in the schools is low, the participation of students in co-curricular activities is likely to be low. In other word, students whose schools have good and adequate infrastructures, playgrounds and agricultural grounds are willing to learn co-curricular activities than those have poor. Therefore the role of infrastructural facilities significantly affects students' participation in co-curricular activities.

According to the research's finding concerning with funding, the result shows that the direction of correlation was positive and low related. This means that if the schools may have more adequate fund for co-curricular activities and may be used appropriately them in the teaching of co-curricular activities, the level of students' participation in co-curricular activities may be high. Moreover, there is found that less adequate fund granted by the government for co-curricular teaching in Myanmar Schools. It seems that it is one of the barriers in more co-curricular participation.

The result of parental involvement showed that the direction of correlation was positive and low related. This means that if the students receive appropriate directions, endowments and encouragements to participate in co-curricular activities by their parents, the level of students' participation in co-curricular activities is high. If so not, students are less and less interest and do finally not participation in co-curricular activities. Therefore, the role of parental involvement significantly affects students’ participation in co-curricular activities.

And the multiple regression analysis revealed that the role of teacher appeared to be the strongest predictor of students’ participation in co-curricular activities. So it may be interpreted that the better the role of teachers in co-curricular teaching, the higher the students’ participation in co-curricular learning would be. The adjusted R^2 value is .216 and this indicates that approximately 22 % of the variance in students’ participation in co-curricular activities can be predicted from the influencing factors.

To enhance the credibility of the current research’s findings, the researcher conducted interview with (13) principals of the sample schools. Based on their responses, it was found that the four factors assigned by the researcher such as the roles of teachers, infrastructures, funding and parental involvement are inclusive in interview responses. So, it is confirmed the quantitative results of the study.

Results of qualitative and quantitative data analysis showed that these four factors have the significant relationship towards students’ participation in co-curricular activities. It can be realized that these factors are necessary to become more participation of students in co-curricular activities at the middle school level in the selected township.

Conclusion

Modern education recognized that when the child comes to the school, he comes in mentally, physically, spiritually, socially and vocationally and as such he must be educated in all of them, now it is recognized that these activities are valuable media for developing proper attitudes, habits, interests, ideals among people. Because of their importance in education, they have been renamed as co-curricular activities as they form an integral part of the school curriculum (Kisango, 2016). Parents, teachers and administrators should implement it effectively in all types of educational setting through all related agencies of education. Co-curricular activities are important elements of the curriculum and should not be treated as extra activities but treated as non-academic improvement activities.

In this research, different variables of determinants of the influencing factors on students’ participation in co-curricular activities were investigated. The study included variables such as role of teachers, role of infrastructures, role of funding and role of parental involvement. It was found out that these variables had a direct impact on the development of the students’ participation in co-curricular activities because of positive correlations between them.

The role of teachers in the development of co-curricular participation among middle school students was very affected as from the analyzed data. It can be concluded that teachers play a very important role in co-curricular teaching. Teachers should be the best role models for instilling or implanting the knowledge of co-curricular activities. In Myanmar, most teachers cannot encourage and stimulate pupils to participate actively in the co-curricular activities in schools because of the assigned monthly content of the academic subjects to finish regularly. Although it was natural process in teaching co-curricular activities in schools, the teachers should try to change their attitude towards teaching co-curricular activities and should not adopt that their responsibility was enough to finish the assigned syllabus.

The research findings also revealed that the role of parental involvement was the further influencing factors on students’ participation in co-curricular activities. By the students’ responses of the dimension of parental involvement from the students questionnaires, parents were seen to contribute positively in their role on the development of students’ participation in co-curricular activities. It can be concluded that when parents or family members are involved in their children's development of co-curricular participation in positive ways, students more participate and realize their potential in co-curricular activities.

According to the research findings of the roles of funding and infrastructures, they play a significant effect on students' participation in co-curricular activities. By this study, it can be concluded that when schools funding is increased and more money allocated towards co-curricular activities, more students participate and then their skills are nurtured. From the quantitative and qualitative findings, Myanmar schools are weak in the part of funding towards co-curricular activities. Moreover, it was found that there are inadequate infrastructures in some schools in the research, so some co-curricular activities cannot be carried out effectively. Therefore, the government and stakeholders such as teachers, parents and education officials should cooperate and put the relevant infrastructures in place to encourage students' participation in co-curricular activities.

To conclude, this study shows that students' participation in co-curricular activities is affected by many factors which co-curricular teachers and learners should be aware of. The four factors investigated in this research are moderately linked to the participation of students in co-curricular activities. It is sure that there are many other residual factors. Another researcher should investigate other influential factors on students' participation in co-curricular activities. Then, the stakeholders in education should provide appropriate plans to improve the development of co-curricular participation among students.

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A STUDY OF THE RELATIONSHIP BETWEEN THE MIDDLE SCHOOL STUDENTS' MATHEMATICS-RELATED BELIEF SYSTEMS AND THEIR PROBLEM SOLVING ABILITY

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Abstract

The main purpose of this research is to study the relationship between the middle school students' mathematics-related belief systems and their problem solving ability. A quantitative research method and descriptive research design were used to study students' mathematics-related belief systems and their problem solving ability. This study was conducted in Yangon Region. The sample schools for this study were randomly selected. Two high schools and one middle school were selected from each district, Yangon Region. Therefore, eight high schools and four middle schools were included in this study. The (600) Grade Eight students were participated in this study. A Mathematics-Related Beliefs Questionnaire (MRBQ) and a problem solving ability test were used as instruments. To measure the reliability of the instrument, a pilot test was conducted to (50) Grade Eight students. The internal consistency (Cronbach's Alpha) of the students' Mathematics-Related Beliefs Questionnaire (MRBQ) was (.736) and students' problem solving ability test was (.733). This means that these instruments have the reliability. The copies of modified instrument were distributed to all the participants of the twelve selected schools with the help of the headmaster/headmistress and teachers from those schools. The data were analyzed by using the descriptive analysis techniques and Person product moment correlation in this study. The research finding revealed that there were positively moderate relationships between the students' beliefs about mathematics education and their problem solving ability ($r = .615$, $p < .01$), the students' beliefs about the self and their problem solving ability ($r = .635$, $p < .01$), the students' beliefs about the social context and their problem solving ability ($r = .606$, $p < .01$). Furthermore, the relationship between the students' mathematics-related belief systems and their problem solving ability was positively high relationship ($r = .790$, $p < .01$). Findings pointed out that the students' mathematics-related belief systems influence on the students' problem solving ability, so there is a relationship between students' mathematics-related belief systems and their problem solving ability.

Keywords: Students' Mathematics-related Belief Systems, Problem Solving, Problem SolvingAbility

Introduction

Education is essential for everyone. It enables an individual to make his life better both as an individual and as a member of his society. Mathematics education also plays a vital role in the present day scientific and technological world. One cannot also do without the use of fundamental processes of mathematics in daily life. It can be visualized as the vehicle to train a person to think, reason, analyze, and to articulate logically. So, mathematics is very important for everyone. Moreover, mathematics is a subject that is filled with problems. According to Branca (1980, cited in Rahayu & Kartono, 2012), the ability of problem solving is the heart of mathematics. Op'tEynde and De Corte (2004) explained that in order for students to become competent problem solvers they must develop a mathematical disposition, where affect plays a major role. More specifically, student's mathematics-related belief systems form a central component of a mathematical disposition and have a strong impact on learning and problem solving (Op'tEynde & De Corte, 2004).

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Statement of the Problem

Mathematics is very important subject. It is a compulsory subject from the primary school level to high school level in Myanmar. However, over four years of the teaching career of the researcher, it was found that many students have the hateful notion in mathematics learning. They may think that learning mathematics and calculating mathematical problems are unattainable tasksand these are not related real life situation. This hateful notion seems to be undermined their mathematics achievement and problem solving ability. A large number of teachers hope that students will be able to improve the mathematics achievement and problem solving ability.

Schoenfeld(1989) pointed out that students' ability to solveproblems is often undermined by their beliefs about mathematics. So, it is important thing that students must possess positive beliefs about mathematics to do mathematical tasks unreservedly. But, the researcher thinks that most students do not have beliefs about mathematics. This is undoubted aspect that beliefs play great role in mathematics learning and teaching.

Schoenfeld (1989) claimed that the learning outcomes of students are strongly related to their beliefs about mathematics. By his claim, how students' mathematics-related beliefs influence on their learning and problem solving of this subject has attracted to the researcher. Therefore, the researcher would like to study the middle school students' mathematics-related belief systems and the relationship between these systems and students' problem solving ability.

Purposes of the Study

The main purpose of this research is to study the relationship between the middle school students' mathematics-related belief systems and their problem solving ability.

The specific objectives are as follows.

- To investigate the middle school students' mathematics-related beliefs
- To examine students' problem solving ability
- To identify the relationship between the middle school students' mathematics-related belief systems and their problem solving ability

Research Questions

Q_1: To what extent do the students possess mathematics-related beliefs?

Q_2: To what extent do the students possess problem solving ability?

Q_3: Is there a relationship between the middle school students' mathematics-related belief systems and their problem solving ability?

Scope of the Study

This research has its own particular limitations. The first limitation is related to the participants of the study. The (600) Grade Eight students from selected eight Basic Education High Schools and four Basic Education Middle Schools, the total twelve schools in Yangon Region are included in this study. The second limitation is that this study is only concerned with the categories and subcategories of students' mathematics-related belief systems which are identified by Op'tEynde, De Corte, and Verschaffel (2002). The three main categories are (1) beliefs about mathematics education, (2) beliefs about the self and (3) beliefs about the social context, i.e., the classroom context. To investigate these beliefs, Mathematics-Related Beliefs Questionnaire (MRBQ) will be used. The third limitation is the content areas of the subject that is mathematics. The content areas are limited to fourteen chapters from Grade Eight mathematics textbook volume I and four chapters from mathematics textbook volume II to construct problem solving ability test that is used to measure students' problem solving ability.

Definition of Key Terms

Students' Mathematics-Related Belief Systems

Students' mathematics-related belief systems can be defined as the implicitly or explicitly held subjective conceptions students hold to be true about mathematics education, about themselves as mathematicians, and about the mathematics class context.

(De Corte & Op'tEynde, 2002)

Problem Solving

Problem solving is the process of working detail of problem to reach a solution. Problem solving may include mathematical or systematic operations and can be a gauge of an individual's critical thinking skills. (Longman Company, 2009)

Problem Solving Ability

In this study, problem solving ability is referred to an essential ability in which includes reading skill to comprehend or understand the statement, process skill to identify the mathematical operations and quantities needed to solve the problem, and computational skill to carry out the computation accurately.

Significance of the Study

With new developments in cognitive science in the 1970s, attention to beliefs and belief systems re-emerged. Students hold certain beliefs about mathematics and about themselves that play an important role in the development of their affective responses to mathematical situations (Mcleod, 1992). More specially, studies on students' value and expectancy beliefs in the context of mathematical learning and problem solving clearly show how these beliefs relate to students' motivation and the way they engage in mathematical learning and problem solving. Beliefs about the self strongly determine students' emotions during problem solving (Op'tEynde et al., 2002). Students' belief about teaching and the practices characterizing their specific classroom context have been found important factors to be taken into account if the academic behaviors in the classroom want to be understood fully.

And also several studies have conducted about the mathematics-related belief systems. The researcher thinks that the results of the current study may raise students' awareness of their probable belief systems and how they influence their learning, problem solving and achievement in mathematics.According to the reasons mentioned above, it is clear that it is necessary to study students' mathematics-related belief systems and how these belief systems impact students' problem solving.

Theoretical Framework

Problem Solving

Polya (1985) proposed that problem solving was a major theme of doing mathematics and teaching students to think was of primary importance. How to thinkis a theme that underlies much of genuine inquiry and problem solving in mathematics. Problem solving has come to be viewed as a process involving the highest faculties – visualization, association, abstraction, comprehension, manipulation, reasoning, analysis, synthesis, generalization – to be managed and all ending to be coordinated.

For a learner to effectively solve a mathematical problem, he/she should clearly identify four components at the initial or approach stage of problem solving.

1. The goal or goals (The thing or things wanted to do in a situation).
2. The givens (The facts and factors that are available to start in a problem situation).
3. The obstacles (The elements or factors that get in the way of a solution).
4. The methods or operations (The procedures that may be used to solve the problem).

Strategies in solving mathematics problems are essential in mathematics education. Problem solving procedure is a plan made as to how question can be solved, and a perspective and pattern in the events. The most commonly used problem solving model is Polya's four-step model including understand the problem, devise a plan, carry out the plan, and look back to check the results (Polya, 1985).

Problem Solving Ability

The efficiency and ability in solving problems is the basis of success in learning mathematics. The learner must have adequate knowledge of such essential information as number facts, relationships of commonly used measures, arithmetical symbols, formulas, the technical vocabulary of arithmetic, and the use of graphs and tables. Problem solving ability depends on not only problem solving intelligence but also the relationship between problemsolving and arithmetical understanding. In addition, an interest in mathematics and in learning to solve problems plays a significant role in problem solving ability.

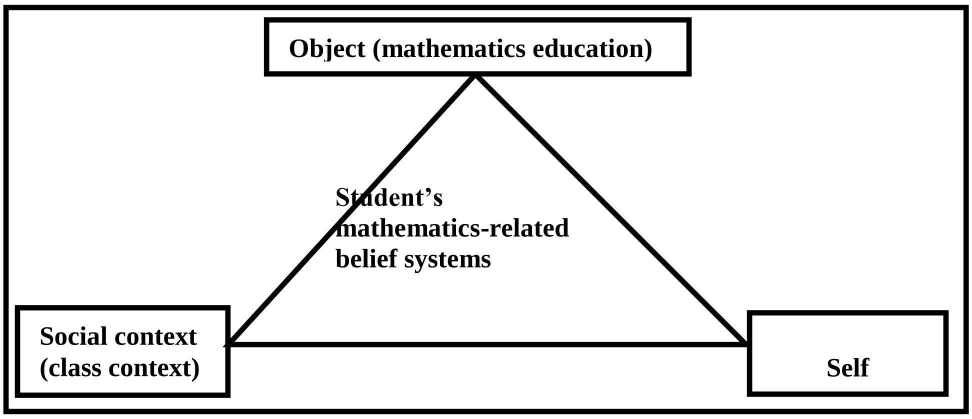
Problem Solving and Beliefs

The ability to solve mathematics problems develops slowly over a very long period of time because it requires much more than merely the direct application of some mathematical content knowledge. Problemsolving performance seems to be a function of at least five broad, interdependent categories of factors: knowledge acquisition and utilization, control, beliefs, affects and socio-cultural contexts (Charles & Lester, 1982, cited in Ozturk&Guven, 2016).

Cognitive skill is needed but itself is not sufficient to support problemsolving behavior. In addition to possessing affectivedomain, problem solvers need to be able to manage their ability and skills. According to Sriraman (2003), it is currentlyaccepted that the cognitive processes involved in problem solving are susceptible to the influence oftheaffective domain in its three fundamental areas: beliefs, attitudes, and emotions.

Students' Mathematics-Related Belief Systems

An analysis of the nature and the structure of beliefs and belief systems show that the social context, the self, and the object in the world that the beliefs relate to, are constitutive for the development and the functioning of these systems. The constitutive dimensions of students' mathematics-related belief systems can then be represented as a triangle (see Figure 1).



Source: From Op't Eynde, De Corte, and Verschaffel (2002), P. 27.

Figure 1 Constitutive Dimensions of Students' Mathematics-Related Belief Systems

Students' mathematics-related beliefs are constituted by theirbeliefs about mathematics education,beliefs about the self, andbeliefs about the social context (i.e. class context). A framework of students' mathematics-related beliefs in which the major components of the modelspresented above were tried to integrate was developed. The different categories and subcategories of the framework are presented in the Table 1.

Table 1 A Framework of Students' Mathematics-Related Beliefs

Beliefs about Mathematics Education	Beliefs about the Self	Beliefs about the Social Context
(a) Beliefs about mathematics as a subject (b) Beliefs about mathematical learning andproblem solving (c) Beliefs about mathematics teaching	(a) Goal orientation beliefs (b) Task value beliefs (c) Control beliefs (d) Self-efficacy beliefs	(a) Beliefs about social norms in their own class -the role and the functioning of the teacher -the role and the functioning of the students (b) Beliefs about socio-mathematical norms in their own class

Source: Adapted from Op't Eynde, De Corte, and Verschaffel (2002), P. 28.

Previous Related Researh

Lerch (2004) conducted a study with the title "Control decision and personal beliefs their effect on solving mathematical problems." He found that belief affected students' approach to problem solving. Specifically, students' personal belief systems provided confidence that would be able to solve the problem. Chirove (2014) conducted the research on "The relationship between learners' mathematics-related belief systems and their approaches to non-routine mathematical problem solving: A case study of three high schools in Tshwane north district (D3), Sourth Africa." He found that a weak positive linear relationship between them.

Research Methodology

Research Design

The research design used for this study was a descriptive research design.

Procedure for the Study

The students' result in mathematics achievement and problem solving ability is still under unsatisfactory condition. One assumption for this may be imperfectly students' beliefs about mathematical context. To what degree the students possess beliefs about mathematical context and are there really influences beliefs on students' mathematics achievement and problem solving ability should be investigated. So the researcher sought out the literature related to this study through books and Internet sources. After that, a Mathematics-Related Beliefs Questionnaire and a problem solving ability test were constructed for this study. To find the reliability of the instruments a pilot test with (50) Grade Eight students was conducted.Then, eight high schools and four middle schoolsfrom Yangon Region were selected by using a random sampling method. Six hundred Grade Eight Students were also selected as participants.The required data are collected with the help of the headmaster/headmistress of those schools and the test was administered and then the data were entered into the computer data file and were analyzed using the Statistical Package for the Social Science (SPSS 22).

Instruments

In this study, a Mathematics-Related Beliefs Questionnaire(MRBQ) and a problem solving ability test for Grade Eight students were used as instruments.

(a) Mathematics-Related Beliefs Questionnaire

Mathematics-Related Beliefs Questionnaire (MRBQ) developed by Op'tEynde and De Corte (2004, cited in Physick, 2010 &Chirove, 2014) was adapted.The total items were (50) on five point Likert-type scale from (1) to (5). For positive items, the score closer to (1) indicated "Never/Strongly Disagree" and "Always/ Strongly Agree" was indicated by the score closer to (5). For negative items, the score closer to (1) indicated "Always/ Strongly Agree" and (5) indicated "Never/Strongly Disagree". To measure the reliability of the questionnaire, the Cronbach's Alpha was used. According to the pilot study, the internal consistency (Cronbach's Alpha) of the questionnaire for all mathematics-related belief systems was (.736).

(b) Problem Solving Ability Test

In order to measure the problem solving ability of the students, a problem solving ability test was constructed .This test covered (18) chapters: (14) chapter (Chapter 1 to 14) from Grade Eight mathematics textbook volume I and (4) chapters (Chapter 1 to 4) from mathematics textbooks volume II. In this test, there are (10) multiple choice items for the score (10) marks of the test and (4) seen and (4) unseen problems for the score (40) marks of the test and the total score was (50) marks. Its internal consistency is (.733).

Population and Sample Size

All the participants in the sample were Grade Eight students. This study was conducted in Yangon Region. There are four districts in Yangon Region. One township from each district was randomly selected for this study.The sample schools for the study were selected by using a stratified random sampling technique. Two high schools and one middle school from each township were selected as the sample. Therefore, twelve schools (eight high school and four middle schools) are included in this study. The total number of students participated in this study were (600). The students in this study were selected by an equal-size (non-proportional) random sampling technique.Table 2 shows the number of population and the sample size in the selected schools.

Table 2Population and Sample Size

No.	District	Township	School	No. of Student	
				Population	Subject
1.	East	Tharkayta	B.E.H.S (4)	287	50
2.		Tharkayta	B.E.H.S (5)	367	50
3.		Tharkayta	B.E.M.S (7)	187	50
4.	West	Mayangone	B.E.H.S (2)	630	50
5.		Mayangone	B.E.H.S (3)	138	50
6.		Mayangone	B.E.M.S (3)	112	50
7.	South	Thongwa	B.E.H.S (1)	237	50
8.		Thongwa	B.E.H.S (2)	240	50
9.		Thongwa	B.E.M.S – Ye New	52	50
10.	North	Hlaingtharyar	B.E.H.S (2)	292	50
11.		Hlaingtharyar	B.E.H.S (3)	389	50
12.		Hlaingtharyar	B.E.M.S (5)	332	50
Total				**3263**	**600**

*Note.*B.E.H.S = Basic Education High School
B.E.M.S = Basic Education Middle School

Data Analysis

The data were analyzed by using descriptive statistics (mean and standard deviation). Moreover, the Pearson product-moment correlation was used to describe the relationships between the middle school students' mathematics-related belief systems and their problem solving ability.

Research Findings

Findings of Students' Mathematics-Related Belief Systems

In order to find out the students' mathematics-related belief systems, (50) items were used. The full score of students' Mathematics-Related Beliefs Questionnaire (MRBQ) was (250). In order to examine the percentage of students who possess mathematics-related belief systems of low, moderate, high levels a descriptive statistics (percentage) was used. The average mean score and the standard deviation by all the participants were (184.19) and (17.005) respectively. So based on these results, if the score was below (167), it would be defined as low level of mathematics-related belief systems. If the score was between (167) and (201), it would be defined asmoderate level of mathematics-related belief systems. If the score was above (201), it would be defined as high level of mathematics-related belief systems. From the total number of participants, 11.3% (N =68) of the students possess low level, 72.5% (N = 435) of the students possess moderate level and 16.2% (N = 97) of the students possess high level of mathematics-related belief systems (see Table 3).

Table 3 Students' Level of Mathematics-Related Belief Systems

Level of Mathematics-Related Belief Systems	Score (x)	No. of Student	Percentage (%)
Low	$x < 167$	68	11.3
Moderate	$167 \leq x \leq 201$	435	72.5
High	$x > 201$	97	16.2
Total		**600**	**100%**

Comparison of the Three Categories ofStudents'Mathematics-Related Belief Systems

When the mean percentages of three categories of students' mathematics-related belief systems are compared, the mean percentage of beliefs about mathematics education was (71.01%), beliefs about the self was (73.44%), and beliefs about the social context was (76.65%) respectively (see Table 4). It indicates that the mean percentage of students' belief about mathematics education was the lowest and students'beliefs about the social context was the highest.It indicates that the mean percentage of students' belief about mathematics education which is the first category of students' mathematics related-belief systems was the lowest and the mean percentage of students'beliefs about the social context which is the third category of students' mathematics related-belief systems was the highest.

Table 4 TheComparison of the Mean Percentages of Three Categories of Students' Mathematics-Related Belief Systems

Students' Mathematics-Related Belief Systems	No. of Student	Mean	Mean Percent-age (%)	Standard Deviation	Mini-mum	Maxi-Mum
Beliefs about Mathematics Education	600	53.26	**71.01**	6.518	36	69
Beliefs about the Self	600	73.44	73.44	8.041	29	95
Beliefs about the Social Context	600	57.49	**76.65**	7.135	27	73

Findings of Students' Problem Solving Ability

In order to find out the students' problem solving ability, a problem solving ability test was administered.The full score of students'problem solving abilitywas (50). In order to access the students' problem solving ability level, it was necessary to examine the percentage of students whoseproblem solving abilitylevel is low, moderate and high in all the participants. The average mean and standard deviation by all the participants were (28.68) and (8.759) respectively. So based on these results, if the score was below (20), it would be defined as low problem solving ability level. If the score was between (20) and (37), it would be defined as moderate problem solving ability level. If the score was above (38), it would be defined as high problem solving ability level. The findings of students' problem solving abilitywere presented in Table 5 in terms of three levels.From the total number of participants, 17.5% (N = 105) of the students were at low level, 59.5%(N = 357) of the students were at moderate level and 23% (N = 138) of the students were at high level of problem solving ability.

Table 5 Students'Level of Problem Solving Ability

Level of Students' Problem Solving Ability	Score (x)	No. of Student	Percentage (%)
Low	$x < 20$	105	17.5
Moderate	$20 \leq x \leq 37$	357	59.5
High	$x > 37$	138	23
Total		**600**	**100%**

Findings of the Correlations between Students' Mathematics-Related Belief Systems and their Problem Solving Ability

The correlation analysis was performed between students' mathematics-related belief systems (overall belief systems, beliefs about mathematics education, beliefs about the self, and beliefs about the social context) and their problem solving ability using the Pearson product-moment correlation. Table 6 shows the correlation between students' problem solving ability and their mathematics-related belief systems in terms of beliefs about mathematics education, beliefs about the self, and beliefs about the social context.

Table 6 The Correlations between Students' Mathematics-Related Belief Systems and their Problem Solving Ability

Students' Mathematics-Related Belief Systems	Correlation (Problem Solving Ability)
Beliefs about Mathematics Education	**.615****
Beliefs about the Self	**.635****
Beliefs about the Social Context	**.606****
Over all Belief Systems	**.790****

**. Correlation is significant at the 0.01 level (2-tailed).

Discussion, Suggestions, Conclusion

Discussion

This research finding supports the finding of Lerch (2004) and is similar to the finding of Chirove (2014) though a little different result had.

According to the research findings of students' mathematics-related belief systems, it was found that (11.3%) of the students possessed low level, (72.5%) of the students possessed moderate level, and (16.2%) of the students possessed high level. These findings revealed the answer to research question (1): To what extent do the students possess mathematics-related beliefs?Moreover, the fact that beliefs about mathematics education was lowest was found so students do not believe and cannot perform to apply their lesson in their daily life. The fact beliefs about the social context was highest indicated that most students depend on teachers and their peers. Positively, the warm relation, collaboration, accommodation, and adjusting between students and teacher and between peers were found.

Concerning with the students' problem solving ability, (17.5%) of the students possessed low level of problem solving ability, (59.5%) of the students possessed moderate level of problem solving ability and (23%) of the students possessed high level of problem solving ability. These findings revealed the answer to research question (2): To what extent do the students possess problem solving ability? This result indicated students had difficulty in thinking unseen problems, formulating solutions from word problems and solving geometrical figures.

The correlation between the students' mathematics-related belief systems and their problem solving ability was found that the correlation (r (10) = .790, $p < .01$). This result showed that the direction of correlation was positive and it indicated that if the students' mathematics-related belief systems were high, the students' problem solving ability was also high and if the students' mathematics-related belief systems were low, the students' problem solving ability was also low. So, this finding revealed the answer to research question (3): Is there a relationship between the middle school students' mathematics-related belief systems and their problem solving ability?

Suggestions

Some suggestions for the improving of each mathematics-related belief systems and problem solving ability are as follows.

Suggestions for Improving the Students' Beliefs about Mathematics Education: Teachers should perform to gain knowledge for students to connect mathematics lessons to their daily life and other course. The facts that mathematics is continuously evolving and new thing are still being discovered should be demonstrated by giving unseen problem such as external problems and unusual problems. Moreover, teachers should never humiliate the students about mathematics learning and doing mathematical task and never use mathematics as a punishment.Teachers should try to make mathematics lessons interesting for students by asking to compete each other in solving problems, to discover own invention and to design a graph by using mathematical calculated data. In teaching mathematics, students' centered approach should be adopted and new lessons should be taught based on previous knowledge. Furthermore, teachers should keep in mind individual difference of the learner while teaching. Consequently, positive beliefs about mathematics education would increase.

Suggestions for Improving the Students' Beliefs about the Self: Teachers should use instructional strategies to encourage the development of critical thinking skills such as think-pair-share, brain-storming, problem-based learning. Teachers should practice students to enjoy pondering mathematical exercise. So, thought-provoking problems should be provided to students. Problem-based learning should be used for active participation of the students. Classroom environment should be full of active activities to promote task value beliefs. Moreover, teachers should contribute students the opportunity to choose mathematical assignments that they can learn from even if they are not at all sure of getting a good grade. Students should be allowed to initiate their own strategies to solve problems and struggle with challenges. Sometime, unusual mathematical problems should be provided to sure the thought that the students could handle more difficult mathematical problems. Such the ways, the students' beliefs about the self will be able to promote.

Suggestions for Improving the Students' Beliefs about the Social Context: Teachers should upgrade not only students' skills but also their intrinsically competent by themselves. When students make mistakes in learning mathematics, the teachers should give explanation again instead of punishment. Students to be improved communication skill, the teaching strategies such as cooperation, collaboration, discussion, group investigation should be used.

Students should be made aware of their belief systems and the possible effects of their naive beliefs to mathematical problem solving. Teachers should incorporate students' belief systems in their teaching and learning process in an attempt to encourage the development of positive, health and enlightened mathematics-related belief systems. So, teachers should assess and be aware of students' active belief systems that adversely affect their mathematical problem solving. By doing so, the students' mathematics-related belief systems and problem solving ability can be promoted effectively.

Conclusion

Nowadays, most of the syllabuses are within ace of abstract in nature, the classroom teaching is likely to abstract and textual material is also abstract. So, it is needed that the students who are continuously trained in solving abstract mathematical problems are expected to prefer abstract problem situations. And, their beliefs appear to be for applying their mathematical knowledge in problem situations.

Certain beliefs affected the behaviors of the students and their decisions, as well as which behaviors they will perform in the process. The statement that students' beliefs affect their decisions was supported by the findings of this study. Students' beliefs have positive beliefs and negative beliefs. While some students' beliefs had a positive effect on the problem solving ability, others had a negative effect. The positive effects cause persistence in looking for a solution. Negative effects are giving up the missing problem solving process, failing to make an effort to solve the problem. Students' negative beliefs prevented them from the transition between the steps of problem solving and prevented their transition between the steps changed according to the tack of the problem.

Most of the participants who possessed positive beliefs thought that problem solving was an enjoyable activity as long as they were able to solve the problems they encountered. They believed that they needed to find solutions to the problems to increase their thinking for problem solving and thought the problem solving as gratifying. Therefore, it can be inferred that there was a direct positive relationship between the beliefs and the problem solving ability. It was also determined that students were motivated by their positive beliefs as long as they were successful.

Students' beliefs grow up along mathematics learning and it used to solve not only mathematics problem solving but also to solve daily life problem. If mathematical classroom practices can have detrimental effects on students' beliefs, it is plausible to hypothesize that alternative learning environments can be designed that foster positive mathematics-related beliefs in children. Students' mathematics-related beliefs are manifested in the classroom in whether and how they ask and answer questions, work on problems, and approach new mathematical tasks. The assessment of students' mathematics-related beliefs can help teachers plan instruction and structure the classroom environment so as to help students develop more enlightened beliefs about mathematics and mathematics learning. Furthermore, students' awareness of how beliefs develop, change over time and affect learning might assist them to develop a healthy relationship with mathematics. The information in this study can provide teachers with valuable information about the beliefs that influence their students' study of mathematics

Finally, the fact that the students' mathematics-related belief systems really impact on students' achievement and problem solving ability cannot deny according to the results of the current study. And, mathematics teachers will realize that their students need to improve mathematics-related beliefs through this study. Although this study cannot fulfill all the aims of teaching mathematics in the middle school, it can be hoped that it can support, to some extent, to try for improving middle school students' mathematics-related belief systems and their problem solving ability in Myanmar.

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