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THE EFFECTIVENESS OF SCIENCE PROCESS SKILLS MODEL IN THE TEACHING OF HIGH SCHOOL CHEMISTRY

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Abstract

The major purpose of this research is to investigate the effectiveness of the science process skills model in the teaching of high school Chemistry. The research design adopted in this study was an explanatory sequential (QUAN → qual) design, one of the mixed methods research designs. The research design for the quantitative study is a single-group pretest/posttest design, one of the quasi-experimental designs. The participants were Grade 10 students selected from BEHS, Hlegu, No. (4) BEHS Thanlyin, BEHS, Pyalo, and No. (1) BEHS Thayet. For this study, Grade 10 students were selected as experimental group from each school by random sampling method. Before the treatment period, the experimental group was administered a science process skills test before the instruction using the science process skills model. Then, the experimental group was treated with the science process skills model. After that, all students in the experimental groups were administered to a science process skills test. As data analysis, the nonindependent samples *t* test was used for the quantitative research study. Data collected from observation checklists were analyzed by content analysis for the qualitative research study. One hundred and seven students from the experimental groups were administered the science process skills tests and were observed. The results indicated that there were significant differences in the science process skills tests scores of experimental groups before and after using science process skills model. Qualitative data indicated that the use of science process skills model tends to facilitate effective teaching-learning implementation. Research findings proved that the science process skills model had a positive impact on acquisition of science process skills and teaching Chemistry at the high school level.

Keywords: Science, Chemistry, Basic science process skills, Integrated science process skills, Science process skills model

Introduction

Education cultivates individuals to be mature and capable of supervising their futures and taking the right decisions. The main responsibility of education is to ensure the formation of rational receptors of cognitive actions, otherwise known as logical cognitive structures (Khin Zaw, 2001). Especially, learning should include the acquisition of core academic content and higher-order thinking skills.

Science process skills enable students to experience hands-on engagement with science materials when solving problems using practical approaches. Science process skills arouse analytic thinking. Analytic thinking activity is the ability to analyze, assess, evaluate, compare, and contrast abstract concepts. In order to develop children’s thinking skills and creativity, science process skills play an important role by providing students to produce scientific knowledge as well as learn the nature of science by doing and experiencing.

One of the science subjects, Chemistry comprises of scientific thinking skills. Thus, the pedagogy for Chemistry should be innovative. The importance of the present study is to examine the effectiveness of science process skills model in the teaching of Chemistry. This study emphasizes processing sequentially, and in multiple modes. Especially, this study develops students in adaptive and productive thinking. It can motivate students' achievement and acquisition of science process skills in teaching high school Chemistry.

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Purpose of the Study

The main purpose of this study is to investigate the effectiveness of science process skills model in Chemistry teaching at the high school level. The specific objectives are as follows:

- To investigate the effectiveness of the science process skills model in high school Chemistry teaching
- To explore the science process skills of students who are taught by the science process skills model
- To study the attitudes of teachers and students relating to the science process skills model
- To make suggestions based on the data obtained for improving the teaching of Chemistry at the high school level

Research Questions

- What are the effects of the science process skills model in the teaching of high school Chemistry?
- Are there significant differences in the science process skills (basic science process skills and integrated science process skills) test scores of experimental groups before and after the instruction using the science process skills model?
- What are the attitudes of teachers and students towards using the science process skills model?

Scope of the Study

The scope of the study is as follows:

- This study is geographically restricted to Yangon Region and Magway Region.
- This study is limited to the selected chapter of Chapter 3: The Electronic Structures of Atoms and Periodic Table, Chapter 4: The Quantities of Substances: Chemical Calculations, Chapter 5: Non-metals: Oxygen, Carbon, and Halogens, and Chapter 6: Acids, Bases, and Salts from Grade 10 Chemistry textbook and is conducted in four sample schools in Yangon Region and Magway Region.
- Participants in this study are (107) Grade 10 students and four teachers from the selected schools within the school year (2020-2021).

Definitions of Key Terms

Science: Science is the study of knowing about the universe through data collected by observation and controlled experimentation (Carin & Sund, 1989).

Chemistry: Chemistry may be defined as the branch of science which is concerned with the study of the composition, properties, and structure of matter and the ways in which substances can change from one form to another or react with one another (Ray, 2007).

Basic Science Process Skills: Basic Science process skills contain skills including observation, classifying, measuring, and calculation, using space/time relationships, communicating, inferring, and predicting (Dahsah, Seetee, & Lamainil, 2017).

Integrated Science Process Skills: Integrated science process skills contain skills including formulating hypotheses, defining operationally, identifying, and controlling variables, experimenting, interpreting data, and making inferences (Martin et al., 2005).

Science Process Skills Model (Operational Definition): The science process skills model is a teaching model with the integration of both basic science process skills and integrated science process skills to shape the effective teaching-learning process.

Review of Related Literature

Philosophical Foundations

Pragmatism, progressivism, cognitivism, and constructivism are deeply taken into philosophical consideration.

Pragmatism emphasizes practical activity. As pragmatism is all about taking action and achieving results, pragmatists view children as active, competent, and capable individuals. The child can seek out and find solutions to the problems that trouble them in their lessons. Problem solving and practical works provide personal experiences. Man is a social being and he gets more and more knowledge through personal experiences.

Progressivists believe that education is fundamental for individuality, progress, and change. According to the progressivist perspective, individuals have responsibility for learning. Finding solutions for problems in the classroom like those students will encounter in their daily lives is the step for their progression. Learning through discussions and group work develops social qualities. Interacting with each other can learn from different points of view. Thus, students should involve in the education process through action and go to the product. Problem solving and thinking critically provide students to be able to ready for the real world and a lot of daily conflicts.

Cognitivism focuses on the mind, and more specifically on mental processes. The mental processes include thinking, knowing, memory, and problem-solving. Knowledge is approached as schema constructions, and learning can be viewed as a change in the learner's schemata or the accumulation of experience from pre-learning. Thus, cognitivism is related to schema theory.

Constructivism sees learning as a dynamic and social process in which learners actively construct meaning the concept from their experiences in connection with their prior knowledge. Students learn best when engaged in learning experiences rather than passively receiving information. Learning is inherently a social process. Learning is embedded within a social context as students and teachers work together to build knowledge. The external world is interpreted within the context of the private world. The essential component of constructivism is an active, free, and striving belief in the meaning of life.

Psychological Foundations

Gagne’s theory of learning, Piaget’s cognitive development theory, Vygotsky’s sociocultural learning theory, Kolb’s experiential learning theory, and Bandura’s social learning theory are deeply taken into consideration as psychological foundations in the examination of the effectiveness of science process skills model in the teaching of high school Chemistry.

According to Gagne, learning a new capability requires prior learning of capabilities. Knowledge acquisition is based on prior learning capabilities. Gagne’s five categories of human performance can explain the students' understanding. When Gagne's events of instruction occur, internal learning processes take place. Gagne's nine events of instruction include gaining attention, informing learners of objectives, stimulating recall of prior learning, presenting the content, providing learning guidance, eliciting performance (practice), providing feedback, assessing performance, and enhancement of retention and transferring the job.

According to Piaget's cognitive development theory, knowledge is not merely transmitted verbally but must be constructed and reconstructed by the learner. Piaget asserted that for a child to know and construct knowledge of the world, the child must act on objects and it is this action that provides knowledge of those objects (Sigel & Cocking, 1977). The intellectual growth of Piaget involves three fundamental processes: assimilation, accommodation, and equilibration.

According to Vygotsky's sociocultural theory, learning is an essentially social process and after the child's immediate social interactions, learning became internalized and there was a shift to the individual level. The zone of proximal development (ZPD) proposes that learning should be compatible with the child's level of development, and interaction should orient instruction towards the ZPD if it is to avoid lagging behind the development of the child (Palincsar, 1998, cited in Yilmaz, 2011).

Kolb provides "a comprehensive theory which offers the foundation for an approach to education and learning as a lifelong process and which is soundly based in intellectual traditions of philosophy and cognitive and social psychology" (ZuberSkerritt, 1992a, cited in Healey & Jenkins, 2000). Kolb's experiential learning theory presents a cyclic model of learning, consisting of four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation.

According to Bandura (1977, cited in Mangal, 2012), the aspects of social learning theory are: learning is a cognitive process that takes place in a social context; learning can occur by observing behavior; learning involves observation, extraction of information from observation is influenced by the type of model as well as a series of cognitive and behavioral processes, including attention, retention, reproduction, and motivation.

Science Process Skills

Today, the trend in teaching science moves from a 'product' approach to a 'process' approach. Science processes form an important part of science education. Thus, teaching science is not merely pouring down knowledge into the intellects of the students. A new approach capable of triggering the processes of thinking, analyzing, and inferring in the student's mind is needed. The scientific process happens naturally in human minds. The science process is beneficial in any circumstances that necessitate critical thinking. Science process skills deal with and cover the activities of materials interaction processes as well as the synthesis of acquired information (Flores, 2004). Science process skills deal with the activities of processes and manipulation of information.

Science can be classified into two dimensions – the process and the product dimensions. The process of science involves the methods of the approach employed and activities engaged in by scientists. These include observation, classification, measurement, inferring, communication, predicting, controlling variables, formulating models, formulation of hypotheses, and manipulating experiments. Science process skills are central to the acquisition of scientific knowledge which is useful in solving problems in society (Abungu, Okere & Wachanga, 2014). According to the

American Association for the Advancement of Science (AAAS, 2010), there are two types of science process skills – basic and integrated. The basic science process skills are simple and integrated science process skills are complex.

Basic process skills are interdependent, implying that more than one of these skills may be displayed and applied in any single activity (Funk et al., 1979, cited in Rambuda & Fraser, 2004). The basic science process skills include observing, inferring, measuring, communicating, classifying, and predicting (Burchfield & Gifford, 1995). The integrated process skills include controlling variables, defining operationally, formulating a hypothesis, interpreting data, and experimenting. Science Process skills are unlimited. They are interrelated and interdependent with each other. Integrated process skills can be achieved only after the attainment of basic process skills.

Description of Science Process Skills Model

The science process skills model consists of three instructional phases. They are (1) pre active phase, (2) interactive phase, and (3) post active phase. Each phase is based on Glaser's basic teaching model, Gerlach and Ely model, Talyzina's cognitivo-cybernetic model, Ned Flander's interaction analysis model, Stolurow's and Davis's computer-based model, and Dr. Khin Zaw's multimodal model.

There are many steps under three phases.

Phase (I) Pre active Phase

(1) Orientation of content with intended learning outcomes,

(2) Assembling appropriate instructional resources and selecting instructional strategies, and

(3) Engaging prior knowledge. The three steps are connected in a linear process flow.

Phase (II) Interactive Phase

(1) Observing

(2) Introduction to Chemistry Concept/ Defining Operationally

(3) Communicating

(4) Classifying/ Controlling Variables

(5) Predicting/ Formulating Hypothesis

(6) Measuring or Focusing Main Concept or Experiencing

(7) Inferring/ Interpreting Data

Phase (III) Post active Phase

(1) Assessment and

(2) Feedback

The science process skills model can be described in Figure 1.

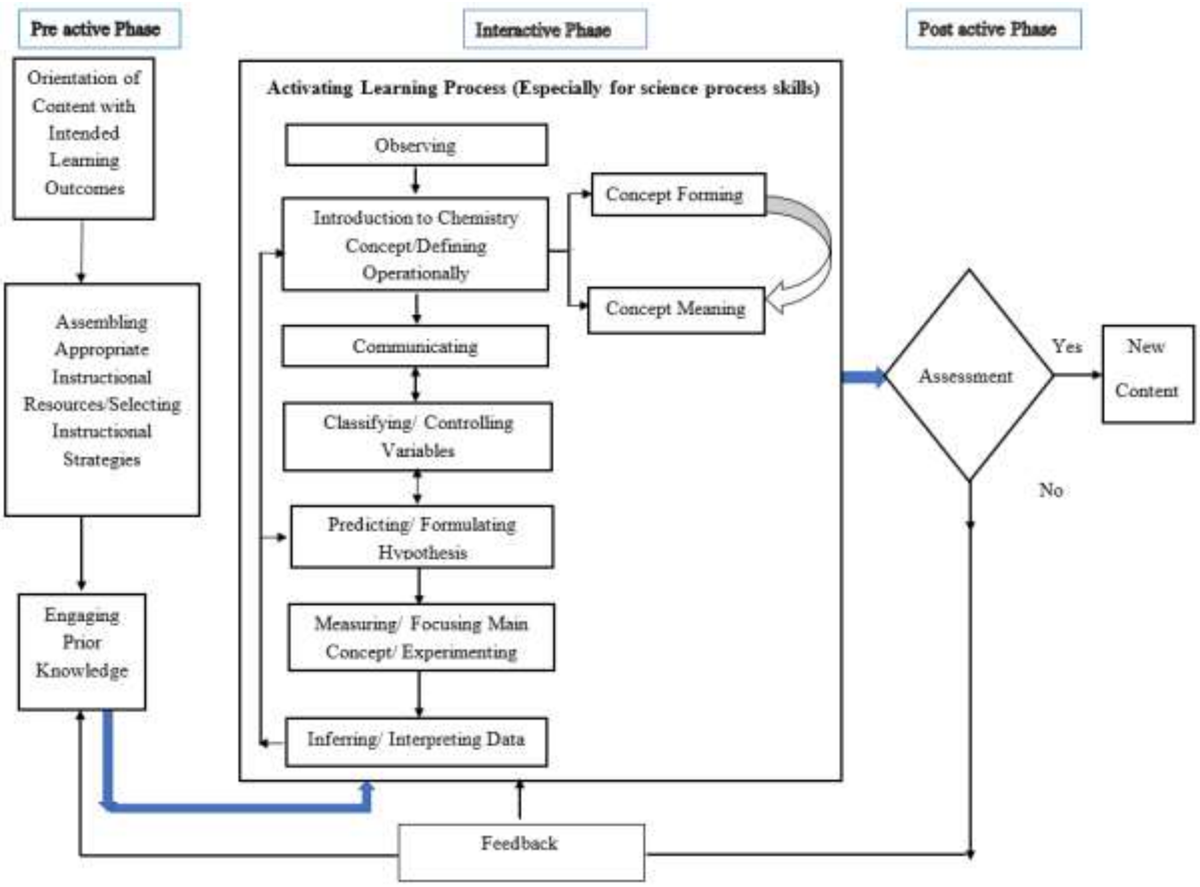

Figure 1 Science Process Skills Model

Method

The research design for this study was an explanatory sequential (QUAN → qual) research design, one of the mixed methods designs. Therefore, quantitative, and qualitative methodologies were used in this study. For the quantitative research methodology, the adopted design was a single-group pretest/posttest design, one of the quasi-experimental designs. The two measures: pretest (before) and posttest (after) can be compared and any differences in the measures are assumed to be the result of the treatment (Jackson, 2012). All participants in this study were Grade 10 students and this study was conducted in Yangon Region and Magway Region. The intact groups were randomly selected and assigned as experimental group and control group. The experimental group received instruction on the science process skills model. Before the treatment period, the experimental group was administered a science process skills test before the instruction using the science process skills model. Then, the experimental groups were taught with the science process skills model. Then, all the students in the experimental groups were administered science process skills after the instruction using the science process skills model. The nonindependent samples *t* test was used to determine whether there are significant differences in the science process skills test scores of experimental groups before and after instruction using the science process skills model. The participants for qualitative research were selected by the purposive sampling method. Thus, all students and one high school teacher from each experimental group were selected as participants for the qualitative research methodology. The data collected from observation checklists were analyzed by content analysis.

Instruments

The instruments used for this study were science process skills test and observation checklists. The instruments were constructed according to the advice and guidance of the supervisor. In order to get validation, the instruments were distributed to nine experts. A pilot study was conducted with (30) Grade 10 students at Basic Education High School, InnTaing in Hlegu Township. The science process skills test was constructed to examine whether there are significant differences between students' science process skills before and after instruction using the science process skills model. It is based on "Developing Science Process Skills Test" (Tezcan & Meric, 2013). The science process skills test includes two parts: basic process skills and integrated process skills. There are 22 items of basic process skills and 18 items of integrated process skills in the science process skills test. The allocated time for the science process skills test was (45) minutes and the given marks were (40) marks. The test items were multiple choice items. The observation checklist was developed to study teachers' and students' activities during treatment through the science process skills model. It is based on the Classroom Observation Schedule (Chebii, Wachanga & Kiboss, 2012). Four rating scale (from 1= not observed to 4= excellent) was used in the observation checklist. In order to get a reliable observation, observation was recorded with a Video Cassette Recorder (VCR) or audiocassette recorder to play back later with the permission of teachers. The total observations are 27 for a total of 48 lesson plans. The interobserver or interrater reliability coefficient for each observation had the lowest value of .78 and the highest value of above .90.

Findings

For quantitative research findings, data were recorded and analyzed systematically. According to the selected quantitative research design, the data obtained from the science process skills test were recorded systematically and analyzed by using the nonindependent samples *t* test to determine whether there are significant differences in the science process skills (basic science process skills and integrated science process skills) test scores of experimental groups before and after the instruction using the science process skills model.

Table 1 *t* Values for Science Process Skills Test Scores of Grade 10 Students in School 1

Paired Sample	N	M	MD	*t*	*df*	*p*	Partial Eta Squared
BSPS (Before)	22	8.59	-6.73	-12.86	21	.000***	.89
BSPS(After)	22	15.32					
ISPS(Before)	22	8.09	-3.96	-8.72	21	.000***	.78
ISPS(After)	22	12.05					
SPS(Before)	22	16.68	-10.36	-17.03	21	.000***	.93
SPS(After)	22	27.37					

Note. BSPS = Basic Science Process Skills; ISPS = Integrated Science Process Skills;
SPS = Science Process Skills.
***$p < .001$.

The results showed that there were significant differences between science process skills (basic science process skills and integrated science process skills) test scores before and after using the science process skills model. Moreover, according to the partial eta squared, the effect size on the science process skills test was a large effect in School 1. It can be interpreted that the use of science process skills model has a significant effect on the acquisition of science process skills of Grade 10 students in School 1 (see Table 1).

Table 2 *t* Values for Science Process Skills Test Scores of Grade 10 Students in School 2

Paired Sample	N	M	MD	*t*	*df*	*p*	Partial Eta squared
BSPS (Before)	29	9.45	-7.24	-13.81	28	.000***	.87
BSPS(After)	29	16.69					
ISPS(Before)	29	7.79	-5.14	-15.66	28	.000***	.90
ISPS(After)	29	12.93					
SPS(Before)	29	17.24	-13.31	-27.36	28	.000***	.86
SPS(After)	29	29.62					

Note. BSPS = Basic Science Process Skills; ISPS = Integrated Science Process Skills;
SPS = Science Process Skills.
***$p < .001$.

u,The results showed that there were significant differences between science process skills (basic science process skills and integrated science process skills) test scores before and after using the science process skills model. Moreover, according to the partial eta squared, the effect size on the science process skills test was a large effect in School 2. It can be interpreted that the use of science process skills model has a significant effect on the acquisition of science process skills of Grade 10 students in School 2 (see Table 2).

Table 3 *t* Values for Science Process Skills Test Scores of Grade 10 Students in School 3

Paired Sample	N	M	MD	*t*	*df*	*p*	Partial Eta Squared
BSPS (Before)	28	9.68	-7.46	-18.22	27	.000***	.92
BSPS(After)	28	17.14					
ISPS(Before)	28	7.52	-6.13	-21.64	27	.000***	.99
ISPS(After)	28	13.65					
SPS(Before)	28	17.20	-13.48	-22.13	27	.000***	.95
SPS(After)	28	30.79					

Note. BSPS = Basic Science Process Skills; ISPS = Integrated Science Process Skills;
SPS = Science Process Skills.
***$p < .001$.

The results showed that there were significant differences between science process skills (basic science process skills and integrated science process skills) test scores before and after using the science process skills model. Moreover, according to the partial eta squared, the effect size on the science process skills test was a large effect in School 3. It can be interpreted that the use of science process skills model has a significant effect on the acquisition of science process skills of Grade 10 students in School 3 (see Table 3).

Table 4 *t* Values for Science Process Skills Test Scores of Grade 10 Students in School 4

Paired Sample	N	M	MD	*t*	*df*	*p*	Partial Eta Squared
BSPS (Before)	28	8.54	-8.67	-29.80	27	.000***	.97
BSPS(After)	28	17.21					
ISPS(Before)	28	7.04	-6.57	-16.30	27	.000***	.90
ISPS(After)	28	13.61					
SPS(Before)	28	15.58	-15.33	-28.14	27	.000***	.97
SPS(After)	28	30.82					

Note. BSPS = Basic Science Process Skills; ISPS = Integrated Science Process Skills; SPS = Science Process Skills.
****p* < .001.

The results showed that there were significant differences between science process skills (basic science process skills and integrated science process skills) test scores before and after using the science process skills model. Moreover, according to the partial eta squared, the effect size on the science process skills test was a large effect in School 4. It can be interpreted that the use of science process skills model has a significant effect on the acquisition of science process skills of Grade 10 students in School 4 (see Table 4).

For qualitative research findings, the data collected from observation checklists on teachers' and students' activities were analyzed by content analysis.

Table 5 Data Coding for Observation on Teachers' Activities in S1, S2, S3, and S4

Teacher's Activity	S1	S2	S3	S4
Engaging prior knowledge	4	3	4	3
Reinforcing students for responses	4	2	3	2
Grouping	4	2	4	2
Distributing things to observe	4	4	4	2
Encouraging students to make an observation	4	3	2	3
Encouraging communication within groups	3	2	3	3
Encouraging classifying lessons with previous knowledge	3	4	4	3
Asking predicting questions	4	4	4	2
Demonstrating the main concept	4	4	4	4
Asking students to infer results	2	3	3	3
Reflecting results for students	2	3	3	2
Assessing with worksheets	4	4	4	4

Note. S1 = BEHS, Hlegu, S2 = BEHS (4), Thanlyin, S3 = BEHS, Pyalo, S4 = BEHS (1), Thayet.
1 = 0% to 25%, 2 = 26% to 50%, 3 = 51% to 75%, 4 = 76% to 100%

In school 1, it was weakly observed in asking students to infer results and reflecting results for students. But, other activities were strongly observed from above 50% to 100%. In school 2, it was weakly observed in reinforcing students for responses, making the class into groups and encouraging communication within groups. It was strongly observed in other activities up to 100%. In school 3, there was no activity under 50% and all the teacher's activities were strongly observed from 50% to 100%. In school 4, it was weakly observed in reinforcing students for responses, grouping, distributing things to observe, asking predicting questions and reflecting results. It can be interpreted that using science process skills model has a significant effect on the teachers' instruction (see Table 5).

Table 6 Data Coding for Observation on Students' Activities in S1, S2, S3, and S4

Students' Activity	S1	S2	S3	S4
Responding to questions relating to previous knowledge	4	3	4	2
Following Instructions	4	4	4	4
Making observation	4	4	4	2
Observing pictures and flashcards relating to the lessons	4	4	4	4
Defining the meaning of the concept and exploring the concept	3	2	3	2
Discussion with other students	3	4	4	4
Classifying the observed facts with the prior knowledge	4	4	4	2
Making predictions	4	4	4	4
Focusing on the main concept	3	1	4	4
Inferring the relationships and predictions among the lesson contents	3	3	3	2
Repeating experiments and measurement after the teacher	2	2	4	4
Answering worksheets	4	4	4	4

Note. S1 = BEHS, Hlegu, S2 = BEHS (4), Thanlyin, S3 = BEHS, Pyalo,
S4 = BEHS (1), Thayet.
1 = 0% to 25%, 2 = 26% to 50%, 3 = 51% to 75%, 4 = 76% to 100%

In school 1, repeating experiments and measurement after the teacher was weakly observed only. In school 2, it was weakly observed in defining the meaning of the concept and exploring the concept and repeating experiments and measurement. The weakest activity in school 2 is focusing on the main concept. In school 3, there was no weak observation on students' activities. In school 4, it was strongly observed in following instructions, observing teaching aids, good discussions, making predictions, focusing on the main concept, repeating experiments and measurement after the teacher, and answering worksheets. The rest activities were weakly observed in school 4. It can be interpreted that the use of science process skills model has a significant effect on the students' learning activities (see Table 6).

Discussion

These results support the research question of whether there were significant differences in the science process skills (basic science process skills and integrated science process skills) test scores of experimental groups before and after the instruction using the science process skills model. The study is also in agreement with the studies of Osman and Verbrianto (2013). They found that there were significant differences in science process skills and achievement between the experimental groups and the conventional group.

According to the observation checklists, the results of the qualitative study pointed out that the teachers implemented the science process skills model successfully and the students followed the instruction. Observation data are analyzed by content analysis. According to the results of the observation of teachers' activities, teachers from four selected schools implemented the science process skills model. In school 4, grouping students, distributing things to observe, reinforcing students for responses, and asking predicting questions were observed for under 50% of the total observation. The classroom setting in school 4 is arranged with the rules of Covid-19. Thus, it was observed that making groups for students was about 50%. In school 2, encouraging communication within groups was weakly observed and it was not the same in school 4. Most of the students in school 2 are fast learners and so they observe the distributed things and communicate within groups. So, the teacher does not need to encourage students to communicate with each other within groups.

Teachers' reflecting results for students were weakly found in school 1 and school 4. This is because the teacher did not have enough time to cover the content of one lesson plan within the limited time. So, the teacher may miss this teaching step. The teacher encouraged students to make observations on the distributed materials for the first time the use of the science process skills model in school 3. In selected four schools, the teacher demonstrated the main concept and assessed students with the worksheets with full percentages.

According to the results of observation of students' activities, students from selected schools followed instructions, observed pictures, and flashcards relating to the lessons, and participated in predicting and answering worksheets successfully. In school 2, the students' focus on the main concept is the weakest. The students from school 2 are active learners and they followed the teachers' instructions and they want to study all the contents which the teacher had taught. Thus, they did not focus on the main concept of the lesson's contents. The result is consistent with Chebii (2011). From his studies, the result indicates that students' and teachers' activities during instruction in the experimental groups had higher mean frequencies in the classroom observation schedules.

Suggestions

With respect to the research findings, the following suggestions should be considered for the use of the science process skills model to be more effective in teaching Chemistry.

Suggestions for Teachers: the teacher should give enough time to think when the teacher integrates the new knowledge with the prior knowledge. The teacher should use the teaching resources such as visual materials which can change students' concrete thinking to abstract thinking. The teacher should arrange an easy way to help language barriers for students. Then, the teacher should understand the science process skills that are related to thinking skills. Finally, the teacher should be good in time management.

Suggestion for Students: The students should study well whenever one lesson has been learned in order to be able to discuss actively with group members in activities. Participating in activities can motivate students' attention and interests and development in learning.

Suggestions for School Administrators: The school administrators should understand the nature of the whole education. As cyberage people, the current function in education should be performed as homeostasis to reach ultimate the aim of education.

Recommendations

Some recommendations for further study are as follows:

- In this study, sample schools were randomly selected from Yangon Region and Magway Region. Thus, further research studies should be carried out in the rest of the States and Regions by using different participants for replication.
- In this study, the content areas were limited to Grade 10 Chemistry textbook. So, further study should be carried out for the other content areas at the high school level.
- In this study, the science process skills model was used for the high school level. Further research should be carried out for various school levels such as primary school level and middle school level.

Conclusion

This study indicated that the implementation of the science process skills model in the teaching of high school Chemistry enhances students' science process skills acquisition. Thus, it can be regarded that the science process skills model has a positive impact on achievement and acquisition of science process skills.

The science process skills model helps students improve the acquisition of science process skills in their daily lives. This model helps students to observe everything around them, apply opportunities such as communicating with other students and predicting something, and decide the results. Concrete rather than an abstract idea can form the lesson concept and get more memorization about it. The science process skills model can give concrete ideas rather than abstract ideas.

The present study on science process skills enhances the achievement in high school Chemistry teaching. Process skills can arouse the students' interest, eagerness, and enthusiasm to learn the Chemistry concept. Learning by doing is the role of the education in the 21st century. Inconsistent nowadays, the students should be active learners and the teachers should be the facilitators for constructing and exploring the knowledge. The students engage the concept with 21st-century skills through the process skills. Particularly, science process skills can help students learn the concepts in science subjects. If students use science process skills in learning Chemistry, they can become independent learners. As teaching is not delivering only knowledge, teachers should provide learners skills to construct concepts and ideas. Meanwhile, it is concluded that the use of the science process skills model in the teaching of Chemistry is pedagogically effective for both teachers and students.

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