THE RELATIONSHIP BETWEEN EARLY NUMERACY SKILLS AND EXECUTIVE FUNCTIONS OF GRADE 1 STUDENTS*

Thet Su Maung[1], Khin Hnin Nwe[2], Myo Ko Aung[3]

Abstract

The main aim of the present study is to assess the relationship between early numeracy skills and executive functions of Grade 1 students. In this study, descriptive survey method and quantitative research design were used. This study was conducted with a sample of 310 (150 males and 160 females) Grade 1 students from Selected Basic Education High Schools in Sagaing Township. The required sample was selected by using random sampling technique. Scale for Early Numeracy Skills of Grade 1 (ENS-G1) students and Behaviour Rating Inventory of Executive Functions (BRIEF) were used as the instruments. As a result of descriptive statistics, the early numeracy skills and executive functions of Grade 1 students were somewhat satisfactory. The result of independent samples *t*-test on the whole scale of the early numeracy skills and executive functions of Grade 1 students by gender revealed that there were no gender differences. ANOVA results showed there were no significant differences in executive functions for all age groups of Grade 1 students, but there were significant differences in early numeracy skills according to age at 0.05 level. Moreover, the results of independent samples *t*-test revealed that there were no significant differences for early numeracy skills of Grade 1 students by selected schools, but there were significant differences for executive functions of Grade 1 students by selected schools at 0.01 level. And then, there were significant differences by father's education and mother's education in both early numeracy skills and executive functions of Grade 1 students and it also revealed that the mean scores of graduated father's and graduated mother's children were significantly higher than non-graduated father's and non-graduated mother's children in executive functions. Finally, the results of Pearson correlation also showed that there was a significant positive relationship between early numeracy skills and executive functions of Grade 1 students.

Keywords: Early Numeracy Skills, Executive Functions.

Introduction

Children are the future of every nation, and the progress of any nation depends upon the education that they acquire today—the same kind of education they will apply on themselves or their nation's future. So, it is necessary for any nation to take special care of children by providing them with an excellent education. No doubt, education is a power that influences individuals' lives. Education is a giant industry that equips citizens for the future with various survival skills and 21st century skills to be able to live in harmony in society.

According to Khin Zaw (1974), the world today is in the greatest period of change in history, but not many of its educational programs at any level are relating their objectives and methodologies to the changing needs of the world. Two very general factors, "information explosion" and "population explosion," are the real causes of most if not all recent changes in education. These factors simply mean "More people to Teach" and "More to Learn" (Footlick, 1966, cited in Khin Zaw, 1974). Moreover, today is the age of science and technology.

Therefore, the role of mathematical skills, that are the basis of science and technology, is so important. Even in the field of liberal arts, it is important to master early numeracy skills because of the use of statistical methods in research for higher education. So, it is crucial to cultivate these early numeracy skills since early childhood for the development of every country.

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[1] Department of Educational Studies, Sagaing Education Degree College

[2] Department of Educational Psychology, Yangon University of Education

[3] Department of Educational Psychology, Sagaing University of Education

Early mathematical and numeracy skills include the general understanding of numbers and basic mathematical concepts (Harris & Petersen, 2019; Toll & Van Luit, 2014). Early mathematical and numeracy skills are the building blocks of all future mathematical classes. Early numeracy skills are also skills that are already being used by most young children daily through play and everyday interactions. These are skills that begin in early childhood and are the foundation for the rest of elementary mathematics and into upper-level mathematical classes as well. These numeracy skills must be introduced at an early age so students are able to continue to build higher level mathematical classes, such as algebra and geometry, depend on a strong foundation of number sense and number skills (Jordan et al., 2009).

Without these skills, students will have to continue to struggle with higher mathematical concepts. Students need to learn how to solve problems, one of the basic early mathematical skills, for all areas of academics and life outside of school. Early numeracy skills also coincide with language and critical thinking development (Toll & Van Luit, 2014; Vilorio, 2014). When children first enter school, they lack language and critical thinking skills. Therefore, the main responsibility of schools is to teach these skills to children.

Executive functioning skills are necessary to persevere in mathematical activities and academic tasks. Executive functions are the cognitive abilities that control and regulate most of what people do in day-to-day life (Diamond, 2013). And then, executive functions are higher level abilities such as planning, goal setting, and impulse controlling, shifting, and updating (Kroesbergen et al., 2009). Kroesbergen et al.'s (2009) research found that executive functions are crucial for counting skills and are more closely correlated to early mathematical success. Students who have stronger executive functions perform better in early mathematical skills than students with a higher IQ.

Executive functions could be used as an indicator for identifying at-risk students for mathematics (Kroesbergen et al., 2009). By teaching students' executive functions alongside early numeracy skills, students will be more prepared to learn advanced mathematical skills throughout their school career. Students not only need a foundation of early numeracy skills, but they also need to build a foundation of executive functions to have a successful academic future (Guhl, 2019).

Therefore, the focus of this study is to explore the relationship between executive functions and early numeracy skills of Grade 1 students.

Main Aim

The main aim of the present study is to assess the relationship between early numeracy skills and executive functions of Grade 1 students.

Specific Objectives

The specific objectives are as follows:

- to study early numeracy skills and executive functions of Grade 1 students
- to compare early numeracy skills and executive functions of Grade 1 students by gender, age, selected schools, father's education, and mother's education
- to find out the relationship between early numeracy skills and executive functions of Grade 1 students

Definitions of Key Terms

Early numeracy skills **:** Early numeracy skills refers to a set of skills at the early stages of the development of number sense, including understanding the meaning of numbers, and the different relationships among numbers (Clarke & Shinn, 2004).

Early numeracy skills **:** Early numeracy skills are the general understanding of numbers and basic mathematical concepts (Harris & Petersen, 2019; Toll & Van Luit, 2014).

Executive Functions : Executive functions are the cognitive abilities that control and regulate most of what we do in day-to-day life (Diamond, 2013).

Review of Related Literature

Early Numeracy Skills

Piaget (1953, cited in Alder, 1963) found there were levels of development at which these processes of adaptation could occur and mature during his research. These levels are known as his four stages of cognitive development. The first is the sensorimotor stage, which occurs between birth and 2 years (Alder, 1963). During this stage, children develop object permanence, which is the concept of an object existing even out of sight. The next stage is the preoperational stage, occurring between 2 and 7 years of age (Alder, 1963). This stage is characterized by the use of language for symbolic representations. According to Piaget, children in this stage have a vague sense of logic, and their mental operations only move in one direction (Copeland, 1974). The next stage is the concrete operational stage, which occurs between the ages of 7 and 12 years (Copeland, 1974). This stage is defined by logical thought based on concrete experiences, hence the name of the concrete operational stage. This stage also sees the development of two-directional thinking, which allows for the concept of conservation to develop. The final stage is the formal operational stage, which develops around 12 years of age and represents the highest level of logical thinking (Copeland, 1974). Hypothetical reasoning and symbolic thought highlight this stage. The ages of all of these stages are flexible, but nevertheless provide valuable insight for educators into the cognitive operations of children.

Relating these theories to first grade mathematics, Piaget's stages of development prove most helpful for educators. For first graders, from the age span of 6 to 7, it is clear that this stage involves a two-stage transition; the preoperational stage and the concrete operational stage. Understanding both stages and the transition between them is critical for developing strong mathematical understanding.

Texas Essential Knowledge and Skills (TEKS) of early numeracy for Grade 1 students are based on Piaget's stages of development. The first TEKS objective is "(1) Number, operation, and quantitative reasoning, where the student needs to describe and compare quantities by using whole numbers" (TAC, 2006). The second TEKS objective to investigate is "(2) Number, operation, and quantitative reasoning where the student needs to recognize and solve problems in addition and subtraction situations" (TAC, 2006). The last TEKS objective to look at is "(3) Measurement, where the student needs to compare the attributes of length, area, weight/mass, capacity, and temperature directly, and the student needs to select and use non-standard units to describe length" (TAC, 2006).

In the late 1970s, Stan Deno and his research team began to identify alternative assessment methods to address the limitations of using individually administered, norm-referenced, and broad achievement tests with students with learning disabilities to monitor educational goals. The

approach that was developed was curriculum-based measurement (CBM), which refers to sets of standardized, short-duration, authentic assessments used to gauge a student's growth in academic skills over time (Deno, 1985, cited in Feldmann, 2012).

Curriculum-based measurement is intended to provide data to meaningfully guide instruction, which in turn leads to increased learning (Howell & Nolet, 1999). CBM will likely continue to fill a practical need based on its key features of feasibility, repeatability, sensitivity to change, and utility in developing measurable performance goals.

Using curriculum-based measurement to measure children's early numeracy skills based on the above key features, children's skills can be effectively measured. Therefore, if the early numeracy skills of Grade 1 students in Myanmar are to be measured, they should be measured based on the curriculum and other previous early numeracy skills tests. In this study, scale for Early Numeracy Skills of Grade 1 (ENS-G1) students based on the curriculum and other previous early numeracy skills tests was used as the instrument.

Executive Functions (EFs)

The study of executive functions and the role of the frontal lobe in human behavior is extensive and dates back as early as the mid-eighteenth century, when Harlow (1868) first described a patient's changing behavior as a result of a brain injury. His descriptions represent a metaphor for the role of the frontal lobe. He describes the frontal lobe as serving as an executive, responsible for making decisions, forming goals, planning, organizing, devising strategies for attaining goals, and changing and devising new strategies when initial plans fail.

Although the construct of EFs was first introduced by Luria in 1966, theoretical consensus about the construct has been slow to develop. The complex nature of EFs, along with a historical lack of consensus regarding their definition, leads to wide variation in how EFs are studied and measured. Nevertheless, many of the current theories and conceptualizations share common roots based on Luria's (1966) model of EFs. Based on the roots of Luria's model, there have been two broad approaches to the development of executive function frameworks.

According to Luria (1966), the brain consists of three functional units, and it is the third unit in which EF mechanisms operate. The first functional unit is located mainly in the brain stem and is responsible for regulating and maintaining arousal of the cortex. The second functional unit is responsible for encoding, processing, and storing information and encompasses the temporal, parietal, and occipital lobes. The third functional unit is located in the anterior region of the brain (frontal lobes), and its functions include programming, regulating, and directing behavior.

Within the third unit, the prefrontal cortex is considered by Luria to be a superstructure that regulates or controls mental activity and behavior. Many current theories that describe how information is processed and used to direct behavior to achieve a goal include some variation of these cognitive mechanisms.

Methodology

Sampling

The participants were 310 Grade 1 students from Selected Basic Education High Schools in Sagaing Township. Selected participants consist of **150 males** and **160 females**. The profile of participants is shown in Table 1.

Table 1 Profile of Participants in the Study

No	Profile of Participants			Total
1	**Gender**	Male	150	310
		Female	160	
2	**Age**	6 years old	75	310
		7 years old	131	
		8 years old	71	
		9 years old	33	
3	**Grade**	Grade 1		310

Research Method

In this study, descriptive survey design and quantitative approach were used.

Research Instrumentation

Firstly, the instrument to measure Early Numeracy Skills of Grade 1 students was developed by researcher. This process was undertaken by following the guidelines of existing standardized tests, such as AIMSWEB Test of Early Numeracy (Grade 1) developed by **Pearson (2005)** and Grade 1 textbook for mathematics and teachers' guide. In this study, the researcher adapted the Early Numeracy Skills components of AIMSWEB Test, Grade 1 text manual and teacher guide book, and the Texas Essential Knowledge and Skills (TEKS) of early numeracy for Grade 1 students based on Piaget's stages of development. Scale for Early Numeracy Skills consists of 7 sub-scales and 70 items. The seven scales are Oral Counting (OC), Number Identification (NI), Number Discrimination (ND), Missing Number (MN), Order Plan (OP), Measurement (M), and Computation (C). The purpose of the scale is to examine the early numeracy skills of Grade 1 students.

After preparing the instruments for Early Numeracy Skills, expert review was conducted for face validity and content validity by 15 experts who have sound knowledge and a close relationship with this study area from the fields of Educational Psychology and Early Childhood Education. According to the value advices of the experts, the irrelevant items were revised. In order to determine the reliability and validity of the instrument, pilot testing was conducted with Grade 1 students from Basic Education Schools. The pilot study was done with the sample of 100 students from No. (1) Basic Education High School (Branch) Katha Township. According to the pilot study, the internal consistency of the scale was **0.85.**

Secondly, the questionnaire for executive functions of Grade 1 students was mainly constructed from Behavior Rating Inventory of Executive Functions developed by Gioia et al., (2000). The BRIEF (Gioia et al., 2000) was an 86-item parent report questionnaire designed to assess executive functioning in children ages 5–18. Parents rate if their child's behavior is "never," "sometimes," or "often" a problem, with higher ratings indicative of greater perceived impairment. The BRIEF was composed of eight sub-scales (Initiate, Working Memory, Plan/Organize, Organization of Materials, Monitor, Inhibit, Shift, and Emotional Control). The BRIEF was normed on 1,419 control children and 852 children from referred clinical groups. Adequate test-retest reliability, internal consistency, content and construct validity, and convergent and discriminate validity have been demonstrated (Pizzitola, 2002, cited in Gioia et al., 2000). Specifically, test-retest reliability statistics range from .79 to .88 during a two-week period, and internal consistency was reported as ranging from .80 to .98 (Gioia et al., 2000).

The instrument used in the recent research was created by modifying the items in the above measure in accordance with Myanmar culture, it was a five-point Likert scale (Strongly Disagree = 1, Disagree = 2, Undecided = 3, Agree = 4, Strongly Agree = 5) and included a total of 55 items (54 (negative items) + 1 (positive items)) in the instrument. The BRIEF was composed of 8 sub-scales (Initiate, Working Memory, Plan/Organize, Organization of Materials, Monitor, Inhibit, Shift, and Emotional Control). According to the pilot study, the internal consistency of the questionnaire was **0.91**.

Quantitative Data Collection Procedure

After getting ethical approval from the Ministry of Education, the consent forms were sent to the headmaster and parents of the respondents. And then, the numeracy skills and executive functions of Grade 1 students were investigated, and the data were collected. Moreover, the other influencing factors on the students' numeracy skills and executive functions, such as age, gender, etc., were also explored.

Among the two instruments, the executive functions questionnaire collected information from parents of Grade 1 students by using the rating scale method. The scale for early numeracy skills of Grade 1 students was collected by an individual interview between each child and the researcher because children of this age have developed such good listening and speaking skills that they listen carefully and answer the questions about themselves, rather than the reading and writing skills they should have to answer self-report questionnaires. At the elementary level, listening and speaking skills are more important and favored than reading and writing skills. (Basic Competencies of Myanmar Language Primary Level, 2008, cited in Yu Mon Thaw, 2017).

Data Analysis and Findings

After collecting the required data, the early numeracy skills and executive functions of Grade 1 students were analyzed.

Comparison for Early Numeracy Skills and Executive Functions of Grade 1 Students

By using the descriptive procedure with the obtained data, early numeracy skills and executive functions of Grade 1 students were estimated.

Table 2 Descriptive Statistics for Early Numeracy Skills and Executive Functions of Grade 1 Students

Variables	*N*	Minimum	Maximum	Mean	Mean (%)	*SD*
Early Numeracy Skills	310	31	70	66.63	95.19**%**	3.684
Executive Functions	310	73	270	198.73	73.60%	39.696

Descriptive analyses revealed that the mean percentage and standard deviations of early numeracy skills and executive functions for the whole sample were 95.19% (*SD*=3.684) and 73.60% (*SD*=39.696) respectively (see Table 2). These findings showed that early numeracy skills and executive functions of Grade 1 students were somewhat satisfactory.

Table 3 Mean Percentage and Standard Deviation for Sub-scales of Early Numeracy Skills and Executive Functions of Grade 1 Students

Variables	Sub-scales	No. of Items	Mean	Mean (%)	*SD*
Early Numeracy Skills	Oral Counting	10	9.93	99.3%	.517
	Number Identification	10	9.94	**99.4%**	.422
	Number Discrimination	10	9.88	98.8%	.417
	Missing Number	10	9.90	99.0%	.796
	Order Plan	10	8.65	86.5%	1.474
	Measurement	10	8.63	**86.3%**	1.433
	Computation	10	9.71	97.1%	.597
Executive Functions	Inhibit	5	19.40	**77.6%**	3.944
	Shift	6	21.34	71.13%	5.073
	Emotional Control	9	31.81	70.69%	6.283
	Initiate	7	23.56	**67.31%**	6.345
	Working Memory	8	30.43	76.08%	6.462
	Plan/Organize	7	25.31	72.31%	5.166
	Monitor	6	21.06	70.2%	5.643
	Organization of Materials	7	25.81	73.74%	5.761

According to the results of Table 3, it can be clearly seen that the mean percentage of number identification was the highest and measurement was the lowest in the early numeracy skills of Grade 1 students. Therefore, it can be said that Grade 1 students can perform the number identification sub-scale better than other sub-scales of early numeracy skills. And then, the mean percentage of inhibit was the highest and initiate was the lowest in executive functions. So, Grade 1 students can perform the working memory sub-scale better than other sub-scales of executive functions, according to the results.

Table 4 Comparison for Early Numeracy Skills and Executive Functions of Grade 1 Students by Gender

Variables	Gender	*N*	Mean	*SD*	*t*	*p*
Early Numeracy Skills	Male	150	66.95	3.827	1.489	.138
	Female	160	66.33	3.530		
Executive Functions	Male	150	200.89	38.060	.931	.353
	Female	160	196.69	41.187		

The result of independent samples *t*-test on the whole scale of the early numeracy skills of Grade 1 students by gender revealed that there was no gender difference (see Table 4). This finding is consistent with previous early numeracy skills research conducted by Howell and Kemp (2009). They found that there was no difference between females and males on most of the components of early numeracy skills. Moreover, according to SEA-PLM 2019 results in mathematical literacy of Grade 5 students, mean differences were not statistically significant in Myanmar by gender (UNICEF & SEAMEO, 2020).

And then, the result of *t*-test on the whole scale of executive functions of Grade 1 students by gender revealed that there was also no gender difference too (see Table 4). The finding is consistent with the results of Ashley Darcy (2014).

Table 5 Comparison for Sub-scales of Early Numeracy Skills of Grade 1 Students by Gender

Sub-scales	Gender	*N*	Mean	*SD*	*t*	*p*
Oral Counting	Male	150	9.95	.398	.581	.561
	Female	160	9.91	.608		
Number Identification	Male	150	9.94	.508	-.078	.938
	Female	160	9.94	.322		
Number Discrimination	Male	150	9.88	.400	-.158	.875
	Female	160	9.89	.434		
Missing Number	Male	150	9.88	.996	-.428	.669
	Female	160	9.92	.549		
Order Plan	Male	150	8.73	1.423	.943	.347
	Female	160	8.57	1.520		
Measurement	Male	150	8.82	1.216	2.327*	**.021**
	Female	160	8.44	1.593		
Computation	Male	150	9.76	.598	1.531	.127
	Female	160	9.66	.594		

Note * The mean difference is significant at 0.05 level.

Based on the results shown in Table 5, there was statistically significant differences in measurement sub-scale only whereas the others sub-scales were not significantly different by gender (see Table 5). According to the results, it was found that male students developed more on the measurement sub-scale than female students.

Table 6 Comparison for Sub-scales of Executive Fun ctions of Grade 1 Students by Gender

Sub-scales	Gender	*N*	Mean	*SD*	*t*	*p*
Inhibit	Male	150	19.59	3.933	.806	.421
	Female	160	19.23	3.959		
Shift	Male	150	21.72	4.940	1.294	.197
	Female	160	20.98	5.183		
Emotional Control	Male	150	32.16	5.645	.942	.347
	Female	160	31.49	6.829		
Initiate	Male	150	24.18	6.096	1.667	.097
	Female	160	22.98	6.536		
Working Memory	Male	150	30.81	6.236	1.014	.311
	Female	160	30.07	6.666		
Plan/Organize	Male	150	25.51	5.074	.639	.523
	Female	160	25.13	5.261		
Monitor	Male	150	21.23	5.535	.489	.625
	Female	160	20.91	5.756		
Organization of Materials	Male	150	25.70	5.721	-.324	.746
	Female	160	25.91	5.814		

According to the results of Table 6, there were no significant differences in all the sub-scales of executive functions of Grade 1 students. The finding is consistent with the results of Ashley Darcy (2014). Burrage et al. (2008) found that the development of executive functions was based on experience, not on age or gender.

Table 7 Comparison for Early Numeracy Skills and Executive Functions of Grade 1 Students by Age Group

Variables	Age	*N*	Mean	*SD*	*F*	*p*
Early Numeracy Skills	6 years	75	65.81	3.794	3.519*	.015
	7 years	131	66.40	4.366		
	8 years	71	67.62	1.967		
	9 years	33	67.27	2.742		
Executive Functions	6 years	75	194.12	42.717	1.142	.332
	7 years	131	199.61	38.781		
	8 years	71	197.15	42.729		
	9 years	33	209.06	26.918		

Note * The mean difference is significant at 0.05 level.

Although there were no significant differences in executive functions for all age groups of Grade 1 students, there were significant differences in early numeracy skills according to age at 0.05 level. To obtain more detailed information of which age had significant differences, Post Hoc Test was executed by Games-Howell multiple comparison procedure (see Table 8).

Table 8 The Results of Multiple Comparison for Early Numeracy Skills of Grade 1 Students by Age Group

Variable	(I)Age	(J)Age	Mean Difference (I-J)	*p*
Early Numeracy Skills	8 years	6 years	1.806**	0.002
		7 years	1.215*	0.036

Note * The mean difference is significant at 0.05 level.
** The mean difference is significant at 0.01 level.

According to Table 8, it can be said that students at the age of 8 years were more willingness to learn and more practice than other age group. According to the result of multiple comparison analysis, early numeracy skills of Grade 1 students was dependent upon their age, but Grade 1 students' executive functions did not depend on their age according to the results of this study.

Table 9 Comparison of Early Numeracy Skills and Executive Functions by Selected School

Variables	School	*N*	Mean	*SD*	*t*	*p*
Early Numeracy Skills	School 1	170	66.62	4.404	-.077	.939
	School 2	140	66.65	2.567		
Executive Functions	School 1	170	204.42	37.81	2.813**	0.005
	School 2	140	191.81	40.953		

Note ** The mean difference is significant at 0.01 level.

According to Table 9, although the results of independent samples *t*-test revealed that there were no significant differences for early numeracy skills of Grade 1 students among selected schools, there were significant differences for executive functions of Grade 1 students among selected schools at 0.01 level. It can be concluded that the mean scores of students from school 1 were higher than the mean scores of students from school 2 in executive functions.

Table 10 Comparison of Early Numeracy Skills and Executive Functions by Father's Education

Variables	Father's Education	*N*	Mean	*SD*	*t*	*p*
Early Numeracy Skills	Graduate	113	68.14	2.314	5.738***	.000
	Non-Graduate	197	65.77	4.034		
Executive Functions	Graduate	113	218.72	31.490	7.255***	.000
	Non-Graduate	197	187.26	39.435		

Note *** The mean difference is significant at 0.001 level.

According to the results of independent samples *t*-test, there was significant differences by father's education in early numeracy skills of Grade 1 students and it revealed that the mean scores of graduated father's children were significantly higher than non-graduated father's children in early numeracy skills. So, it can be said that father's education was related to early numeracy skills of Grade 1 students. This finding was consistent with the previous research conducted by Yu Mon Thaw (2017). Therefore, father's education can be considered as a factor that effect on early numeracy skills of Grade 1 students (See Table 10).

And then, there was significant differences by father's education in executive functions of Grade 1 students and it also revealed that the mean scores of graduated father's children were significantly higher than non-graduated father's children in executive functions. So, it can be said that father's education was related to executive functions of Grade 1 Students.

Table 11 Comparison of Early Numeracy Skills and Executive Functions by Mother's Education

Variables	Mother's Education	*N*	Mean	*SD*	*t*	*p*
Early Numeracy Skills	Graduate	137	67.89	2.427	5.584***	.000
	Non-Graduate	172	65.64	4.191		
Executive Functions	Graduate	137	217.25	31.111	8.005***	.000
	Non-Graduate	172	184.05	39.814		

According to the results of independent samples *t*-test, there were significant differences by mother's education in early numeracy skills of Grade 1 students, and it revealed that the mean scores of graduated mother's children were significantly higher than those of non-graduated mother's children in early numeracy skills. So, it can be said that mother's education was related to early numeracy skills of Grade 1 students. This finding was consistent with the previous research conducted by Yu Mon Thaw (2017). She found that father's education and mother's education were related to students' literacy and numeracy (Yu Mon Thaw, 2017). Therefore, mother's education can be considered as a factor that affects the early numeracy skills of Grade 1 students (see Table 11).

And then, there were significant differences by mother's education in executive functions of Grade 1 students, and it also revealed that the mean scores of graduated mother's children were significantly higher than those of non-graduated mother's children in executive functions. So, it can be said that mother's education was related to executive functions of Grade 1 students.

Table 12 Correlation between Early Numeracy Skills and Executive Functions of Grade 1 Students

Variables	Early Numeracy Skills	Executive Functions
Early Numeracy Skills	-	.850*** .000 310
Executive Functions	.850*** .000 310	-

Note *** The mean difference is significant at 0.001 level.

The table indicated that there was a significant positive relationship between early numeracy skills and executive functions of Grade 1 students at 0.001 level. So, it could be said that Grade 1 students who have higher executive functions had higher early numeracy skills. Moreover, the two variables were highly correlated with each other.

Conclusion, Discussion and Recommendations

Conclusion and Discussion

This study was conducted to find out the relationship between early numeracy skills and executive functions of Grade 1 students. A total of 310 Grade 1 students: 48.4% (150) males and 51.6% (160) females from two basic education schools in Sagaing Township were selected as participants for this study. As a result of descriptive statistics, the early numeracy skills and executive functions of Grade 1 students were somewhat satisfactory. The result of independent samples *t*-test on the whole scale of the early numeracy skills of Grade 1 students by gender revealed that there was no gender difference. This finding is consistent with previous early numeracy skills research conducted by Howell and Kemp (2009). They found that there was no difference between female and male in most of the components of early numeracy skills. Moreover, according to SEA-PLM 2019 results in mathematical literacy of Grade 5 students, mean differences were not statistically significant in Myanmar by gender (UNICEF & SEAMEO, 2020). And then, the result of *t*-test on the whole scale of executive functions of Grade 1 students by gender revealed that there was also no gender difference too. The finding is consistent with the results of Ashley Darcy (2014). According to the results of independent samples *t*-test on all sub-scales of early numeracy skills, there was statistically significant difference in measurement sub-scale only whereas the others sub-scales were not significantly different by gender. According to the results, it was found that male students developed more on the measurement sub-scale than female students.

And then, the result of independent samples *t*-test on the whole scale of the executive functions of Grade 1 students by gender revealed that there was no gender difference too. To know the results of all sub-scales of executive functions, independent samples *t*-test was computed. According to the results, there were no significant differences in all sub-scales of executive functions of Grade 1 students. The finding is consistent with the results of Ashley Darcy (2014). Ashley Darcy (2014) found that there was no significant difference in executive functions of young children by gender. Burrage et al. (2008) also found that the development of executive functions was based on experience, not on age or gender.

According to ANOVA result, although there were no significant differences in executive functions for all age groups of Grade 1 students, there were significant differences in early numeracy skills according to age at 0.05 level. To obtain more detailed information of which age groups had significant differences, Post Hoc Test was executed by Games-Howell multiple comparison procedure. According to the result, it can be said that students at the age of 8 years were more willingness to learn and practice than other age groups. According to the result of multiple comparison analysis, early numeracy skills of Grade 1 students were dependent upon their age. But Grade 1 students' executive functions did not depend on their age, according to this study.

To investigate the mean differences of the early numeracy skills of Grade 1 students by selected schools, independent samples *t*-test was conducted and there were no significant differences for early numeracy skills of Grade 1 students by selected schools, but there were significant differences for executive functions of Grade 1 students by selected schools at 0.01 level. It can be concluded that the mean scores of students from school 1 were higher than the mean scores of students from school 2.

And then, there were significant differences by father's education and mother's education in both early numeracy skills and executive functions of Grade 1 students and it also revealed that the mean scores of graduated father's and graduated mother's children were significantly higher than non-graduated father's and non-graduated mother's children in executive functions. So, it can be said that father's education and mother's education were related to both early numeracy skills and executive functions of Grade 1 students.

Moreover, according to the Pearson's Correlation, there was a significant positive relationship between early numeracy skills and executive functions of Grade 1 students at 0.001 level. So, it could be said that Grade 1 students who have higher executive functions had higher early numeracy skills. Therefore, the two variables were highly correlated with each other.

Therefore, parents should consider the fact that their children's early numeracy skills and executive functions should be supported by day-by-day experiences at home. Parents should spend more time with their children on early numeracy skills and executive functions related activities. Primary teachers should arouse children's interest in early numeracy skills and executive functions concept. Most important of all, for primary teachers and all the personnel in the field of early education, more attention should be given to implement teaching learning activities that are carefully planned to achieve learning objectives of developing children's early numeracy skills and executive functions development.

Recommendations for Future Research

To explore the early numeracy skills of Grade 1 students, the future researcher should consider variables not only executive functions but also parental support, gender and age etc. More research should be done on the Grade 1 students' early numeracy skills and executive functions with a study of longitudinal design to clarify the Grade appropriate differences in early numeracy skills and executive functions, and how their Grade level affects their level of early numeracy skills and executive functions. Further studies should be investigated for every Grade level to have comparison between different Grades. To be concluded, it is hoped that the findings presented in this study will provide some insights in the influence of early numeracy skills and executive functions in the future.

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