

A STUDY ON THE EARLY NUMERACY SKILLS DEVELOPMENT OF GRADE 1 STUDENTS

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Abstract

The main aim of the present study is to assess the early numeracy skills development of Grade 1 students. In this study, quantitative approach was used. The participants were 100 Grade 1 students in No (1) Basic Education High School (Branch) in Katha Township. Scale for Early Numeracy Skills of Grade 1 Students (ENS-G1) was used as the instrument. It consists of 61 items and is divided into 7 sub-scales: (1) Oral Counting (OC), (2) Number Identification (NI), (3) Number Discrimination (ND), (4) Missing Number (MN), (5) Order Plan (OP), (6) Measurement (M), and (7) Computation (C). Alpha reliability for ENS-G1 was 0.85. In this study, descriptive statistics of the early numeracy skills development results indicated that, the mean percentage result was the highest in Number Identification and Quantity Discrimination sub-scales, and the lowest in Measurement sub-scale. Therefore, it can be said that Grade 1 students can perform Number Identification and Quantity Discrimination sub-scales better than other sub-scales. And then, the results of *t*-test on the sub-scales of the early numeracy skills development of Grade 1 students by gender revealed that there was no gender difference for the whole early numeracy skills test. This is an important finding because it highlights that difference in early numeracy skills development is not necessarily due to gender. To investigate the mean differences of the early numeracy skills development of Grade 1 students by age group, independent samples *t*-test was conducted and it became apparent that there were significant mean differences in Order Plan and Measurement sub-scales at 0.01 level and 0.05 level respectively whereas the others dimensions were not significantly different. According to the results, it was found that 7-year-old students developed more on the Order Plan sub-scale and Measurement sub-scale than 6-year-old students.

Keywords: Early Numeracy Skills, Oral Counting, Number Identification, Number Discrimination, Missing Number, Order Plan, Measurement, and Computation.

Introduction

Early numeracy skill is the general understanding of numbers and basic mathematical concepts (Harris & Petersen, 2019; Toll & Van Luit, 2014). Early numeracy skills are the building blocks of all future mathematical classes and are also skills that are already being used by most young children daily through play and everyday interactions (Help your child, n.d.). 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 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).

Proficiency in early numeracy skill is important for academic mastery as well as occupational success. Most occupations require minimal skill by applying a variety of numeracy skills concepts, from calculating the value of money to advanced skills. Numeracy skill is necessary for successful and independent living in the home and community (Patton et al., 1997).

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So, this is a major concern for a large portion of the adult population who lack early numeracy skills.

Individuals who possess well-established skills will tend to advance in their occupations, because careers with the highest rate of growth require individuals who are proficient in mathematics and science (National Science Board, 2003). For the Myanmar to continue competing globally, it is important to have mathematically competent citizens. Well-developed students with early numeracy skills understand the meaning of numbers and develop strategies to solve problems ranging from basic number ordering to complex numerical procedures for complex number operations.

Without the strong numeracy foundation, students will not have anything to build on when they learn more advanced skills, higher mathematical concepts and continue to struggle. Students need to learn how to solve problems, one of the basic early numeracy skills, for all areas of academics and life outside of school. The main early mathematical and numeracy topics are counting, comparing and classifying, and geometry (Harris & Petersen, 2019; Aunio et al., 2015; Ramani & Eason, 2015; Aubrey & Godfrey, 2003). In addition, early math and numeracy skills include logical thinking, problem solving, and reasoning skills (Aunio et al., 2015). As simple as these skills may seem, they are arguably the most important skills a student will learn to aid in their future academic success.

Main Aim

The main aim of present study is to assess the early numeracy skills development of Grade 1 students.

Specific Objectives

The specific objectives are as follow;

1. to examine the early numeracy skills development of Grade 1 students by gender.
2. to compare the early numeracy skills development of Grade 1 students by age.

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).
- Oral Counting (OC)** : The OC measure requires the participant to begin with 1 and orally count for one minute (Clarke & Shinn, 2004).
- Number Identification (NI)** : The NI requires students to use a list of random numbers ranging from 1 to 20 and orally identify those (Clarke & Shinn, 2004).
- Number Discrimination (ND)** : The ND requires the participant to look at two numbers and to name the number that is larger and smaller (Clarke & Shinn, 2004).

- Missing Number (MI)** : The MN requires the participant to identify the missing number in a 3-consecutive number string within the 1-20 range (Clarke & Shinn, 2004).
- Order Plan (OP) (Patterning)**: The OP tests the child's ability to choose the next number or object according to the given pattern. (Operational Definition)
- Measurement (M)** : The measurement tests the child's ability of the measurement which is about time and measuring. (Operational Definition)
- Computation (C)** : The computation tests the child's basic computational abilities. (Operational Definition)

Review of Related Literature

Piaget (cited in Alder, 1963) found there were levels of development at which these processes of adaption could occur and mature during his research. These levels are known as his four stages of 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 the logical thought based in concrete experiences, hence the name of concrete operational stage. This stage also sees the development two-directional thinking, which allows for the concept of conservation to develop. The final stage is the formal operational stage developing 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 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, 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 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 of academic skills over time (Deno, 1985, cited in Feldmann, 2012).

Curriculum-based measurement is intended to provide data to meaningfully guide instruction that 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, it 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 Students (ENS-G1) based on the curriculum and other previous early numeracy skills tests were used as the instrument in this study.

Method

Sampling

The participants were 100 Grade 1 students from No (1) Basic Education High School (Branch) in Katha Township. They are (55) males and (45) females.

Research Method

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

Research Instrumentation

The instrument to measure Early Numeracy Skills of Grade 1 students was developed by researcher. This process was undertaken by 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, researcher adapted from the Early Numeracy Skills components of AIMSWEB Test, Grade 1 text manual and teacher guide book, and Texas Essential Knowledge and Skills (TEKS) of early numeracy for Grade 1 students based on Piaget's stages of development.

The instrument used in this study was adapted to Myanmar version to be suitable for Myanmar Grade 1 students. Next, revisions in item length, and the wording of items were made during preliminary administrations of the instrument and pilot study was done with a sample of 30 Grade 1 students from No (2) Basic Education High School, Katha Township to test whether the wording of items, statements and instructions had their clarity in Myanmar version.

After preparing the measuring scale, expert review was conducted for face validity and content validity by 15 experts who have sound knowledge and closed relationship with this study area from Sagaing University of Education and Yangon University of Education. According to comments and suggestions of 15 experts, the wording of the items was revised.

Scale for Early Numeracy Skills consists of 7 scales and 61 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 study was to examine the early numeracy skills development of Grade 1 students. The questionnaire is

designed to measure Early Numeracy Skills of Grade 1 students based on the curriculum of Grade 1 text manual and teacher guide book, other previous early numeracy skills tests, and Texas Essential Knowledge and Skills (TEKS) of early numeracy for Grade 1 students based on Piaget's stages of development. The internal consistency of the scale is 0.85.

Table 1 Distribution of Sub-scales in the Early Numeracy Skills of Grade 1 Students

Skills	Sub-scales	Numbers of Question	Marks	Time
Early Numeracy Skills (ENS)	Oral Counting	1	10	within 1-minute
	Number Identification	10	10	within 1-minute
	Number Discrimination	10	20	within 1-minute
	Missing Number	10	10	within 1-minute
	Order Plan	10	10	within 1-minute
	Measurement	10	20	from 5-7minutes
	Computation	10	20	from 5-7minutes
		Total Marks		100

Quantitative Data Collection Procedure

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

The scale for early numeracy Skills of Grade 1 students will be collected by an individual interview between each child and the researcher because children of this age have developed more listening and speaking skills, so they listen carefully and answer questions when asked questions about themselves rather than reading and writing about themselves. 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).

Findings

After collecting the required data, the numeracy skills development of Grade 1 students was analyzed.

Descriptive Statistics of the Early Numeracy Skills Development of Grade 1 Students

The early numeracy skills development of Grade 1 students includes 7 sub-scales such as Oral Counting (OC), Number Identification (NI), Quantity Discrimination (QD), Missing Number (MN), Order Plan (OP), Measurement (M), and Computation (C). In terms of descriptive statistic, minimum-maximum scores, means and standard deviations for the early

numeracy skills development were calculated to analyze data. The results were described in Table 2.

Table 2 Descriptive Statistics of the Early Numeracy Skills Development of Grade 1 Students

Sub-scales	N	Minimum	Maximum	Mean	Mean %	SD
OC	100	6	10	9.86	98.6	.652
NI	100	4	10	9.92	99.2	.614
QD	100	14	20	19.84	99.2	.735
MN	100	0	10	9.87	98.7	1.012
OP	100	6	10	8.79	87.9	1.328
M	100	6	20	16.64	83.2	3.073
C	100	8	20	19.62	98.1	1.384
Total	100	44	100	94.54	94.54	6.357

According to Table 2, the mean percentage results for the early numeracy skills development of the Grade 1 students were the highest in Number Identification (NI) and Quantity Discrimination (QD) sub-scales and the lowest in Measurement (M) sub-scale. The Missing Number (MN) sub-scale was the second highest among the 7 sub-scales. Therefore, it can be said that Grade 1 students can perform Number Identification and Quantity Discrimination sub-scales better than other sub-scales of Early Numeracy Skills Development.

Comparison of Means, Standard Deviations and the Results of *t*-test on Dimensions for the Early Numeracy Skills Development of Grade 1 Students by Gender

In order to know the Early Numeracy Skills Development of Grade 1 Students in terms of gender, the independence samples *t*-test was used. The results of *t*-test were mentioned in Table 3.

Table 3 Results of Independent Samples *t*-test on the Early Numeracy Skills Development of Grade 1 Students by Gender

Sub-scales	Gender	N	Mean	SD	<i>t</i>	<i>Df</i>	<i>p</i>
OC	Male	55	9.89	.599	.522	98	.603
	Female	45	9.82	.716			
NI	Male	55	9.85	.826	-1.180	98	.241
	Female	45	10.00	.000			
QD	Male	55	19.75	.947	-1.430	98	.156
	Female	45	19.96	.298			

Sub-scales	Gender	N	Mean	SD	<i>t</i>	<i>Df</i>	<i>p</i>
MN	Male	55	9.80	1.353	-.763	98	.447
	Female	45	9.96	.208			
OP	Male	55	8.82	1.321	.233	98	.816
	Female	45	8.76	1.351			
M	Male	55	17.02	2.978	1.366	98	.175
	Female	45	16.18	3.157			
C	Male	55	19.67	1.667	.420	98	.676
	Female	45	19.56	.943			
Total	Male	55	94.80	7.773	.450	98	.653
	Female	45	94.22	4.073			

The results of *t*-test on the sub-scales of the early numeracy skills development of Grade 1 students by gender revealed that there was no gender difference for the whole early numeracy skills test (see Table 3). 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 on most of the components of early numeracy skills.

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).

Comparison of the Early Numeracy Skills Development of Grade 1 Students among Age Groups

To investigate the early numeracy skills development among age groups, firstly, the participants were grouped into two groups according to their age years: 6 and 7 years.

Table 4 Results of Independent Samples *t*-test on the Early Numeracy Skills Development of Grade 1 Students by Age Groups

Sub-scales	Age	N	Mean	SD	<i>t</i>	<i>Df</i>	<i>P</i>
OC	6 years	69	9.80	.778	-1.448	98	.151
	7 years	31	10.00	.000			
NI	6 years	69	9.88	.738	-.872	98	.385
	7 years	31	10.00	.000			
QD	6 years	69	19.83	.822	-.281	98	.779
	7 years	31	19.87	.499			

Sub-scales	Age	N	Mean	SD	<i>t</i>	<i>Df</i>	<i>P</i>
MN	6 years	69	9.83	1.212	-.646	98	.520
	7 years	31	9.97	.180			
OP	6 years	69	8.55	1.334	-2.778**	98	.007
	7 years	31	9.32	1.166			
M	6 years	69	16.20	3.184	-2.161*	98	.033
	7 years	31	17.61	2.604			
C	6 years	69	19.48	1.632	-1.539	98	.127
	7 years	31	19.94	.359			
Total	6 years	69	93.57	7.163	-2.339*	98	.021
	7 years	31	96.71	3.164			

Note * The mean difference is significant at 0.05 level.

** The mean difference is significant at 0.01 level.

To investigate the mean differences of the early numeracy skills development of Grade 1 students by age group, independent samples *t*-test was conducted and it became apparent that there were significant mean differences in Order Plan (OP) and Measurement (M) sub-scales at 0.01 level and 0.05 level respectively whereas the others dimensions were not significantly different (see Table 4). According to the results, it was found that 7-year-old students developed more on the Order Plan (OP) sub-scale and Measurement (M) sub-scale than 6-year-old students.

This finding is consistent with previous research conducted by Jordan et al., (2009). They found that there was a positive and statistically significant association between the ages of entry into kindergarten and exist number sense scores of children. Moreover, older kindergarten children were found to have better number sense scores than younger kindergarten children.

Discussion

Findings from this study significantly extend the knowledge of the early numeracy skills development of Grade 1 students. The results reported above were largely descriptive and provided the first evidence that the majority of Grade 1 students showed good performance in early numeracy skills development. Proficiency in early numeracy skill is important for academic mastery as well as occupational success. Most occupations require minimal skill by applying a variety of numeracy skills concepts, from calculating the value of money to advanced skills. Numeracy skill is necessary for successful and independent living in the home and community (Patton et al., 1997). Therefore, this factor mainly affects the large group of adults with weak early numeracy skills.

Conclusion

This study followed up quantitative study and results. As a result of the study, the early numeracy skills development of Grade 1 students starts to develop and can be improved as much as they can. According to this study, comparing students' early numeracy skills by age group, it was found that the older group (7-year-old students) can perform better than the younger group (6-year-old students). This is because the older group of students had more access to the early numeracy skills and had more practice experience. This finding is consistent with previous research conducted by Jordan et al., (2009).

And then, there was no general pattern based on gender. This is an important finding because it highlights that difference in early numeracy skills development is not necessarily due to gender. The difference could be due to individual developmental needs. The finding is consistent with the results of Howell and Kemp (2009) and SEA-PLM (2019).

Suggestion

Parents should consider the fact that their children's early numeracy skills development and problem behaviors should be supported by day-by-day experiences at home. Parents should spend more time with their children on early numeracy skills related activities. Primary teachers should arouse children's interest in early numeracy skills 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 development.

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Appendix

Sample Items for Early Numeracy Skills of Grade 1 Students

၁။ ၁မှ ၁၀၀ထိ ကိန်းတို့ကို တစ်မိနစ်အတွင်း အသံထွက်၍ ရွတ်ဆိုပြပါ။ (Oral Counting)

၂။ အောက်ပါဇယားကွက်များမှ ညွှန်ပြသောကိန်းတို့၏ အမည်ကို ပြောပြပါ။

(Number Identification)

၇	၁၇	၁၀	၁၁	၁၈	၈	၆	၃
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၃။ (က)အောက်ပါတို့မှ ပိုများသော အရာနှင့် ပိုနည်းသော အရာကို ပြောပြပါ။

(Quantity Discrimination)

ဖားနှင့်ဘဲ



၃။ (ခ)အောက်ပါတို့မှ ပိုများသောကိန်းနှင့် ပိုနည်းသောကိန်းကို ပြောပြပါ။

(Quantity Discrimination)

၁၃	၁၄	၈	၇	၁၅	၆
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၄။ အောက်ပါကိန်းတန်းတို့ရှိ ကွက်လပ်များတွင် ရှိရမည့် ကိန်းများကို ပြောပြပါ။ (Missing Number)

၇, ၈, ၉, -----	၄, -----, ၆, ၇	၁, ၂, -----, ၄
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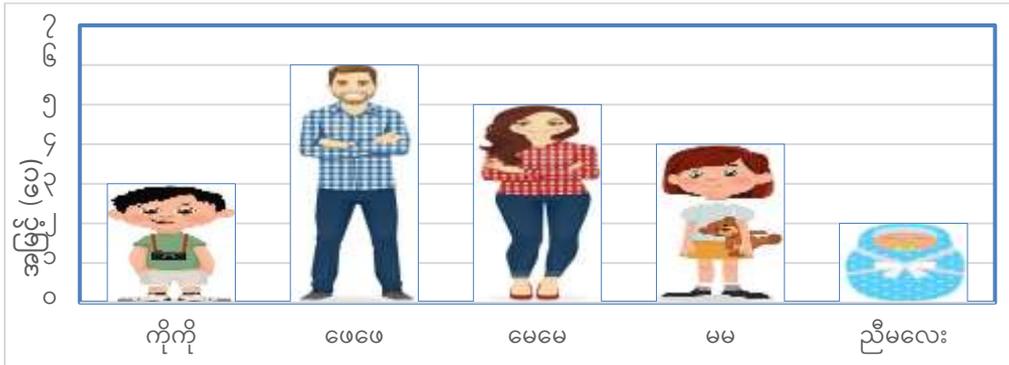
၅။ (က) အောက်ပါတို့မှ နောက်ထပ်လာမည့် ပုံကို ညွှန်ပြပါ။ (Order plan of pattern)



၅။ (ခ)အောက်ပါ ကွက်လပ်များတွင် နောက်ထပ်လာမည့် ကိန်းကို ပြောပါ။ (Order plan of pattern)



၆။(က)ပေးထားသော ပုံကို ကြည့်၍ မေးခွန်းများကို ဖြေဆိုပါ။ (Measurement)



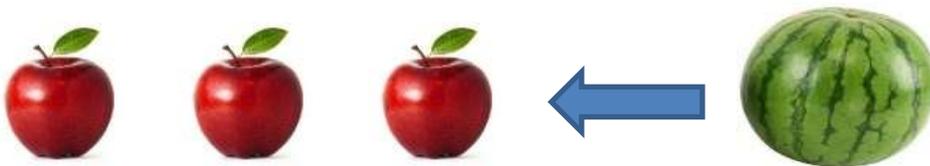
- (၁) ပေးထားသော ပုံတွင်ပါသော မိသားစုဝင် အရေအတွက်ကို ပြောပြပါ။
- (၂) ပေးထားသော ပုံတွင် မည်သူက အရှည်ဆုံးလဲ။
- (၃) ပေးထားသော ပုံတွင် မည်သူက အပုဆုံးလဲ။
- (၄) မေမေ၏ အရပ်အမြင့်ကို ပြောပြပါ။
- (၅) ကိုကို၏ အရပ်အမြင့်ကို ပြောပြပါ။
- (၆) မမ၏ အရပ်အမြင့်ကို ပြောပြပါ။

၆။ (ခ)နာရီတွင် ပြထားသော အချိန်ကို ပြောပြပါ။



၇။(က)အောက်ပါ ပုစ္ဆာများကို အဖြေရှာပါ။ (Computation “Addition”)

(၁) သီဟတွင် ပန်းသီး ၃ လုံးနှင့် ဖရဲသီး ၁ လုံးရှိသည်။ သီဟတွင် သစ်သီးအားလုံး စုစုပေါင်းမည်မျှရှိ သနည်း။



၇။(ခ)အောက်ပါ ပုစ္ဆာများကို အဖြေရှာပါ။ (Computation “Subtraction”)

(၂) ရေကန်ထဲတွင် ဂဏန်းစုစုပေါင်း ၆ ကောင်ရှိသည်။ ဂဏန်း ၁ ကောင်ထုတ်လိုက်လျှင် ရေကန်ထဲ၌ ဂဏန်းမည်မျှ ကျန်မည်နည်း။

