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Research Article

Singapore mathematics approach in aiding the modular print distance learning modality in teaching mathematics

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ABSTRACT

A research investigation was conducted to find out the efficacy of the Singapore mathematics approach in aiding the modular print distance learning modality. This study was a quasi-experimental research design using two groups of participants, the Singapore math group and the traditional group. The group was fairly the same with both groups having the same number of participants and the grades of the students were fairly equal. Each group consisted of 42 participants, for a total of 84 participants. The participants were given a pretest to measure their prior knowledge. The result showed that the Singapore Math learning approaches positively affected the learning of the learners in mathematics. In addition, the use of the Singapore Mathematics approach was significantly better than the traditional approach in teaching solving word problems among the learners it has a significant improvement in the knowledge and application skills of the learners was clearly manifested in the Singapore Math approach compared to the Traditional approach of teaching. Further, the use of the Singapore Mathematics Approach was significantly better than the Traditional Approach in teaching solving word problems among the learners. Hence, the use of the Singapore Math Approach should be encouraged as an alternative to teaching solving word problems inside the classroom.

Keywords: Efficacy; Distance Learning Modality; Mathematical Learning Skills; Singapore Mathematics Approach

1. INTRODUCTION

This pandemic caused hindrances to face-to-face education or even blended learning. However, the education sector needs to re-examine and regulate the utilization of technology for emergency remote instruction to happen between students and also teachers. In response to this crisis and to ensure the continuity of learning while assuring the health, safety, and well-being of all learners, teachers, and other employees, the Department of Education issued DepEd Order No.12 series of 2020 to establish new learning delivery. The alternative modes of delivering learning were envisioned to reach all learners regardless of who and where they are. Among the delivery, modalities are printed modular learning. It gives the students the opportunity to learn in their own phase but also leads to some confusion and questions in problems solving in the math subjects.

Making mathematics engaging and simple to learn is one of the key educational issues. The majority of the time, children struggle to master math. In the nation's public secondary schools, this is a fact. When presented with a math issue they are unable to solve, the majority of pupils lose up quickly. They find a way to ask their teachers or their students for assistance. In the worst situation, they would give up, realizing they could not comprehend the issue and were insufficient at solving mathematical issues. It can be difficult to understand a math problem from the student's point of view. The researcher personally noticed that they lose interest, felt sleepy, and would not answer the problem while doing other unnecessary things not related to math. This led to lower academic performance and success among the students.

Learners typically behaved more like passive listeners when teachers conducted educational processes in the classroom. No lesson could be successful without appropriate student participation. It was essential to implement learner-centered innovative teaching strategies in the classroom so that the students could engage in the educational process (Shafiuddin, 2010). The student's interests should always be prioritized by the teachers.

Correlating the subject matter with the problem of life can awaken interest. Teaching through Singapore math lessons should start with the teacher structuring the context and presenting the problem. Students then answer the problem in 10 minutes while the teacher checks their development and follow-ups on which students were using which methods. Then the teacher starts a whole-class discussion. In the "Singapore Math" lesson, the teacher may appeal to students to discuss their ideas and integrate the new technique in answering the questions by bar model. The teacher would request the students to reflect on and equate the different thoughts—which ideas were inappropriate and why, which ideas were right, which ones were alike to each other, and which ones were more effective or smarter. Through this conversation, the lesson permitted students to learn different mathematical ideas or techniques (McDougal & Takahash, 2014).

The researchers was challenged to have a critical awareness of how effective teaching through Singapore Math was in teaching Mathematics in this modular distance learning. Thus, this study set out simple aims which would help the students and also the teachers. Einstein famously said that "his pencil was more intelligent than he was." Meaning, that he could achieve more after using his pencil as an aid to thinking than he could unaided. There was a need to recognize that teaching Mathematics through Singapore math was the pencil of today. The researcher would only fully attain the benefits of Singapore math in teaching, learning, and doing mathematics. This became unthinkable for a student to solve a complex mathematical problem without ready access to problem-solving. The study was conducted in the second quarter of the school year 2021-2022.

As a Grade 7 teacher for four (4) years, with the flexibility to think and act, whose motive was to make learning more interesting and challenging through the use of teaching Singapore math approach in teaching Mathematics, the researcher was encouraged to have a critical awareness of the contribution of the strategy.

2. RESEARCH METHOD

The study was conducted within the Department of Education Division of Iligan City, particularly at Kiwalan National High School, Matu-og, Kiwalan, Iligan City, Philippines. The participants of the study were 84 Grade 7 students of Kiwalan National High School during the school year 2021-2022. The students were equally divided into two groups. The first group was 42 participants and the second group was 42 participants as well. The participants were selected by the coin toss method. In order to make a toss coin method, the respondents must have the same grade in mathematics as the other for the first quarter or quietly the same grades. As such, it was now determined by a tossed coin to which group the respondents belonged. Moreover, the groups were composed of relatively the same type of participants as the other group. After the pairing, with the use of the toss coin method, the group was assigned as the Traditional Group and the Singapore Math Group and was divided equally. So, there were 42 respondents in the Traditional Group and 42 respondents also in the Singapore Math Group

This study was utilizing a self-constructed test which was vital to know the performance of the traditional and problem-solving groups based on the pretest and posttest results. The students were given the pre-test before the math topic begins while the post-test was administered after the unit topic was discussed involving the Singapore math approach through mathematical learning skills in mathematics. The unit topics include measurements, properties of algebraic expressions, and problem-solving involving algebraic equations. Then a questionnaire was given to the students to find out what mathematical learning l skills were exhibited in Math involving the Singapore math approach toward mathematical problem-solving. Data gathered were coded, encoded, and analyzed to obtain information in order to answer the questions put forward for this investigation.

Descriptive statistics like mean and percentages were used to determine the performance of students and analyzed the data obtained from the results of the questionnaires. Analysis of Covariance (ANCOVA) was used to determine the differences in the posttest scores of the respondents between the Traditional and Singapore Math group when controlling their pretest scores.

3. RESULTS AND DISCUSSION

This section presents the data interpretation and analysis. It includes the frequency and percentages to describe the performance of the respondents in their pretest and posttest scores in the Traditional and Singapore Math groups.

Table 1 How do the respondents perform in their pretest scores in the Traditional group and Singapore Math group?

Pretest Scores of the Participants

Pretest Scores	Performance	Traditional Group		Singapore Math Group	
		F	%	F	%
22-30	Mastered	1	2.0	2	4.0
15-21	Nearing Mastery	36	86.0	33	79.0
8-14	Least Mastered	5	12.0	7	17.0
0-7	Not Mastered				
Total		**42**	**100.0**	**42**	**100.0**

Note: Traditional Group: Mean (SD) =17.43 (2.43) Singapore Group: Mean (SD) = 17.00 (2.39)

Table 1 shows that most of the participants (33 or 79%) in the Singapore Math group had nearing mastery performance in their pretest scores, a little bit lower compared to those participants (36 or 86%) in the Traditional group. Moreover, there were 7 or 17% of the participants in the Singapore Math group who had the least mastered performance level, and a corresponding 5 or 12% for the Traditional group. The result further revealed that the two groups had comparable performance levels prior to the implementation of the intervention.

The reason for the result above could be explained due to the lack of prior knowledge and previous experiences with the test. Schoenfield (1989) demonstrated that learners' previous mathematical experience was also influenced by the culture of the classroom. He noted that if the culture mainly focused on memorization of steps in solving word problems, then the learners might be prevented to enter this meaning-making space in solving word problems. Gurganus (2007) stated that previous instructional experiences could significantly impact achievement. If previous teachers did not explain concepts well, use effective teaching methods, or allow time for mastery and success, students' mathematics learning would be affected.

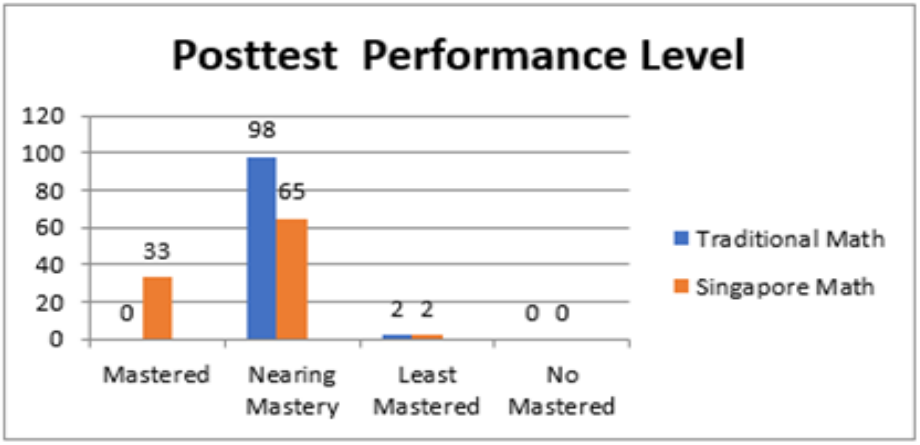

Figure 2. *Posttest Performance Level*

Figure 2 shows that the majority of the participants (27 or 65%) in the Singapore Math group belonged to nearing mastery performance and 14 or 33 % of them categorically were within mastered performance in their posttest scores. In the Traditional group, no one of the participants got the mastered performance while still most of them (41 or 98%) were nearing mastery performance in their posttest scores. The result suggested that the two groups had incomparable performance levels after the implementation of the intervention.

Each and every one of these pupils were able to achieve notable improvements across the board. Similar findings were achieved by research published in the UK, which suggested that teaching Singapore math in the west would result in a modest improvement in pupils' math abilities. Gains were comparable to an additional month of training after one academic year of Singapore math instruction, the study found. Although it may sound foreign, it was simply simple, mathematics was presented in a forceful and effective manner (Mahoney, 2012).

Table 3 Difference Between the Pretest and Posttest Scores of the Participants in the Traditional Group

Paired Variable	Mean ± SD	Paired Mean Difference	T-value (df)	P-value	Remark
Pretest	17.43±2.43				
Posttest	18.02±1.98	-0.60	-2.574* (41)	0.014	***Significant***

*Note: *-significant at 0.05 level*

The **Table 3** reveals that there was a significant difference between the pretest and posttest scores of the participants in the Traditional group since the observed p-value of 0.014 (t=-2.574) did not exceed at the 0.05 level of significance. This result portrayed that the posttest scores of the participants were significantly better as compared to their pretest scores. Further, the participants showed better improvement in their performance without the use of the intervention. Thus, the null hypothesis of no significant difference between the pretest and posttest scores of the participants in the Traditional group was rejected.

According to Bruner's (1966) Theory on Constructivism, learning was an active process in which learners constructed new ideas or concepts based upon their current/past knowledge. Similarly, in the data above, the participants in the Traditional group constructed their current and past knowledge in solving word problem and showed improvement in their performance.

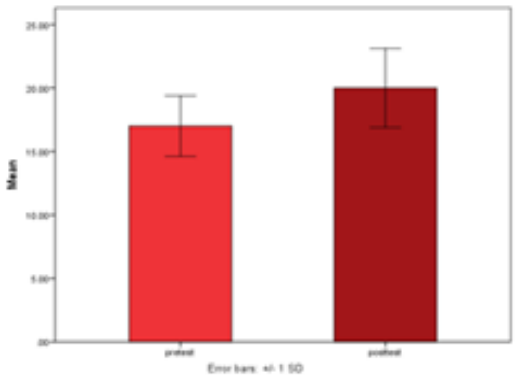

Figure 4. *Mean Pretest and Posttest Scores in Singapore Math Group*

Figure 4 shows that there was a highly significant difference between the pretest and post-test scores of the participants in the Singapore Math group since the observed p-value of 0.000 (t=-7.633) did not exceed the 0.01 level of significance. This result indicated that the posttest scores of the respondents were significantly better as compared to their pretest scores. Further, the respondents showed better and clear improvement in their performance with the use of the intervention. Thus, the null hypothesis of no significant difference between the pretest and posttest scores of the participants in the Singapore Math group was rejected.

This was similar to the study of Thiyagu (2013) that Singapore's math method was child-focused. It sought to make sure that the student gained a full and complete understanding of the fundamental mathematical concepts, rather than merely memorizing a rote collection of facts. This approach not merely enhanced mathematical learning. It also offered a firm foundation from which broader mathematical principles could be extrapolated.

Table 5 Difference Between the Pretest Scores of the Participants

Group	Mean ± SD	Mean Difference	T-value (df)	P-value	Remark
Traditional (n=42)	17.43±2.43	0.43	0.815 (82)	0.417	*Not significant*
Singapore Math (n=42)	17.00±2.39				

Note: ns-not significant means P-value > 0.05

Table 5 reveals that there was no significant difference in the mean pretest scores of the respondents between the Singapore Math and the Traditional groups since the observed p-value of 0.417 exceeded the 0.05 level of significance. This result suggested that the two groups of participants had comparable performance levels prior to the application of the Singapore Math intervention. Further, this result showed that this was a good indication of quasi-experimental research since the two groups had similar performance and statistically no difference in their mean pretest scores. Thus, the null hypothesis of no significant difference in the pretest scores of the respondents between the Singapore Math and the Traditional groups was not rejected.

This outcome was comparable to that of the research by Cal and Obaob (20013), where the pretest score difference between the Singapore Math group and the control group (traditional group) was not statistically significant because of the challenges the students had with the subject.

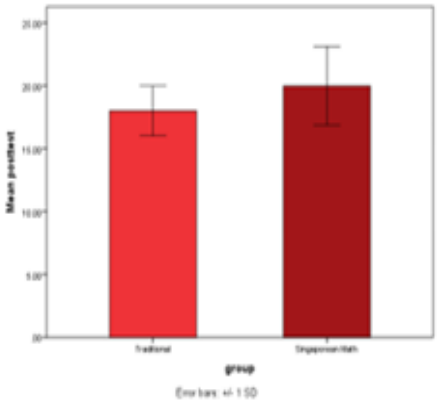

Figure 6. *Mean Posttest Scores between Traditional and Singapore Math Groups*

Figure 6 presents the subject and the one-way ANCOVA was calculated to determine the effect of the Singapore Math learning approach on the posttest scores controlling for the effect of pretest scores. Pretest scores were significantly related to posttest scores [F=61.247, p=0.000]. The group showed a significant difference in terms of posttest scores [F=27.578, p=0.000] after eliminating the effect of the pretest scores of the participants. The result showed that there was a statistically significant difference between the Singapore Math group (M=20.152, SE=0.306) and the Traditional group (M=17.871, SE=0.306) when controlling for the pretest scores. This result further observed that the Singapore Math learning approach positively affected the learning of the learners in mathematics. Thus, the null hypothesis of no significant difference in the posttest scores of the participants between the Singapore Math learning and a Traditional group controlling their pretest scores was rejected.

According to Blalock (2011), the mathematics skills of students who were taught Singapore Math surpassed the skills of students taught in more traditional math. Schools throughout the United States all shared a common goal of elevating student achievement and producing citizens that could succeed in a global society. It was important to consider whether they should change how they teach mathematics. According to this study, three schools in a north Louisiana school district benefited from a change to Singapore Math. It was likely that the positive impact of Singapore Math would continue to be experienced.

4. CONCLUSION

The Singapore math approach, when introduced in math class would enable the learners to perform better performances. it concluded that the use of the Singapore Mathematics approach was significantly better than the traditional approach in teaching solving word problems among the learners. Further, significant improvement in the knowledge and application skills of the learners was clearly manifested in the Singapore Math approach compared to the Traditional approach of teaching. The theory of Constructivism by Piaget (1896) was highly significant in this study since the Singapore Math approach was constructive learning. The learners formulated their own way as they followed the three important concepts that were from concrete to visual and then to abstract to improve their learning in solving a word problem. This supported the idea of Cognitive Development by Vygotsky that stated that the most significant application an educator could put into place was his ideas of the "zone of proximal development and scaffolding". This permitted teachers to comprehend what a child could make if they only had aid. The Singapore Math participants were observed to be more interactive, and confident, and most importantly, showed improvement in solving word problems after the intervention was done. Thus, the use of the Singapore Math Approach may be encouraged as an alternative to teaching strategy in solving word problems inside the classroom.

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CONFLICT OF INTEREST

There are no conflicts of interest declared by the authors.

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