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The Effects of Singaporean Math Model Method in Learning Place Values in Mathematical Operations

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Abstract

The study was conducted to determine if the utilization of Singaporean Math Model Method in learning place value in mathematical operations has an impact to the improvement of students' performance. A quantitative design was used in the study. The essential data were gathered from a total number of 67 respondents, 34 students from the experimental group and 33 students from the control group, with the aid of validated questionnaire. Data were analyzed and interpreted using the Average Weighted Mean and T-test as statistical tools. According to the findings of the study, data revealed that the result of pre-test and post-test of both experimental and control group is significant. Result showed that there is a significant difference of the utilization of Singaporean Math Model Method in learning Place Values in Mathematical Operations in Grade 3 Pupils at Kaputian Central Elementary School. Recommendations were also included in this study.

Keywords: mathematical operations, Singaporean Math Model Method, place values, pupils

1. Introduction

Place value is extremely important in identifying and computing problems in mathematics subject. Many young learners struggled in learning place values because it is abstract. Attention span, overtaxed memory and answering without understanding are some errors that can be made in learning place values.

In the international study, the development of place value perception has not often been investigated because of the absence of conceptual approaches and empirical research based on the topic. This model, the stage sequence gives elaboration in conceptual place value understanding to know the capabilities and hardship in some major school students (Herzog, Ehlert & Fritz, 2017).

In the national study, Ateneo de Manila University the traditional place values teaching is considered as practice for learning the standard algorithms. Some related competencies in the Philippine curriculum for the first grader who visualized and gives the place value and value of a digit in one-and two-digit numbers and renames number into tens and ones. In the lesson, forty-seven stars are organized in four rows of ten and one row of seven. It then states that forty-seven is composed of four tens and seven ones. Next, the text mentions that in 47, the value of four is four tens or 40, and the value of 7 is seven ones. A place value chart is presented at the end of the lesson (Verzosa, 2015).

In Kaputian Central Elementary School, Ms. Estella a substitute teacher of Mrs. Eleonor Rebong a Grade III adviser who was also teaching mathematics said that most of the students are not interested in math subject. The students easily got bored because the teacher uses only chalk and board. Students know how to solve the problem but cannot explain the process of solving especially in place value. The researchers observed that the students at Peñaplata College have difficulty in math. Most of them know how to solve, but they don't know how to explain the process of

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getting their answers. This is the reason why researchers are well motivated to conduct the study of the effects of Singaporean Math Model Method in learning place values in mathematical operations.

1.1. Statement of the Problem

The main focus of this study aimed to determine the effectiveness of using Singapore Math Model Method in learning Place Values in Mathematical Operations.

Specifically, it sought answers to the following questions:

a) What are the pre-test mean scores of both controlled and experimental group?
b) What are the post-test mean scores of both controlled and experimental group?
c) Is there any significant difference between the post-test of the controlled and experimental group?
d) Is there a significant difference in the pre-test and post-test mean scores in the controlled group?
e) Is there a significant difference in the pre-test and post-test mean scores in the experimental group?
f) Is there a significant difference in the mean gain scores of the students in the experimental group who used the Singaporean Math Model Method and students in the control group who were exposed to the traditional method?

1.1. Theoretical Framework

This study is anchored on Constructivist Theory of Jerome Bruner (1966) which states that learning process involves the active participation of learners in primary students that can make new ideas or information from their experience or prior knowledge. Learners can construct information and making decisions, based on a cognitive structure and mental models in cognitive structure give significance and organization to experience and make the students go beyond the information given. Bruner stated that learners have difficulties in math because it is abstract.

He supported the Theory of Constructivism. According to him, learning is repetition, continuous, complex and connected. Many studies have proved that an effective technique for professional development is upon on experience. The nature of the constructivist approach to the instructor gives importance to the role of reflective activities in teacher practice. The findings of this study about constructivist teacher education have strongly suggested the application of reflective teaching practice using model (Kumari, 2014).

Constructivism is an epistemology used to explain how individual know what they know. It says that learners make their knowledge and understanding to the topic by experiencing things and reflects their experiences. It affirms that learning is an activity to the learners. This theory assumes that students will try to make sense of all the information that they perceive and that each student will, therefore, construct their understanding from the information (Bhattacharjee, 2015).

This study elaborates that constructivist works in conceptual learning arose in mathematics education. At the same time, learners who have learning disabilities react to their learning style, specifically in their experienced learning interaction. Their learning style did not meet or reach the semi-concrete stage of operation, which to prevent in solving difficult problems in difficult digit numbers. The study shows that the transition from concrete or semi-concrete to an abstract concept is important and needed to support the understanding of students who have learning disabilities (Xin, Liu, Jones, Tzur, & Si, 2016). However, behaviorists believe that knowledge exists outside of people and independently of them, and it is pointed out that learning is based only to their conventional body (Scheurman, 1998).

2. Methods

2.1. Research Design

The study utilized the experimental method. Experimental method study gives descriptions of events and phenomena. Goleña (2012) defines an experimental approach as a collection of research designs, guidelines for using them, principles and procedures for determining statistical significance, and criteria for assessing the quality of a study for

some researchers, the experimental method is the premier method, all others being ground clearing operations, that is, preliminary data collection and interpretation exercises to prepare for a formal experiment. In this study, the researchers will gather necessary data to identify "The effects of Singaporean Math Model Method in learning in place values in mathematical operations in Grade III Pupils at Kaputian Central Elementary School, Island Garden City of Samal, Philippines.

The researchers gathered data from the respondents through questionnaires which identified the effects of Singaporean Math model Method in learning place values in mathematical operations and served as the main instruments in gathering and collecting the needed data for this study.

2.2. Research Participants

The study was conducted at Kaputian Central Elementary School, Island Garden City of Samal. The distribution of respondents was according to class section, which were categorized into experimental and control groups. There are sixty-seven (67) Grade III pupils of Kaputian Central Elementary School, District III Kaputian, Island Garden City of Samal who are involved in the study and enrolled in Mathematics subject. There are thirty-four (34) students in the experimental group and thirty-three (33) students in the control group. Both groups will be given a pre-test and a post-test.

2.3. Research Instrument

The instrument that the researchers used in the data gathering processes in this study is a researcher-made questionnaire. This will be composed of 30 items statement. It was used to identify the effects of Singaporean Math Model Method in learning place values in mathematical operations with the indicators: ones, tens, hundreds, thousands, ten thousand, and addition and subtraction with/without regroupings. The respondent has expected to identify the place value of each digit number and can also explain the given problem in the mathematical process. The research instrument was submitted first to the adviser and panel of examiners for corrections, validation, and approval. These instruments are made in brief sentences to provide basic understanding in the light of the study. The scaling for the effectiveness of Singaporean Math Model Method adopted is as follows:

Table 1. Descriptive Interpretation of the Score Interval

Range of Test Scores	Descriptive Equivalent	Interpretation
25.20 – 30.00	Outstanding	This means that the respondents show extremely high performance in learning place value in mathematical operations.
22.80 – 25.19	Very Satisfactory	This means that the respondents show high performance in learning place value in mathematical operations.
20.40 – 22.79	Satisfactory	This means that the respondents show satisfactory performance in learning place value in mathematical operations.
18.01 – 20.39	Fairly Satisfactory	This means that the respondents show unsatisfactory performance in learning place value in mathematical operations.
0.00 – 18.00	Did Not Meet Expectations	This means that the respondents need improvement on the performance in learning place value in mathematical operations.

2.4. Statistical Treatment of the Data

The responses gathered from the questionnaires had been tallied and tabulated in a master data sheet. The data collected were entered into IBM SPSS (Statistical Package for Social Science) version 22 for analysis. Data were analyzed using average weighted mean and t-test at 0.05 level of significance.

3. Results and Discussion

3.1. Pre-Test Mean Scores of the Experimental and Control Groups

Table 2 shows the pre-test mean scores of the students before application of Singaporean Math Model Method in Learning Place Value in Mathematical Operations. The thirty-four (34) respondents in the experimental group have the pre-test mean score of 13.18 and thirty-three (33) respondents in the controlled group, has the pre-test mean score of 10.30. Both have a descriptive equivalence of did not meet expectations. This implies that the respondents need improvement on the performance in learning place value in mathematical operations.

According to Natcha and Satoshi (2006) the issues of having low performance in the mathematics subject within their particular ability in problem-solving. This study attempts to express the reason of having the low accomplishment of the learners through the analysis of their abilities level that was classified into five stages; reading, comprehension, transformation, process skills, and encoding. They observed that most of the learners' errors occurred at comprehension level because some of their errors didn't occur at the reading level.

Table 2. Pre-test Mean Scores of the Experimental and Control Groups

Groups	N	Mean	Descriptive Equivalent
Experimental	34	13.18	Did Not Meet Expectations
Control	33	10.30	Did Not Meet Expectations

3.2. Post Test Mean Scores of the Experimental and Control Groups

Table 3 shows the post-test mean scores of the experimental and control groups. It was revealed that the experimental group obtained a mean score of 24.91 with a descriptive equivalent of very satisfactory while the control group obtained a mean score of 13.88 with a descriptive equivalent of did not meet expectations. This means that the respondents in the experimental group and the control group have shown different descriptive equivalence. The control group needs to improve on the performance in learning place value in mathematical operations. However, the respondents from the experimental group show very satisfactory performance in learning place value in mathematical operations.

The study of the UCL Institute of Education and Cambridge University (2015) stated that the first conclusive proof that so much eastern teaching methods can improve pupils' maths performance is revealed in research just published. A study shows that learners who were instructed through the Singaporean Math approach learn faster than their classmates - creating, on average, an additional month of progress in an exceedingly year.

3.3. Significance of the Difference in the Pre-Test Mean Scores of the Experimental and the Control Groups

Table 4 shows the significance of the difference in the pre-test mean scores of the experimental and control groups. The experimental group obtained a pre-test mean score of 13.18 and the control group obtained a pre-test mean score

of 10.30. This gave a p-value of .010. The null hypothesis was then rejected since the p-value was less than $\alpha = 0.05$ level of significance. This means that there was a significant difference in the pre-test mean scores of the experimental and control groups. The result further suggested that before the experimental was done. The students from the experimental group have an edge compared to the students from the control group as revealed in their pre-test scores.

Table 3. Post-test Mean Scores of the Experimental and Control Groups

Groups	N	Mean	Descriptive Equivalent
Experimental	34	24.91	Very Satisfactory
Control	33	13.88	Did Not Meet Expectations

This study stated that considering the individual differences of the students is an effective and productive learning-teaching process. The individual differences of learners such as physical characteristics, intelligence, perception, gender, ability, and learning styles are important for teachers to know (Kubat, 2018).

Table 4. Significance of the Difference in the Pre-test Mean Scores of the Experimental and the Control Groups

Pretest Mean Scores		Mean Difference	Computed t-value	p-value	Remark
Experimental	Control				
13.18	10.30	2.88	2.67	.010	Significant

3.4. Significance of the Difference in the Pre-Test and the Post Test Mean Scores of the Control Group

Table 5 shows the significance of the difference in the pre-test and post-test mean score of the control group. It was revealed that the control group obtained a pre-test mean score of 10.30 while its post-test means score was 13.88. This resulted in a p-value of .003. The null hypothesis was then rejected since the p-value was less than $\alpha = 0.05$ level of significance. This means that there was a significant difference in the pre-test and post-test mean scores of the control group. The result above suggested that when the experiment was done, there was a guaranteed that the control group obtained a significant increase in the test as revealed in the mean scores.

The changes within the instruction of individual teachers directly involved changes in their students' accomplishment. For every teacher, class achievement in ideas and problem-solving was higher at the end of the study than at the beginning (Fennema, et.al, 2010).

Table 5. Significance of the Difference in the Pre-test and the Post-test Mean Scores of the Control Group

Mean Scores of Control Group		Mean Difference	Computed t-value	p-value	Remark
Pretest	Posttest				
10.30	13.88	3.58	3.11	.003	Significant

3.5. Significance of the Difference in the Pre-test and the Post-test Mean Scores of the Experimental Group

The table shows the significance of the difference in the pre-test and post-test mean scores of the experimental group. It was revealed that the experimental group obtained a pre-test means the score of 13.18 while its post-test means score was 24.91. This gave a p-value of 0.000 which was less than $\alpha = 0.05$. Therefore, the null hypothesis was rejected. That is, there is a significant difference in the pre-test and post-test mean scores of the experimental group. The result above implies that using Singaporean Math Model Method is effective in learning Place Value in

Mathematical Operations. It shows that there was a significant increase in scores after exposing to the Singaporean Math Model Method in the class.

This study described the task of Singapore's student performance in Mathematics Processing Instrument. In Singapore, the popular method for problem-solving is a visual method. In using this visual problem-solving strategy, the learners will be successful in solving the problems. The method will work, and it expressed what is in the textbook (Ho & Lowrie, 2014).

Table 6. Significance of the Difference in the Pretest and the Posttest Mean Scores of the Experimental Group

Mean Scores of Experimental Group		Mean Difference	Computed t-value	p-value	Remark
Pretest	**Posttest**				
13.18	24.91	14.75	11.73	.000	Significant

3.6. Significance of the Difference between the Mean Gain Scores of the Experimental and the Control Groups

Table 7 shows the significance of the difference between the mean gain scores of the experimental group obtained a mean gain score of 11.78 while the control group obtained a mean gain score of 3.58. This resulted in a p-value of 0.00 which was less than $\alpha = 0.05$. Therefore the null hypothesis was rejected, that there was a significant difference in the mean gain scores of the experimental and the control groups. The result above suggested that Singaporean Math Model Method was considered effective. One factor that was worth reflecting was perhaps the flexibility of the teacher (actually, one of the researchers) who handled both the control and experimental groups. The teacher possibly knew how to handle the experimental group effectively using the Singaporean Math Model Method, thereby contributing to a significant increase in the post-test scores of the group. In essence, the traditional method of teaching in place values in mathematical operations cannot be separated from the non-traditional method, that is, both methods may co-exist to increase teaching-learning effectiveness. Since there is a significant difference between the groups mean gain scores, the use of Singaporean Math Model Method is highly suggested.

Many young learners found out that mathematics is a difficult subject because it is abstract. To pass the math subject is to know and master the procedures. Singaporean Math Model Method helps the students understand the basic math principles. The learners that have difficulty in learning the traditional math method find Singaporean Math Model Method easier and understandable (Cruz, 2012).

Table 7. Significance of the Difference between the Mean Gain Scores of the Experimental and the Control Groups

Mean Gain Scores		Mean Difference	Computed t-value	p-value	Remark
Experimental	**Control**				
11.74	3.58	8.16	9.86	.000	Significant

4. Conclusions and Recommendations

The following are the conclusions based on the results presented: (1) both experimental and control groups of student have shown the same level of performance in learning place values in mathematical operations in the pre-test. (2) Singaporean Math Model Method was more effective in significantly increasing the performance level of the experimental group in learning place value in mathematical operations. Although there is an increase in the mean score of the control group in the post-test but it was not significant enough to increase their level of performance in general. (3) Singaporean Math Model Method was more effective method compared to the traditional method of teaching as shown in the results. This may increase the teaching-learning effectiveness specifically in the learning of place values in mathematical operations.

In the light of the findings mentioned above and conclusions of this study, the following recommendations were offered: (1) teachers should apply Singaporean Math Model Method in Teaching Place Values in Mathematical Operations. This method is a better alternative in the traditional method. (2) School administration of Kaputian Central Elementary School should suggest or recommend every teacher to apply Singaporean Math Model Method in teaching place values in mathematical operations. Other schools may do the same. (3) Future researchers should research more accurate results and they should conduct research to address other factors like a wide sampling of respondents, time duration or long exposure in teaching the method, apply to other topics in mathematics in any grade level and conduct to the other school or another learning environment.

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