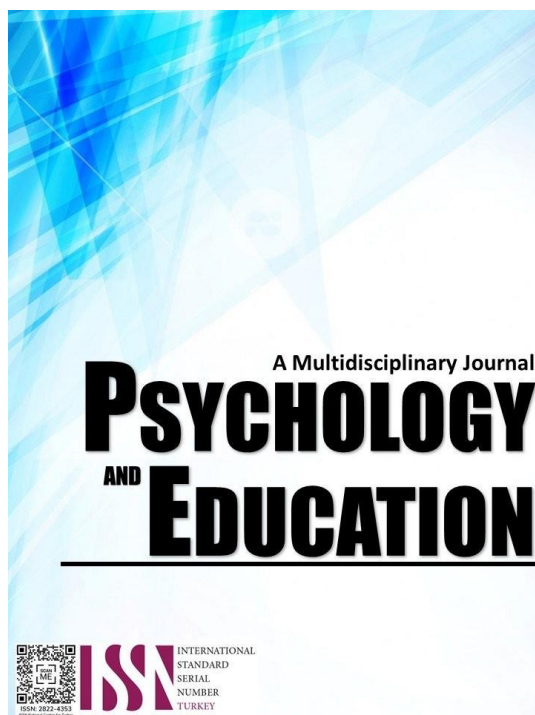


**MATHEMATICS PERFORMANCE OF KINDERGARTEN USING TOUCH
MATH TECHNIQUES IN NAGA NORTH DISTRICT IV, NAGA CITY:
BASES FOR DEVELOPMENT PLAN**



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Mathematics Performance of Kindergarten Using Touch Math Techniques in Naga North District IV, Naga City: Bases for Development Plan

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Abstract

This study investigates the impact of the Touch Math approach on enhancing kindergarten readiness and mathematical achievement. A total of 40 pupils, aged five to six, were divided into two groups: a control group using traditional methods and an experimental group employing the Touch Math approach. Initial assessments revealed varied levels of numerical readiness among the children, with 88% able to identify and work with shapes, while only 25% demonstrated proficiency in recognizing basic addition concepts. The analysis of pretest scores indicated no significant difference between the two groups, with both performing similarly. Post-intervention results demonstrated a marked improvement in the experimental group, which achieved a mean score of 30.75 and a standard deviation of 5.88, compared to the control group's mean score of 20.9 with a standard deviation of 4.33. The difference of 9.85 was statistically significant, as confirmed by a t-test result of 5.89, which exceeded the critical values for both the 5% and 1% confidence levels. Consequently, the null hypothesis was rejected, indicating that the Touch Math approach significantly enhanced the mathematical abilities of the kindergarten pupils. Overall, the study concludes that the Touch Math method is more effective than traditional teaching methods in fostering essential mathematical skills in young learners. This finding underscores the importance of innovative teaching strategies in early childhood education, aiming to better prepare children for future academic success in mathematics.

Keywords: *mathematics, performance, techniques, development*

Introduction

Kindergarten used to mean brightly colored paintings, music, clay, block building, bursting curiosity and intensive exploration" (Martin, 2015), but today's trend leans toward a more structured, academic curriculum. Because of stricter accountability standards and increased pressure applied on local school districts for higher standardized test scores, kindergarten teachers must move quickly to help students achieve more in a shorter period of time. What used to be first grade work is now expected to be learned in kindergarten (Anderson 2016). This trickle-down effect does not leave much time for developmentally appropriate activities that help students learn and understand mathematical concepts, and it also takes away from the development of the love of learning.

A quality kindergarten experience can better prepare a child for the later, more traditional mathematics instruction by developing curiosity and confidence through math explorations and investigations. Unfortunately, not all children have been afforded the opportunity to attend a good quality pre-kindergarten. Affluent parents have the means to select the school of their choice; parents from a lower socioeconomic status do not.

The way math is taught in the early years of school affects not only math achievement and skill development, but also a child's disposition to learn" (Perlmutter, 2016). In order to understand and enjoy mathematics, children must literally reinvent it through their own daily explorations and with number games. A quality pre-kindergarten can provide the age-appropriate activities necessary to help students enter kindergarten confident in their abilities and interested in learning more about numbers.

Math manipulative can be borrowed to be used at home for practicing one-to-one correspondence, sequencing, striations, classification, and making patterns. This continued exploration of mathematics at home instils a feeling of competence and a favorable disposition toward problem-solving. Because early education programs often involve parents extensively, family processes may be impacted. Some long-term effects may include the attitudinal and behavioral measures of parent-child interactions, parent attitudes, school involvement, and educational experiences. Ideally, this will continue throughout the child's school years (Reynolds, Hagemann, 2016).

Giving children a positive, early understanding of mathematical concepts by using developmentally appropriate practices is possible by making sure that every child has the right to attend a quality kindergarten. Every child benefit by this experience, especially in mathematics. Once a child has developed a love of learning math and has experienced the wonder of math explorations, confidence soars and he/she is ready to move on to a more structured form of mathematics instruction.

Traditional instruction methods remained insufficient in teaching the mathematics skills to the students with special needs. Therefore, multi-sensory teaching methods must be used in teaching mathematics skills to the pupils at an early stage and pupils with special needs. Touch Math is a one of the multisensory teaching techniques which is used to teach the mathematics skills especially number sense and four operations skills. The aim of this study is to make an analysis on the effect of using Touch Math as an alternative approach to enhance the teaching of mathematics.

Touch Math is a multisensory technique for teaching number sense, addition, subtraction, multiplication and division (Scott, 2013). The Touch Math program was first developed in 1975 by an elementary school teacher Janet Bullock while searching an appropriate

method to increase student's success who were struggling math concepts.

Touch Math is a technique combining vision, movement, hearing and touch senses and is used to teach especially number sense and four operation skills. In Touch Math technique, reference points calling Touch Points are placed on each number. These points can help students to see the conceptual meaning of symbolic value. Touch Math technique is developed for teaching mathematical skills to individuals with special needs as well as individuals that exhibit normal development. This multisensory technique is especially helpful to students with learning difficulties and mental disabilities for developing mathematical skills (Scoot, 2013). Most useful aspect of this technique for individuals with special needs is that it allows doing addition without finger calculation or having to keep numbers in memory (Miller and Mercer, 2017).

The researchers want to prove that in using touch math, all children will be able to have the chance to reach their maximum potential and master the basic fundamental operations in Mathematics. By becoming aware of the learning needs of children who are not fully functional in school, teachers would be able to expand their horizons and be open to new strategies and techniques in exercising their profession, contributing to the general welfare of the society.

In Touch Math teachers should manage the instruction process and should organized the instruction such as concrete form abstract according to the approach of Bruner (2016). Accordingly; in concrete phase numbers or points should be prepared as concretely and representation should be as touching the numbers and points. In representational phase, points should be put on the symbolic numbers and representation should benefit from the vision of touch points. And last in abstract phase touch points shouldn't be put and students should count by supposing touch points are there. Briefly in concrete phase represents "Touch", representational phase represents "See" and abstract phase represents "Count" without touch points.

Scott (2013) continued the research and conducted a study to examine using a multisensory program to instruct students with mild disabilities in addition and subtraction concepts. Touch math was chosen for the study because it was not based on memorization of facts but was a technique for acquiring the facts (Scott, 2013). According to some researches, traditional method of teaching remained insufficient in teaching different mathematics skills to students most specially those students with special needs. A multi-sensory teaching method was developed to cater their needs. Many researchers suggest using multisensory approaches for teaching mathematical skills (Vinson, 2014). In relation to that, Touch math is one of the multisensory approaches in teaching number sense, basic math facts most specially those four basic operations which combines vision, movement, hearing and tactile components. Furthermore, touch math program is an appropriate technique for "Number and Operations Standard" (Vinson, 2014) because it is a multisensory approach in teaching, there are points to help students in conceptual learning of numbers and the basic operation, it remediates.

Research Questions

The main goal of the study is to investigate the effect Touch Math approach in enhancing kindergarten readiness and achievement in mathematics. Specifically, it seeks answer to the following problems:

1. What is the profile of the kindergarten of Tulay Elementary school as to:
 - 1.1. age; and
 - 1.2. sex?
2. What is the level of readiness and mathematics achievement the kindergarten pupil in for the first grading periods?
3. What is the posttest performance of the pupils in the control group (traditional teaching) and experimental group (using touch math)?
4. Is there a significant difference on the pupil's performance in math of the two groups?
5. What is the effect of touch math in the performance of the kindergarten pupils in math?

Methodology

Research Design

The study used the experimental research design, using the pretest posttest methods. This is the most appropriate design in this particular study since the proponent wanted to determine the effect of the touch math approach/program in teaching the basic mathematical operation (addition and subtraction) to kindergarten pupils.

Experimental research designs are the primary approach used to investigate causal(cause/effect) relationships and to study the relationship between one variable and another. This is a traditional type of research that is quantitative in nature.

This study is an experiment where the researcher manipulates one variable, and control/randomizes the rest of the variables. It has a control group, the subjects have been randomly assigned between the groups, and the researcher only tests one effect at a time.

Pretest-Post-test Design, the subjects are randomly assigned to either the experimental or the control group. Both groups are pretested for the independent variable. The experimental group receives the treatment and both groups are post-tested to examine the effects of manipulating the independent variable on the dependent variable.

Respondents

The respondents of the study were the kindergarten pupils of Tulay Elementary school, school year 2018-2019. They were randomly selected based on the number of respondents as needed in the experimentation. They were divided into two groups, the experimental and the control groups. The experimental group received the motivational techniques using the Touch Math approach.

Table 1. *The Respondents of the Study as Divided into two groups the experimental and the control groups*

Group	Male	Female	Number of cases or Pupils
Experimental (Using Touch Math)	10	10	20
Control (Traditional approach)	10	10	20
Total	20	20	40

A total number of 40 pupils will be employ for this study. The ages of these participants range from 5 to 6 years with a mean age of 5.5. The selection of the participants will be done in the school classroom thus eliminating biases that tend to result from age differences and intelligence levels through the provision of a column for age range.

Instrument

The propose study used the standard Kindergarten Readiness Indicator Checklist prepared by the National Center for Learning Inc.

Other instrument was prepared by the teacher such as the pretest posttest test in mathematics.

The second instruments are the pretest-posttest test used to determine the effect of the Touch Math. This is 20 items test on addition and subtraction which contain, 10 items for addition and 10 items for subtraction. This was validated using test-retest method.

As the name suggests, the test-retest approach is done by administering the test and then giving the same test to the same group of students after a certain interval of time. The questionnaire was pre-tested to 20 pupils (non-participant of the study) in order to determine its validity and reliability. The two set of scores were be correlated using Pearson's product moment method.

The validated instrument was then be administered to the identified respondents of the study.

Procedure

Permission to conduct the study was asked from the District Supervisor and the principal of Tulay Elementary School to allowed the proponent to conduct the experimentation of Touch Math to the Kindergarten pupils. After the granting of the permission the researcher personally conduct the experiment for one month.

Data Analysis

The data analyses started with tallying, recording and tabulating the raw data. The organized data was then subjected to statistical treatment as basis for analysis and interpretation. The following statistical tools were use.

Percentage. This statistical measure will be used in determining the demographic profile of the respondents.

Pearson Product Moment Correlation. This statistical test was used to determine the reliability of the pretest-posttest, The Pearson correlation coefficient, is a statistical formula that measures the strength between variables and relationships. To determine how strong the relationship is between two variables, the coefficient value range between -1.00 and 1.00.

For the comparison of the two groups to determine the effect of the touch math, t-test for independent sample was used.

Results and Discussion

This section presents the data gathered from the instrument of the study. It was presented in table form and was analyze and interpreted using propitiate statistical tools

Profile of the Kindergarten

Table 1. *Age Distribution of the kindergarten pupils of Tulay Elementary School*

Ages	Touch Math		Traditional		Total
	F	%	F	%	
5	11	55%	10	50%	21(52.50%)
6	9	45%	10	50%	19(47.59%)
	10	100	20	100	40

Age Distribution of the kindergarten pupils of Tulay Elementary School is presented in table 1. As presented in the table, a total of 21pupils or 52.50% were five (5) years old, and 19 pupils or 47.59 % were six years old. These 40 pupils were divided into and group as the traditional or control group and touch math or the experimental group.



The traditional or the control group have 10 pupils with ages 5years old and another 10 pupils who were 6 years old. In the touch math or experimental group was composed of 11 pupils who were 5 years old and 9 pupils who were six years old.

Table 2. Sex Distribution of the kindergarten pupils of Tulay Elementary School

Sex	Touch Math		Traditional		Total
	F	%	F	%	
Female	12	60%	11	55%	21 (52.51%)
Male	8	40%	9	45%	19(47.59%)
	10	100	20	100	40

Table 2 presents the sex distribution of the kindergarten pupils of Tulay Elementary School. As shown in the table there were 21 female pupils or 52.51% and 19 male pupils or 47.59 of which 12 female pupils and 8 male pupils in the experimental or touch math group. On the other hand there were 11 female pupils and 9 male pupils in the control or the traditional group.

Level of Numerical Readiness of the Kindergarten Pupils of Tulay Elementary School

On the level of numerical readiness of the kindergarten pupils on the start of the school year or during the first grading period, table 3 indicated that pupils is ready on the following: thirty five (35) or 88%(out of the 40 pupils respondents can identify and work with shapes; twenty (20) pupils or 50% can use objects or draw pictures to represent a number 1-10 and more; fifteen (15) or 38% can Count how many objects are in a group (one by one); thirteen (13) or 33% can recognized that subtraction means taking away from one group; twelve (12) pupils or 30% can compare a group of objects to another group to figure out which is greater or less than the other and can add and subtract numbers 1through 10; ten (10) pupils or 25% can recognize that addition means putting two groups together, use objects to show how to break up numbers less than or equal to 10 in more than one way, and find the number of objects to make any group of 1 to 9 into a group of 10.

Most of the kindergarten pupils are not yet ready on the following numerical skills: Use objects to show how to break up numbers less than or equal to 10 in more than one way with twenty three (23) pupils or 58%; Recognize that subtraction means taking away from one group, fourteen (14) pupils or 35%; Add and subtract numbers 1 through 10, fourteen (14) pupils or 35%; Can solve simple addition and subtraction word problems, 14 pupils or 35%; and Recognize that addition means putting two groups together with 12 pupils or 30%.

Table 3. Individual Level of Readiness on Mathematics of the Kindergarten Pupil During the First Grading Periods

	Ready			Moderate Ready			Not Yet Ready		
	F	%	R	F	%	R	F	%	R
1. Can count how many objects are in a group (one by one	15	38	3	25	62	2	0	00	9.5
2. Compare a group of objects to another group to figure out which is greater or less than the other.	12	30	5.5	25	60	3	4	10	7
3. Recognize that addition means putting two groups together.	10	25	8	18	45	4	12	30	5
4. Recognize that subtraction means taking away from one group	13	33	4	13	33	7	14	35	3
5. Add and subtract numbers 1 though 10	12	30	5.5	14	35	6	14	35	3
6. Use objects to show how to break up numbers less than or equal to 10 in more than one way	10	25	8	7	18	8	23	58	1
7. Find the number of objects to make any group of 1 to 9 into a group of 10	10	25	8	26	65	1	4	10	7
8. Use objects or draw pictures to represent a number 1- 10 and more	20	50	2	16	40	5	4	10	7
9. Can solve simple addition and subtraction word problem	9	23	10	17	13	9.5	14	35	3
10. Can identify and work with shapes.	35	88	1	5	13	9.5	0	00	9.5

Legend: 3.00 - 2.25, Ready; 2.24- 1.50, Moderately Ready; 1.49 - 1.00 Not yet Ready

Table 4 presents the general Kindergarten Pupils perception on their Level of readiness on mathematics. As shown on the table the pupils are can already count how many objects are in a group (one by one), can see objects or draw pictures to represent a number 1-10 and more and can identify and work with shapes. These skills are needed in addition and subtraction skills.

Table 4. Level of Numerical Readiness of Kindergarten as a Group

	Numerical Readiness	WM	Description
1. Can count how many objects are in a group (one by one)		2.37	Ready
2. Compare a group of objects to another group to figure out which is greater or less than the other		1.70	Moderately Ready
3. Recognize that addition means putting two groups together		1.65	Moderately Ready
4. Recognize that subtraction means taking away from one group		1.97	Moderately Ready
5. Add and subtract number 1 though 10		1.95	Moderately Ready
6. Use objects to show how to break up numbers less than or equal to 10 in more than one way		1.68	Moderately Ready



7. Find the number of objects to make any group of 1 to 9 into a group of 10	2.15	Moderately Ready
8. Use objects or draw pictures to represents a number 1-10 and more	2.40	Ready
9. Can solve simple addition and subtraction word problems	1.87	Moderately Ready
10. Can identify and work with shapes	2.87	Ready

Legend: 3.00 - 2.25, Ready; 2.24 - 1.50, Moderately Ready; 1.49 - 1.00 Not yet Ready

On the other hand they are moderately ready on the following: comparing a group of objects to another group to figure out which is greater or less than the other; recognize that addition means putting two groups together; recognizing that subtraction means taking away from one group; adding and subtracting numbers 1 through 10; Using objects to show how to break up numbers less than or equal to 10 in more than one way; finding the number of objects to make any group of 1 to 9 into a group of 10 and solving simple addition and subtraction word problems. Hence most of the kindergarten pupils need an activity that will enhance their addition and subtraction knowledge and skills.

Kindergarten Performance on the Traditional and Touch Math Approaches

Table 5. Pretest Result on the Pupils Performance in Math

Pupils	Touch Math Experimental Group Pretest	Traditional Control Group Pretest
1	23	18
2	15	10
3	19	17
4	10	18
5	11	13
6	13	14
7	18	9
8	19	13
9	14	14
10	15	14
11	17	16
12	16	15
13	7	12
14	21	16
15	11	14
16	15	15
17	13	17
18	11	14
19	12	15
20	18	16
$\sum X$	228	290
Mean	14.4	14.5
Sd	4.07	2.37
Test Computed	0.095	
T - Value	2.021 (5%)	
(Table Value)	2.704 (1%)	
Df	40	
Decision	Insignificant, Accept The Null Hypothesis	

Table 5 present the pretest result on the pupil’s performance in math of the kindergarten pupils using touch math and the traditional approaches. As presented in the table the touch math obtained a mean of 14.4 and a standard deviation of 4.07. This indicated that more or least the pupils have an average score of 14.4 in the given test of 25 items. The standard deviation of 4.07 indicated that the pupils score were heterogenous. This can be shown on the difference of the range or the difference between the highest score and the lowest score which is $16(23-7=16)$

On the other hand, the tradition or the control group obtaining a mean of 14.5 and a standard deviation of 2.37. These group shown that the score of the pupils were homogenous. To determine the significant difference of the pretest of the two groups the t-test was computed and the result was 0.095. This value is less than the table value of 2.021 at 5% and 2.704 at 1% level of confidence. Hence the null hypothesis was accepted this mean that there is no significant difference of the performance of the kindergarten pupil on the pretest in the experimental/touch math and the control group. Both groups have the same level of performance in the pretest.

Table 6. Posttest Result on the Pupils Performance in Mathematics

Pupils	Touch Math Experimental Group Posttest	Traditional Control Group Posttest
1	45	25
2	30	17
3	35	17

4	35	27
5	22	15
6	29	20
7	29	19
8	30	15
9	33	15
10	25	16
11	28	29
12	29	34
13	27	323
14	41	20
15	25	18
16	35	24
17	28	20
18	26	20
19	25	24
20	38	20
$\sum X$	615	418
Mean	30.75	20.9
Sd	5.88	4.33
Test Computed	5.89	
T - Value	2.021 (5%)	
(Table Value)	2.704 (1%)	
Df	40	
Decision	Reject The Null Hypothesis, Significant	

Table 6 present the kindergarten pupils posttest performance in Mathematics on the experimental /touch math and the control group/traditional approaches. As shown in the table the mean of the experimental/touch math was 30.75 and a standard deviation of 5.88. On the other hand, in the control or traditional approach the mean was 20.9 with a standard deviation of 4.33. There is a mean difference of 9.85. This is large enough to infer that there is a significant mean different between the experimental and the control groups on the performance of the posttest.

To further test is a significant difference excess between the two groups the t-test was computed and reveal the result of 5.89. This value is greater than the table values of 2.021 at 5% and 2.704 at 1% confidence level hence the null hypothesis was rejected. It can be said that one group is better than the other. The use of Touch Math with the greater mean is better in the enhancement of the pupils' ability on mathematics particularly the basic fundamental operation of numbers.

Effect of Touch Math in the Performance of the Kindergarten Pupils in Math

The use of touch math has proven to improve the mathematical abilities of the kindergarten pupil particularly on the basic operation of numbers. It shows great improvement on the posttest. This result is supported by some researchers as positively impacting students' performance in cardinality, operational algorithms, conceptual understanding, application, fluency, automaticity, and modeling. (Kot, Terzioglu, & Yikmus, 2018) "Good mathematics teachers typically use 2 ©2019, Touch Math®, LLC visuals, manipulatives, and motion to enhance students' understanding of math concepts." (Boaler, 2018) The importance of visualization and multiple representations of math concepts can be supported by the work of both the National Council for the Teaching of Mathematics (NCTM) and the Mathematical Association of America (MAA) which have long advocated for the use of multi-sensory approaches in mathematics to promote engagement and conceptual understanding.

Touch Math has the ability to bridge the gap between concrete and representational mathematics. The program takes into account students' academic and cognitive proficiencies and deficiencies while enriching both the concept and the computation. The sequences that Touch Math follows are built upon the work of Dr. Jean Piaget and Dr. Lev Vygotsky. The work of both Piaget and Vygotsky led to some of the most utilized constructivist methodologies and developmental theories of our modern educational systems. (Bullock, 2009) The multi-sensory approach of using touch points to an abstract item such as a number, helps students conceptualize the total quantity of digits. When students conceptualize quantities without degradation of their working memory or executive processes, students gain procedural and conceptual content at an increased rate. Cognitive systems and neuroscience research suggests "... that the neurobiological basis of mathematics cognition involves complicated and dynamic communication between the brain systems for memory, control and detection and the visual processing regions of the brain." (Boaler, 2018)

Conclusions

Based on the finding of the study the touch math technique can be said to be applicable in teaching addition and subtraction skill to kindergarten children or children with learning difficulties.

Touch math is an effective technique in the acquisition of addition and subtraction skills, and the findings are in conformity with others

obtained in a limited number of studies in the literature. Therefore, this study sets an example for future studies in this field. Moreover, other potential contributions to the effectiveness of the touch math technique may be the teacher's previous experience in teaching kindergarten children as well as the information and skills provided by the researcher during the training sessions.

Based on the conclusion of this study the following were recommended

Touch math should be accepted as a researched -based technique to teach number sense and four fundamental operation skills

Teachers could be trained so that they are able to use touch math in teaching mathematics.

Future studies may examine the effectiveness of the touch math technique in teaching different basic math skills.

New studies may be conducted to evaluate this technique's efficiency, in addition to its effectiveness. Instructors can use the touch math technique in teaching basic addition skills. Furthermore, they can teach subtraction, multiplication, and division skills through the use of this technique.

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