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PERFORMANCE OF THE STUDENTS IN FINDING THE SQUARE OF NUMBERS USING THE ALTERNATIVE METHOD

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ABSTRACT

Squaring numbers is one of the topics in mathematics, which is traditionally solved by multiplying the number by itself. This method of solving is widespread and many are already used to it. But despite of it, there are others who are struggling in solving and prefer to use the calculator. This study made used of two group experimental design in determining the significant difference of student's performance in finding the square of numbers using the traditional and alternative method. The analysis of f-test revealed that a computed f-value of 4.73 with a p value of 0.038 suggests that there is a significant difference in the mean speed of the experimental and control group. Which means that students using the alternative method performs faster in finding the sum of squares than those using the traditional one. Furthermore, the analysis of f-test also revealed that there is no significant difference between the means of accuracy of the control and experimental group. This means that regardless of whatever method is being used both groups were able to give accurate answers. It is recommended to incorporate this method in teaching and in finding the square of numbers during class discussion. Thus, the findings of this study is a response to the call of The National Council of Teachers of Mathematics (NCTM, 2000) that students should develop their "flexibility in exploring mathematical ideas and trying alternative solution paths.

Keywords: Squaring Numbers, Alternative Method, Traditional Method, Constructivism, Student's Performance

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INTRODUCTION

Problem solving is one of the focus of school mathematics according to the Curriculum and Evaluation Standards for School mathematics for the year 1980. And the primary goal of mathematics instruction is to have students become competent solvers. This goal, depends on one's conceptualization of what mathematics is and what it means to understand mathematics. Mathematics could be understand as a body of facts and procedures dealing with quantities, magnitudes and forms and relationships among them. At the other end of the spectrum, mathematics is conceptualized as the science of patterns, an empirical discipline closely akin to the sciences in its emphasis on pattern seeking on the basis of empirical evidence. Mathematics is a living subject which seeks to understand patterns that permeate both the world around us and the mind within us. It is therefore important that students move beyond rules to be able to express things in the language of mathematics. This transformation suggests changes both in curricular content and instructional style. It involves renewed effort to focus on seeking solutions, not just memorizing procedures; exploring patterns, not just memorizing formulas and formulating conjectures, not just doing exercises (Schoenfeld, 1992).

Furthermore, to stay aligned with the transformation and new educational standards, teachers must be able to teach mathematics using various techniques and alternative strategies to reach the students. Which is different from the traditional method of teaching mathematics which usually consists of memorization, practical use of numbers and equations, work sheets, and is usually teacher centered (Moore, 2012).

Teaching styles in mathematics classroom could not just affects student's performance but could also cause math trauma. Teachers may create anxiety by placing too much emphasis on memorizing formula, learning mathematics through drill and practice and other traditional way of understanding math. With this anxiety or tension, understanding and recall become cluttered by emotions which makes students unable to think. Rather than mathematical methods and rules, learners need to acquire abilities to analyze, question, test and find solutions. But who will bring about this change in instruction and how? There must be a cooperation between teachers and students. Teachers can encourage students to come up with possible ways in understanding math. Thus, students can also innovate and discover techniques that would make math easier and interesting (Ufuktepe &Ozel, nd).

Mathematics is an avenue for many of the most powerful techniques people can use of. Part of its growing power derives from the facts, formulas and techniques it provides to the society. According to the constructivists' point of view, knowledge is actively constructed by

learners through the interaction with their physical and social environment and through the information that the students then passively receive; students are the ones who actively involved in the construction of knowledge. Mathematics investigation is sustained exploration of an open-ended mathematical situation where students investigate, look for patterns, explore possibilities and design problems.

Teachers play an important role in teaching through problem solving. NCTM (2000) indicated that teachers must "decide what aspects of a task to highlight, how to organize and orchestrate the work of the students, what questions to ask to challenge those with varied levels of expertise and how to support students without taking over the process of thinking for them and thus eliminating the challenge". Hiebert and Wearne (1993) found that teachers in problem – solving classrooms used fewer problems, spent more time in each problem and asked more conceptual questions that teachers in more traditional classrooms. Despite the importance of the teacher's role in problem-solving instruction, little research suggests how teachers learn to teach through problem solving (Cai, 2003).

Traditional method in solving math problems is very common in education at university level. Traditional method ignores the students consequently the mental level of interest of the students. It involves coverage of the context and rote memorization on the part of the students. It did not involve students in creative thinking and participation in the creative part of activities. Most of the time, during teaching learning process, instruction remain unilateral which is and consider to be orthodox activity. The up-and-coming trends changed the present scenario and adopted the constructivist approach which is moral and more focus on innovative activities and knowledge acquisition. It seems more feasible to follow constructivist approach for the teaching of Math at the Bachelor of Science in Secondary Education level and constructivism is more feasible in engaging the students in innovative and creative activities.

Alternative solutions are an important feature of effective problem – based mathematics instruction (Cai, 2003). Teaching mathematics through problem solving provides a learning environment for students to explore problems in their own and to invent ways to solve the problems. Such activities allow them to facilitate connections of related ideas, to consolidate their mathematical knowledge and to think creatively (Polya, 1973; Kalman, 2004; Krulik & Rudnick, 1994; as cited in Lee, 2011). As suggested by Evans (2012), teaching through problem solving offers the promise of fostering student learning.

Although problem solving with alternative solutions may foster students' mathematics learning, there were, however, limited empirical studies that directly addressed how mathematical problem solving with alternative solutions could influence students' problem solving performance (Grobe & Renkl, 2006). Mixed results have been found on the relationship between alternative solutions and problem solving performance. It is to this reason that the researchers came up with an alternative method in finding the squares of numbers. This alternative method was being applied and assess to determine whether student's performance in finding squares of numbers have improved or not.

Finding the squares of numbers has become easy using the traditional method to most of the people engaging to it. Despite to that, others are still struggling to do the process of solving maybe because of the varied reasons; weak knowledge in multiplying numbers, low comprehension on how to square numbers and the like. Whatever the reasons, the researchers would like to look for an alternative method in squaring numbers. Thus, they had formulated a formula that could serve as an alternative method in squaring numbers.

To square any two or more digit number N, the number to be squared N will be added by its last digit $(N + n_n)n_n$ and side by squaring the last digit n_n^2 and then putting them together.

FORMULA:

$$(N + n_n)n_1 | n_n^2$$

Where:

N – the original number

n_n – the last digit of the number

n_1 – the number when the last digit of the original number is pulled out

Observe this:

Example 1: get the square of 22.

$(N + n_n)n_1 | n_n^2 = (22 + 2)2|2^2$

$= (24)2|4$

$= 48|4$

$= 484$

The result from the left side and in the right side will be put together to get the answer.

Example 2: Get the square of 39.

$(N + n_n)n_1|n_n{}^2 = (39 + 9)3|9^2$

$= (48)3|81$

$= 144|81$

$= 144$

$+ \quad 81$

1521

In this case since the square of the last number has two digits, we'll add them by aligning the first digit of the number in the right to the last digit of the left.

Example 3: Get the square of 235.

$(N + n_n)n_1|n_n{}^2 = (235 + 5)23|5^2$

$= (240)23|25$

$= 5520|25$

$= 5520$

$+ \quad 25$

55225

Example 4: Get the square of 1997.

$(N + n_n)n_1|n_n{}^2 = (1997 + 7)199|7^2$

$= (2004)199|49$

$= 398796$

$+ \quad 49$

3988009

Note: The same process is applied to finding the square of numbers with more digits

MATERIALS AND METHODS

This study used two group experimental design appropriate for profiling the variables of this research. This design is appropriate in determining the speed and accuracy of the students' performance in squaring numbers using the alternative method. The table below shows the schematic diagram of the study.

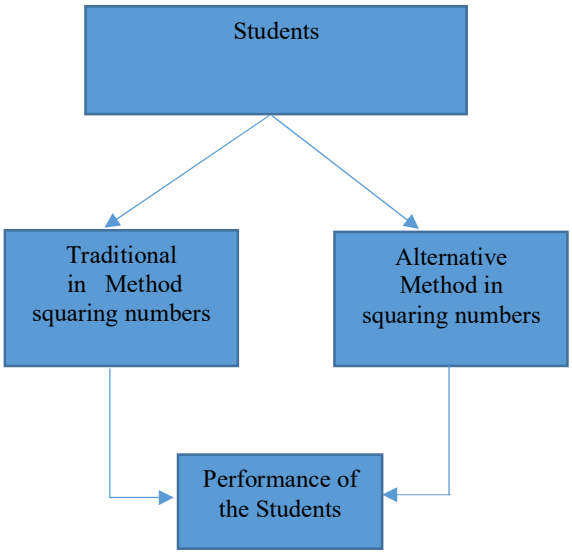

Fig.1. Schematic Diagram of the Study

There were 30 selected students as respondents from a single group that undergone pre=test. A unified researcher made test containing 15 items of numbers to square was given to them. The respondents were then ranked according to their speed and accuracy towards answering the given test questionnaire. The students were split into two groups. Those who were ranked in the even numbers fell into the experimental group, while others were on the control group. After the groups have been classified, each group were given another unified set of test questionnaire containing 15 items of numbers to square. The control group solved them using the traditional method. On the other hand, the experimental group solved them using the introduced formula.

After which, analysis of variance was used to assess whether the means of two groups are statistically different in terms of accuracy and speed.

RESULTS AND DISCUSSIONS

After the participants was being subjected into pre test and post test data were being analysed and interpreted. The following are the results and an explanation of how the students performed.

Table1. Mean Score of Students Performance in terms of Speed in Finding the Square of Numbers using the Alternative and Traditional Method

	N	Mean Score	SD
Experimental Group	15	2.47	1.165
Control Group	15	1.9	0.79

As presented in the table above, the participants' speed in answering the problem using the alternative method (M = 2.47) is faster than the traditional method (M = 1.9). This may be due to the reason that the formula used by the experimental group made squaring numbers faster especially when the number being squared has more digits. Also, the method became quite interesting to the respondents based on what is shown during the conduct of the study. The result supports that alternative methods are designed to solve mathematics problems quickly (Cohen, I.S., & Fowler, J.V., 1998)

Table 2. Mean Score of Students Performance in terms of Accuracy in Finding the Square of Numbers using the Alternative and Traditional Method

	N	Mean Score	SD
Experimental Group	15	9.867	3.74
Control Group	15	11.73	3.74

The result shows that control group is more accurate than the experimental group. This may be due to the reason that students had already familiarized and are already used in using the method unlike to the experimental group who were given only 1 week to familiarize the given formula.

Table 3. Significant Difference between the Speed of Students in Control Group and Experimental Group

Source	DF	SS	MS	F	P
Between	1	546	546	4.73	0.038
Within	28	3231	115		
Total	29	3777			

The analysis of f – test revealed that a computed f – value of 4.73 with a p – value of 0.038 suggests that there is a significant difference in the mean speed of the experimental and control group in favour to the experimental group. The respondents in the experimental group performed faster than the control group since the formula utilized by the latter was purposely made to make squaring numbers faster than the traditional method especially when the numbers being squared has more digits.

Table 4. Significant Difference between the Accuracy of Students in Control Group and Experimental Group

Source	DF	SS	MS	F	P
Between	1	26.13	26.13	2.72	0.110
Within	28	268.67	9.60		
Total	29	294.80			

The analysis of f – test revealed that a computed f – value of 2.72 with a p – value of 0.110 suggest that there is no significant difference between the means of the accuracy of the control and experimental group.

CONCLUSION

The results of this study indicated that students improved their performance in finding the square of a number in terms of speed in solving. Furthermore, the result also indicated that whatever method is being used whether alternative or traditional it still resulted to the same result. This means that the alternative method could be an avenue for the students to lessen the time for them to solve a given problem. The result also shows that coming up with an alternative method in solving problems in math enable students to think, question, probe and enable them to analyse and get ideas. Thus it is recommended for teachers to encourage

students' engagement in coming up alternative solutions to mathematical problems. Though, traditional method is always effective in solving math problems but coming up with the alternative method would prove student understands towards mathematical concepts.

This study also reveals the effectiveness of solving mathematical problem using alternative solutions. Thus, it is recommended that this alternative solution should be implemented by other classroom teachers to improve student's performance. It is also recommended the need to establish other alternative solutions in math, not just to improve student's performance but also to lessen math anxiety. Thus, with those alternative solutions it would be beneficial to conduct experimental studies with both treatment group receiving instruction in alternative solutions and a control group without receiving such instruction or could be receiving the traditional method of solving, this would better understand the effectiveness of alternative solutions in math.

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