



TEACHING STRATEGIES IN SOLVING MATHEMATICAL WORD PROBLEMS

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Abstract :

This study employed the quantitative-descriptive research design in the assessment of the teaching strategies of Mathematics teachers in solving mathematical word problems. The quantitative-descriptive research design was used to present how the teachers describe the effectiveness of the strategies in teaching word problem solving in Mathematics. It was also employed to look into the problems being met by teachers in teaching word problem solving skills and how serious are they. The quantitative-descriptive research design was also utilized to propose developmental activities illustrating the various teaching strategies in solving mathematical word problems to enhance the effectiveness of Mathematics teachers. This study was conducted in Camachiles National High School during the school year 2023-2024. The respondents were 14 Mathematics teachers who provided information to answer the sub-problems raised in the study. Weighted mean was employed in the study to treat the data statistically.

Summary of Findings: 1.0 Effectiveness of the Strategies in Teaching Word Problem Solving in Mathematics Teaching strategies being used by the Mathematics teachers in the solution of mathematical word problems which were described to be “very effective” were Make a Table and Write a Number Sequence with weighted means of 3.69 and 4.00, respectively. Teaching strategies which were described to be “moderately effective” were as follows: Find a Pattern (WM=3.35); Work Backwards (WM=3.26); Guess and Check (WM=3.15); Draw a Picture (WM=3.45); and Make a List (WM=3.38). The overall weighted mean was 3.47 for a descriptive equivalent of “moderately effective.” 2.0 Problems Being Met by Teachers in Teaching Word Problem Solving Skills “Very serious” problems being met by the Mathematics teachers are student difficulties in comprehension and student difficulties in decoding with weighted means of 3.62 and 3.81, respectively. “Moderately serious” problems being met by the Mathematics teachers are need for application of concepts and skills related to real-life situations (WM=3.27), students’ over-dependency on calculators and other tools (WM=2.92), high expectations of test results from students (WM=2.75), integration of technology (WM=3.49), limited resources/materials (WM=2.75), and limited time for fun activities (WM=3.08). The overall weighted mean was 2.87 for descriptive equivalent of “moderately serious.” 3.0 Proposed Developmental Activities The outputs of the study are developmental activities illustrating the various teaching strategies in solving mathematical word problems to enhance the effectiveness of Mathematics teachers.

Based on the findings of the study, the following conclusions were drawn: 1. Generally, the teaching of word problems in Mathematics through various strategies is moderately effective which indicates that the ability of Mathematics teachers’ to teach important problem solving skills to students still need improvement. 2. The very serious problems met by the Mathematics teachers in the implementation of teaching strategies are student difficulties in comprehension and decoding. 3. There are various developmental activities for the Mathematics teachers to focus to improve the mathematical skills of students.

Based on the findings and conclusions drawn, the following recommendations were offered: 1. The developmental activities illustrating the various teaching strategies in solving mathematical word problems should be evaluated and further revisions or improvement be made for their effective implementation. 2. More instructional materials using the various teaching strategies in solving mathematical word problems should be developed. 3. Other researchers may conduct a similar study on a wider scope to validate the findings of the study.

Keywords: teaching strategies, mathematical word problem

INTRODUCTION

Mathematics is concerned with the method used in the teaching and learning process in addition to issues encountered in the cognitive domain. The Philippines’ education system is still dominated by traditional Mathematics teaching, which frequently overlooks the goal of Mathematics education – to prepare students to deal successfully with real-life situations. This affects the declining performance of the students in their overall mathematical ability, especially in problem solving (Dinglasan, et.al., 2023).

Mathematics is expected to provide high quality education that emphasizes problem-solving and makes the learners globally competitive. As stated in the third edition of the World Economic Forum (2020), problem solving is one of the top abilities most in-demand in the next five years. Furthermore, the Department of Education (DepEd) developed a curriculum that emphasizes the twin goals of Mathematics, problem solving skills and critical thinking.

Despite the innovations made by international and local education system, students still considered Mathematics the most challenging subject, specifically problem solving. According to the study of Roman (2019), from the result of national assessments and research from the Philippines over the past 15 years, students show poor Mathematical performance that is noticeable from basic education to higher education levels. It is supported by the study of Imam (2016) that the country's Mathematics performance is still considered poor, and affirms that the initial result of current efforts of the government by adopting the K-12 curriculum did not do much to change the status quo.

Problem solving has a special importance in the study of Mathematics. The main goal in teaching mathematical problem solving is for the students to develop a generic ability in solving real-life problems and to apply Mathematics in real life situations. It can also be used, as a teaching method, for a deeper understanding of concepts. Successful mathematical problem solving depends upon many factors and skills with different characteristics.

One of the main difficulties in learning problem solving is the fact that many skills are needed for a learner to be an effective problem solver. These factors and skills make the teaching of problem solving one of the most complex topics to teach. Mathematics is used to quantify numerically and spatially natural as well as man-made situations. It is used to solve problems and it has helped in making social, economic and technological advances.

Problem solving is an important component of Mathematics education. It refers to a systematic approach in conceptualizing and understanding a given problem, designing strategies to solve the problem and evaluating the strategies implemented. It involves mathematical tasks that have the potential to provide intellectual challenges for enhancing students' mathematical understanding and to develop their ability to find meaningful solutions to solve problems using effective and timely strategies (Albay, 2020).

Quinto and Mabansag (2023) reported that Mathematics remains a challenge for most educational institutions. For this reason, different approaches that promote students' active participation in the teaching and learning process have emerged. In recent years, using problem solving in teaching Mathematics subjects was one of the methods used in teaching the subject, and Mathematics teachers have considered the shifting of emphasis from teaching problem solving to teaching through problem solving. Important Mathematics concepts and procedures can be best taught through problem-solving tasks or activities, which engage students in thinking about the important mathematical concepts and skills they need to learn.

In a learning environment where the problem-solving approach in teaching Mathematics is applied, the students with different performance levels work in pairs or in small groups to learn the mathematical concepts by engaging themselves in a problem solving task or activity whose required solutions and processes are not clearly known. As such, students need to explore the concepts, develop an understanding of the problem, make connections with mathematical knowledge previously learned, and select an appropriate mathematical skill that leads to the solution of the problem.

In the past several decades, there had been significant advances in the understanding of the complex processes involved in problem-solving. Approaches like teaching for problem-solving, teaching through problem-solving and teaching about problem-solving have brought about significant improvements in the problem-solving skills of students. However, these improvements have not lifted the rank of the Philippines in both the National Achievement Test (NAT) and in international examination, vis-à-vis the Third International Mathematics and Science Study (TIMSS).

Over the last few years, issues connected with learning and teaching mathematics have become a matter of the highest importance for everyone involved in education and training. Mathematical competence has been identified as one of the key competencies necessary for personal fulfillment, active citizenship, social inclusion, and employability in modern society. Moreover, in preparing young people for the 21st century makes the acquisition of literacy and numeracy the main priority for cooperation in education.

The major reasons for such a huge interest in learning and teaching mathematics are growing needs for mathematical skills and proficiency in modern society and at the same time difficulties in learning mathematics and a large numbers of low achieving students. The problems connected with learning mathematics are common in many societies. The proportion of low achieving students in mathematics to the total number of students is an important factor of mathematics education quality.

In the modern society today, new paths in education are created taking into consideration changes that take place in all the areas of everyday life. Developing technologies create opportunities to access information and educational content that were not available before. Mobile learning, online learning, and open-source learning are only some of the solutions that make the learning process leave the classroom and enable students to experience it at any time and place.

Changes taking place in student-teacher relations are a natural consequence of the new technologies development and that knowledge is much more accessible at the moment. Students' increasing activeness requires some changes in the role teachers used to play in the learning process. The teacher has to become more of a guide for their students. It is the student who has become a central figure both in the classroom and in the whole process of learning.

Teaching Mathematics is extremely challenging and prospective school teachers must be prepared to teach everything from counting to algebraic thinking. They must not only understand the Mathematics they are to teach but also be able to engage students in that content. The subject knowledge is indispensable because only teachers who have a deep understanding of content are capable of making connections, promoting discovery, evaluating alternative responses, and providing experiences that promote higher-level thinking skills.

Convincing students that they can do Mathematics and helping them enjoy it are important goals. The decisions teachers make in the classroom about how to offer all students experiences with important mathematics and how to accommodate the wide-ranging interest, talents and experiences of students are essential to giving all students access to Mathematics.

The approach of education is now more on learner-centered rather than teacher-centered. It is high time to encourage teachers to produce activities that are more on student-centered, which focuses on students' needs for learning and communicating effectively. The teacher provides opportunities for students to engage actively in meaningful communication, encourages them to take ownership of their own learning, and gives them explicit instruction in the content and language skills they need and in strategies for gaining that knowledge and those skills.

Cognizant of the importance of Mathematics as a basic subject and alarmed by the prevailing situation as far as students' performance particularly in solving word problems in Camachiles National High School, Division of Mabalacat City, the researcher decided to propose developmental activities illustrating the various teaching strategies in solving mathematical word problems to enhance the effectiveness of Mathematics teachers.

Statement of the Problem

This study assessed the teaching strategies of Mathematics teachers in Camachiles National High School, Division of Mabalacat City in solving mathematical word problems during the school year 2023-2024.

Specifically, it sought to answer the following sub-problems:

1. How do the teachers describe the effectiveness of the strategies in teaching word problem solving in Mathematics?
2. What are the problems being met by teachers in teaching word problem solving skills and how serious are they?
3. What developmental activities illustrating the various teaching strategies in solving mathematical word problems can be proposed to enhance the effectiveness of Mathematics teachers?

METHODOLOGY

This chapter presents the methodology of the study. It includes the research design, the sources of data, instrumentation and data collection, and tools for data analysis.

Research Design

This study employed the quantitative-descriptive research design in the assessment of the teaching strategies of Mathematics teachers in solving mathematical word problems.

The quantitative-descriptive research design was used to present how the teachers describe the effectiveness of the strategies in teaching word problem solving in Mathematics. It was also employed to look into the problems being met by teachers in teaching word problem solving skills and how serious are they.

The quantitative-descriptive research design was also utilized to propose developmental activities illustrating the various teaching strategies in solving mathematical word problems to enhance the effectiveness of Mathematics teachers.

Sources of Data

This study was conducted in Camachiles National High School during the school year 2023-2024. The respondents were 14 Mathematics teachers who provided information to answer the sub-problems raised in the study.

Instrumentation and Data Collection

The main data gathering tool of this study was a constructed questionnaire. It consists of two parts. Part I focused on how the teachers describe the effectiveness of the strategies in teaching word problem solving in Mathematics. Part II looked into the problems being met by the Mathematics teachers in the implementation of their teaching strategies relative to the teaching of word problems and how serious are they. Upon completion of the questionnaire, it was presented to the researcher's adviser. Suggestions were incorporated to improve the instrument.

The researcher personally distributed the questionnaire himself. Once the accomplished questionnaires were retrieved, responses were tabulated and interpreted based on appropriate statistical tools.

Tool for Data Analysis

The following tool was used to treat the data statistically:

1. Weighted Mean

This was used to answer sub-problem numbers 1 and 2.

The formula is:

$$WM = \frac{\sum fx}{N}$$

Where:

WM = Weighted Mean

$\sum fx$ = the sum of the products per column

N = the number of respondents

To interpret the data, the following references were used:

Point Values	Statistical Limits	Descriptive Equivalent (DE)	
		For Sub-Problem 1	For Sub-Problem 2
5	4.50-5.00	Highly Effective (HE)	Highly Serious(HS)
4	3.50-4.49	Very Effective (VE)	Very Serious (VS)
3	2.50-3.49	Moderately Effective (ME)	Moderately Serious (MS)
2	1.50-2.49	Slightly Effective (SE)	Slightly Serious (SS)
1	1.00-1.49	Not Effective (NE)	Not a Problem (NP)

RESULTS AND DISCUSSION

This chapter presents the data gathered and their analysis and interpretation to answer the sub-problems raised in the study.

Effectiveness of the Strategies in Teaching Word Problem Solving in Mathematics

This section presents how the teachers in Camachiles National High School, Division of Mabalacat City describe the effectiveness of the strategies in teaching word problem solving in Mathematics in answer to sub-problem number 1.

Table 1 presents the data.

TABLE 1
Effectiveness of the Strategies in Teaching Word Problem Solving in Mathematics

Teaching Strategies	WM	DE
Find a pattern	3.35	ME
Make a table	3.69	VE
Work backwards	3.26	ME
Guess and check	3.15	ME
Draw a picture	3.45	ME
Make a list	3.38	ME
Write a number sentence	4.00	VE
Overall WM	3.47	ME
Legend: WM = Weighted Mean		
Point Values	Statistical Limits	Descriptive Equivalent (DE)
5	4.50 – 5.00	Highly Effective (HE)
4	3.50 – 4.49	Very Effective (VE)
3	2.50 – 3.49	Moderately Effective (ME)
2	1.50 – 2.49	Slightly Effective (SE)
1	1.00 – 1.49	Not Effective (NE)

As shown in Table 1, the teaching strategies which proved to be “very effective” in the solution of mathematical word problems include making a table (WM=3.69), and writing a number sentence (WM=4.00). Making a table is very effective when a problem has data that need to be organized. It is also helpful when the problem asks to record a large amount of information. The teaching strategies which are “moderately effective” are finding a pattern (WM=3.35); working backwards (WM=3.26); guessing and checking (WM=3.15); drawing a picture (WM=3.45); and making a list (WM=3.38). Overall, the teaching-strategies being used by the Mathematics teachers are “moderately effective” with average weighted means of 3.47.

Finding a pattern is a strategy in which learners look for patterns in the data in order to solve the problem. Learners look for items or numbers that are repeated or a series of events that repeats. Working backwards is useful when one can clearly define the goal or end stage of the problem. Guessing and checking is a strategy to guess a solution and use the guess in the problem to see if one gets the correct answer. Drawing a picture gets the problem out of one’s head and onto the paper. Making a list puts things in order. To answer a question, one makes a list. By making a systematic list, learners will see every possible answer. The various approaches in teaching problem solving skills were discussed extensively in the study of Albay (2020). The study utilized the problem-solving approach as supported by various collaborative strategies.

Problems Being Met by Teachers in Teaching Word Problem Solving Skills

This part of the chapter presents the problems being met by the Mathematics teachers in teaching word problem solving skills and how serious are they in answer to sub-problem number 2. Table 2 shows the data.

TABLE 2
Problems Being Met by Teachers in Teaching Word Problem Solving Skills

Problems	WM	DE
• Need for application of concepts and skills related to real-life situations	3.27	MS
• Students’ over-dependency on calculators and other tools	2.92	MS
• Student difficulties in comprehension	3.62	VS
• Student difficulties in decoding	3.81	VS
• High expectations of test results from students	2.75	MS
• Limited integration of technology	3.49	MS
• Limited resources/materials	2.75	MS
• Limited time for fun activities	3.08	MS
Overall WM	2.87	MS
Legend: WM = weighted mean		
Point Values	Statistical Limits	Descriptive Equivalent (DE)
5	4.50 – 5.00	Highly Serious (HS)
4	3.50 – 4.49	Very Serious (VS)
3	2.50 – 3.49	Moderately Serious (MS)
2	1.50 – 2.49	Slightly Serious (SS)
1	1.00 – 1.49	Not a Problem (NP)

The “very serious” problems being met by the Mathematics teachers are student difficulties in comprehension and decoding with weighted means of 3.62 and 3.81, respectively. The need for application of concepts and skills related to real-life situations; students’ over dependency on calculators and other tools; high expectations of test results from students; integration of technology; limited resources/materials; and limited time for fun activities are considered “moderately serious” problems. All these have weighted means that ranged from 2.75 to 3.49. Overall, these problems are “moderately serious” with WM of 2.87.

Students’ poor performances with mathematical word problems are pressuring Mathematics teachers. The “moderately serious” problems being met by teachers call for support and encouragement from the educational leaders of these teachers.

Developmental Activities in Solving Mathematical Problems

Developmental activities to illustrate the various teaching strategies in solving mathematical word problems were proposed to enhance the effectiveness of Mathematics teachers to answer sub-problem number 3.

The preparation of a developmental activity has a lot of importance and benefit to the teachers and learners. Teachers use the developmental activity as their guide to teach a subject or topic. As a result, it keeps them on track to accomplish the objectives. Planning is an important aspect of teaching practice when teachers make decisions that ultimately impart students' opportunities to learn. Planning commonly refers to the time teachers spend preparing and designing activities for students. From tasks and activities to instructional practices employed during lessons, teachers need to consider a variety of aspects of their instruction before students even enter the classroom.

Anyone who has taught Mathematics for any length of time will know how difficult it can be to teach learners to solve Mathematics problems out of context. Present learners with a familiar setting or a sum that they have tackled before then they are usually fine, but turn it into an unfamiliar problem then it's a different matter. However, in the same ways that strangers are taught strategies for other areas of Mathematics, strategies to solve Mathematics problems can be taught in the same ways.

SUMMARY

This study employed the quantitative-descriptive research design in the assessment of the teaching strategies of Mathematics teachers in solving mathematical word problems.

The quantitative-descriptive research design was used to present how the teachers describe the effectiveness of the strategies in teaching word problem solving in Mathematics. It was also employed to look into the problems being met by teachers in teaching word problem solving skills and how serious are they.

The quantitative-descriptive research design was also utilized to propose developmental activities illustrating the various teaching strategies in solving mathematical word problems to enhance the effectiveness of Mathematics teachers.

This study was conducted in Camachiles National High School during the school year 2023-2024. The respondents were 14 Mathematics teachers who provided information to answer the sub-problems raised in the study.

Weighted mean was employed in the study to treat the data statistically.

Summary of Findings:

1.0 Effectiveness of the Strategies in Teaching Word Problem Solving in Mathematics

- 1.1 Teaching strategies being used by the Mathematics teachers in the solution of mathematical word problems which were described to be "very effective" were Make a Table and Write a Number Sequence with weighted means of 3.69 and 4.00, respectively.
- 1.2 Teaching strategies which were described to be "moderately effective" were as follows: Find a Pattern (WM=3.35); Work Backwards (WM=3.26); Guess and Check (WM=3.15); Draw a Picture (WM=3.45); and Make a List (WM=3.38).
- 1.3 The overall weighted mean was 3.47 for a descriptive equivalent of "moderately effective."

2.0 Problems Being Met by Teachers in Teaching Word Problem Solving Skills

2.1 "Very serious" problems being met by the Mathematics teachers are student difficulties in comprehension and student difficulties in decoding with weighted means of 3.62 and 3.81, respectively.

2.2 "Moderately serious" problems being met by the Mathematics teachers are need for application of concepts and skills related to real-life situations (WM=3.27), students' over-dependency on calculators and other tools (WM=2.92), high expectations of test results from students (WM=2.75), integration of technology (WM=3.49), limited resources/materials (WM=2.75), and limited time for fun activities (WM=3.08).

2.3 The overall weighted mean was 2.87 for descriptive equivalent of "moderately serious."

3.0 Proposed Developmental Activities

The outputs of the study are developmental activities illustrating the various teaching strategies in solving mathematical word problems to enhance the effectiveness of Mathematics teachers.

CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn:

1. Generally, the teaching of word problems in Mathematics through various strategies is moderately effective which indicates that the ability of Mathematics teachers' to teach important problem solving skills to students still need improvement.
2. The very serious problems met by the Mathematics teachers in the implementation of teaching strategies are student difficulties in comprehension and decoding.
3. There are various developmental activities for the Mathematics teachers to focus to improve the mathematical skills of students.

RECOMMENDATIONS

Based on the findings and conclusions drawn, the following recommendations were offered:

1. The developmental activities illustrating the various teaching strategies in solving mathematical word problems should be evaluated and further revisions or improvement be made for their effective implementation.
2. More instructional materials using the various teaching strategies in solving mathematical word problems should be developed.
3. Other researchers may conduct a similar study on a wider scope to validate the findings of the study.

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