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## **Schematic Presentations on the Achievement of Grade 6 Pupils in Solving Word Problems in Math**

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### **ABSTRACT**

This action research aimed to determine how schematic or visual representations help Grade 6 pupils to solve word problems in math. In this action research, the schematic presentations utilized by the researcher are: number lines, a straight line that shows the order of and the relation between numbers; strip diagram, a bar divided into rectangles that accurately represent quantities noted in the problem; pictures, simple drawings of concrete or real items; and graphs and charts, drawings that depict information using lines, shapes, and colors. Based on the results, the Grade 6 pupils have shown commendable progress in solving word problems in math, as shown in their mean scores. Based on the interviews with the pupils they find ease in solving in solving math problems with schematic presentations; they also find these interesting, and they aid in memory. It is recommended that schematic representation will be continuously used; however, teacher observers suggested that pupils will be guided to use their own schematic visuals to the problems posed instead of the teachers presenting visuals to them for the learners to actively engage with the material they generated by themselves.

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### **CONTEXT AND RATIONALE**

The primary goal of the school's mathematics curriculum is to provide students with the opportunity to transfer and apply their acquired knowledge and skills to solve various problems (Permata, 2018). By engaging in problem-solving activities, learners develop critical thinking, analytical reasoning, and problem-solving skills essential for success in both academic and real-life contexts. Ultimately, the goal is to equip students with the ability to use mathematics as a tool to navigate and solve challenges they encounter in various aspects of their lives.

Word problems are pivotal in shaping the understanding of mathematical operations and indirectly honing operational skills in elementary education. Engaging with word problems at this level establishes a foundation for modeling more intricate and practical problems in the future. Additionally, word problems contribute to the enhancement of comprehension, critical thinking, judgment, memorization, and self-assessment abilities among students (Debrinti, 2015).

However, pupils are facing difficulties in solving Math problems. Despite having learned the necessary mathematical concepts, they find it challenging to apply their knowledge in a real-world context. As shown in the study of Mingke and Alegre (2019), pupils often struggle with identifying which operations to use when solving word problems, are uncertain about the problem-solving process, exhibit a lack of interest in reading word problems, and find discussions on the topic to be dull or uninteresting.

The same situation is also faced by the researcher in her Grade 6 Math Class. Her pupils manifest difficulties in solving word problems. Despite having taught the concept of area and providing instruction on how to approach word problems, many of her students are unable to correctly identify the relevant information in the problem, decide which operation to use, and carry out the necessary calculations. Some students may misinterpret the problem, others may struggle with understanding the mathematical language used, and some may feel overwhelmed by the task.

One of the sources of difficulty in solving word problems is poor reading comprehension and a lack of understanding of the keywords used in math word problems (Vula et al., 2017). Teachers commonly attribute students' difficulties in solving word problems to their ability to understand the problems (Pearce et al., 2011). Previous research (Vilenius-Tuohimaa et al., 2008) has shown that students' performance in mathematics word problem-solving is linked to their overall reasoning skills and reading comprehension ability. According to Clements (Riastuti et al., 2017), common errors made by students include difficulties in comprehension and transformation, as well as a tendency towards carelessness.

Logan and Ho (2013) emphasized the importance of students comprehending a problem before attempting to solve it. When students lack understanding of the problem, they encounter difficulties in problem-solving and struggle to contextualize the problem. Utilizing diagrams to illustrate mathematical concepts is crucial for elementary students when tackling non-routine problems. These visual aids enable students to construct mental models (Pape, 2004) and structure their thoughts in coherent and systematic ways (Ainsworth & Loizou, 2003).

The researcher is eager to address these difficulties of the pupils by teaching the pupils solving word math problems through visual or schematic presentations. Visual presentations can take various forms, such as diagrams, charts, graphs, or multimedia presentations. By incorporating visual aids into the lesson, the researcher aims to provide students with additional support and clarity when tackling word problems.

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## ACTION RESEARCH QUESTIONS

This action research aimed to determine how visual representations help Grade 6 pupils to solve word problems in math.

Specifically, it sought answers for the following questions:

1. What is the achievement of the grade 6 pupils on problem solving when the visual representation is used in teaching?
2. What are the views of the pupils regarding the use of visual representation in solving word problems in Math?
3. What are the recommendations to improve the use of visual representation in solving word problems in Math?

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## THE INNOVATION, INTERVENTION AND STRATEGY

Beyond a mere image or elaborate illustration, a visual representation—commonly known as a schematic representation or schematic diagram—is a precise portrayal of the mathematical quantities and relationships within a given problem. The objective of this visual aid is to mirror a student's comprehension of the problem and assist them in accurately solving it. Various tools can be employed for representation, such as sketches, geometric shapes, lines, symbols, or conventional notation. Representation holds significance as it aids in enhancing comprehension and retention of the problem (Debrinti, 2015).

In this action research, the schematic presentations utilized by the researcher are: number lines, a straight line that shows the order of and the relation between numbers; strip diagram, a bar divided into rectangles that accurately represent quantities noted in the problem; pictures, simple drawings of concrete or real items; and graphs and charts, drawings that depict information using lines, shapes, and colors.

In facilitating the use schematic presentation, the following steps were done:

1. selection and preparation of visuals that align with the specific math concept;
2. presentation of the word problem to the pupils and reading it aloud together; then pupils identify key information and understand the problem context;
3. utilization of the selected visual aids to represent the information and relationships described in the word problem;
4. walking pupils through the problem-solving process step by step, referring to the visual representations as needed;
5. classroom discussion and pupils are to share their thoughts and strategies for solving the problem; and
6. application of the problem-solving strategies pupils have learned to new situations or contexts.

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## ACTION RESEARCH METHODS

**Participants and other sources of data and information.** The participants of the study were the Grade 6 pupils of Apostol Memorial Central Elementary School (AMCES). Other sources of information for the study were the observation notes of the teacher observers while the math classes were conducted, the interviews among the learners and teachers, and the scores representing the achievement of the learners on word problem solving when the visual presentation was used in teaching the concepts.

**Data Gathering Methods.** In order to answer the questions, the research instruments used in data gathering were the interview guide, the observation sheets and the math tests on problem solving. The interviews and focused group discussion were done to the pupils and to the teacher observers. Interview questions for the pupils were set in easier statements so that they can provide answers. They were allowed to speak in vernacular in answering the questions. Meanwhile, the teachers were also interviewed based on their observation on the use of the visual representation in teaching word problems in Math. Meanwhile, the tests were conducted after every session where the visual representation is used in teaching.

**Ethical Considerations.** The researcher ensured that the ethical considerations were employed in the study. Firstly, the researcher made sure that teachers who were interviewed were fully informed about the study and voluntarily agreed to participate. This was done through the process of obtaining informed consent, where the teachers were clearly informed about the nature of the study and their rights as participants.

Secondly, the consent emphasized the voluntary nature of participation, meaning that the teachers were not under any obligation to take part in the study if they do not give consent. This ensured that their involvement was based on their own free will.

Lastly, confidentiality was prioritized, particularly regarding the identities of the pupils involved in the study. This means that the names of the students who participated in interviews were kept confidential and not disclosed, protecting their privacy and anonymity.

**Data Analysis Plan.** The data collected from the interviews underwent thematic analysis, which involved sorting through the responses to identify key themes relevant to the study's questions. To achieve this, the researcher began by thoroughly reviewing the interview transcripts recorded during the interviews. Then she extracted codes from the transcripts and organized them into categories to facilitate the identification of appropriate themes. These themes were subsequently presented and discussed in the following section of the paper. Additionally, observation notes were utilized to further enrich the discussions. The scores were analyzed through average.

## RESULTS AND DISCUSSION

The subsequent sections present the results about the test scores revealing the achievements in word problem solving of the pupils under study, the views of the pupils and the observers regarding the use of the visual representations in to enhance the skills of the pupils in solving word problems in Math. This also presents the recommendations on how the use of the visual presentations can be improved.

### Scores Representing Achievement of Grade 6 Pupils in Solving Word Problems in Math

Table 1 presents the achievement scores of Grade 6 pupils in solving word problems in math across three tests. The mean score for each test indicates the average performance of the pupils on that particular test.

Table 1 suggests that Grade 6 pupils have shown commendable progress in solving word problems in math, as shown in their mean scores. This positive trend reflects the effectiveness of teaching strategies and the pupils' efforts in mastering word problem-solving skills over time.

Table 1

Scores Representing Achievement of Grade 6 Pupils in Solving Word Problems in Math

Math Tests	Mean Score
Order of operations	8.93
Ratio and proportion	8.17
Percent	8.93
Exponents	8.65
Integers	8.79

Highest Possible Score: 10 points

### Views on the Schematic Presentations in Teaching Word Problems

**Views of the Pupils.** Based on the interview with the pupils about the use of the presentations on word problem lesson, their views are described as: **ease in solving; interesting, and aid in memory** – referring to their views about the presentations.

For the pupils, the visual presentations give them ease in solving the word problems in math. The visuals serve as their guide on what to solve, according to these pupils:

Mas mapadali po ang pagsolve kasi mayron po kaming guide. (It is easier to solve since we have a guide.) P1

Di na po mahirap. Kasi may mga pictures po. (It is no longer difficult since there are pictures.)P4

Moreover, the pupils also claimed that the diagram and drawings presented to them before they solve the problem is making them think they can easily solve the word problem since they already have the guide.

May guide na po kasi. Kaya mas Madali na ang pag solve. P2

Masolve ko na po ang math problems kasi may drawing. P3

The pupils also consider the use of schematic presentations as interesting since they can visually analyze the word problems. As commented by one of the pupils:

Yong drawing po gusto ko po talaga kasi mas malaman mo ang sagot. Gusto ko po talaga merong drawing ibigay si mam..P8

Interesado po ako sa drawing. Kasi maganda sya tingnan. Mawala yong isip mo na mahirap ang math. P10

Nakikingin po talaga ako habang ginatingnan ko yong ginapakita ni teacher. P4

There are also pupils who have responded that one of the best thing about the visuals presented by the teacher is that she can memorize the steps in how to solve similar problems.

Maalala ko po yong gipakita ni mam...kaya makasagot po ako. P5

The responses of the pupils suggest that incorporating visual elements into teaching methods can enhance pupils engagement and motivation in learning. When students are interested in the material presented visually, they are more likely to pay attention, participate actively, and retain information better.

In support to the views given by the pupils, the teacher observers also noted that visual presentations can indeed provide clarity and aid in understanding complex mathematical concepts, especially when it comes to word problems. By using diagrams, charts, and other visual aids, pupils can better visualize the problem, identify key information, and formulate a plan to solve it.

Those visuals that you used are for me very much useful. I have really noticed that pupils are more engaged. Nakikinig sila...tinitingnan talaga nila ang mga visuals mo tapos diba mapansin mo...sumasagot sila what those pictures represent. Nasusundan nila actually. Observer 1

Moreover, the interest in visual presentations implies that students may find it easier to comprehend and internalize complex concepts when they are presented visually. Visual aids can provide clarity, simplify abstract ideas, and facilitate understanding by illustrating relationships, patterns, and connections in a tangible way.

When you draw a circle representing the whole cake and divide it into three equal parts. Then, they could shade the portion of the circle to represent the portion being eaten, it is already a representation which they can connect to their life experiences. Kasi familiar ang cake sa culture natin. Observer 2

The moment you show presentations in connection to the problem what I admired most ay very much connected sya sa topic. So yon, pupils can see connections. That is why you can notice pupils are happy kasi they make connections eh. Observer 1.

Based on the observations of the teacher observers, it can be gleaned that the presentations used in this study are considered helpful for the learning of the pupils. However, the succeeding sections show that there are recommendations to improve its use.

### **Recommendations to Improve the Use of Schematic Presentations in Teaching Word Problem Solving**

The learners have recommended that the schematic presentations will be continuously used. As found in their responses:

Sana po ganito palagi pag may problem solving kami. P6

Mahirap po basta word problems. Pero if may ipakita na hint (referring to the presentations) si teacher, madali po. P7

Gamitin palagi para makasagot kami. P9

From the responses of the pupils, it can be deduced that they indeed would like the visuals to be part of teachers' presentation when they are tasked to solve problems. The responses of the pupils indicate a clear preference for the inclusion of visuals in teachers' presentations when solving problems. Their positive feedback suggests that they find visual aids helpful and effective in understanding and solving mathematical problems.

For the teacher observers, by incorporating visuals, teachers can create more engaging, effective, and inclusive learning experiences that support pupils' understanding and mastery of mathematical concepts. However, they have recommended that instead of teachers will be the one to present the visuals, pupils should be taught to make their own visuals for the given word problem.

Yes, na find out man natin na maganda man talaga ang strategy, pero dapat patungo tayo sa goal that pupils will be trained to make their own visualization of the problem given. This is the most important skill. Sige lang, papunta na talaga yan doon diba? Observer 2

On a similar point, other teacher observer suggested that pupils will be guided to use their own schematic visuals to the problems posed.

I suggest that pupils will be the one to draw or make representations. However, we can help siguro as teachers by given them hints, like an ba ang dapat a visual kung ito ang problem at bakit ganon ang visuals na appropriate. Observer 1

Based on the responses, this underscore that there is a need to encourage pupils to create their own schematic visuals fosters active learning and student-centered approaches. Instead of passively receiving information, students actively engage with the material by generating their own visual representations of the problem.

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## **REFLECTION AND RECOMMENDATION**

The pupils' positive response to the use of visual presentations in problem-solving highlights the effectiveness of incorporating visual aids in teaching mathematics. Their preference for visuals suggests that these tools enhance clarity, understanding, and engagement in learning. Additionally, the suggestion to guide pupils in creating their own schematic visuals reflects a student-centered approach that promotes active learning and ownership of learning outcomes. As a math teacher, all of these will be considered in my future plans of incorporating different strategies in teaching math problems.

Based on the findings, the researcher would like to recommend the following:

1. teachers may use schematic presentations when teaching word problems to elementary pupils; however this can also be tried to high level mathematics specially for complicated concepts;
2. math teachers may explore other strategies in teaching word math problems and also conduct an action research related to such; and

3. teachers may train their pupils to create their own visuals when solving math problems.

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