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Think, Talk, Write Strategy: Enhancement of Senior High School Mathematical Problem Solving

EDUARDO D. POKLIS, JR.
Urdaneta City
eduardo.poklis@deped.gov.ph

MARC JERICKSON V. POJAS
Urdaneta City
mjericksonpojas23@gmail.com

WARLITO V. TELLES JR.
Urdaneta City
warlitojr.telles@deped.gov.ph

NESTOR DORIANO
Urdaneta City
doriano.nestor.ucu.18@gmail.com

Abstract — Enhancing problem-solving skills is crucial for academic achievement and daily practical application, yet a significant number of students face challenges in this area, particularly in subjects such as Mathematics. This research aims to identify the underlying causes of poor problem-solving skills among Grade 11 STEM students at Juan G. Macaraeg National High School during the first quarter of the 2023 – 2024 school year. The study adopts a mixed-methods approach, employing purposive and convenient sampling for learner interviews. To pinpoint the issues, students underwent a one-time quiz focused on exponential word problems, with those who performed poorly becoming interview respondents. Both teacher and student responses were categorized into think, talk, and write strategies. The study's revelations include learners perceiving problem-solving as burdensome, akin to a weight on their shoulders, while teachers struggle with time constraints in delivering essential competencies. Additionally, teachers tend to overlook the significance of verbal communication when addressing worded problem-solving, while students often seek assistance from peers and knowledgeable individuals to navigate challenges. Furthermore, it was observed that neither learners nor teachers consistently applied the GRESA (Given, Required, Equation, Solution, Answer) method when solving word problems. Notably, the think-talk-write cooperative learning strategy, a recommended approach, was not integrated into the teaching-learning process for word problem-solving. This study underscores the importance of implementing the think-talk-write strategy to evaluate its potential impact on enhancing the problem-solving skills of learners. By addressing these identified issues, the research aims to contribute valuable insights and practical interventions to improve problem-solving proficiency in the academic context.

Keywords — Think Talk Write Learning, Module, Performance, Assessment

I. Introduction

Problem-solving plays a vital role in our daily lives, it helps us to produce the best solution that challenges our cognitive thinking. If it is neglected then a problem will arise, moreover, life will be difficult to deal with. Furthermore, problem-solving is an important aspect of students' academic success. However, when students hear the word 'problem-solving,' they often think of Mathematics and they fall glum, thinking of their grades deteriorating as they accept the fact that they may not be able to solve the given problems. They often think of themselves as unintelligent and that they are not able to solve the problem because they fail to study harder. Although that may be the case in some students, the cause is not the same for all. Students frequently struggle with problem-solving. Nonetheless, students are still required to understand a specific problem that occurs not only in their Mathematics subject but also throughout their education.

According to Orton, a mathematics word problem as a query necessitating the application of mathematical knowledge for resolution, emphasizing the initial need to extract pertinent information from a given sentence. In contrast, Gurung characterizes mathematics word problems as challenges articulated in sentences and solved through structural expression and basic operations. Additionally, Hadion identifies these problems as mathematical-verbal conundrums with written formulations incorporating symbols like %, +, -, ÷, and ×. Synthesizing these definitions, we conclude that mathematics word problems involve deciphering questions expressed in sentences, demanding precise comprehension to discern the requisite mathematical concepts for resolution.

In the early stages of schooling, students focus on arithmetic, mastering operations like addition, subtraction, multiplication, and division. Initially, mathematics questions predominantly employ symbolic expressions, fostering the belief that memorizing steps and procedures is sufficient for conquering mathematical challenges. This early exposure often relies on keywords (or cue words) approach, where students scan for specific words indicating the operations to be applied. However, this method, as suggested by Veloo, Sainah, Saman, Raimah, and Timah, may lead to a lack of critical thinking, as students tend to focus on identifying keywords rather than deeply engaging with the problems.

Furthermore, research indicates that students often struggle with mathematics word problems presented in the English language, revealing a disparity between proficiency in computational mathematics and challenges posed by word-based scenarios. This observation underscores the importance of developing comprehensive problem-solving skills beyond mere memorization, encouraging students to approach mathematics with a nuanced understanding rather than relying solely on predefined procedures.

Literature Review

In the study by Meutia et.al (2020), students' problem-solving abilities required significant attention. To enhance students' problem-solving skills, it is advisable for teachers to give their

students the attention they need and offer a variety of mathematical questions, providing plentiful opportunities for students to engage with different problem-solving scenarios and develop their proficiency in the subject. They may gauge the students' improvement time after time. As mentioned by Tan and Salingay (2018), results will provide valuable insights to educators, highlighting the importance of exposing students to a diverse range of mathematics problems to foster the development of various solution strategies and problem-solving heuristics.

In dealing with problem-solving, the skills in English comprehension must be developed. A student cannot perform any problem if they lack the knowledge in English proficiency. As cited by Misme and Yawiloeng (2023) from a study by Peter (2019) Learning mathematics in English is viewed as a problematic challenge to students especially since English is not their mother tongue language. It is not easy to learn mathematics in English since the learners must understand the mathematical relationship between the components of words (Machaba, 2021). "The education of individuals who are well integrated, free and independent in their thinking, concerned about improving and enhancing the world, and eager to participate in making life more meaningful and worthwhile for all".

The curriculum here in the Philippines is learner–centered, wherein the teacher is going to do less talk since the students must learn by doing more activities. The think–talk–write strategy in teaching mathematics is aligned with the curriculum. According to the study of Guswinda et.al. (2019) the students who used the think–talk–write (TTW) strategy had better performance than the students who used the scientific method.

The skill of solving problems does not only come from one factor that is the students but also comes from many factors such as strategy, lecturer, and class atmosphere. The students usually feel bored during problem-solving lectures as the main strategy in teaching. The atmosphere does not support the problem-solving lecture. Thus, there should be a synergy among strategy, material, and the skill of the lecturer to create a suitable atmosphere to teach problem-solving.

To address the issue of problem-solving skills of the students, there should be a solution. One of them is providing a teaching strategy called Think-Talk-Write. Think-Talk-Write is a strategy to build precisely to think and reflect to organize ideas and to test the ideas before students are asked to write (Aziz and Maaliah,2017).

II. Methodology

The researchers made use of the Mix Method Research Design SURVEY-PHENOMENOLOGY, which was popularized by John W. Creswell, in this study the researcher's asked permission from the Principal, Assistant Principal, and Advisers of the Grade 11 STEM Learners before conducting the research. The researchers sought approval of the expert to validate the questionnaire to be used for the interview. After the validation, the researchers conducted a

one-time 5 item exponential word problem solving to the 133 Grade 11 STEM learners. The learners who did not get 3 correct answers became the respondents for the interview. The researchers randomly selected 30 learners which came from 4 different sections. The researchers purposively and conveniently interviewed 7 or 8 available learners in each section. Through this research design, the researchers identified the observable causes of a student's poor performance in Mathematics and determined if the think-talk-write strategy is provided as an intervention. All data gathered was treated with full confidentiality and it was only utilized for the purpose of this study.

The General Mathematics teachers were interviewed to determine if the think-talk-write strategy was fully utilized. This study was conducted in the first semester of the school year 2023-2024.

III. Results and Discussion

T The main findings of this study demonstrate that, since individuality and persistence are seen as the objectives of problem-solving, thinking is the primary method while talking is not used. The GRESA (Given, Required, Equation, Solution, Answer) method is the last written strategy that few students and teachers are utilizing to employ to solve the problem at hand.

Profile of the Respondents

Table 1 presents the profile of the respondents in terms of age, sex, combined monthly family income, final grades in Mathematics and English.

Table 1
Profile of the Respondents

Profile	Frequency	Percentage
Age		
14	1	1
15	19	14
16	106	80
17	6	5
18	1	1
Sex		
Male	42	32
Female	91	68
combined monthly family income		
10,000 below	33	25
10,001 - 30,000	49	37
30,001 - 50,000	36	27
50,000 above	15	11

Final Grades in Mathematics		
90 below	27	20
90 - 94	73	55
95 - 97	30	23
98 - 100	3	2
Final Grades in English		
90 below	12	9
90 - 94	82	61
95 - 97	38	29
98 - 100	1	1

The table above summarize the students' profile, highlighting that 79.70 % are 16 years old, with more females (68.42%) than males (31.58%). Most students have a monthly family income between 10,000-30,000 pesos (36.84%). The table also displays the students' final grades, with a majority scoring 90-94 in Math (54.89%) and English (61.65%).

Understanding and Addressing Challenges in Problem-Solving Skills

This study demonstrates the way senior high school STEM students in Grade 11 and General Mathematics teachers view the difficulties associated with developing students' problem-solving abilities. Time constraints and cognitive obstacles are related to the think strategy. The talk strategy demonstrates how the respondent uses coping mechanisms and pedagogical approaches to improve their problem-solving abilities. The last writing tactic illustrates how they tackle problem-solving by crafting answers from online sources and mathematical methodologies.

Think

Cognitive Barriers

The respondents read and reread the given scenario before they can formulate the things, they need to answer it. They read the question multiple times. They can solve illustrative or figurative problems but if it is a word problem they can no longer comprehend and analyze the scenario. Some learners are good in English comprehension but when it comes to mathematical language they can no longer understand and interpret the given statements. The learners took a lot of time to answer the problems. Most of them are stocked up on just one problem and they can no longer proceed with the following questions.

Some learners illustrate problem-solving as a yoke laid on their neck. It is very hard to carry, and one cannot go through the process easily. Problem-solving serves as a heavy leaden in their studies.

The learners believe that the problems given to them were already explained by their teacher, so they go over their notes to check the necessary procedures for answering them. They always asked for more time to answer the problems.

Time Constraints

Addressing the lack of emphasis on problem-solving in mathematics education is crucial, but it often takes a backseat due to concerns about covering the extensive array of essential learning competencies within a limited timeframe. In the initial quarter, spanning 9 weeks with a designated 36 teaching hours, logistical constraints are further exacerbated by the allocation of 4 hours for various examinations (diagnostic test, pre-test, post-test, first periodical examination). This reduces the available instructional time to a mere 32 hours. Additionally, the presence of numerous school activities introduces additional disruptions, thereby diminishing the time dedicated to teaching.

Remarkably, the challenge is compounded by the commitment to impart a comprehensive set of 30 competencies during this first quarter alone. The intricate balance between fulfilling curricular requirements and fostering problem-solving skills remains elusive, prompting a reevaluation of the current teaching approach to create space for a more holistic and effective learning experience.

Notably, one teacher took a personalized approach, advocating individualized responses to questions to bolster students' self-confidence and problem-solving abilities. This tailored method aimed to cultivate a sense of autonomy and competence among learners. It was recognized that true learning often occurs when individuals push themselves to their limits.

Talk

Coping Strategies

Some students accepted that they don’t possess the necessary skills and abilities in problem-solving. They believed that their knowledge of mathematics was very poor, but they tried to overcome it by asking for help from their classmates through brainstorming. They seek help from people who are knowledgeable from their family and relatives. No matter how they explain it to them if they are left alone to answer the related question, they can no longer answer it. The learner's term for it is “mental block”.

Pedagogical Approaches

The teacher implemented a dynamic teaching strategy by encouraging learners to engage in peer tutoring and collaborative class discussions and activities. Working in pairs to tackle questions, students were prompted to actively participate in the learning process. In addition, the teacher provided a fill-in-the-blanks form as a structured guide, outlining steps in problem-solving to scaffold their understanding.

Write

Crafting Answers from Online Sources

Most of the students cannot explain their procedures in solving the problems. They just analyze it and try to guess the correct answer and try to check if it satisfies the questions.

The students look for the internet to solve the problem by:

a. Google;

b. Watching tutorials on YouTube; and

c. Asked Chat GPT.

Problem-Solving Methodologies in Mathematics

The researchers found out that out of 30 respondents only 2 said that they follow the GRESA (Given, Required, Equation, Solution, Answer) method in solving mathematical word problems.

Only one of the teachers makes use of the GRESA method in solving the problems. The other teacher doesn't even know the meaning of GRESA.

Cooperative Learning and Think-Talk-Write Strategy

Upon introducing the think–talk–write cooperative learning strategy, the General Mathematics teachers acknowledged its potential but observed a hesitancy to fully embrace it in practice. The reluctance stemmed from past experiences where, during group problem-solving sessions, students tended to distribute individual numbers without engaging in meaningful idea-sharing or discussions. The collaborative effort often devolved into a mere compilation of responses, with learners relying heavily on the answers provided by the more proficient members of their group. Reflecting this concern, one teacher expressed skepticism, stating, "How can they share if they don't know how to do it?"

Recognizing the value of the think–talk–write strategy, the researchers identified a need for a conducive environment and ample time to foster its effective implementation. It became evident that, given sufficient time, there is a willingness to explore and employ the think–talk–write approach, with the hope that it would encourage more meaningful collaboration and discussion among students.

IV. Conclusion

Most students are 16 years old, predominantly female, and most belong to families with a monthly income between 10,000 to 30,000 pesos. Academic achievements, as reflected in final grades, show a concentration of scores between 90-94 in both Math and English.

The study sheds light on significant challenges such as struggle to comprehend and analyze scenarios, leading to prolonged problem-solving times and a sense of burden among learners. The overarching issue of time constraints, exacerbated by the need to cover a comprehensive set of competencies within a limited timeframe, underscores the complexity of balancing curricular requirements with the fostering of problem-solving skills. Amid these challenges, valuable coping strategies emerge, with students seeking support from peers, family, and online resources, including Chat GPT. The implementation of dynamic pedagogical approaches, such as peer tutoring and collaborative discussions, signifies an effort to address these challenges and promote a more interactive learning environment. Notably, the varied use of problem-solving methodologies, particularly the GRESA method, highlights the need for a more standardized and widely understood approach in mathematics education.

In conclusion, the study suggests that incorporating the TTW strategy into mathematics education using English language can significantly improve students' comprehension of word problems. It provides students with opportunities to learn mathematics in an English setting, enabling them to engage with their teachers and peers in a collaborative manner, fostering effective problem-solving through thinking, discussing, and writing. Thus, it strongly recommends the utilization of the "think, talk, write" strategy as a valuable approach for teaching students how to effectively solve mathematical word problems.

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