Journal Writing in Solving Worded Problems: Does it Help?

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Abstract

Concern about teaching problem solving and mathematical thinking has paved way for the development of a writing-to-learn approach in math. This study explored whether journal writing can help the students in solving worded problems. Using the qualitative method of research, the students were required to make journals of their experiences in performing problem solving tasks. The students were required to do a lot of writing in their problem-solving activities. In making the journals, the students focused on key words, relationships, processes and lessons learned through writing statements, procedures and self-assessment. The students' experiences as stated in their journal and transcripts of the interview served as the data in the study. Findings showed that students' dispositions towards solving worded problems were altered with the use of writing and portfolio as their output. Journal writing as an approach in solving worded problems helped the students become more conscious about the way they conceptualize a problem for it to be solvable. It guided problem solvers in every step of their solutions. It also developed their communication skills and boosted their confidence to solve a math problem. The use of journal writing in solving worded math problems is highly recommended because it is essential for independent learning, improving communication skills, an approach for self–assessment, and interactive activity.

Keywords: Qualitative study, experiences, journal writing, solving worded problems

Introduction

Problem-solving is a dominant mathematical competency in the 21st century. It plays a vital role in the process of teaching and learning of mathematics. Educators strive hard to seek appropriate methods that may help students to become better problem solvers in real-world situations. Until now, many researchers continue to investigate suitable methods in

improving the abilities of students.

For students to feel comfortable with the process of solving a worded problem, mathematics teachers provide many problem-solving experiences in their classes. Letting students engage in this activity may develop their mathematical thinking and reasoning. According to Laguda (2007), problem-solving is the process of interpreting a situation mathematically that usually engages several repetitive cycles of expressing, testing, and revising mathematical interpretation.

Problem-solving is a form of inquiry learning that requires the application of existing knowledge to the unfamiliar with innovative situations to gain new knowledge (Edwards, 2008). It also refers to a vehicle for learners to evaluate, construct, and refine their own beliefs and theories about mathematics as it relates to the beliefs and theories of others. Schoenfeld, (1992) mentioned that engaging in problem-solving involves finding an answer for a particular problem and encouraging learners to develop their ability to think mathematically. The processes involve the use of content knowledge, procedures, strategies, language, and reflections.

According to Rosario (2015), with his length of experience in teaching mathematics, solving mathematical word problems has been a trend in mathematics education. A standard view among most teachers and students is that it is in solving word problems where students are having difficulty and eventually fail in the subject.

In the local setting, it is also a common observation that students can hardly solve worded math problems. This observation may be due to fear in problem-solving, poor comprehension, lack of knowledge on the problem presented, procedural errors, and difficulty level of the problem. However, when students solve math problems with the aid of effective strategies, they can probably obtain the correct solutions.

One of the strategies employed by teachers in different disciplines as part of teaching and learning assessment is to require students to have their folder or journals. It is in the journal where they keep all their outputs, including reflections for every output. Through this strategy, students could realize their mistakes and become comfortable in expressing their plans and ways to improve their learning. Journal writing is uncommon in mathematics classes. The traditional problem-solving drill is the most common strategy observed in most mathematics classes.

One of the alternative methods in education used in the assessment of the students' individual or group performance is journal writing. Several researchers emphasized the necessity of using journal writing (Birgin, 2003; De Fina, 1992; Gussie, 1998; Micklo, 1997; Mumme, 1991; Norman, 1998). These authors asserted that journal writing gives more reliable and dynamic data about students for teachers, parents, and also the student himself. Also, using this assessment method in primary schools provides getting clear information about students and

fulfilling their weaknesses and helps teachers in planning teaching progress.

Winsor and Ellefson (1995) emphasized that for the learning process and learning product, journal writing is a fusion of process and product. It is the process of reflection, selection, rationalization, and evaluation, together with the product of those processes.

The Vermont Department of Education seeks to promote a vision for the use of portfolios, which supports teachers in answering some crucial questions. One of these questions is, "how do I know my students are becoming effective writers and problem solvers?" Many Vermont teachers and administrators have recognized the value of the portfolio as a powerful instructional and assessment tool.

Pujiastuti (2015) stated that three indicators measure the students' mathematical communication ability. These indicators include the following: (1) Expressing a situation or mathematical idea in the form of images, (2) Expressing a situation or mathematical idea in the form of mathematical models and solving them, and (3) Expressing and explaining an image or mathematical model in the form of mathematical ideas.

Because of these, the researchers believed that there is a need for a shift of teaching strategies from traditional methods to more interactive activities such as journal writing, even in mathematics education. Also, the students must develop and master their problem-solving skills with the aid of journal writing. These skills can help students improve their comprehension abilities and understanding of the problems to be solved in mathematics. So, this research aims to study the experiences of students and the processes involved with the use of writing for learning mathematics after being exposed to numerical and written problem-solving activities. The findings of this study may help provide valuable sources of information to teachers to adopt more effective strategies in teaching students how to solve worded math problems.

Theoretical Framework

This study is anchored on approaches to and strategies of problem-solving. In cognitive psychology, problem-solving refers to a mental process or a phenomenon dedicated to solving problems by discovering and analyzing problems. It is a process dedicated to finding not just any solution, but the best solution to resolve any problems. There is no such thing as one best way to solve every kind of problem. Unique problems depend upon the situation. There are unique solutions too.

Moreover, the process does not necessarily refer to solving psychological/mental issues of the brain. It also refers to solving every kind of problems in life in a proper manner. Expert psychologists approve the following steps in problem-solving: (1) identifying the problem, (2) defining/understanding the problem, (3) forming a strategy, (4) organizing information, (5) allocating resources, and (6) evaluating the results (Shrestha, 2017).

Problem-solving strategies are the steps that one would use to find the problems that are in the way of getting one's own goal. Bransford and Stein (1993) state this as the "problem-solving cycle." In this cycle, one can recognize the problem, define the problem, organize the knowledge of the problem cycle, figure out the resources at the user's disposal, monitor one's progress, and evaluate the solution for accuracy. The reason it is called a cycle is that once one completes a problem, another usually occurs.

Polya (1957) described what constitutes problem-solving. These references have many common threads. They have models of the process that are broken down into a varied number of stages. Many studies on problem-solving relate to Polya (1957), who stated that there are many reasonable ways to solve problems. A lot of problem-solving experiences facilitate the development of skills in choosing an appropriate strategy. Students can learn to become better problem solvers. Polya's "How to Solve It" book presented four phases or areas of problem-solving, which have become the framework often recommended for teaching and assessing problem-solving skills. The four steps are: understanding the problem, devising a plan to solve the problem, implementing the plan, and reflecting on the problem. Learning these and other problem-solving strategies enables students to deal more effectively and successfully with most types of mathematical problems.

Problem-solving processes are very useful in mathematics, science, social sciences, and other subjects. Students should be encouraged to develop and discover their problem-solving strategies and become adept at using them for problem-solving. This technique helps them with their confidence in tackling problem-solving tasks in any situation and enhance their reasoning skills. As soon as the students develop and refine their range of problem-solving strategies, teachers can highlight or concentrate on a particular strategy, and discuss aspects and applications of the strategy. As necessary, the students should develop their flexibility to choose from the variety of strategies they have learned.

Among these different strategies, journal writing intends to enhance the process of problem-solving in a more meaningful way. Various studies assert journal writing as one of the strategies in problem-solving. There are several ways of explaining journal writing. In this study, journal writing refers to writing what students perform after solving worded problems. This method encourages the students to reflect on their experiences to assess their performance in solving problems.

In the study of Lomibao and Luna (2016), they maintained that mathematical communication in mathematics class is effective in improving student's achievement, conceptual understanding, and reducing mathematics anxiety. Communicating mathematics can help raise the level of confidence among students in their classes.

According to Bulpitt and Martin (2005), learning from experiences is

seen by many educators as a crucial way of narrowing the gap between theory and practice in their respective disciplines. These experiences assess with reflective journal writing. Reflective learning journals is a form of mental processing with a purpose and anticipated outcome. This outcome is applied to relatively complicated or unstructured ideas for which there is not an obvious solution. Feedback and opportunity for reflection are also powerful writing features that support learning.

Altland (2017) postulated that having students record their math activities through writing and sketching can help reinforce mathematical understanding. Writing about math processes and creating diagrams and pictures stimulate different pathways of the brain. A math journal provides students of all abilities and ages the flexibility to examine and express their mathematical reasoning. This practice is especially useful when math concepts are too complex or abstract to keep track of mentally. Walker (2006) also asserted that journal writing facilitates reflection and allows students to express feelings regarding their educational experiences.

Journal writing is a useful problem-solving tool in varied situations. There are strategies in solving a problem like creating story problems to demonstrate theories of algebra, computer troubleshooting, or auto detailing choices. Using writing to understand and present complex ideas encourages students to make meaning out of the material.

Word problems in mathematics often pose a challenge because they require the students to read and comprehend the text of the problem. It also identifies the question and creates and solves a numerical equation. Many students may have difficulty reading and understanding the written content in a word problem. For this reason, students should learn key terminology before attempting to solve mathematical word problems. The technique of using writing in a journal or notebook while solving problems has several functions. It develops the fluency and flexibility of students to become adept at mathematical thinking and reasoning. It also fosters and facilitates creative thinking. It also makes students conscious of the step-by-step processes they use as they solve problems, and develop the ability to conceptualize in a variety of content areas.

For teachers, active engagement in solving worded problems can help students conceptualize their mental processes.

Objectives

The main focus of this study is to explore whether journal writing can help students in solving worded problems. Specifically, it aimed to determine the students' feelings about solving math problems; the common methods used by the students in solving math problems; benefits of writing initial statements and procedures in solving worded problems; the contribution of writing reflections over their activities in solving worded problems; and

the aspects of writing journals that contribute to Mathematics learning.

Methodology

Design

This study utilized the qualitative method of research. It is an exploratory study that identified and described the experiences of students in math problem-solving activities with the aid of journal writing and compiling outputs in a portfolio.

Participants and Study Site

The participants of the study include a single intact group of students, particularly the Bachelor of Elementary Education students during the first semester of school year 2016-2017. These students were enrolled in Advanced Algebra and Trigonometry in which they solved word problems as an application to Linear and Quadratic Equations. Overall, 40 students participated in the study. There were more female respondents than male. The majority (35 or 87.5%) of the students graduated from public high school.

Instrumentation and Data Collection Procedure

The researchers obtained data about the respondent's profile. The respondents were requested to make journals every time they performed worded problems. In addition to the journals made by the respondents, they were also interviewed using a semi-structured interview guide. The interviews were recorded using a cellphone's recorder to ensure more accurate data transcription and enable the researchers to focus on the responses of the interviewees. Brief notes were also taken to clarify responses and help pose follow-up questions during the interview sessions. The researchers evaluated the journals made by the respondents. They also analyzed the transcripts of the interview which served as the data analyzed in the study.

Ethical Consideration

The researchers informed the respondents about the nature and purpose of the research. They also informed the respondents about the plans for using the results of the interview, and the protocols observed. These preliminary activities were done to protect the anonymity of the respondents. Before the actual interview, the researchers requested the participants to read and sign the consent form and the recording of the interview. The researchers also assured the participants that their participation in the research was voluntary and that they have the freedom to withdraw their consent at any time.

Analysis of Data

The researchers transcribed the recorded interview. Spot-checking procedures were used to ensure the accuracy of the transcription. Three analyses were employed, namely: data reduction, description, and coding of data into themes. Reduction means setting aside all biases and prejudices of the phenomenon (Creswell, 1998).

Description refers to understanding the reality of the subjects. The coding of data into themes uncovers the central process of the phenomenon. All analyses were based on the field texts and processed using the Repertory/Kelly Grid. This method helped in organizing and recognizing features as themes that collectively described their feelings/ insights on the use of journal writing in solving worded math problems. The process involved sorting, categorization (cool analysis), and theoretical sensitivity. In theoretical sensitivity, the researcher was guided by the following questions: (1) what concepts/categories are similar or different? (2) What are the commonalities of the concepts? and (3) what concepts or categories should come together, or what concepts are aspects or properties of what category?

Results and Discussions

Students' feelings about solving math problems

Eshun (2004) defines an attitude towards mathematics as "a disposition towards an aspect of mathematics. An individual has acquired this attitude through his or her beliefs and experiences. Such attitude, however, could be changed." The findings of this study verified the initial idea or expectations of the researcher about the actual behavior of students when they encountered math worded problems to solve.

Table 1 presents the statements made by the students regarding their feelings when solving worded problems in their mathematics class. The shared feelings of the students toward solving math problems were categorized into negative and positive views based on their statements during the interview.

Table 1
Students' Feelings toward Solving Math Problems

Categories	Statements
1. Negative Views	
a. Worried/Fearful	*"I am worried about not getting the correct answer because I am not good at math."* *"I can only solve worded problems which are simple, but most of the time, I am pressured because deep understanding is needed."* *"I need guidance from other people who are good at solving worded problems."* *"I feel shaky when solving a worded problem, especially when it is hard to solve."* *"I do not have much interest in math subjects, so I usually have fears when solving a math problem."* *"I have fears in dealing with fractions."* *"I am always doubtful of my answers, so I prefer not to try."*
b. Confused	*"I do not know which formula to use because there are a lot of them."* *"Transforming words into mathematical expressions is confusing, and it requires many solutions and processes to get the right answer."* *"It involves many complicated mathematical symbols."* *"I need to read the question many times until I obtain the equation."*
2. Positive Views	
a. Challenged	*"It allows me to apply what I learned from previous lessons."* *"When it is very tricky, I enjoy solving."* *"I become a braver person coz I overcome my fear of doing things that are hard."* *"I should try to solve any math problem with the help of my teacher and classmates."*
b. Confident	*"I feel confident because I love solving math problems."* *"Solving worded problems is already easy because I have been doing this since elementary."* *"I feel confident because in solving worded problems, we are solving real situations."*

The results reveal that many students have negative feelings toward solving worded problems. They were hesitant to do problem-solving tasks

because they felt worried, fearful, and confused. They considered problem-solving a difficult task because of the complicated mathematical symbols. They find difficulty in deciding what formula to use with the many equations and formulas they encounter in their mathematics class. Some students surrender right away in doing the task without first trying. They disclosed that the task requires analytical thinking and a set of processes to get the desired answer. As a result, the students feel bad about this kind of activity.

On the other hand, some students felt challenged and confident when exposed to solving math problems. They claimed that they enjoy solving math problems, and feel fulfilled when they do this kind of activity. These views coming from the students can help them succeed in solving math problems, even how difficult it is. As part of their learning activities in mathematics class, these students would try their best to solve a given problem.

Common methods used by students in solving worded math problems

Table 2 presents the common methods used by students in solving worded problems. The table shows three main categories of how students solve math problems, namely: seeking help from references or other people, understanding first the problem, and solving directly math problems with various techniques. These techniques include trial and error, algebraic skills, translation of words and sentences into mathematical expressions, Polya's, and AGONSA methods. The students divulged that these are the methods they have learned from their previous mathematics classes. It is commendable to note that they were able to express what they usually do when solving math problems.

Table 2
Students' Methods of Solving Math Problems

	Categories	*Statements*
1.	Seeking help from references, friends and classmates	*"I try to solve then compare my answer with my classmates."* *"I ask help from my friends and classmates who are good at math."* *"I read some reference books, browse my notes related to the problem, and I browse the internet."*
2.	Understanding first the problem	*"I usually take down notes and put in mind the important details of the problems."* *"I need to think critically."* *"I read the problem many times until I fully understand it."* *"I determine the use of each term in the problem and how they contribute to the solution. Then I do the algebraic processes in solving equations."*
3.	Solving directly a math problem with various techniques - Applying trial and error - Applying algebraic skills - Translating words and sentences into mathematical expressions - Applying Polya's strategy - Applying AGONSA method	*"I apply the trial and error method and recall some lessons related to the given problem."* *"I put extra effort into solving them by aiming to find the appropriate equation."* *"I apply algebraic skills like combining similar terms, substitution, etc."* *"I start translating words and sentences into mathematical expressions or equations and apply different steps in solving worded problems."* *"I apply the Polya's strategy, such as indicating the given and what is being asked, and then I solve."* *"I use the AGONSA method where A for what is asked, G for Given terms and their values, O for Operations to be used, N for writing the Number sentence, S for solutions and A for the Final Answer."*

For this result, students tend to become better in math with proper

guidance and providing them with alternative methods that may make problem-solving easier and enjoyable. In the problem-solving process, some students are knowledgeable of and able to apply Polya's Problem Solving Technique. This technique includes four areas of problem-solving which are often recommended for teaching and assessing problem-solving skills. The four steps consist of the following: (1) understanding the problem, (2) devising a plan to solve the problem, (3) implementing the plan, and (4) reflecting on the problem. Meanwhile, it is noteworthy that there are students who are capable of applying the AGONSA method.

Benefits and detriments of writing initial statements and procedures in solving worded problems

Journal writing is emerging as a popular alternative to student assessment. Also, a portfolio is a purposeful collection of students' work as indicators of their effort, progress, and achievement over time to gauge their cognitive and affective development. For mathematical learning, the purpose of journal writing and having a portfolio is to understand "student's thinking, student's growth over time, mathematical connections, students' views of themselves as mathematicians, and the problem-solving process" (Stenmark, 1991).

Table 3 presents the responses of the students when asked how journal writing particularly writing initial statements and procedures, helped them in solving worded math problems. The students expressed how they feel about the requirements of the Polya's Steps in Solving Worded Problem. The researchers classified the responses of the students as to how the method of writing the details and procedures of the problem-solving had helped them become a successful problem-solver into three categories.

Some of the students liked the whole activity, and it provided them opportunities to learn the steps better and develop their problem-solving skills. From the journals made by the students, the researchers analyzed their responses when asked about the advantages of writing details of the procedures they followed in solving worded problems. The students were asked to focus their answer on the benefits they derived from doing the journal writing activity. Results of the analysis and reduction of responses into categories based on similarity reveal three main categories. These categories are as follows: (a) it made the problems easier to understand, (2) it helped the students have a clear focus and attention, and (3) it developed patience.

Table 3
Students' Responses on the Advantages of Writing Details and Procedures in Solving Worded Problems

Categories	*Statements*
a. It made the problems easier to understand	*"I was able to identify the necessary information easily from the problem."*
	"I was able to formulate the equations which describe the relationship between the variables in the problem."
	"It helped me understand the situations easier and gave me the idea on how to solve the problems. It helped me explain my solutions more clearly."

b. It provided students a clear focus and direction	*"It led me to get the right formula. It guided me to solve the problem."* *"If I find it hard to do the next step, I can go back with the previous step to give me a clue how to continue."* *"It guided me in every step of the solutions I wrote."* *"Math language is quite confusing, but in writing procedures in the solutions, it made the steps logical. It was like organizing a plan for doing a particular task."*
c. It developed patience	*"When I did not get the correct answer, I can easily identify where I got mistakes in my solutions, I only have to be more patient."* *"It gave me an opportunity to explain like I am doing a demo, which is very helpful for us as education students."* *"It gave us a feeling of pride because I know we were able to surpass the difficult problem-solving activities."* *"It tested our patience, and I did many efforts to solve them."* *"It made our problem-solving activities in solving problems more meaningful."*

In this study, journal writing was found as an effective strategy, as reflected in the portfolio of the students. The students had obtained satisfactory scores. They learned the need for writing details in the solutions, like indicating what they know from the problem and what is needed to be known. Writing detailed procedures in every step may be a tedious process. Still they find it helpful as this enriches their knowledge to recall all the fundamental properties, definitions, axioms, theorems, and operations in algebra.

The students' ability to write in detail the steps and procedures in solving worded problems had enabled them to understand the situation quickly. It also helped them identify the given, and decide on what formula to use and do the necessary calculations. Writing the details of what one had done enables the students to master and explain thoroughly the step, which may lead to a better understanding of the problem situation.

Journal writing did not only make the students have a better understanding of the problem, but also made them have a clear focus and attention. The students disclosed that the practice of writing the details of problem-solving procedures had guided them in making decisions on the correct formula to be used. It likewise gave them the right clue on how to proceed with the problem-solving process and made them realize that problem solving is a logical process.

The students also developed patience in solving problems as an effect of writing the details of problem-solving procedures. The problem-solving process is tedious. Writing every step one does in the process even makes it more tedious. Mathematics enthusiasts who have mastered the steps may find writing the steps a very time-consuming task. They have to write all the necessary information as an essential aspect of their solutions. The students were able to realize that solving problems requires patience, that they have to make extra effort to become successful problem solvers. As a consequence, they developed self-confidence, particularly in explaining what they had done and how they did the problem-solving tasks.

Contributions of writing reflections in solving worded problems

For the evaluation of the students' outputs or what they have just finished solving, writing reflections is a must. Writing reflections allowed the

students to see what went wrong in their solutions if they got an incorrect answer. On the other hand, if they got the correct answer, they still needed to write reflections, and they appreciated doing the entire process.

Below are the categories of the students' responses to their reflections on the contribution of writing in problem-solving activities.

Table 4
Students' Responses on the Contribution of Writing Reflections about their Problem- Solving Activities

Categories	*Statements*
1. Assessed self-performance	*"It improved my mathematical skills."* *"It developed my mathematical communication."* *"It boosted my critical thinking ability and analysis."* *"I was able to assess my performance."* *"It helped me understand equations I have not learned before."*
2. Identified weakness and strength	*"It is not easy to solve worded problems."* *"I found out that I am not good at problem-solving, so I need to improve more."* *"I can freely express my assessments of how I did the activities."* *"I learned that while writing reflections, I was able to identify which types of problems were hard and easy for me."* *"I was able to find out that I lacked patience in understanding the problems."*
3. Provided more chances to get the correct answer	*"I learned to apply what I forgot to do when I was solving the problems. When I do not indicate the procedure in my solution, I am confused with what to do next."* *"In reality, we need to have a good mathematical ability for us to adapt easily to a problem. Though the problems were very tough, it pushed me to try again to get the correct answer."* *"I had to go over my solutions to improve them and finally get the correct answer* *"It serves as a critic of what I have done so that I can do better in solving. "* *"Analysis of the problem is necessary for understanding the situation. Read, understand, think, plan, look for the possible answers, and look back on what have done."*
4. Gained Confidence and Satisfaction	*"Solving math problems is neither easy nor difficult if you exert effort and are equipped with knowledge related to the problem. With the help of tutors and friends, I was motivated to try and try to solve them."* *"I realized that though the problems given were different, some of these were just treated the same way in terms of procedure."* *"I learned to be more patient, and I learned that it requires exerting extra effort."* *"We need to experience solving them. I have experienced an easier way of solving a worded problem."*

Based on the responses of the students, writing reflections provided many opportunities to assess their performance in solving math problems. An analysis of the journals made by the students reveals four categories of the contributions of writing reflections on the students' capability in performing problem solving tasks. After making the reflections, the students assessed themselves better, identified their weaknesses, provided more chances to get correct answers, and gained confidence and satisfaction in solving worded problems.

The students found that the activity had helped them improve their ability to manipulate mathematical information to explain and justify their solutions. It also had helped them evaluate their ability to analyze mathematical arguments. Writing reflections also enabled the students to realize the difficulty in solving worded problems. The students also stated that they could relay with confidence how they did the problem-solving tasks. They were able to determine what they can and cannot do. Hence, they were motivated to improve their difficulties. Therefore, they were able to build trust in themselves.

Writing reflections includes the development of mathematical thinking and the opportunity to reflect on one's learning processes (Baxter, Woodward, & Olson, 2005). Journal writing would help students to learn about their thought processes, and therefore, increase confidence and positive self-worth (Grbavac, Piggot, & Rougeux, 2003).

Moreover, when the students' portfolios were evaluated, key features were observed. The students analyzed the problem as a whole. Then they started identifying terms: the known and unknown. It was then followed by how they went about the problems and wrote all the procedures. Lastly, they looked back at the output by evaluating their tasks (usually they did the checking by the use of substitution).

Aspects of journal writing that contribute to learning in Mathematics class

In this study, five aspects of journal writing may improve learning mathematics among students. Journal writing serves the following purposes: (1) it facilitates independent learning, (2) improves communication skills, (3) provides self–assessment, (4) encourages interactive activities, and (5) allows teachers to assess students' performance.

Table 6 summarizes these aspects as supported by their statements during the interviews.

For independent learning, the students consider their integral part in the learning process by striving hard to solve problems on their own and do their best. It serves as an avenue to express what they cannot express during class discussions and assessments when there is limited time.

Table 5
Aspects of Journal Writing in Solving Math Problems

Categories	*Statements*
1. Facilitates independent learning	*"It is very appropriate for students who cannot actively participate during class discussions because they are shy."* *"When students do this, students can learn independently and given more chance to express how he/she perform in class."* *"Though it is time-consuming, it is better than when teachers rush a lesson."* *"Because it could be a great help for students to acquire knowledge while doing the activities, and students have a chance to solve math problems on their own."* *"We can recall our learning since elementary, and we are free to apply a method in solving a problem."*
2. Improves communication skills	*"Teachers might differ in strategies, but this can help students learn not only mathematical skills but also improves their communication skills."* *"It helps us trust other's opinions because, with this kind of activity, we learned to interact with our classmates. While we were troubled in some problems, we discussed how to solve them and for us to succeed, we needed to listen to one's explanation, and we made some arguments before we arrived at a conclusion."* *"It can help students become familiar with mathematical terms."*
3. Provides self-assessment	*"This helped me reflect if I understand a lesson or not. It is one way to test or evaluate our knowledge. I was also able to identify my weakness, which I need to improve."* *"It would test students' ability and make us become patient in solving worded problems, and when we get used to it, we could just answer problems easily."*
4. Encourages interactive activities	*"It is thrilling; it is fun and very encouraging."* *"It helped me solve problems and in mingling with my classmates and friends in solving such problems."* *"It makes students more active in doing activities. They gain more knowledge in answering math problems."*
5. Allows teachers to assess students' performance	*"It is very applicable to very large size of class like in our case where we are all forty. Our instructor has time to evaluate our performance based on what we wrote in our journals."* *"Students can understand problems this way, especially when the teacher is not approachable."* *"It can improve our learning and can serve as a supplemental form of assessment."* *"It gives more chances for the students to show how they perform in math class. It is an application of what we have learned."*

There are some features of such a teaching approach. Building on the work of journal writing takes a view of students constructing their learning in a social context, where communication and sharing are central to mathematical growth and understanding. It improves their communication skills because during the process they learn to express in writing all they can say related to a given problem. It might not be in verbal form. Still, at least they translate their thinking into visual representations through texts or models. It would be beneficial to those students who do not usually recite during the class lecture. Sometimes, those who do not talk much have more clever ideas. So, when there are opportunities to express what is in their minds in this kind of medium, they tend to reveal more meaningful and accurate ideas.

Writing a journal also provides self-assessment. It allows them to assess themselves in terms of how they perform mathematical competencies in writing the solutions and how they behave to obtain the right answer. It is also considered an interactive activity because it produced excitement and fun among the students while they did the whole problem-solving activities. They did not work alone. They had free time to investigate how they were going to solve a problem, can compare the answers, and discuss who had the correct answer. Students also gained more knowledge from this activity because it widened their learning opportunities. Lastly, journal writing is considered an effective tool for teachers to assess students' performance.

Wood, Cobb and Yackel (1993) elaborate on teachers' responsibility in the mathematics classroom as playing the dual role of fostering the development of conceptual knowledge among students and facilitating what is often referred to as taken-as-shared knowledge in the classroom community. It serves as an alternative to what the teacher cannot assess students' performance in quizzes, seat works, and recitation. Common use of traditional measurement and assessment methods prevents finding out students' skills and their developmental potentials (Baki & Birgin, 2002). Teachers must understand that not all students have the courage to approach them. So, when students do not understand the lesson, they do not continue anymore solving the problem unless their teacher encourages or motivates them to do the task. Some teachers remain unaware that they do not realize their responsibility to help their students. There may be teachers who are bothered why some of their students do not perform well in their class. Reasons seem to reflect on how they teach a lesson or based on the capability of the students to understand. Thus, teachers must understand and address these cases. In this study, students reflected on their portfolios their appreciation to their teachers for introducing this approach to them. It allowed them to express what they felt, made them faced their fears, and let their teacher knew who they really were as learners in the class.

Conclusions

Journal writing in solving worded math problems was used as a problem-solving strategy. The use of journal writing had improved their attitude or viewpoints regarding solving worded problems. It led to a growing appreciation of mathematics and the development of conceptual structures.

When students solved worded problems, they underwent three main processes, namely: identifying what is known and unknown, performing operations and algebraic methods, and reflecting or assessing their work. Journal writing as an approach in solving worded problems helped the students become more conscious about the way they conceptualize a problem for it to be solvable. It guided problem solvers in every step of their solutions. It also developed their communication skills and boosted their confidence to solve a math problem. Self-assessment is one of the key purposes of journal writing. It is where students assess their performance in terms of the outputs they made, and in terms of how well and poorly they performed the task because of their attitude or capability.

Recommendations

Emphasis on writing may be adopted by mathematics teachers in their classes as a strategy in learning lessons by the students. Mathematics teachers may require their students to write one journal entry a week that allows enhancing their mathematical thinking and writing skills. Students should be made more confident in solving worded problems by recognizing what they can do and providing assistance and feedbacks while they solve. Students may be encouraged to reflect on their own learning process to identify their strengths and weaknesses by writing journals. With the advancement of technology, writing journals may be done through blogs, Facebook group page, Google classroom, and other learning management systems.

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