ACTIVITY SHEETS FOR THE IMPROVEMENT OF PROBLEM-SOLVING SKILLS

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Abstract

The study determines whether the proposed activity sheets are effective to enhance the students' performance in solving mathematical word problems. Also reveals the profile of the students and the validation of the activity sheets. Using the experimental design, the Grade 7 students from Punta Integrated School were requested to serve as the respondents of the study. The sixty (66) students were divided into two: thirty-three (33) students in the controlled group and the other thirty-three (33) students in the experimental group. The experimental group was subjected to the use of developed activity sheets. There was a significant relationship between the students' profile and their levels of performance in solving mathematical problems; thus, the null hypothesis was rejected at a 0.05 level of significance. This means that gender, age, and the subject of interest are related to the performance of the students. There was a significant difference between the performances of the students; hence, the null hypothesis that the activity sheets have not significantly affected the performance of the students in solving mathematical word problems was rejected. The study is limited to students of Punta IS. Activity sheets utilized were researcher-made and used for pilot testing. The activity sheet was a basis for the utilization of the activity sheet for the improvement of problem-solving skills.

Keywords: Activity Sheet; Problem-Solving; Mathematics

1. Introduction and Rationale

One of the accredited subjects that students must take in school is Mathematics. Some students love mathematics while others have difficulty dealing with this subject. Students who struggle know that they need to learn Mathematics because of its importance in their daily lives. The mathematical knowledge and skills help them in their everyday living like the four fundamental operations of Mathematics.

Word problem-solving in Mathematics is an important aspect of learning not only the subject but also thinking. Unfortunately, in everyday work, students show difficulties solving word problems, even when they may be skilled in performing other mathematics tasks. It is easy for the students to perform the basic mathematical operations such as addition, subtraction, multiplication, and division but without reflective thinking. Students can easily identify units of measurement and execute mathematical calculations about

numbers and equations. On the other hand, when the operations are behind word problems, they struggle to know what to do. In some cases, Students attempt to get to the bottom of a word problem and are able to recognize some essentials of the problem, but they are unable to widespread all the required operations and are incapable to generate an adequate answer.

In this study, the researcher purposes for an intervention that will help to enhance the level of performance of the students in solving mathematical word problems using activity sheets. The activity sheets consist of several mathematical problems which are needed in this study. It will use to test the level of performance of the students in solving mathematical word problems in terms of comprehension, analysis, and computational skills.

2. Literature Review

The following literature are believed to be related to the current study.

Mathematics is an essential topic in general because of its practical value to individuals and society. However, before a student can successfully solve a problem, he must possess good reading, comprehension, analytic and computational skills. Mathematical problem solving and reading comprehension go hand in hand. Solving arithmetic issues necessitates or needs pupils to use two abilities at once: reading and computation. It is a two-edged sword that students should conquer.

In mathematics education, problem-solving is very important. It is described as "not only a goal of studying mathematics but also a major way of doing so" by the National Council of Teachers of Mathematics (n.d). (p. 52). Students' ability to solve problems is recognized by educational academics and practitioners as crucial to their overall performance (Swanson et al., 2013).

In solving word problems, students have to assemble concepts and procedures and apply them towards the solution of one problem. Failure to address the challenge can be caused by a flaw in any of the concepts or processes used. However, the most basic difficulty students have in solving word problems lies in the ability to understand the 9 mathematical problem structure that is embedded in the problem text. Difficulty with comprehending the problem structure often leads to errors in the choice of the solution strategy.

The most important mathematical skills that will be measured in the study is problem solving. It has been regarded as a focal point of Mathematics and in the last 30 years its presence in curricula has increased notably (Castro 2008). It is regarded as the methodological backbone to approach mathematical content since it both requires and helps develop skills in analysis, comprehension, reasoning, and application.

According to Briggs-Hale, Judd, Martindill and Parsley (2007), problem solving involves helping students pursue solutions to intriguing problem using what they know about mathematics facts, skills, and strategies. Solving problem is enhanced when the student discuss is a problem together and when instructions used in guiding questions encourage students to discover a strategy or solution on their own. It usually entails a number of different procedures or stages. Some of these will require specific methods that are particular to the subject area.

(Valencia, 2010), the issue of age differences on mental test is another complex one. The makers of popular mental test believed that intelligence grows from infancy to adolescence. Mental abilities were thought to stabilize after the age 18 until the late twenties or early thirties. Then from thirty until age of sixty there are usually plateaus or improvement in different spheres.

Sakic, Burusic, and Babarovic (2013) affirm that older pupils do marginally better in school, at least in early primary, and add that "variances in brain development might be associated to differences in functions required for good school performance." Thus, they attribute the impact of age differences to maturity.

It can be denied that as humans grow; they experience a general change in the ways they process information. In cognitive performances, older adults are expected less than adolescents. In the study by Campbell and Charies cited by Galoti (2004), they found out that there are similar age-related declines in

working memory. In their study, there were three groups 20 to 39 years old, 40 to 59 years old and 60 years old and above as participants who were given algorithm task of squaring two-digit numbers.

Huang and Invernizzi (2012) found that younger students had lower literacy measures scores than the older students in the same class, and, even though they were not as marked, these differences still existed in second grade. In their study of the impacts of early and delayed school enrolment, they found that some children were younger, and some were older than the norm, Yesil Dagli and Jones (2012) described that "Delayed enrolled children had greater mathematical skills than on-time enrolled children, who had stronger skills than the early enrolled children." This suggests that students who are younger than their grade level are more likely to suffer in Math. It also suggests that older kids have an edge in this area.

Medical and physiological studies reveal several variations in men and women capabilities caused by the gender factor. Women have dubbed as the weaker sex, but the dimension of their weakness needs proofs at this modern age. Male by virtue of their physical powers, stamina, and greater physical detachment from home activities, would have some time and better chances to innovate and try new ideas.

Gender studies is a field of interdisciplinary study and academic field to gender identity and gender representation as central categories of analysis. This field includes Women' studies (concerning women feminine, gender and politics) and Men's studies. Gender studies are sometimes offered in conjunction with sexuality studies. This discipline study gender and sexuality in fields of literature, history, political science, sociology, anthropology, cinema and media studies, human development, law, and medicine. It also analyses race, ethnicity, location, nationality, and disability.

In the study made by Jose as cited by Muvises (2003), it was found out that women responded readily to people. They are more oriented towards caring, welfare and relationship. On the other hand, tend to perceive themselves, they are giving much emphasis on personal autonomy and interdependence.

One of the personal characteristics that has been linked to differences in motivational functioning and self-regulated learning is gender. Gender difference is a concept that we hear a lot in our daily lives, particularly at school (Santrock, 2011). The disparity is likely to have an impact on learning and development in male and female capacities, as evidenced by studies conducted by Zhu (2007) and Pargulski & Reynolds (2017), which reveal that males outperform females in problem solving.

Interest is one of the factors that affect learners' language of learning as cited by Hosenfield (2003). He said that no matter how good a teacher is, it will not bring learning on the part of the learner who does not want to learn. His desire to learn should come from within the learner himself and his eagerness to learn may affect his performance in a particular subject.

According to Krapp (2002), interest describes the cognitive and affective relationship between students and particular classes of subject matter. Student approaches to different subjects can be expected to vary just as to background and the basic abilities that each student brings to each subject will vary.

Based on Redish, (et.al, 2000), interest refers to preference to engage in some type of activities. An interest may regard as a highly specific type of attitude. When one is interested in a particular phenomenon or activity, he is favorably inclined to attend to it and give it time to it. Each student brings to the class a set of attitudes, beliefs, and assumptions about what sort of things he will learn, what skills will be acquired and what will be expected to do.

Magan (1999) states that to proceed at a job or a course of training, a person must have not only the aptitude required for it, but also a set of interest that will enable him to enjoy its various aspects. Interest as well as aptitude must therefore be considered in choosing a vocation and training to prepare for it.

Analytical skills refer to the ability to visualize, articulate, conceptualize or solve both complex and uncomplicated problems by making decisions that sensibly given the available information.

Consistent findings indicate that addressing academic problems becomes increasingly difficult the longer the problem goes untreated and as the content expectations become more demanding in later grades, so

early identification is the key (Chard, et. al. 2008). When a student's confidence increases, so will his or her achievement (Parsons, et. al. 2009).

According to Hans Niels Jahnke, "Analysis as an independent subject was created in the 17th century during scientific revolution. Kepler, Descartes, Fermat, Huygens, Newton and Leibniz to mention but a few important names, contributed to its genesis." As a formal concept, the method has variously been ascribed to Alhazer, Rene Descrates and Galileo Galilei. It has also been ascribed to Isaac Newton, in the practical method of physical discovery (which he did not name or formally describe).

Kranda (2008) investigated the link between students' accurate mathematical vocabulary understanding and their academic accomplishment, concentrating on word problem comprehension and the ability to apply proper mathematics language in word problem solving. The impact of vocabulary instruction for the understanding of mathematical concepts by student is researched by McConnell (2008). When students are explicitly taught to utilize mathematical language, they get a greater understanding of mathematical concepts and find it easier to solve word problems.

Vilenius-Tuohimaa, Aunola, and Nurma (2007) investigated "the interplay between mathematical word problem solving skills and reading comprehension" (p. 409). Their results suggested that the two skills were in fact interrelated, and they found "a strong correlation between all math word problem types and reading comprehension types" (Vilenius-Tuohimaa et al., 2007, p. 422).

The addition of language information, which forces children to develop a problem model, is the main difference between computation and problem solving. A word problem, unlike a computation problem, requires students to detect missing information in the text, create the number sentence, and deduce the calculation problem for finding the missing information. This obvious distinction would appear to change the task's nature, but no research has investigated how difficulty in one subdomain corresponds to difficulty in the other, or whether students' cognitive qualities changed depending on where the mathematics difficulty is located.

A related literature, on the other hand, focuses on the interaction between arithmetic and reading. Math difficulty is often characterized in this research using a broad measure that captures various aspects of performance, and then subgroups are constructed to see how performance on different math domains alters with or without concurrent reading difficulty. Research has shown that students with difficulty in both math and reading (usually defined in terms of word recognition) experience more pervasive deficits in computation and problem solving. This could be owing to a unique pattern of underlying domain-general ability deficiencies linked to comorbidity.

3. Research Questions

This study aimed to determine the effectiveness of the activity sheets in enhancing the performance of the students in solving mathematical word problems.

Specifically, it sought to answer the following questions.

1. What is the profile of the students in terms of:

1.1. Age,

1.2. Subject of Interest,

1.3. Sex/ gender?

2. What is the level of performance of the following students in the pre –test and post – test in solving mathematical word problem:

2.1. Controlled Group,

2.2. Experimental Group?

3. Is there a significant relationship between the students' profile and their levels of performance in solving mathematical problems?
4. Do activity sheets significantly affect the performance of the students in solving mathematical word problems?

4. Scope and Limitations

This study aimed to determine the effectiveness of the developed activity sheets to the level of performance in solving mathematical word problems.

The respondents consisted of sixty (66) selected Grade 7 students which consists of thirty-two (32) male and thirty-four (34) female students in Punta Integrated School. The activity sheets were given during the third quarter period to the students. These activity sheets were used by the students after it was evaluated by the group of teacher validators.

This study was conducted during the school year 2017 – 2018. The inclusion of the topics on problem solving involving angles and angle measure, polygons, and circles. The Activity Sheets were the researcher – made and will be used for pilot testing, further validity, and reliability.

5. Research Methodology

5.1. Sampling Technique

The selected Grade 7 students at Punta Integrated School were chosen as the respondents of this study. The students used the Activity Sheets in solving mathematical word problems. The samples were purposively taken for the convenient of the researcher especially in conducting his research study. The group comprised of sixty (66) students, thirty-three (33) students from the controlled group and thirty-three (33) students from the experimental group. Mathematics Teachers from secondary public schools Districts West I and II of the School Division of Calamba City were also purposively chosen as the respondents of the study for they were the ones to validate the Activity Sheets made by the researcher.

5.2. Data Collection

This research made used of two instruments, the teacher's made test. Instrument I is the 30-item test about word problems in Geometry. The test was divided into three parts: 10 – item test for comprehension, 10 – item tests for analysis and 10 – item tests for computational skills. Instrument II was the activity sheets given to the students to test their comprehension, analysis, and computational skills in solving mathematical word problems.

The developed Activity Sheets were already validated in terms of content validity and its effectiveness. A questionnaire was prepared by the researcher that were given to the Mathematics Teachers from Secondary Schools. It is composed of questions about the validation of Activity Sheets in terms of content, appropriateness, adaptability, usability/ utility and aesthetic value.

The instrument used to measure the performance of the students was a teacher-made test consisting of twenty (30) items (KR20=0.72) which appears to be reliable. This test was used for both pre-test and post-test.

The students utilized the developed activity sheets which covered some topics in Geometry 7. A 30 – item question for the pre-test were given to the group of students.

At the end of the testing period, the group of students was given their post-test where in the items were parallel to the pre-test measured the significant difference on their performance. The results of the post-test determined the effectiveness of the material.

5. 3. Ethical Issues

To address ethical considerations on this study, the researchers asked permission to conduct this study from the school head of the desired school. The researcher also asked the respondents' consent to participate in the study through a written letter and verbal consent. Anonymity of the respondents and the confidentiality of their scores and responses were kept confidential and private.

6. Results and Discussion

6.1. Dem

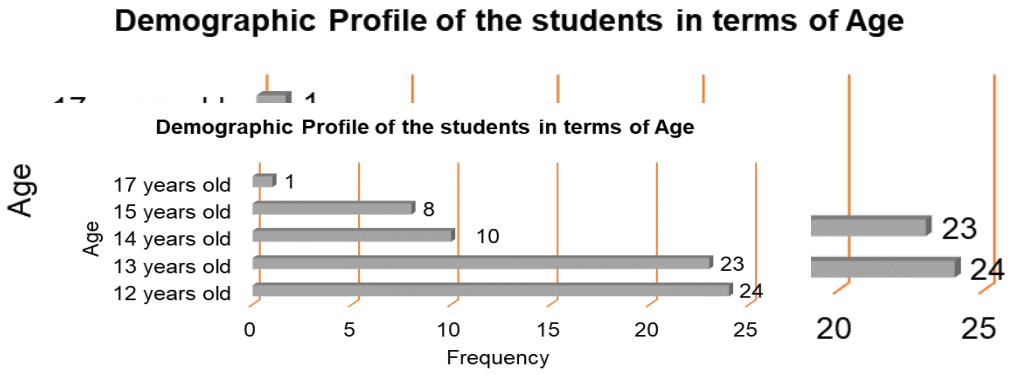

Figure 2. Demographic Profile of the students in terms of Age

The graph illustrates the answer to the problem number 1 on the profile of the students in terms of age. The number of students under 12 years old were 24, 23 students for 13 years old, 10 students for 14 years old, 8 students for 15 years old and 1 for 17 years old with the total frequency of sixty-six (66) students.

6.2. Demographic Profile of the students in terms of Gender.

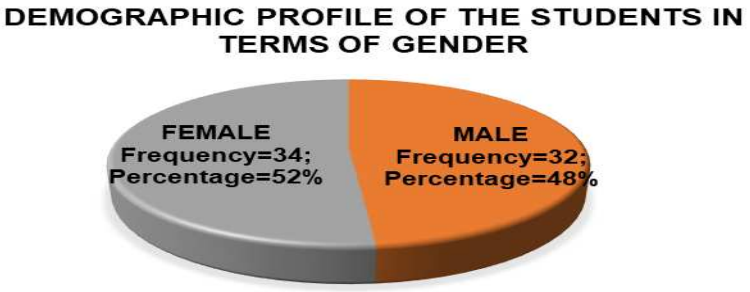

Figure 3. Demographic Profile of the students in terms of Gender.

The graph shows the answer to the problem number on the profile of the students' gender. There are thirty-two (32) male students with a total percentage of 48% and thirty-four (34) female students with the total percentage of 52%. The total number of students were sixty-six (66) with a total percentage of 100%

6.3. Demographic Profile of the students in terms of Subject Interest

The graph presents the demographic profile of the students in terms of Subject Interest.

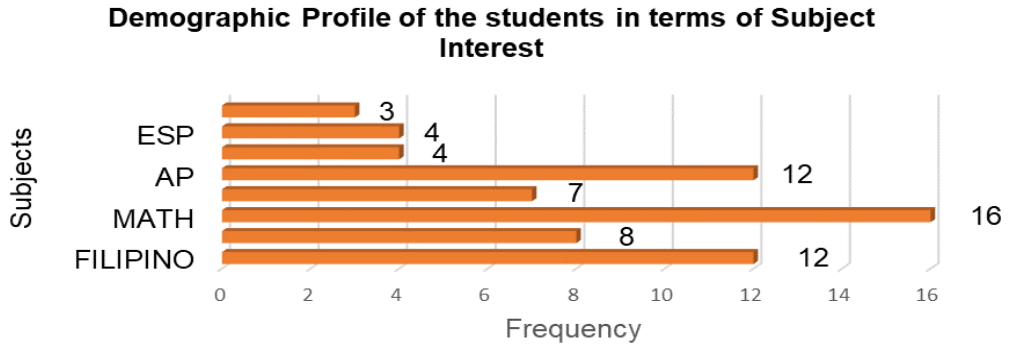

Figure 4. Demographic Profile of the students in terms of Subject Interest

The graph shows the answer to the problem number 1 on the students' profile in terms of subject Interest. There are 3 students who have interest in MAPEH, both 4 students for ESP and TLE, 12 students for Araling Panlipunan (AP), 7 students for science, 16 students for Mathematics, 8 students for English and lastly 12 students for Filipino with the total of sixty-six (66) student – respondents.

6.4. Difference between the Pre-test Scores of Controlled Group and Experimental Group in Solving Mathematical Word Problems

Table 2 shows the significant difference between the pre-test scores of controlled and experimental groups in solving mathematical word problems. It reflects that the difference between the pre-test score in control group (M = 12.24, SD = 3.12) and the pre-test score in experimental group (M = 12.18, SD = 5.38) statistically not significant since the t-value is 0.06 and the p-value is 0.96.

Table 2. Difference between the Pre-test Scores of Controlled Group and Experimental Group in Solving Mathematical Word Problems

Group	Test	Mean	SD	Mean Diff	t-value	p-value	Remarks
Controlled	Pre-test	12.24	3.12	0.06	0.06	0.96	Not significant
Experimental	Pre-test	12.18	5.38				

6.5. Difference between the Pre-test and Post-test Scores of Controlled Group in Solving Mathematical Word Problems

Table 3 shows the significant difference between the pre-test and post-test scores of the controlled group in solving mathematical word problems. The data shows that the scores in pre-test (M = 12.64, SD = 3.12) and post-test (M = 16.33, SD = 3.21) of the controlled group is statistically significant revealed by t-value of 6.33 and p-value of 0.000.

Table 3. Difference between the Pre-test and Post-test Scores of Controlled Group in Solving Mathematical Word Problems

Test	Mean	SD	Mean Diff	t-value	p-value	Remarks
Pre-test	12.64	3.12	-3.69	6.33	0.000	**Significant
Post-test	16.33	3.21				

**p<0.01

6.6. Difference between the Pre-test and Post-test Scores of Experimental Group in Solving Mathematical Word Problems

Table 4 shows the significant difference between the pre-test and post-test scores of the experimental group in solving mathematical word problems. The data shows that the scores in pre-test (M = 12.18, SD = 5.38) and post-test (M = 21.42, SD = 2.93) of the experimental group is statistically significant revealed by t-value of 12.73 and p-value of 0.000.

Table 4. Difference between the Pre-test and Post-test Scores of Experimental Group in Solving Mathematical Word Problems

Test	Mean	SD	Mean Diff	t-value	p-value	Remarks
Pre-test	12.18	5.38	-9.24	12.78	0.000	**Significant
Post-test	21.42	2.93				

**p<0.01

6.7. Difference between the Post-test Scores of Controlled Group and Experimental Group in Solving Mathematical Word Problems

Table 5 shows the significant difference between the post-test scores of controlled and experimental groups in solving mathematical word problems. It reflects that the difference between the post-test score in control group (M = 16.33, SD = 3.21) and the post-test score in experimental group (M = 21.42, SD = 2.98) is statistically significant revealed by the t-value of 6.66 and p-value of 0.000.

Table 5. Difference between the Post-test Scores of Controlled Group and Experimental Group in Solving Mathematical Word Problems

Group	Test	Mean	SD	Mean Diff	t-value	p-value	Remarks
Controlled	Post-test	16.33	3.21	-5.09	6.66	0.000	**Significant
Experimental	Post-test	21.42	2.98				

**p<0.01

6.8. Difference between the Pre-test and Post-test scores in the level of performance of the Controlled Group

Table 6 shows the significant difference between the pre-test and post-test scores in the level of performance of the controlled group in solving mathematical word problems. It shows that the analysis skill with t-value of -1.71 and p-value of 0.097 and the computational skill with t-value of -2.68 and p-value of 0.012 were both not significant in terms of the level of performance in solving mathematical word problems. The comprehension skill is statistically significant with t-value of 7.86 and p-value of 0.000.

Table 6. Difference between the Pre-test and Post-test scores in the level of performance of the Controlled Group

Level of Performance	Test	Mean	SD	Mean Diff	t-value	p-value	Remarks
Analysis	Pre-test	4.55	1.42	-0.57	-1.71	0.097	Not Significant
	Post-test	5.12	1.73				
Comprehension	Pre-test	3.55	1.77	-.2,87	7.86	0.000	**Significant
	Post-test	6.42	1.76				
Computational	Pre-test	4.15	1.42	-0.64	-2.68	0.012	Not Significant
	Post-test	4.79	1.34				

**p<0.01

6.9. Difference between the Pre-test and Post-test scores in the level of performance of the Experimental Group

Table 7 shows the significant difference between the pre-test and post-test scores in the level of performance of the experimental group in solving mathematical word problems. It shows that the analysis skill with t-value of 7.19 and p-value of 0.000, comprehension skill with t-value of 10.41 and p-value of 0.000 and the computational skill with t-value of 9.27 and p-value of 0.000 are both significant in terms of the level of performance in solving mathematical word problems.

Table 7. Difference between the Pre-test and Post-test scores in the level of performance of the Experimental Group

Level of Performance	Test	Mean	SD	Mean Diff	t-value	p-value	Remarks
Analysis	Pre-test	4.61	2.28	-2.33	7.19	0.000	**Significant
	Post-test	6.94	1.39				
Comprehension	Pre-test	3.70	2.14	-3.48	10.41	0.000	**Significant
	Post-test	7.18	1.48				
Computational	Pre-test	3.88	2.25	3.42	9.27	0.000	**Significant
	Post-test	7.30	1.16				

**p<0.01

6.10. Level of Performance of Controlled Group in Solving Mathematical Word Problem in terms of Pre-test and Post-test

Table 8 shows the level of performance of controlled group in solving mathematical word problem in terms of pre – test and post – test. It shows that the controlled group were able to get higher scores in the post – test than the pre – test as indicated with the level of their performance (24 – 30: pre-test = 0, post-test = 1) which is interpreted as “Outstanding”. (18 – 23: pre-test = 3, post-test = 12) interpreted as “Very Satisfactory”. (12 – 17: pre-test = 18, post-test = 20) interpreted as “Moderately Satisfactory”. (6 - 11: pre-test = 12, post-test = 0) interpreted as “Less Satisfactory”. No one in the controlled group were able to get scores under the range of 0 – 5 which is interpreted as “Not Satisfactory.”

Table 8. Level of Performance of Controlled Group in Solving Mathematical Word Problem in terms of Pre – test and Post – Test

Performance	Frequency		Interpretation
	Pre-test	Post-test	
24-30	0	1	Outstanding
18-23	3	12	Very Satisfactory
12-17	18	20	Moderately Satisfactory
6-11	12	0	Less Satisfactory
0-5	0	0	Not Satisfactory
Total	33	33	

6.11. Level of Performance of Experimental Group in Solving Mathematical Word Problem in terms of Pre-test and Post-test

Table 9 shows the level of performance of experimental group in solving mathematical word problem in terms of pre – test and post – test. It shows that the experimental group were able to get higher scores in the post – test than the pre – test as indicated with the level of their performance (24 – 30: pre-test = 2, post-test = 5) which is interpreted as “Outstanding”. (18-23: pre-test = 3, post-test = 27) interpreted as “Very Satisfactory”. (12 – 17: pre-test = 11, post-test = 1) interpreted as “Moderately Satisfactory”. (6 - 11: pre-test = 17, post-test = 0) interpreted as “Less Satisfactory”. No one in the experimental group were able to get scores under the range of 0 – 5 which is interpreted as “Not Satisfactory.”

Table 9. Level of Performance of Experimental Group in Solving Mathematical Word Problem in terms of Pre-test and Post-test

Performance	Frequency		Interpretation
	Pre-test	Post-test	
24-30	2	5	Outstanding
18-23	3	27	Very Satisfactory
12-17	11	1	Moderately Satisfactory
6-11	17	0	Less Satisfactory
0-5	0	0	Not Satisfactory
Total	33	33	

6.12. *Significant relationship between the students' profile and the* levels of performance in solving mathematical problems

Table 10 shows the significant relationship between the students' profile to the performance in solving mathematical problems. Data from this study indicates that there is very low and slight correlation between students' profile to the performance in solving mathematical problems. In a further analysis of the Pearson r product-moment correlation coefficient, it was found that there is significant relationship between the two variables. Thus, the null hypothesis that there is no significant relationship between the students' interest and the levels of performance in solving mathematical problems is rejected at 0.05 level of significance. This means that the gender, age, and subject of interest do relate to the performance of the students.

Table 10. Significant relationship between the students' profile and the levels of performance in solving mathematical problems

Student's Demographic Profile	Performance	Pearson product-moment correlation coefficient computed value	Interpretation
Gender	Pre-test Post-test	0.335	slight correlation, definite but small relationship
Age	Pre-test Post-test	0.201	very low correlation, almost negligible relationship
Subject Interest	Pre-test Post-test	0.181	very low correlation, almost negligible relationship

6.13. Significant difference between the performances of the students in solving mathematical word problems

Table 11 presents the significant difference between the students' performance in solving mathematical problems. In determining the difference between the performances of the students in solving mathematical problems, the data showed in table 10 were statistically treated using t-test assuming two unequal variances. The computed value of -5.249 for Experimental group in their pre-test and post-test is greater than the critical value of 1.998, based on the analysed data, it is significant difference disregarding its negative sign to the performance of the students.

Table 11. Significant difference between the performances of the students in solving mathematical word problems

Performance	T-test Assuming Two Unequal Variances Computed Value	T-test Assuming Two Unequal Variances Critical Value	Interpretation
Experimental Group	-5.249	1.998	Significant
Controlled Group	-8.667	2.010	Significant
Post-test	-6.735	1.998	Significant

7. Conclusions

Based on the findings and procedures done, the conclusions about the study were as follows.

1. There is a significant relationship between the students' profile and the levels of performance in solving mathematical problems. This means that the gender, age, and subject of interest relate to the performance of the students.

2. There is significant difference between the performances of the students. Hence, the activity sheets have not significantly affect the performance of the students in solving mathematical word problems was rejected.

8. Recommendations

Based on the findings and conclusions drawn, the following are hereby recommended:

1. Mathematics teachers should assess first the problem-solving skills of their students, then provide more insights of additional instructions and better teaching strategies that will help the students improve their mathematical problem – solving skills.
2. It is recommended too that the school board, schools administrators and Mathematics teachers prepare a regular monitoring plan on the performance of the students to maintain their satisfactory performance in Mathematics.
3. Mathematics experts may conduct further studies regarding the improvement of students' mathematical problem-solving skills.
4. Future researchers may perform similar studies that will give more improvement, variety of variables aside from what had been used in this study and innovations to increase more the performance of the learners.

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