

An Investigation of Grade 7 Learners' Performance and Engagement Level using Teaching through Problem Solving

Sittie Salwah V. Guro, Douglas A. Salazar, Joanrose Luib, Hassan Gandamra, Joy Magsayo
School of Graduate Studies, Department of Science and Mathematics Education, College of Education, MSU – Iligan Institute of Technology, Iligan City, Philippines, 9200

Corresponding Author: Sittiesalwah.guro@g.msuiit.edu.ph, douglas.salazar@g.msuiit.edu.ph, joanrose.luib@g.msuiit.edu.ph, Hassan.gandamra@g.msuiit.edu.ph, joy.magsayo@g.msuiit.edu.ph

Abstract—This study aimed to investigate the effectiveness of the Teaching through Problem Solving (TTP) method in improving Grade 7 students' performance and engagement level which can help improve in the teaching and learning process. The researcher implemented contextualized data organizational problems that reflect the local culture, environment, and issues of the participants. The researcher aim to assess how incorporating real-world problems into math lessons influences students' Performance and Engagement level. The study used a quasi-experimental design and supplemented through the interview in gathering information. Sixty-five (65) learners from one selected private secondary school of Marawi City in Lanao del Sur, Philippines were part in the study in two-week intervention. Learners' performance refers to the problem-solving test that was rated with validated rubric. In this study, the respondents were given a pre-test before the TTP class session and post-test after introducing the TTP method. Then the interview with selected students followed to gather insights regarding the TTP method in solving contextualized data organizational problems. The results of the study aimed to bring to light the significance of local context to learning outcomes through problem-solving strategies. It has been shown that the performance of the respondents in the pretest was failed and the performance in their posttest was passed. The general findings of the engagement level of the participants revealed that the teaching method enhance their problem solving skills as evidence by an over-all weighted mean of 3.63 with description of "Agree". Moreover, the respondents' general view on the class sessions with the use of TTP method was positive in which, according to them, the method would help them in solving statistical problems.

Keywords—Teaching through Problem-Solving (TTP), Performance, Engagement Level, Localized Statistical Problems.

I. INTRODUCTION

In the dynamic landscape of mathematics education, there is an urgent call for pedagogical approaches that not only improve student performance but also foster active engagement and meaningful learning experiences. Traditional lecture-based approaches typically emphasize rote procedures and passive reception of knowledge which can lead to slow learner particularly in mathematics. This is true for culturally diverse and resource-poor regions like Lanao del Sur where contextual, linguistic, and socioeconomic factors limit students' ability to learn effectively. To overcome these ailments, this study looks into the effects of Teaching Through Problem Solving (TTP) on the performance and engagement level of Grade 7 students particularly in the concept of data organization of Statistics. Teaching through problem solving is an instructional approach in which teachers use problem solving as a primary means to teach mathematical concepts and help students synthesize their mathematical knowledge Donaldson (2011), Hiebert & Wearne (2003) as cited by Donaldson (2011), Teaching through problem solving (TTP) is based on the premise that students develop, extend and enrich their understanding by solving problems. There are two main goals of teaching through problem solving: (a) for students to grow in their mathematical understanding and (b) for students to become better problem solvers. In this study, both problem-solving ability and engagement level of the Grade 7 learners will be desired outcomes.

This study primarily differs from the existing studies as emphasized on contextualized learning of data organizational problems that resonate within the learners' own context, cultural and community experience in Lanao del Sur. It highlights what is important to learners and can help validate their identity and lived experiences which in turn can increase enthusiasm and engagement with math.

Since the child is the centre of educative process, the purpose of the study is to show the effectiveness of TTP method to the students' ability to solve data organizational problems independently. Many studies on TTP focus on Mathematics in general but there is limited research on its effectiveness in teaching Statistics. This study will help to bridge the gap by applying TTP to contextualized data organizational problems. With this in mind, the researcher endeavoured to investigate whether this method is of great help in teaching. In particular, this study attempted to know if this could be an effective teaching method that supports the development of performance of the learners in solving data organizational problems. In addition, this paper aimed to investigate how localized data collection statistical Problems improve students' performance and their engagement levels in Statistics.

Objectives

The primary objective of this study is to determine the effectiveness of Teaching through Problem Solving (TTP) in improving Grade 7 learners' performance and engagement

level. Specifically, the study aims to answer the following research questions:

1. Determine the Performance level using contextualized data organizational problems of Grade 7 learners;
2. Determine the Engagement level using contextualized data organizational Problems of Grade 7 learners;
3. Compare the mean score difference in the Performance level between pre-test and post-test score of the students of Grade 7 learners; and
4. Gather learners' perception when working through problems after experiencing the method.

II. METHODOLOGY

This study is a mixed-methods quasi-experimental study (quantitative and qualitative data) assessing the effectiveness of TTP. The quantitative phase follows a pretest-posttest design while the qualitative phase is enhanced with interviews and observational data. Participants are Grade 7 students from one selected private secondary school in Lanao del Sur. Three sections are selected using the purposive sampling technique, based on availability and support of school administrators with a number of 65 learners.

The study was conducted during the fourth quarter of class 2024-2025. The development of the Achievement Test, Engagement Level Questionnaire, TTP Lesson Plans and the materials such as Engagement Level Observation Checklist and Interview Guide will be the stage of the study. To ensure content and construct validity of these instruments, instrument validation will be conducted by three (3) instrument validators who are experts in the field of Mathematics Education. These validators will assess the content, technicality, and other criteria necessary to produce flawless research instruments. Following the validation, the researcher inspired and modified the questionnaire items by the study of (Saga, 2024) and An adapted Engagement Level questionnaire from the study of (Lascona, 2022) in accordance with the corrections made by the panel of validators. Afterwards, the researcher asked permission from the one (1) high school principals to conduct pilot testing among twenty-one (21) Grade 8 students from one selected private secondary school in Marawi City, Lanao del Sur. The responses in the Achievement Test were processed and subjected to a reliability test. Microsoft Excel 2023 was used to compute the reliability test using Cronbach's Alpha. After the content validity and reliability testing, the researcher administered the main gathering procedures to the Grade 7 student participants. Statistical tests such as mean, frequency counts, percentage were used to describe and interpret the results of the pretest-posttest. A rating scale will be used to engagement level of the participants. In this case, a four-point Likert scaling is used to interpret the data gathered from the engagement level questionnaire.

III. DATA ANALYSIS

This chapter presents the findings and interpretations of the data analysis for both quantitative and qualitative data. The presentation follows the objectives. To display the study's results, tabular figures and textual formats were employed.

4.1 Quantitative Data Analysis

Table 1 shows the frequency distribution of the respondent's age from grade 7 learners. As seen in the table, most of the participants were 13 years old, which corresponds to 32 or 49.2% of the sample. There are 7 or 10.8% of them who were 12 years old, 20 or 30.8% were 14 years old and there are 6 or 9.2% were 15 years old, respectively.

TABLE 1. Distribution of the Participants' Age

Age	Frequency (f)	Percentage (%)
12 years old	7	10.8
13 years old	32	49.2
14 years old	20	30.8
15 years old	6	9.2
Total	65	100.0

Hence, based on the table majority of the participants is 13 years old which is in the right age for their grade level. This also implies that the participants may have the ability to apply concepts to specific examples and able to construct hypothetical solutions to a problem. This is also the stage where the participants starting to think more deeply and solve problems in a more logical way. They are also becoming more curious and open to interactive and hands-on learning making this age great match for the approach. They are also still adjusting which makes it meaningful to explore how they perform and engage in their learning during this time. Lupdag (2007), cited by lominog and basher 2019), stated that the age of the students is not only considered in terms of learning process of the students or respondents. Expectedly, participants are in the range of age where they can distinguish and understand mathematical concepts.

TABLE 2. Distribution of the Participants' Gender

Gender	Frequency (f)	Percentage (%)
Male	33	50.8
Female	32	49.2
Total	65	100.0

Table 2 shows frequency of the participants' age. As seen in this table, majority of the participants are male students. This corresponds to 33 or 50.8% of the sample while only 32 or 49.2% of them are female students.

This scenario can surprise anyone in the field of education because studies have already consistently shown that female students frequently dominate classrooms. But this time, studies show that male students dominate classroom. According to Carpenter, Jacobs Franke and Levi (1998), as cited by Brown and Kanyongo (2017), there are gender differences in problem solving strategies in which girls tended to employ "concrete solution strategies like modelling and counting, while boys tended to use more abstract solution strategies that reflected conceptual understanding" (Fennema and Carpenter, 1998). Moreover, Ganley and Lubienski (2016), as cited by Hadjinor and Pangandamun (2018), found that at both elementary and secondary levels, boys and girls score similarly on many state test and girls get relatively good grades in Math classes. Therefore, gender may affect the academic performance of the students in terms of learning.

Table 3 shows the frequency and percentage distribution of the participants' latest grade in Math. As shown, none of the participants had 72 below; 2 or 3.1% of the participants got 73, 76, 87, 88 and 93 latest grade; 4 or 6.2% of the participants got 75 latest grade; 5 or 7.7% of the participants got 77, 78, 80, 86 and 90 latest grade; 3 or 4.7% of the participants got 83; 1 or 1.5% of the participants got 81, 85, 89, 91 and 92 latest grade in math; 6 or 9.2% of the participants got 79, 82 and 84 latest grade in Mathematics. Majority of the participants had the average of 79, 82 and 84, which shows that the participants passed their previous Mathematics class. However, out of 65 participants there are 2 participants who had a grade of 73 and 4 participants had grade of 75. This may mean that they had learning difficulties. It could be due to personal reasons and teacher-related factors such as ineffective teaching strategies. Skemp (1971), as cited by Ponce and Amparo (2016), claimed that sufficient prerequisite of knowledge is necessary for a full understanding of Mathematics. When this is lacking, the student's ability to grasp new material is severely compromised. In such a case, when the individual does not understand mathematical concepts, he or she may just accept what teacher says without learning the deeper meaning of concepts. This often means rote memorization instead of deep understanding.

TABLE 3. Distribution of the Participants' Latest Grade in Mathematics

Grade	Frequency (f)	Percentage (%)
73	2	3.1
75	4	6.2
76	2	3.1
77	5	7.7
78	5	7.7
79	6	9.2
80	5	7.7
81	1	1.5
82	6	9.2
83	3	4.7
84	6	9.2
85	1	1.5
86	5	7.7
87	2	3.1
88	2	3.1
89	1	1.5
90	5	7.7
91	1	1.5
92	1	1.5
93	2	3.1
Total	65	100.0

Table 4 shows the participants' transmuted grade, frequency, percentage, mean score and qualitative description of the overall pre-test score. On the average, with a mean score of 6.78, the participants' pre-test score had a grade of equivalent of 68.75 which is described as failed. The result implies that most of the participants found mathematics difficult in terms of problem solving. The researcher believes that one of the reasons why the participants had low performance in the pre-test is that most of them also performed poorly or fairly satisfactory in their previous Mathematics subjects. This supports the claim of Lahoy, as cited by Basher and Lominog (2019), that a poor performance in Mathematics can be traced back to their previous lower level schooling. This could be due to the teacher who did not understand the basis for planning instruction.

Hence, teachers must expose their students to more realistic math problems.

Table 4. Mean of the Pre-test Scores of the Participants

Score	Transmuted Grade	Frequency	Percentage	Mean Score/Grade	Qualitative Description
2	55.00	1	1.5	6.78/68.75	Failed
3	57.50	6	9.2		
4	60.00	9	13.8		
5	62.50	6	9.2		
6	65.00	9	13.8		
7	67.50	9	13.8		
8	70.00	11	16.9		
9	72.50	4	6.2		
10	75.00	3	4.6		
11	77.50	2	3.1		
12	80.00	3	4.6		
13	82.50	2	3.1		
Total		65	100.0		

Scaling: 98 and above – Excellent 81-86 – Fair/Satisfactory
93-97 – Very Good 75-80 - Passing
87-92 – Good 74 and below – Failed

Furthermore, the results reveal that the students really need intervention to improve their performance in Mathematics. In this case, TTP could be of great help. The students are more likely to solve problems when they find out for themselves.

TABLE 5. Mean of the Post-test Scores of the Participants

Score	Transmuted Grade	Frequency	Percentage	Mean Score/Grade	Qualitative Description
3	57.50	1	1.5	10.63/75.19	Passed
5	62.50	1	1.5		
6	65.00	1	1.5		
7	67.50	6	9.2		
8	70.00	2	3.1		
9	72.50	10	15.4		
10	75.00	11	16.9		
11	77.50	10	15.4		
12	80.00	7	10.8		
13	82.50	8	12.3		
14	85.00	4	6.2		
16	90.00	3	4.6		
17	92.50	1	1.5		
Total		65	100.0		

Scaling: 98 and above – Excellent 81-86 – Fair/Satisfactory
93-97 – Very Good 75-80 - Passing
87-92 – Good 74 and below – Failed

Table 5 shows the participants' transmuted grade, frequency, percentage, mean score and qualitative description of the overall post-test score. The result shows that their average mean score is 10.63, equivalent of 75.19 described as passing.

The tables imply that all the participants passed the post-test. During the intervention, the researchers observed that the TTP approach helped improve their performance that they were inspired to solve mathematics problems because of the localized statistical problems. In relation to this, Niess (2005) discussed the importance of teaching mathematics and science and noted that regardless of how teachers first learned the specific content, they can teach the content in a different way than how it was learned.

Furthermore, learning content using TTP is different from learning to teach that content with the usual practice of teaching-learning process. Among the Sections, Obaidallah had the highest mean score both pre-intervention and post-

intervention of 8.09 and 12 mean score of the pretest and posttest. When the implementation is done correctly, researcher found the teaching approach helpful especially those who were performing at an average level (Obaidella Section). Overall, the scores of the participants in the pre-intervention are 6.78 and post-intervention score of 10.3 in the mean score indicates an improvement in their performance by around 3.85 on average. This TTP approach can help educators become more effective teachers and also allow students to modernize their learning experience. During the observation, teaching approach helps the students to cope up and learn more the better on how to analyze the Mathematical problem and it also helps them to their academic performance.

IV. CONCLUSION

The implementation of Teaching Through Problem Solving (TTP) particularly when combined with contextualized tasks has the potential to significantly improve both the performance and engagement level of Grade 7 learners in mathematics. By allowing students to explore and make sense of real-life problems, TTP encourages deeper understanding and interest in learning by supporting students to investigate and work through authentic problems. Therefore, as teachers seek for a more inclusive mathematics education, approaches such as TTP will be a critical consideration, particularly so when the content highlights the students own cultural and environmental contexts.

Hence, the Teaching through Problem Solving approach together with the relevant and contextualized scenarios is an effective strategy in the enhancement of academic performance and engagement of Grade 7 learners. This study recommends the In-Country Integration of Local Context or Relocation of Mathematics instruction to local contexts so that it becomes culturally relevant and culturally responsive especially with the rich cultural background of the people of Lanao del Sur.

V. RECOMMENDATION

Based on the findings, there are some key important implications need to attain for best result. These include the extension of the implementation beyond two weeks and future researchers may also explore the application of TTP across different grade levels to further validate its effect on learning.

ACKNOWLEDGEMENT

The researcher extends heartfelt gratitude to the following individuals whose support and contributions made the completion of this study possible. Their assistance was instrumental to this success.

To Department of Science and Technology – Science Education Institute (DOST-SEI) for the scholarship granted to her.

To her academic and thesis adviser for the invaluable support and expertise throughout the research.

Sincere thanks are also given to the instrument validators, school administrators, teachers, and Grade 7 students of the participating school in Marawi City for their cooperation.

To her family, friends, classmates and husband for their unwavering love, support, and prayers.

Above all, the Almighty God for the strength and guidance to complete this study

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