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Efforts to Improve Students' Problem Solving Abilities and Mathematical Disposition by Implementing the Problem Based Learning Model Assisted by PowerPoint-Based Interactive Learning Media

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Abstract

This research aims to determine the difference in improving problem-solving abilities and mathematical disposition of students who use the Problem Based Learning model assisted by PowerPoint-based interactive learning media and students who are given the application of conventional learning. The research method used is quantitative research in the form of a quasi-experiment. The data collection technique used in this research is using pretest and post test. Data analysis was carried out using parametric tests in the form of t-tests. The results of data analysis show that students' problem-solving abilities who use Problem Based Learning experience compared to students who take part in conventional learning is 62,55% to 43,5%. Apart from that, the increase in students' mathematical disposition for students who used the Problem Based Learning model compared with students who took part in conventional learning is 73,90% to 68,93%. This means that it can be concluded that there is a difference in the increase in problem-solving abilities and mathematical disposition of students who use the Problem Based Learning model assisted by PowerPoint-based interactive learning media and students who are given the application of conventional learning.

INTRODUCTION

Mathematical problem-solving ability is one of the main competencies that students must have. However, findings from several studies and surveys show that there are still many students who face difficulties in solving mathematical problems. Problem solving in the context of mathematics is the act of finding solutions to mathematical problems faced using the mathematical knowledge one has (Komariyah et al., 2018).

Students' mathematical disposition is one of the supporting factors for the development of students' mathematical problem-solving abilities. However, according to Dwinta and Karlimah (2018), there are still many students who have a low mathematical disposition. The National Council of Teachers of Mathematics (NCTM) defines mathematical disposition as a tendency to think and act positively to trigger interest and appreciation for mathematics (Muflihatusubriyah et al., 2021). From these problems, a

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more innovative and interactive learning approach is needed to improve students' abilities in solving mathematical problems and also a positive mathematical disposition.

Problem-based learning is an effective approach to improving students' mathematical problem-solving skills. Through this learning, students are invited to be actively involved in solving mathematical problems that are relevant to everyday life. This can develop students' critical and creative thinking skills (Lestari, 2021). The Problem Based Learning (PBL) model has been proven to be an effective learning model in improving students' problem-solving abilities. Problem-based learning is an innovative teaching approach where teachers encourage students to develop abilities in problem solving, creativity, and critical thinking abilities (Susilawati et al., 2017).

However, so that PBL implementation can achieve more optimal results, support from appropriate learning media is needed, one of which is the use of interactive learning media. Interactive multimedia refers to multimedia presentations that are designed to not only convey information messages but also interact with their users (Prasetyo, 2020). By applying the Problem-Based Learning model assisted by PowerPoint, it can influence students' mathematical problem-solving abilities by building a discussion and question-answer atmosphere in the classroom, which can help students become more active and dare to express their opinions, thus enhancing the learning process (Ananda, 2023).

Based on the problems described previously, it can be said that improving students' problem-solving abilities and mathematical disposition requires appropriate learning models and support from relevant learning media. Therefore, the author is interested in conducting research with the title "Efforts to Improve Students' Problem Solving Abilities and Mathematical Disposition by Implementing the Problem Based Learning Model Assisted by PowerPoint-Based Interactive Learning Media".

METHOD

This research uses a quantitative approach because it relies on data in the form of numbers that can be processed through statistical techniques. This approach is in line with Arikunto's perspective, which states that quantitative research involves the collection, interpretation, and analysis of numerical data (Shofiatul, 2022). This research is a type of quasi-experimental research using a non-equivalent control group design. The independent variable in this research is the application of the Problem-Based Learning Model assisted by PowerPoint-based interactive learning media. The dependent variable in this research is increasing students' problem-solving abilities and mathematical disposition.

The sampling technique applied in this research is Cluster Random Sampling, namely grouping based on region or location of the population because the research object has a very broad scope (Pulungan, 2018). The classes selected as research samples were class 7A with 25 students as a control class with conventional learning and 7B with 25 students as an experimental class with PBL learning assisted by PowerPoint-based interactive learning media.

The data collection technique used in this research is using pretest and post-test

instruments to measure students' mathematical problem-solving abilities as well as questionnaire instruments to measure students' mathematical dispositions. The data analysis used in this research is comparative parametric statistical data analysis because this research aims to compare two groups (Muhid, 2012). The data analysis was carried out using SPSS Statistics 24 for Windows software in the form of a t-test.

RESULTS

From the results of research carried out by researchers, data on students' problem-solving abilities and mathematical dispositions were obtained, both initial and final data. The following is the explanation.

1. Students' Mathematical Problem Solving Ability

Students' mathematical problem-solving abilities were obtained through pretest and posttest results in the two classes studied, namely the experimental class and the control class. The aspects studied are related to the achievement of indicators of students' mathematical problem-solving abilities, which include understanding problems, planning solutions, carrying out calculations, and checking again. A recapitulation of the results of each indicator of problem-solving ability in the pretest data can be seen in Table 1 below.

Table 1. Recapitulation of Achievements of Students' Mathematical Problem Solving Ability Indicators (Pretest)

Indicator	Achieved score (%)	
	Experimental Class	Control Class
Understand the problem	2,8	1,2
Plan a solution	46,6	49
Doing calculations	31,2	39,6
Check again	4	0,8
Average achievement	**21,15**	**22,65**

The pretest results of students' mathematical problem solving abilities in the experimental class and control class after the data were obtained obtained the average value, standard deviation, maximum and minimum values as follows.

Table 2. Recapitulation of Statistical Data on Students' Mathematical Problem Solving Ability (Pretest)

Statistics	Experimental Class	Control Class
N	25	25
Average	26,24	27,92
Standard Deviation	5,30	10,12
Minimum	16	10
Maximum	42	48

After being given a pretest, the two classes will be treated according to the provisions previously explained. Next, both classes were given a posttest to determine the increase in mathematical problem solving abilities. The following is a recapitulation of the results of each indicator of problem solving ability in the posttest data.

Table 3. Recapitulation of Achievements of Students' Mathematical Problem Solving Ability Indicators (Posttest)

Indicator	Achieved score (%)	
	Experimental Class	Control Class
Understand the problem	88	19,2
Plan a solution	75	80
Do calculations	65,6	70
Check again	21.6	4,8
Average achievement	**62,55**	**43,5**

The pretest results of students' mathematical problem solving abilities in the experimental class and control class after the data were obtained obtained the average value, standard deviation, maximum and minimum values as follows.

Table 4. Recapitulation of Statistical Data on Students' Mathematical Problem Solving Ability (Posttest)

Statistics	Experimental Class	Control Class
N	25	25
Average	65,04	50,8
Standard Deviation	14,57	9,29
Minimum	42	36
Maximum	86	80

The next step to be taken is to carry out a t-test. The results of the normality test and homogeneity test on mathematical problem-solving abilities stated that the sample data was normally distributed and not homogeneous. However, in the Independent Sample T-Test, a homogeneous sample is not an absolute requirement that must be met. So, even though the sample data is not homogeneous, you can still carry out a t-test, namely the Independent Sample T-Test. The results of the t-test calculations obtained a significance value of 0.000, which means <0.05. So it can be concluded that there is an increase in the mathematical problem-solving abilities of students who are given the Problem Based Learning model assisted by PowerPoint-based interactive learning media with students who are given the application of conventional learning.

2. Students' Mathematical Disposition

Students' mathematical disposition was obtained through the results of the initial and final questionnaire data in the two classes studied, namely the experimental class and the control class. The aspects studied are related to the achievement of students' mathematical disposition indicators which include, showing confidence in applying mathematics, being flexible in completing mathematical tasks, having perseverance & tenacity in completing mathematical tasks, showing curiosity in mathematics, introspecting mathematical thinking processes, appreciate the use of mathematics in various contexts, and recognize and appreciate the important role of mathematics. A recapitulation of the achievement results for each indicator of students' mathematical disposition in the initial questionnaire data can be seen in Table 5 below.

Table 1. Recapitulation of Achievement of Students' Mathematical Disposition Indicators (Initial Questionnaire)

Indikator	Achieved score (%)	
	Experimental Class	Control Class
Showing confidence in applying mathematics	68,67	65,17
Being flexible in completing mathematical tasks	66,83	68
Having perseverance & tenacity in completing mathematical tasks	65,13	65,13
Showing curiosity in mathematics	59,67	56,83
Introspecting mathematical thinking processes	68,83	70,33
Appreciate the use of mathematics in various contexts	69,75	75,25
Realize and appreciate the important role of mathematics	74	76
Average achievement	**67,55**	**68,10**

The results of the initial questionnaire on the mathematical disposition of students in the experimental class and control class after the data were obtained obtained the average value, standard deviation, maximum and minimum values as follows.

Table 2. Recapitulation of Student Mathematical Disposition Statistical Data (Initial Questionnaire)

Statistics	Experimental Class	Control Class
N	25	25
Average	107,2	107,52
Standard Deviation	12,19	5,69
Minimum	64	97
Maximum	124	117

After all students in both classes have taken the posttest, the next step is that both classes will be given a final questionnaire to determine the improvement in mathematical disposition. The following is a recapitulation of the results of achieving each mathematical disposition indicator in the final questionnaire data.

Table 3. Recapitulation of Achievement of Students' Mathematical Disposition Indicators (Final Questionnaire)

Indikator	Achieved score (%)	
	Experimental Class	Control Class
Showing confidence in applying mathematics	74,83	65,50
Being flexible in completing mathematical tasks	68,33	69
Having perseverance & tenacity in completing mathematical tasks	72	65,50
Showing curiosity in mathematics	62	57,33
Introspecting mathematical thinking processes	76,17	73,33

Appreciate the use of mathematics in various contexts	82	76,25
Realize and appreciate the important role of mathematics	82	75,75
Average achievement	**73,90**	**68,93**

The results of the final questionnaire on students' mathematical disposition in the experimental class and control class after the data were obtained obtained the average value, standard deviation, maximum and minimum values as follows.

Table 4. Recapitulation of Student Mathematical Disposition Statistical Data (Final Questionnaire)

Statistics	Experimental Class	Control Class
N	25	25
Average	116,8	108,88
Standard Deviation	6,71	7,11
Minimum	106	96
Maximum	130	124

The final step is to carry out data analysis using the t-test. The results of the normality test and homogeneity test on mathematical disposition stated that the sample data was normally distributed and homogeneous. The results of the t-test calculations obtained a significance value of 0.000, which means <0.05. So it can be concluded that there is an increase in the mathematical disposition of students who are given the Problem Based Learning model assisted by PowerPoint-based interactive learning media compared to students who are given the application of conventional learning.

DISCUSSION

The results of the findings above will be clarified in the following discussion regarding students' problem-solving abilities and mathematical dispositions. Following is the discussion.

1. Students' Mathematical Problem Solving Ability

Mathematical problem-solving abilities in the pretest data between the experimental class and the control class showed a very small difference in improvement. The control class that used conventional learning obtained a higher average achievement with the lowest level of achievement on the "Check again" (0.8%) and the highest on the "Plan a solution" indicator (49%). However, after being given treatment, the experimental class that applied the Problem Based Learning model showed a higher increase in mathematical problem solving abilities compared to the control class. The indicator with the highest level of achievement is "Understand the problem" (88%), while the indicator with the lowest level of achievement is "Check again" (21.6%).

Based on the explanation above regarding mathematical problem-solving abilities from pretest data (before being given treatment) and posttest (after being given treatment), it is always seen that the “Check again” indicator always gets the lowest score. This is due to the large number of students who do not do it. Some students were satisfied with the solutions they had obtained, so they did not feel the need to check

again in other ways. Maybe the student is just repeating a process that has been done before with more precision.

Similar results can also be seen from the average scores obtained from the two classes. The control class that used conventional learning excelled in the pretest data with an average score of 27.92. However, in the post-test data, the class that implemented the Problem Based Learning model assisted by PowerPoint-based interactive learning media obtained a higher average score than the control class with an average score of 65.04. Apart from that, the results of data analysis using the t-test with the help of SPSS software showed a significance value that was smaller than a ($0.000 < 0.05$), which indicated that there was a difference in improvement between the two classes.

2. Students' Mathematical Disposition

As with mathematical problem-solving abilities, the mathematical disposition in the initial questionnaire data between the experimental class and the control class also showed very small differences in improvement. Table 1 shows that the average achievement from the experimental class and control class is 67,55% to 68,10%. The control class that used conventional learning obtained the lowest achievement level on the indicator "Showing curiosity in mathematics" (56.83%) and the highest on the indicator "Realizing and appreciating the important role of mathematics" (76%). Table 3 shows that the average achievement from the experimental class and control class is 73,90% to 68,93%. After being given treatment, the experimental class that applied the Problem Based Learning model showed the indicator with the highest level of achievement is "Appreciate the use of mathematics in various contexts" (82%) and "Realize and appreciate the important role of mathematics" (82%), while the indicator with the lowest level of achievement is "Showing curiosity in mathematics" (62%).

From the explanation above regarding the mathematical disposition of the initial questionnaire data (before being given treatment) and the final questionnaire (after being given treatment), it is always seen that the indicator "Showing curiosity in mathematics" always gets the lowest score. This is caused by many students who are too confident or confident in the material or mathematical concepts they have, so that students' curiosity is very small.

Similar results can also be seen from the average scores obtained from the two classes. The control class that used conventional learning excelled in the initial questionnaire data with an average score of 107.52. However, in the final questionnaire data, the class that applied the Problem Based Learning model obtained a higher average score than the control class with an average score of 116.8. This conduct that Applying a Problem Based Learning (PBL) model with the help of PowerPoint media Can provide opportunities for students to more actively seek and investigate ways out of problems are given through systematic stages, so that students can Discover their knowledge, attitudes, and skills as a form of their learning results, Students' enthusiasm increased with the existence of PowerPoint, which displays videos and images that are more attractive and fit the material (Mudiana, 2021). Apart

from that, the results of hypothesis testing using the t-test with the help of SPSS software show a significance value that is smaller than a (0.000 < 0.05), which indicates that there is a difference in improvement between the two classes

CONCLUSION

The Problem Based Learning model is an application of learning that involves students in solving a problem, so that students can develop their knowledge and build self-confidence. Based on the results of research and discussions related to the application of the Problem Based Learning model assisted by PowerPoint-based interactive learning media in the One Variable Linear Equation material, two conclusions were obtained, namely that the increase in mathematical problem solving abilities achieved by students who used the Problem Based Learning model assisted by PowerPoint-based interactive learning media was greater. Significantly, compared to students who took part in conventional learning, the increase in mathematical disposition achieved by students who used the Problem-Based Learning model assisted by PowerPoint-based interactive learning media was better than students who took conventional learning

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