THE INFLUENCE OF THE PROBLEM-BASED LEARNING MODEL ON THE MATHEMATICS LEARNING ACHIEVEMENT IN RELATION AND FUNCTION MATERIAL OF GRADE X STUDENTS AT SMK NEGERI 1 TOMA

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Abstract

The specialist's point is to decide the impact of the Issue Put together Getting the hang of learning model with respect to the math learning accomplishment of class X understudies at SMK Negeri 1 Toma. This exploration utilizes quantitative strategies with a Semi Trial approach. Inspecting was done utilizing the Group Irregular Examining procedure, where the class was picked arbitrarily from every one of the populaces utilized by the scientist. There was likewise a complete exploration populace of 47. The classes picked by the specialists were the ATPH-X class with 18 understudies as the exploratory class and TKJ-X with 20 understudies as the control class. The instrument utilized is a test. The aftereffects of exploration information handling showed that the typical score for the trial class pretest was 45.48 and the control class was 41.00 and the exploratory class posttest was 78.61 and the control class was 61.75. Speculation testing utilizes the Free Examples Test where the Sig (2-followed) esteem is 0.000 < 0.05. It tends to be reasoned that there is a tremendous contrast in the Posttest of the two classes, implying that the Issue Based Getting the hang of learning model affects understudy learning accomplishment in relationship material and capability. This is impacted by understudies who assume a functioning part in tackling issues connected with regular day to day existence. The findings of this study ought to be taken into consideration by future researchers when choosing a learning model. They propose that: (1) the Problem Based Learning model becomes an alternative for teachers in order for students to maximize their learning outcomes, particularly with regard to the Relationship and Function material; (2) students are advised to improve their ability to understand the material through their knowledge of everyday life; and (3)

Keywords: Problem Based Learning Model; Learning Achievement; Relations And Functions

Abstrak

Maksudnya adalah untuk mengetahui pengaruh model pembelajaran Issue Dikumpulkan Pemahaman terhadap prestasi belajar matematika siswa kelas X di SMK Negeri 1 Toma. Eksplorasi ini menggunakan strategi kuantitatif dengan pendekatan Semi Trial. Inspeksi dilakukan dengan menggunakan prosedur Pemeriksaan Tidak Teratur Kelompok, di mana kelas dipilih secara sewenang-wenang dari setiap populasi yang digunakan oleh ilmuwan. Populasi eksplorasi juga berjumlah 47

orang. Kelas yang dipilih oleh para ahli adalah kelas ATPH-X dengan 18 siswa sebagai kelas eksplorasi dan TKJ-X dengan 20 siswa sebagai kelas kontrol. Instrumen yang digunakan adalah tes. Hasil akhir penanganan informasi eksplorasi menunjukkan nilai tipikal pretest kelas trial sebesar 45,48 dan kelas kontrol sebesar 41,00 serta posttest kelas eksplorasi sebesar 78,61 dan kelas kontrol sebesar 61,75. Pengujian spekulasi menggunakan Uji Contoh Bebas dimana nilai Sig (diikuti 2) sebesar 0,000 < 0,05. Hal ini dimungkinkan karena terdapat perbedaan yang sangat besar pada hasil Posttest kedua kelas, yang berarti bahwa model pembelajaran Issue Based Getting pemahaman mempengaruhi prestasi belajar siswa pada materi dan kemampuan hubungan. Hal ini dipengaruhi oleh siswa yang berperan aktif dalam mengatasi permasalahan yang berkaitan dengan kehidupan sehari-hari. Temuan penelitian ini hendaknya menjadi bahan pertimbangan bagi peneliti selanjutnya ketika memilih model pembelajaran. Mereka mengusulkan agar: (1) model Problem Based Learning menjadi salah satu alternatif bagi guru agar hasil belajar siswa dapat maksimal, khususnya pada materi Hubungan dan Fungsi; (2) siswa disarankan untuk meningkatkan kemampuan memahami materi melalui pengetahuan kehidupan sehari-hari; dan (3)

Kata Kunci: Model Pembelajaran Problem Based Learning; Prestasi Belajar; Relasi Dan Fungsi

A. Introduction

Mathematics is a mandatory part of the curriculum in vocational schools (SMK) aimed at developing students' academic abilities. According to the Ministry of Education and Culture (2022:133) in the content standards, "mathematics is a science that studies or trains logical thinking, which is important for human life in developing modern technology." Mathematics is considered a subject that not only needs to be understood but also serves as a tool for redesigning concepts, honing, and training the thinking skills necessary to solve problems in daily life.

The goal of the mathematics subject is to prepare students to appreciate the relevance of mathematics in everyday life. This includes the ability to relate mathematics learning to facts, concepts, principles, operations, and mathematical relationships. Moreover, learning mathematics also functions to train students' brains and develop analytical skills in problem-solving.

At SMK Negeri 1 Toma, various teaching models are used in mathematics instruction by teachers, one of which is the conventional model or lecture method. In this model, students are not encouraged to be active or think creatively in finding solutions to the problems being taught. As a result, students may become lazy learners because teachers do not employ effective teaching methods that make mathematics more appealing.

Therefore, the teaching model used by teachers significantly impacts students' learning achievements. Teachers can implement various teaching models to cultivate students' interest in learning and prevent them from being lazy in studying

mathematics. Improving students' mathematics achievement also involves developing their skills in understanding problems, solving questions, and interpreting solutions. In every instance, mathematics instruction aims to assess how well students can solve problems and master mathematical concepts while actively engaging in mathematical problem-solving.

The teaching model applied by teachers at SMK Negeri 1 Toma is conventional, where the learning is centered on the teacher, and the teacher controls most of the instructional presentation, which can also be referred to as the lecture method. In this model, students are not active in the learning process, leading to ineffective understanding when working on mathematical problems, especially in the topics of Relations and Functions. Furthermore, teachers do not provide freedom for students to think creatively and seek solutions to problems, resulting in a less varied classroom atmosphere and less student engagement during the learning process.

In addition to the observations described above, the researcher also collected supporting data by reviewing students' test answer sheets as follows:

Figure 1. Student Test Answer Sheet
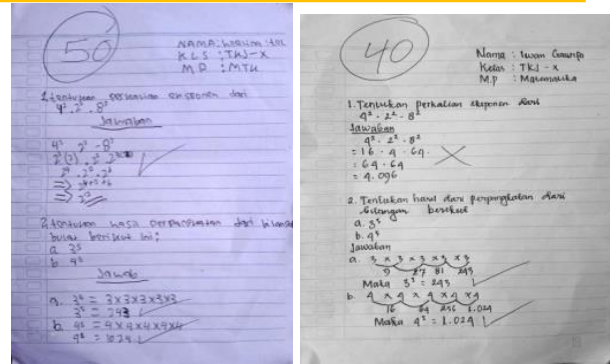
Source: Researcher 2023

Based on the test results above, the researcher found that the average score of the students was 33.33. Therefore, the researcher suspects that the learning outcomes are still low due to the teacher not using the appropriate teaching model, which leads to suboptimal mathematics achievement. To address this issue, the researcher hypothesizes that the Problem-Based Learning (PBL) model could be a solution to the challenges faced by the students.

The Problem-Based Learning (PBL) model is an approach where students actively engage in seeking solutions to given problems. Through this approach, it is hoped that students can learn about knowledge related to the issues they encounter and develop problem-solving skills. PBL aims to apply real-world problem contexts as a framework for students to hone their critical thinking skills and gain the ability to solve problems. According to Rusman (2015:112), "The Problem-Based Learning model uses real (authentic), unstructured, and open-ended

problems as the context for students to develop skills and build new knowledge."

The Problem-Based Learning model has characteristics such as starting the learning process with problem presentation, usually involving issues related to real-world contexts, and promoting group learning where students actively formulate problems and provide solutions. In this context of Problem-Based Learning, the researcher is particularly interested in examining how students' learning achievements in mathematics, especially in the topics of Relations and Functions, are impacted.

From the issues mentioned, the researcher found that although some teachers at SMK Negeri 1 Toma have implemented innovative teaching models, such as realistic mathematics education, the application has not been optimal. Therefore, to assist students in better understanding mathematical concepts, there is a need to explore alternative innovative teaching models that can create more engaging, effective, and efficient learning experiences, thereby enhancing student interest in the learning process.

B. Research Methods

The approach of this research is quantitative. According to Sugiyono (2018:13), "the quantitative approach is a positivist-based research method that uses concrete data in the form of numbers to be analyzed using statistics as a calculation tool." This type of research is a quasi-experiment. According to Sugiyono (2016:144), "the quasi-experimental design has a control group but cannot fully control external variables that may affect the implementation of the experiment."

This research divides the classes into two groups: the experimental class using the Problem-Based Learning model and the control class using the lecture method. The implementation of the teaching model in both classes is conducted by the researcher themselves as the teacher, with the aim of generating data for the study.

Table 1. Research Design

Class	Pre-Test	Treatment	Post-Test
Experiment (E)	$Q_{1(E)}$	X(E)	$Q_{2(E)}$
Control (K)	$Q_{3(K)}$	-	$Q_{3(K)}$

Explanation:

X = experimental class that receives treatment with the Problem-Based Learning model

Q_1 = administration of the pre-test in the experimental class

Q_2 = administration of the post-test in the experimental class

Q_3 = administration of the pre-test in the control class

Q_4 = administration of the post-test in the control class

The population in this study consists of all Grade X students at SMK Negeri 1 Toma.

Table 2. Condition of Grade X Students at SMK Negeri 1 Toma Academic Year 2023/2024

No	Class	Gender		Total
		Male	Female	
1	ATPH X	8	10	18
2	TKJ X	6	14	20
3	OTKP X	1	8	9
	Jumlah			47

Source: Administrative Office of SMK Negeri 1 Toma

Based on the data obtained by the researcher, there are 3 Grade X classes at SMK Negeri 1 Toma. Therefore, the researcher used the entire population as the sample for the study by employing the Cluster Random Sampling technique. In this method, classes are randomly selected from the entire population used by the researcher. Thus, the classes selected through Cluster Random Sampling are designated as the experimental and control classes.

The data collection tools used by the researcher are:

1 **Pre-Test** The pre-test is administered to both sample groups in the form of an essay test consisting of 5 questions. The purpose of the pre-test is to evaluate the normality and homogeneity levels between the two classes that are the subjects of the research.

2 **Post-Test** The post-test is the final evaluation conducted on both groups, including the experimental and control groups, after the activities have concluded. This post-test consists of 5 essay questions.

Validity Test

Table 3. Interpretation of Data Processing for Validity Test Results of the Post-Test Trial

Item Question	Sig.(2-tiled)	Description
(1)	0,039	Accepted
(2)	0,001	Accepted
(3)	0,000	Accepted
(4)	0,000	Accepted
(5)	0,013	Accepted

Source: Results of Data Processing for Research Instrument Trial 2024

Based on the results of the validity test calculations for the post-test above, the Sig. (2-tailed) values are less than the significance level of 0.05. Therefore, it can be concluded that the test items numbered 1 to 5 are valid.

Reliability Test

Based on the reliability analysis of the pre-test and post-test trials using SPSS Version 25, the results are interpreted as follows:

Table 4 Reliability Test Results of the Pre-Test Trial

Reliability Statistics	
Cronbach's Alpha	N Of Items

.739	5	

Source: Results of Data Processing from the Research Instrument Trial 2024

From the reliability calculation results above, a Cronbach's Alpha value of 0.739 was obtained for the initial test trial. This value indicates that the initial test is considered reliable, as it exceeds the acceptable reliability standard of 0.60.

Table 5. Reliability Test Results of the Final Test Trial

Reliability Statistics	
Cronbach's Alpha	N Of Items
.751	5

Source: Results of Data Processing from the Research Instrument Trial 2024.

rom the reliability calculation results above, it is known that the Cronbach's Alpha value for the final test trial is 0.751. This indicates that the final test is considered reliable, as it exceeds the acceptable reliability standard of 0.60.

Difficulty Level of the Test

Based on data analysis using SPSS Version 25 to measure the difficulty level of the initial and final tests, the results are as follows:

Table 6 Interpretation Of Data Processing For Difficulty Level Results Of The Initial Test Trial (Pretest)

Item Number	Difficulty Level	Description
(1)	0,47	Medium
(2)	0,80	Easy
(3)	0,55	Normal
(4)	0,5	Normal
(5)	0,22	Difficult

Source: Results of the Data Processing of the Research Instrument Trial 2024.

Based on Table 6, according to the difficulty level criteria from SPSS, there is one easy question, three medium questions, and one difficult question.

Table 7 Interpretation of Data Processing on Difficulty Levels from the Final Test (Posttest) Trial Results.

Item Number	**Difficulty Level**	Description
(1)	0,48	Medium
(2)	0,76	Easy
(3)	0,56	Normal
(4)	0,48	Normal
(5)	0,26	Difficult

Research 2024

From Table 7 above, according to the SPSS criteria for difficulty levels, there is one easy question, three medium questions, and one difficult question.

Sumber: Hasil Pengolahan Data Uji Coba Instrumen

Discrimination Power

Based on data analysis using the discrimination power test from the results of the pretest and posttest trials with SPSS

Version 25, the following results were obtained:

Table 8 Interpretation of Data Processing on Discrimination Power Test Results of the Pretest Trial.

Item Number	Pearson Correlation	Description
(1)	0,49	Good Question
(2)	0,66	Good Question
(3)	0,71	Good Question
(4)	0,74	Good Question
(5)	0,44	Good Question

Based on the results of the discrimination power test calculations from the pretest above, according to the SPSS discrimination power criteria, it can be concluded that items number 1 to 5 on the test are categorized as good questions.

Table 9. Discrimination Power Data Results of the Posttest Trial.

Item Number	*Pearson Correlation*	Description
(1)	0,46	Good Question
(2)	0,69	Good Question
(3)	0,81	Good Question
(4)	0,75	Good Question
(5)	0,54	Good Question

From the results of the discrimination power test calculations from the posttest above, according to the SPSS discrimination power criteria, it can be concluded that items number 1 to 5 on the test are categorized as good questions.

C. Research Results and Discussion

Average X, SD, and Variance of the Pretest for Experimental and Control Classes

After analyzing the final test data for the experimental and control groups using SPSS Version 25, the following results were obtained:

Table 10. Average, Standard Deviation, and Variance of the Pretest for Experimental and Control Classes

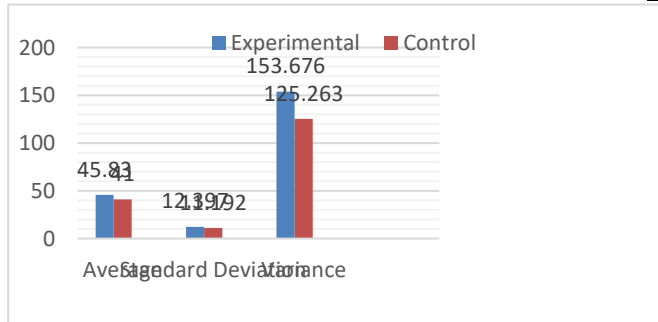| Statistics		
Result	Class	
	Eksperimental	Control
N	18	20
Result	45,83	41,00
Standard Deviation	12,397	11,192
Variance	153,676	125,263

Source: SPSS Version 25.

Figure 1

Diagram of Average, Standard Deviation,

and Variance of the Pretest
for Experimental and Control Classes.

From the data, the average score for the experimental class in the pretest is 45.83, while for the control class it is 41.00. The standard deviation for the experimental class is 12.397, whereas for the control class it is 11.192. The variance for the experimental class is 153.676, and for the control class, it is 125.263.

Average, Standard Deviation, and Variance of the Posttest for Experimental and Control Classes

Based on the analysis of the posttest data for the experimental and control classes using SPSS Version 25, the following results were obtained:

Table 11

Average, Standard Deviation, and Variance of the Posttest
for Experimental and Control Classes.

Statistcs		
Result	Class	
	Eksperimental	Control
N	18	20
Result	78.61	61.75

Standard Deviation	10.545	9.904
Variance	111.193	98.092

From the data, the average score for the experimental class in the final test is 78.61, while the control class averages 61.75. The standard deviation for the experimental class is 10.545, and for the control class, it is 9.904. The variance for the experimental class is 111.193, and for the control class, it is 98.092

Normality Test

Based on the results of the initial and final test analysis for the experimental and control classes using the Kolmogorov-Smirnov test with SPSS Version 25.

Based on the table above, it can be seen that the significance value (sig.) for the initial test in the experimental and control classes is 0.200. This value is greater than the significance level of 0.05, indicating that both classes have a normal distribution.

Based on Table 12 above, the significance value (sig.) for the final test in the experimental and control classes is also 0.200, where the sig. value is greater than

the significance level of 0.05. This indicates that both classes are normally distributed.

1   **Homogeneity Test**

Based on the output from the final test data for the experimental and control classes using the variance homogeneity test with SPSS Version 25, the following output was obtained: It is known that the significance value (sig.) Based on Mean is 0.754, which is greater than the significance level of 0.05. This indicates that there is no significant difference between the groups (homogeneous). Furthermore, the significance value (sig.) Based on Mean is 0.645, which is also greater than the significance level of 0.05. This shows that there is no significant difference between the groups, allowing us to conclude that the groups are homogeneous.

2   **Hypothesis Testing**

Based on the obtained mean and standard deviation of the post-test (final test), the hypothesis testing was conducted using a t-test with SPSS Version 25.

Table 12. Hypothesis Test Results

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	sig	t	df	*Sig.*(2-tailed)
Prestasi Belajar	Equal variances assumed	.216	.645	5.082	36	.000
	Equal variances not assumed			5.065	34.981	.000

Source: SPSS Version 25 Output

Based on the output from SPSS Version 25 in Table 12 presented above, it is known that the significance value (sig.) (2-tailed) is 0.000. This sig. value is lower than the significance level of 0.05. Therefore, the alternative hypothesis (H_a) is accepted, and the null hypothesis (H_o) is rejected. Thus, it can be concluded that there is an effect of the Problem Based Learning model on the mathematics learning achievement of Class X students in the material of Relations and Functions at SMK Negeri 1 Toma.

Here's the translation of your text into English:

Research Findings

The findings obtained by the researcher during the implementation of the Problem-Based Learning (PBL) model are as follows:

a) Students find it easier to understand the mathematical problems presented, as the learning is based on real-life issues.

b) There is an improvement in students' understanding when solving mathematics problems related to everyday life.

Students feel more comfortable expressing their opinions to provide solutions to the existing problems, which creates a more effective classroom atmosphere. During group learning, students also interact with each other to solve the problems posed by the teacher related to Relations and Functions, and they find it easier to complete the exercises in the student worksheets (LKS) and the final test, although there are still some questions that they cannot solve well.

The researcher also encountered several challenges while using the Problem-Based Learning model, including:

a) Some students are reluctant to engage in group discovery activities.

b) It is difficult to reach a consensus within the group, making it challenging to divide tasks and determine solutions for the questions in the LKS.

c) The PBL model requires a significant amount of time to implement

d) To address these weaknesses, the researcher undertook several actions, including:

e) Monitoring, guiding, and directing students during group discussions to ensure all group members actively participate in solving the existing problems.

Utilizing time as effectively as possible during learning to avoid prolonged sessions, ensuring that the learning objectives can be achieved comprehensively.

Discussion

This study aims to determine the effect of the Problem-Based Learning model on the mathematics learning achievement of tenth-grade students at SMK Negeri 1 Toma, specifically on the topic of Relations and Functions. The Problem-Based Learning model in the experimental class began with a review of previous materials related to Relations and Functions. Following this, the learning objectives and information about the material to be studied were communicated to help students understand the goals to be achieved. The teacher then posed real-life problems related to the topic of Relations and Functions, which were solved collaboratively.

The next step involved asking students to solve the problems presented in the LKS through group discussions and prepare a report of their group's work, which they would then present in front of the class. This was done to help students become accustomed to articulating their ideas or opinions in order to find solutions to the problems posed by the teacher. This

approach is supported by Tan in Rusman (2012:229), who states that "Problem-based learning is an innovation in education because, in PBL, students' thinking skills are truly optimized through a systematic group or team process, allowing them to empower, hone, test, and develop their thinking abilities continuously."

D. Conclusion

Based on the data analysis results presented in Chapter IV, it was found that the average Posttest score for the experimental class was 78.61, while the control class had an average of 61.75. The results of the hypothesis test using the Independent-Samples T Test indicated that the significance value (sig.) (2-tailed) was 0.000, which is less than 0.05. This shows that there is a statistically significant difference between the Posttest scores of the two classes. Therefore, it can be concluded that the Problem Based Learning (PBL) model has an impact on the mathematics learning achievement regarding relations and functions for 10th-grade students at SMK Negeri 1 Toma. Consequently, the alternative hypothesis (Ha) is accepted and the null hypothesis (Ho) is rejected.

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