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# Differences in Learning Outcomes of Students' Two-Variable Linear Equation System in View of the Application of the Learning Model

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**Abstract:** In the focus of the discussion of Linear Equation of Two Modes, this study intends to examine the differences in learning outcomes between students who follow learning with direct method (DI) and students who follow learning with problem-based method (PBL). This study used a semi-exploratory method involving MTs Nurur Rohmah students who were divided into control and experimental groups with 20 students each. The control group was taught with PBL model, while the experimental group was taught with DI model. Data were collected through a learning outcome test (posttest) given to students in both classes. Both groups had non-normally distributed data when tested for normality of posttest data. Mann-Whitney test showed that the learning achievement. The ability to solve the Two-Variable Linear Equation System of students who learned with the Problem-Based Learning method was overall better than students who learned with the direct learning method.

**Keywords:** implementasi, model problem based learning (PBL), model direct instruction (DI), sistem persamaan linear dua variabel

## INTRODUCTION

Education is something that is so crucial in the life of the nation and an absolute necessity that must be pursued for its development. Hamalik stated that education is a method to influence students so that they can change themselves, so that they become more useful for community life (Permasih, 2021). Mathematics is an important part of various fields of science that must be mastered before education can be carried out. According to Zega (2020), Mathematics plays a very important role in routine life, such as sharpening rational, structured, innovative reasoning skills and expertise to build solutions to mathematical problems so that it must be studied and understood by students in all educational institutions.

Unfortunately, currently, many students face difficulties in understanding mathematics lessons. According to Hesni (2020) Most students today do not feel happy with mathematics lessons because they think that mathematics is a difficult field of study to understand. Common reasons that make someone have difficulty learning mathematics include interest and enthusiasm for learning, teachers, the surrounding environment, social influences, and subject matter. (Audina & Dewi, 2021). As a result, the average student's learning achievement does not reach the standards set by the Minimum Completion Criteria (KKM). Learning objectives, according to Jenkins and Unwin, are statements that describe the skills that students are expected to master after following the learning process (Nur Nahdiyatin, 2016).

Lecturers as educators play a role in designing and implementing the teaching and learning process (Ali, 2022). Therefore, teachers are encouraged to help students overcome the obstacles they encounter so that they are more active in the learning process. However, some teachers still rely on traditional learning methods with lectures, resulting in students becoming passive. Based on observations of Class VIII MTs Nurur Rohmah, the learning achievements achieved by the majority of students have not reached the minimum standard score set by the school, which is seventy, so that the results obtained are less than satisfactory. Interpretation of the Two Variable Linear

Equation System (SPLDV) is the main cause of students' low average scores. This occurs due to the implementation of a learning system that is less appropriate to improve student activity. To improve the activity and performance of students' mathematics learning, both individually and in groups, it is highly recommended to use an educational methodology that focuses on strategies for overcoming difficulties.

One of the teaching concepts that focuses on problem solving is the Problem-Based Learning (PBL) approach. This method is a strategy where students learn to become active learners to overcome complex difficulties in realistic situations. Based on research by Suswati Umi (2021), the project-based learning method has the potential to improve student achievement in the cognitive, affective, and psychomotor domains. Meanwhile, research by Hasrul Bakri states that PBL allows students to solve life problems through the process of discovery, learning, and independent thinking. (Nurun Nafiah & Suyanto, 2017). According to Duch, the problem-based learning method is an educational strategy that relies on realistic scenarios so that students have critical thinking skills, problem-solving skills, and in-depth knowledge (Rahmawati et al., 2020). According to Kurniasih (2014: 40) the problem-centered teaching method is a learning approach that presents various real-world issues experienced by students and inherently stimulates their learning process. Through PBL students gain experience, face real-world problems and focus on communication, collaboration and utilizing available materials to form ideas and improve reasoning skills.

The characteristics of the PBL learning model according to Dirgatama are (1) Learning is student-centered, meaning that education focuses on students (2) The learning process takes place in small groups, students form discussion groups, (3) Educators or teachers act as guides and discussion leaders, (4) Focus on problems and provide methods to improve problem solving skills, (5) Current knowledge can be accessed through independent learning or self-directed learning (Diniati, 2022).

The PBL model also has advantages and disadvantages. According to Putra, the advantages of the PBL model are that students can solve difficulties, gain understanding and understand concepts thoroughly, train students' independence and maturity, and improve students' work abilities both individually and together, this is equivalent to problem-solving abilities. (Anggraeni et al., 2022). Some of the weaknesses of the PBL model are as follows: (1) This technique is not suitable for all subject matter, (2) There is a high level of similarity in student abilities in a class, making it difficult to divide existing tasks, (3) Requires a long learning time, (4) Requires teacher ability to motivate students to collaborate effectively in groups (Dirgatama et al., 2016).

Based on the discussion above, the PBL model is expected to be a noble alternative. Several studies examining the PBL approach include a study conducted by which found that the learning achievement of students guided by the PBL approach showed more significant learning progress compared to traditional learning methods. Likewise, a study conducted by Apriyani et al (2018) also found that the use of the PBL approach and the application of the expository method resulted in significant differences in the average learning achievement of students based on t-test testing for average differences.

This encourages analysts to apply the Issue Based Learning (PBL) technique and compare it with the Immediate Educating (DI) method in dealing with the Two Factor Straight Condition Framework (SPLDV) learning. Therefore, this exploration focuses on the differences in SPLDV learning outcomes of students at MTs Nurur Rohmah which are displayed by Applying the Problem Based Learning (PBL) model and presenting students through the Individual Learning (DI) model.

## **METHOD**

This analysis is a comparative study with a quasi-experimental method. The approach applied in this study examines learning outcomes evaluated using multiple-

choice and essay tests, which have been validated by teachers and supervisors before being used. Furthermore, the average academic scores of students who are provided with the PBL approach (experimental group) and those taught with the DI technique (comparison group) with SPLDV material are calculated.

After running the test, the next step is to analyze and use a hypothesis test in the form of a test of the difference in the mean values of the two unpaired groups, namely using the t-test if the information collected is evenly distributed or apply the Mann-Whitney test if the data obtained does not follow a normal distribution. Before conducting the hypothesis test, we conduct a check on the normality and uniformity of the initial data. The normal distribution check is carried out using the Liliefors test and the uniformity test is carried out using the Fisher test (Lolombulan, 2017).

## RESULT AND DISCUSSION

The study of information from the final lesson evaluation (SPLDV) in Group VIII-A as the experimental group and class VIII-B as the comparison group at MTs Nurur Rohmah, involving a total of 56 students with each class containing 20 students, is presented below.

Table 1. Statistical Value of Posttest Data

No.	Statistics	grades in class	
		experiment	control
1.	Minimum Score	60	50
2.	Maximum Score	95	80
3.	Amount	2450	1900
4.	Average	80	70
5.	Standard deviation	7,90	8,90
6.	Variance	63,60	80,40

Looking at Table 2, we can see that the average value of the posttest data of the experimental group is 80 with the lowest score of 60 and the peak point of 95. While the average score of the posttest data of the control group is 70, with the lowest score of 50 and the highest score of 80. The final exam data in the experimental class is more varied compared to the control group. This is indicated by the variance values in both classes, where the variance of the data in the Trial Group is 63.60 while in the comparison group it is 80.40. Based on the calculation of variance, the standard deviation of the Average value of the test group is 7.90 and the control group is 8.90.

The first thing to check to test the hypothesis is to check the prerequisites of the analysis. These prerequisites include testing the normal distribution of data with the Liliefors test at a significance level of less than 0.05. The consequences of the fairness of the posttest information investigation from exploratory collection show a score of  $L_{(count)} = 0.20$  and  $L_{(table)} = 0.1640$ . Because  $L_{(count)} > L_{(table)}$ , the posttest information of the trial group comes from a community that is not routinely conveyed. Meanwhile, the regularity test of the posttest information of the benchmark group shows a score of  $L_{(count)} = 0.15$  and  $L_{(table)} = 0.1640$ . Because  $L_{(count)} > L_{(table)}$ , the posttest information of the reference group comes from a community that is not usually disseminated.

Since the information from both groups comes from a population that is not often distributed, hypothesis testing is carried out using the Mann-Whitney Test (U-test). Speculative investigation shows a score of  $z_{(count)} = 6.05$  and  $z_{(table)} = 1.95$ , so  $z_{(count)} > z_{(table)}$ . The adequacy of learning materials for the two-factor straight requirements for students who use the PBL approach shows better results compared to students who use the DI approach.

Referring to the research results when learning in the experimental classroom using the PBL model, it can be seen that students' enthusiasm for learning is higher. This is in line with the opinion of Dirgatama et al. (2016) regarding the benefits of PBL, namely that this learning system encourages students to solve problems they encounter in real-life situations, making them more active. This concept is also in line with the opinion of Suwarno (2018) who stated that the problem-based learning (PBL) model encourages student involvement in finding solutions to the challenges they face in an independent manner. The PBL model is better for students because the learning process focuses on students, resulting in an overall student academic performance of 80, compared to learning using the DI model where teachers are more proactive so that students become less active during the lesson and result in a lower average learning score of 70. The results of this study are in line with the findings of Aisyah (2018) who stated that the learning achievement of students involved in project learning is more effective than conventional teaching methods.

## CONCLUSION

Data analysis from this study shows that the problem-centered learning (PBL) approach is more effective in increasing the learning achievement of the Two-Variable Linear Equation System material by students at MTs Nurur Rohmah. The recommendations from this researcher are:

1. When teaching, teachers apply the PBL approach as a strategy to improve student performance in mathematics. They are also encouraged to continue experimenting and evaluating various teaching techniques that are in line with the lesson topic.
2. By using a problem-based learning pattern, students must actively discuss, ask, and answer questions from other students and teachers to achieve maximum satisfaction.
3. It is hoped that scientists can further improve the achievements of this research and become a reference or guide for further researchers.

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