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IMPROVING CRITICAL THINKING SKILLS IN A THREE-VARIABLE LINEAR EQUATION SYSTEM THROUGH A PROBLEM BASED LEARNING MODEL IN CLASS X MA NURUL ULUM

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Abstract: The critical thinking ability of students who are classified as weak is a trigger for teachers to be required to be smart in choosing which learning model to use. Problem Based Learning is a learning model that is able to develop students' critical thinking skills using problems as their starting point. The purpose of this study was to determine the effect of using the Problem Based Learning model on increasing students' critical thinking skills in solving SPLTV questions. This research used the Quasi Experimental design experimental research method and was carried out in May 2022, class X MA Nurul Ulum, Mertak Tombok, NTB. Data collection techniques used are observation, documentation, interviews, and tests. Data analysis used the Normality Test, Homogeneity Test and Hypothesis Test which were calculated using SPSS 16 for Windows. The results showed that learning with the Problem Based Learning model experienced an increase in critical thinking skills with an average value of 31,87 to 76,25 with the results of the hypothesis test showing the results of 7,401 > 2,021 or $t_{table} < t_{count}$ which means that the Problem Based learning model Learning can improve students' critical thinking skills and is massive to use.

Keywords: Problem Based Learning, Critical Thinking Skills, SPLTV

INTRODUCTION

In this era of globalization, changes and developments have occurred not only in the world of science and technology but also in various aspects, such as socio-culture, changes in attitudes and behavior, and the world of education has also experienced the same thing. Education is basically an effort to provide knowledge, insight, expertise, and skills to individuals to develop the potentials that exist within them through learning. Recently, on September 6 2017, the President of the Republic of Indonesia issued Presidential Regulation (Perpres) Number 87 of 2017 concerning strengthening character education. Where Strengthening character education is designed to prepare a golden generation in 2045 which has advantages in global competition in the 21st century. This Presidential Regulation is in line with the objectives of the 2013 Curriculum, which is to prepare the nation's generation to have the ability to live with character as individuals who think productively, critically, creatively, innovative, and affective. The world of education can never be separated from the process of learning and teaching. Where in the process required a learning model that is able to improve the quality of education. (Afifah, N., 2015) defines a learning model as a plan or a pattern that is used as a guide in implementing classroom learning or learning in tutorials. The learning model is a conceptual framework that describes systematic learning procedures for managing student learning experiences so that certain desired learning goals can be achieved (Eismawati, E., et.al., 2019). In this case the learning model that researchers want to use is the problem-based learning model, in which this model will make students more cooperative in participating in each learning activity.

Giving problems in learning activities will automatically make students more interested in being able to be more active in learning. Giving problems also triggers students to be able to think critically. So that for students who are less interested in learning mathematics there will be motivation to study more deeply related to the problems that have been given by a teacher. Where the ability to think critically is one aspect of learning mathematics that is very important. Because students will gain experience in knowledge and critical thinking skills to solve problems (Pradita, D.A.R., et.al. 2021).

In the current era of globalization students are not only required to be able to understand learning, but are also required to be able to think critically. Critical thinking is the ability to systematically evaluate the quality of one's own and other people's reasoning or thoughts. Critical thinking is relative, rational, organized, and directed thinking to analyze, study, evaluate, make decisions, and solve problems (Munawwarah, et.al., 2020). Enis defines critical thinking as "reason able and reflective thinking focused on deciding what to believe or to do" (Pradita, D.A.R., 2019). This means that by thinking critically one is able to improve the assessment of one's statement and one will think rationally and focus on the decision whether to believe or do it. Critical thinking is closely related to problem solving skills. Critical thinking is one of the most important skills in mathematics. In learning mathematics there is a structure and characteristics that are very strong and clear between one concept and another.

In Indonesia, especially in learning mathematics in general, teachers often use conventional learning models (lectures) or learning models that focus only on teacher explanations (Teacher Centre). So that new breakthroughs are needed in learning activities which are expected to be able to make changes for the future. Hoowever in reality, Students' critical thinking skills are still relatively low and do not develop optimally because the teacher prioritizes the completeness of the material rather than using methods that are able to develop students' critical thinking abilities. In addition to the lack of variety of learning models used by teachers, the lack of student involvement in the problem solving process also triggers students to be lazy to think and students to become passive when learning takes place. Students will only be fixated on one learning step and are not used to questions that have many possible answers. (Faradillah, A., 2018) states that mathematics is a hierarchical subject where knowledge of a topic is a continuation of the previous topic so that students must be able to understand new knowledge by having pieces of information about previous knowledge. Mathematics is built into a chain of knowledge that starts with defining an object that only involves various calculation operations (Faradillah, A., 2018).

Basically the ability to think critically, logically and systematically and creatively is part of the thinking ability of every different person. the teacher's task is to guide and direct students to be able to improve students' critical thinking skills (Rihayati, et.al., 2021). Munandar argued that the basis for critical thinking is the stages of cognitive behavior in Bloom's Taxonomy, namely knowledge, understanding, application, analysis, synthesis, and evaluation. According to him, critical thinking is a high-level thinking skill starting from the level of analysis, synthesis, and evaluation (Mawaddah & Maryanti (2016); Kurniawati, R.F., 2018).

Understanding concepts in learning mathematics is very important so that students are able to understand what is being learned and later it will be easier to participate in learning activities at a higher level. If students are able to understand the concept well, it will be easier to build more complex mathematical abilities (Jamilun & Suhar., 2016).

Based on the results of observations made by researchers at MA Nurul Ulum Mertak Tombok, that in the learning process applied at MA Nurul Ulum Mertak Tombok, Praya District, Central Lombok Regency, teachers often use the lecture method where the teacher is the center of learning (teacher center) so that the ability to think critically students are still relatively low and have not developed optimally because teachers in class still prioritize the completeness of the material, so they rarely use methods that can improve students' critical thinking skills themselves. So that the level of students' understanding of the material being taught is not optimal and students become passive. In addition, the lack of student involvement in the learning process also triggers students to be lazy to think and the lack of variations in the learning model used by the teacher also triggers student boredom in the learning process.

To respond to the problem of students' critical thinking skills, it takes effort from the teacher to choose and use learning models that are able to develop students' critical thinking skills. One learning model that can improve students' critical thinking skills is the Problem Based Learning model. Problem Based Learning (Problem Based Learning) is an innovative learning model that provides active learning conditions to students and involves students to solve a problem through the stages of the scientific method. The aim is that students can learn knowledge related to these problems and at the same time have the skills to solve problems (Arifin, A.H., 2012).

One learning model that is able to assist students in developing critical thinking skills is the Problem Based Learning model (Problem Basic Learning). The Problem Based Learning (PBL) learning model is a learning approach that uses problems in everyday life as a context for students to learn about critical thinking, problem solving skills, and to gain knowledge and concepts from the subject matter presented (Faradillah, A., 2018).

Problem Based Learning is not just for solving problems, but rather providing learning opportunities where problem solving is the focus or starting point for student learning. Students work on problems to identify and seek the knowledge they need to model problems (Izzati, N., et.al., 2019). The purpose of this study was to determine the effect of using the Problem Based Learning model on increasing students' critical thinking skills in solving Three Variable Linear Equation System (SPLTV) problems.

METHOD

This research uses quantitative research methods with the type of experimental research that uses Quasi Experimental Design the pretest-posttest group design model (Sugiyono, 2016). The subjects used were class X students of MA Nurul Ulum, Mertak Tombok, NTB in May 2022. With the treatment design as shown in the table below.

Tabel 1. Treatment Design

Class	Pretest	Design	Posttest
A	O_1	X_1	O_2
B	O_1	X_2	O_2

Information :
A : Experiment Class
B : Control Class
O_1: Administration of pretest for experimental class and control class
O_2: Giving Posttest to the experimental class and control class
X_1: Application of the Problem Based Learning model in the experimental class
X_2: Application of conventional learning models

The instruments used were tests and student activity observation sheets. Testing the effectiveness of the Problem Based Learning learning model is obtained from data on the results of critical thinking skills by using test questions to students based on indicators of critical thinking skills, namely: students are able to interpret and analyze problems in questions, students are able to explain strategies used in solving problems and are able to evaluate return the results of the problem solving used.

Data collection techniques used in this study were observation, documentation, unstructured interviews and tests. The data analysis technique uses normality, homogeneity and hypothesis tests. The normality test used is the Kolmogorov-Smirnov test and the homogeneity test of variance uses the F test. The research hypothesis uses the t test. All tests were carried out using the SPSS for Windows 16 program.

RESULT

After conducting the research, it can be seen that the results obtained by each class are as follows:

Table 2. Data Description

Statistics	**Learning Model**	
	PBL	**Convensional**
Mean	76.25	54.5
Median	75	55
SD	11.445	7.052
Varians	130.978	49.737
Minimum	60	45
Maksimum	95	65
Range	35	20

The table above shows the values obtained by each class. The experimental class using the Problem Based Learning model obtained an average posttest score of 76.25 with a standard deviation of 11.445, a maximum value of 95 and a minimum value of 60. Meanwhile, the control class using conventional learning models obtained an average value of 54.5 with the standard deviation is 7.052, the maximum value is 65 and the maximum value is 45. From the distribution of the data above, it can be concluded that there is an influence between the use of conventional learning models and the Problem Based Learning model. This is indicated by the posttest average value of the experimental class which is much higher than that of the control class.

Analysis Prerequisite Test

Normality Test

The normality test in research is for the distribution or distribution of scores on students' critical thinking data using the Problem Based Learning model. The normality test uses the Kolmogorov-Smirnov test with the test criteria if the significance is > 0.05 then the data is normally distributed, whereas if the significance is <0.05 then the data is not normally distributed. The results of the normality test for the critical thinking data of experimental class students can be shown in Tables 3 and 4 below.

Table 3. *Pretest and Posttest Normality Test Results for Critical Thinking of Experimental Class Students*

No	Activity	Sig.
1	*Pretest*	0.200
2	*Posttest*	0.87

Table 4. *Pretest and Posttest Normality Test Results for control class students' critical thinking*

No	Activity	Sig.
1	*Pretest*	0.200
2	*Posttest*	0.61

Based on the two tables above, it can be concluded that the distribution of data used by researchers is normally distributed.

Homogeneity Test

Another prerequisite test for parametric analysis is the data homogeneity test. Test the homogeneity of the variance of students' critical thinking learning outcomes on the subject of the Three-Variable Linear Equation System (SPLTV) carried out using the Levene Test (Test of Homogeneity of Variances) with the test criteria if the significance value is > 0.05 then the data is homogeneous, whereas if the significance is < 0.05 then the data is not homogeneous. The results of the data homogeneity test for the results of critical thinking of experimental class students can be shown in the table below.

Table 5. Experimental Class Homogeneity Test Results

No	Activity	Sig.
1	*Pretest-Posttest*	0.496

Table 6. Control Class Homogeneity Test Results

No	Aktivitas	Sig.
1	*Pretest-Posttest*	0.30

Based on the two tables above, the experimental class sig = 0.496 > α 0.05 and the control class = 0.30 > α 0.05, it can be concluded that the two data distributions above are homogeneous.

Hypothesis Esting

After the normality test was carried out, it was found that the samples of the two classes were samples that were normally distributed and had a homogeneous variance, so a hypothesis test was carried out. In this study using the t test, namely where the hypothesis test is used to analyze data if the topic of the problem consists of one dependent variable and one independent variable (Mertayasa & Suardika, 2019).

The results of the hypothesis test at a significant level of 0.05 and dk = $n_1 + n_2 - 2 = 24 + 20 - 2 = 42$ obtained t_{count} of 7,401 and t_{table} 2,021 so that 7,401 > 2,021 or $t_{count} > t_{table}$ then H_0 rejected and H_a accepted. Then seen from the posttest average results of the experimental class is higher than the control class. In brief, the results of the hypothesis test calculations can be seen in the table below:

Table 7. *Results of Hypothesis Testing of Experimental Class and Control Class*

Data	Eksperimen	Control
Rata-rata	76.25	54.5
t Count	7.401	
t table	2.021	
Conclusion	**Influence**	

DISCUSSION

The results of hypothesis testing prove that there are differences in critical thinking skills between the experimental class using the Problem Based Learning model and the critical thinking abilities of the control class using conventional learning models. This is because the Problem Based Learning model is a learning approach in which students work on authentic problems with the intention of compiling their own knowledge, developing inquiry and high-level skills, developing independence and self-confidence (Suyitno & Waluya, 2018).

Broadly speaking, the similarities that can be associated with conventional learning and problem-based learning are students who are unable to play an active role in learning, will have difficulty and will become a scourge in the class and will affect other friends. this is in line with the opinion (Derfia, et.al., 2020) that there is a need for a learning model that supports the learning objectives that have been designed so that they can run massively.

The Problem Based Learning model is not just for solving problems, but rather provides learning opportunities where problem solving is the focus or starting point for student learning. Students work on problems to identify and seek the knowledge they need to model problems (Zulkarnain & Budiman, 2019). In the PBL learning process, there are several stages, namely student orientation to problems, organizing students to learn, guiding individual and group investigations, developing and presenting work, as well as analyzing and evaluating the problem solving process.

The Problem Based Learning model requires students to be active in every problem solving process and provides opportunities for students to be able to develop their critical thinking skills through complex problem solving processes in small discussion groups so that the ability to analyze, evaluate, explain strategies, and the ability to evaluate student problems becomes more Good. In small discussions, students are required to be active and critical in solving problems. They are given the freedom to convey their thoughts in solving problems or in defending their opinions about the problems being worked on. In accordance with Anisa Yulianti's research (2019) that the application of the Problem Based Learning model assisted by information technology is able to improve students' critical thinking skills in solving the problems presented. Likewise with research conducted that the ability to solve problems, think critically and think creatively is an educational goal and a necessity for students to face the real world (Zohdi, S. (2018); Handayani & Wardani (2015)).

CONCLUSION

Problem Based Learning is proven to improve students' critical thinking skills in solving SPLTV questions. This is indicated by the results of the hypothesis testing which was carried out showing the results of 7,401 > 2,021 or $t_{table} < t_{count}$, which means that there is an effect of using the Problem Based Learning model on increasing students' critical thinking skills in solving SPLTV questions for class X.

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