

Library Research the Effect of *Problem Based Learning* (PBL) Learning Model on Students' Critical Thinking Skills

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Article Info	ABSTRACT
<p>Article History Received : 24 Oktober 2022 Accepted : 26 Oktober 2022 Published : 29 Oktober 2022</p> <p>Keywords: Problem Based Learning (PBL) Learning Model, Critical Thinking Skills, Answer Process</p>	<p>This study aims to find out the results of a Library research using the Problem Based Learning (PBL) learning model on students' critical thinking skills. This type of research is qualitative research using the Library Research research method or library study conducted at Digital Library UNIMED for two months, starting from February to April 2022. The data analysis technique in this study used Miles and Huberman analysis technique. The data used in this study is secondary data from several literatures that are used as references in this study, the researcher conducted data reduction and selects 4 journals and 2 theses as the main subject in conducting research. Based on the results of research and analysis obtained, it can be concluded that the Problem Based Learning (PBL) learning model has a large effect on students' critical thinking skills with the acquisition of an average effect size value of 0,95. This Shows that the effect obtained is in the large category and a series of stages in the PBL learning model are able to fulfilling indicator of students' critical thinking skills. The answer process of student also in solving problems whose learning using the PBL model has increased.</p> <p style="text-align: right;">This is an opes access article under the CC-BY-SA license</p>



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INTRODUCTION

Education has a fundamental role in advancing and developing a nation. Education serves to print human resources as a driving force behind the wheels of superior nation development. This identifies that education is not a fixed thing but a moving one that requires continuous improvement to form intelligent and critical human resources in receiving and processing complex information and problem solving.

To improve the quality of human resources, the government has been working on an education system aimed at developing the potential of students as written in Law No. 1. 26/2003 on the National Education System stated that education is a conscious and planned effort to realize a learning atmosphere in order for students to actively develop their potential for spiritual strength, self-control, personality, intelligence, noble character, and skills. He also had the necessary resources for himself, society, nation and country (Sanjaya, 2006). The improvement of the quality of education, especially in the field of mathematics, is one of the strategic steps in realizing the improvement of the quality of human resources (SDM), which is able to compete.

Thinking skills are indispensable in dealing with life's challenges. These skills include critical thinking, creative thinking, and problem-solving skills (Nuryanti et al., 2018). Based on these statements, it can be seen that critical thinking is part of thinking skills. Critical thinking skills are required in various problem solving problems in mathematical learning that tend to lead to abstract material.

Critical thinking becomes an attachment to mathematical learning, because mathematics relies on cognitive abilities that require logical reasoning. Critical thinking is not simply formed, but it requires a stimulus so that the child has the skills to solve the problems he or she faces. By thinking critically, students can identify reliable sources, distinguish relevant and irrelevant information, identify problems, formulate, and identify relevant information, hypothesis analysis, and draw conclusions.

According to Henita, etc. (2019) mathematical critical thinking is the process of discovering, analyzing, and evaluating information obtained from observations to make decisions on mathematical problems. This is an important point for a person with a critical thinking ability to observe carefully, openly with a new perspective and have analytical capabilities that can be used in a variety of situations. In line with that, Rochaminah (Kurniasih, 2012) defines critical thinking ability as non procedural thinking activity, namely ability to find analogy, analysis, evaluation, non-regular problem solving and proving. So it can be concluded that critical thinking is an ability that a person has to think rationally in analyzing situations or problems and in making decisions or doing actions, then collecting information and making conclusions from these information. Mathematical critical thinking is the ability of a person to solve a mathematical problem by collecting information and then drawing conclusions from it.

Although this is already the goal of mathematics in school, in fact, critical thinking has not been the focus of learning. This is evident from several studies that show that students' critical thinking skills are still low. As shown by the results of The Trends International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA) published by the Ministry of Education and Culture show that the abilities of junior high school students especially in mathematics are still below international standards. The average score obtained by Indonesian students in both TIMSS and PISA is still far below the international average. Even the latest results of the 2012 PISA study put Indonesia in 64th place out of 65 participating countries or one level above Peru which is ranked last with an average score of 375, while the international average score of 500 (Mahmuzah, 2015). In fact, PISA measures communication ability, reasoning, representation, problem solving, argumentation, communication and high-level thinking. Based on this it can be said that the critical thinking ability of students in Indonesia is still low (Steven, 2019).

This phenomenon also occurs at SMP Negeri 21 Medan, which is that the students do not have indicators that should belong to a mathematically critical person. Students only believe in the completion presented by the teacher or presented on the book and the internet. The student could not explain the process in the given problem resolution. This explains that students have such a low mathematical critical thinking ability that students have not been able to convey their ideas. This shows that learning is still dominated by teachers. Students have not been able to state situations or problems into the form of symbols and mathematical models and have not been able to analyze given problems.

In general, students have difficulty interpreting, analyzing, evaluating and drawing conclusions from given problems. Whereas these four components are indicators of critical thinking ability. To strengthen the reason, the researcher gave an initial critical thinking ability test to 26 grade VII students. This test is useful for measuring the extent of students' critical thinking ability by involving the use of the National Science Olympiad (OSN) which has such a high level of difficulty that it requires students to think critically in completing the given test.

Of course, there are many things that can affect students' low critical thinking skills, including students being used to work on problems with routine procedures, students are also not able to work with models in concrete but complex situations, students' lack of activity in the learning process, lack of concentration, a

complex learning environment the lack of support and attitude of students who lack to criticize any given material. Based on the results of the interview, it was found that teachers did not apply the learning model in class, only using conventional learning where more teachers were active in the learning process. In learning activities teachers usually explain concepts informatively, provide examples of problems and provide training problems (Islahuddin, 2018). From this kind of learning process, students are used to accepting knowledge instead of constructing their knowledge so that the thinking skills to solve students' problems are low. The problems presented in the learning process focus only on the low level so that they are not sufficient to improve students' critical thinking skills.

Learning that facilitates students' thinking activities is by using a learning model that matches the critical thinking character itself. One of the learning models that facilitate student thinking is the Problem Based Learning (PBL) or Problem-Based Learning (PBM). According to Diani, et al. (2016) the Problem Based Learning learning model is a learning model that uses real problems encountered in the environment as the basis for gaining knowledge and concepts through critical thinking and problem solving abilities. This is in line with Arends' opinion (Trianto, 2009) problem-based teaching is a learning approach in which students work on concrete problems with the aim of compiling their own knowledge, developing high-level research and thinking skills, developing independence and confidence.

In the Problem Based Learning (PBL) learning model, it starts by presenting real problems whose solution requires cooperation among students. In this case, the teacher only guides the student to elaborate the problem-solving plan into the stages of the activity, so the teacher should not immediately give them concepts, formulas, etc. Thus problem-solving allows students to think and indirect problem-based learning to gradually improve students' critical thinking ability (Yanti et al., 2017). The stages in PBL are linked to a scientific approach. The stage of formulating the problem, the teacher leads the student to observe the problem to be solved. The stage of analyzing problems, the teacher encourages students to review problems from various perspectives. In the stage of formulating hypotheses, teachers encourage students to formulate problems faced with the form of questions. The stage of collecting data, the teacher encourages and guides students to search and collect information related to the problem solving provided. In the hypothesis testing phase, the teacher directs the student to reason so that the student is able to examine the data and can see its relationship to the problem under study. The stage of determining problem resolution, the teacher facilitates the student to present the problem solving results, thus creating the student's competence in choosing alternative problem resolution and the consequences of each choice (Sanjaya, 2006). With the existing stages, PBL can develop thinking skills and problem-solving skills that are included in critical thinking.

In this study, researchers conducted library research to be an alternative to conducting research. According to Nazir (Sari, 2020) library research is a technique for collecting data by conducting research on books, literature, records, and various reports related to problems to solve. Library research itself is conducted by looking at the number of similar studies that have been conducted so that data organization, information retrieval, preliminary research on similar topics can be used to see how the problem-based learning (PBL) model can influence the learning process. students' critical thinking skills. Based on the presentation, the author feels that the Problem Based Learning (PBL) learning model is highly likely to influence students' critical thinking ability, hence researchers conduct research under the title "The Study of the Influence of the Problem Based Learning Model (PBL) on Students' Critical Thinking Ability".

RESEARCH METHOD

This type of research is qualitative research. According to Afrizal (2014) qualitative research is a study that collects and analyzing data in the form of words and human deeds and researchers do not attempt to calculate or quantify the qualitative data obtained and thus do not analyze the numbers.

The type of qualitative research used is descriptive in the form of library studies. Library studies are studies that collect information and data with the help of various references in libraries such as documents, books, scientific articles, journals, scripts and other relevant data sources. Afrizal (2014) stated that the study of literature is a "publishing" of literature. The paper is a research paper containing information obtained from journals, books and working papers. In this type of study, knowledge, ideas or findings are examined in the literature, providing theoretical and scientific information on the effect of the Problem Based Learning (PBL) learning model on students' critical thinking ability

RESULTS AND DISCUSSION

The subjects in this study are the research results of a scientific article in the form of a national-scale journal in Indonesia on the application of problem-based learning (PBL) models to influence students' critical thinking abilities. The study's objectives are 4 journals and 2 scripts that address the problem-based learning model in influencing students' critical thinking abilities.

The journals and scripts are as follows:

Table 1. List of research sources

No.	Writer	Year	Jenjang	Article
1	Steven, dkk	2019	SMP	Journal
2	Meilinda, Dina	2019	SMP	Journal
3	Prihono, Eko dan Fitriatun	2020	SMP	Journal
4	Marinda, dkk	2018	SMP	Journal
5	Silaen, Hengki	2021	SMP	Scripts
6	Lubis, Indah	2019	SMP	Scripts

The problem-based learning model influences students' critical thinking ability. It is seen that a series of activities in the learning process involve student activities and stages of problem-based learning models that are believed to meet student critical thinking indicators. Learning stages with problem-based learning models include orienting students to concrete/real problems, organizing students to study, guiding individual and group investigations, developing and presenting work results and evaluating problem-solving processes.

The first step is to orient students on concrete/real problems of teachers to act as stimulus or stimuli that interest students so that students are interested in the problems that arise. The more interesting the problems that arise, the more stimulating it is to find explanations that make students try to learn and search for information related to the given problems. The second stage organizes students to learn, at this stage students build up the information they get and develop their knowledge and experience. Since problem-based learning models are usually done in groups, students will become accustomed to socializing which elicits conversation and cooperation between individuals, thus increasing students' intellectuals. At this stage, teachers must have creativity in providing stimulus that elicits students' curiosity about the problems that have been exposed. In the first and second stages of learning with a problem-based learning (PBL) model, students' critical thinking abilities in interpretation indicators allow students to understand the problem by describing the information they get from the given problem.

The next stage is to guide the investigation of individuals and groups, at this stage students are actively working in groups or individuals and the role of teachers as facilitators for students. At this stage teachers must be able to direct students to important questions that should be the purpose of learning. Teachers can give students the opportunity to discover or apply their own ideas. With the right problem, students will actually learn, so that they will gain a deeper understanding of what is learned and take longer to remember the information they get. At this stage, students will develop critical thinking skills, especially in analysis indicators where students are able to plan for problem resolution by properly creating problems that are presented into mathematical models so that students can use appropriate and complete strategies to solve problems. Since the problem-based learning (PBL) model is carried out as a group, students will cooperate with their group in finding and collecting the information needed for problem resolution. It's at this stage that students learn a lot by reading books, over the internet and experimenting so that they will develop their thinking skills in sorting out information relevant to the given problems.

The fourth stage is developing and presenting the results, at this stage students present the results obtained either individually or groups and other students or groups responding to the results. At this stage students openly express their thoughts, ideas gained during the investigation into the problem. So that it will stimulate students' critical thinking in comparing students' various problems, observations, and views. A critical thinking indicator that can be improved is evaluation, by having open discussions with students, students are able to choose the right problem resolution and be able to solve problems well through appropriate steps and calculations.

The fifth step of the problem-based learning (PBL) model is to analyze and evaluate the problem-solving process. In this stage students analyze and reexamine whether the results they suspect are true or not. At this stage an indicator of critical thinking ability that can be improved is inference. Teachers should be able to direct and guide students in showing which data is appropriate so that students can come to conclusions on problem resolution appropriately and completely.

From the above explanation, it is seen that each stage of the problem-based learning (PBL) model has a positive impact on improving students' learning activities. It is also seen that each indicator of students' critical thinking ability can be fulfilled through every stage in the problem-based learning (PBL) model. Based on the average effect size calculation of the various research results described above, it will be seen how much the problem-based learning model has on students' critical thinking ability. As for the effect size calculation using Cohen's formula with the help of Microsoft excel applications, the effect size is shown in the following table:

Table 2. Effect Size Calculation

No	Jurnal	N		SD		Rata-rata		SD Gabungan	Effect Size	Keterangan
		Eksperimen	Kontrol	Eksperimen	Kontrol	Eksperimen	Kontrol			
1	Steven, dkk (2019)	34	33	19,95	14,91	59,56	51,52	17,6495551	0,455535562	KECIL
2	Melinda (2019)	37	37	15,89	18,61	75,46	51,89	17,30352854	1,362149919	SANGAT BESAR
3	Wahyunanto, dkk (2020)	32	32	11,20036	11,0462	81,25	75,26	11,12353217	0,538498016	SEDANG
4	Marinda, dkk (2018)	30	28	13,4	10,89	38,7	20,92	12,25417327	1,450934274	SANGAT BESAR
Rata-rata Effect Size									0,951779443	BESAR

From the figure above, there can be an increase in the average experimental class of the average control class. Meanwhile, effect size acquisition is in a small category with $0,20 \leq d < 0,50$ which is in Steven journal, etc. (2019). Effect size acquisition in moderate category with $0,50 \leq d < 0,80$ in Wahyunanto journal, etc. (2020). Meanwhile, the category is very large with $0,80 \leq d < 1,20$ which is in the journals Meilinda (2019) and Marinda, etc. (2018).

The results of calculating the average effect size of an analyzed journal were obtained that the highest effect size was 1.45 for Marinda's journal, et al. (2018) and the lowest effect size was 0.45 for Steven's journal, et al. (2019) and the average effect size obtained from the four analyzed journals was 0.95. The results of these average effect sizes are categorized into major categories. This suggests that there is an effect of large problem-based learning models on students' mathematical critical thinking ability. Continuous PBL learning will make students actively involved in learning, so it can be said that the problem-based learning (PBL) model influences students' critical thinking ability.

The implementation of problem-based learning (PBL) models has improved the student's answer process in solving problems. The first in the critical thinking ability indicator is interpretation, the student has begun to understand the meaning of the given problem so that the student can pour out his or her ideas by writing down the known and asked questions from the presented problem. The second indicator is analysis, the student has been able to write down the relationships between statements, questions, and concepts given in the problem shown by building a mathematical model precisely and explaining precisely, thus determining the problem-solving strategy appropriately. The third is the evaluation indicator, students are already able to use the right strategy in solving the problem, complete and correct in doing calculations. The last one is inference, the student has been able to draw conclusions from the problems presented according to the question and the answers from strategies chosen by the student appropriately. From the results of the analysis above it can be seen that by applying the problem-based learning (PBL) model to the learning process, the student's answer process in solving problems related to critical thinking skills improved.

CONCLUSION

Based on the results of analysis through several literature, it can be concluded that:

The learning model of problem based learning (PBL) has an effect on the ability of the learner. students' critical mathematical thinking. This is facilitated by the stages of problem-based learning (PBL) models that meet mathematical critical thinking indicators, including orienting students to problems, organizing students to study, guiding individual and group investigations, developing and presenting work results, and lastly analyzing them. and evaluate the problem solving process

The student's answer process in solving problems related to thinking ability. In recent years, the use of problem-based learning (PBL) models has increased. It is seen that the student's answer results related to critical thinking tests represent indicators of interference, analysis, evaluation and inference. In addition, it can be seen from some literature that shows the improvement of each indicator of students' critical thinking ability after the implementation of the problem-based learning (PBL) model in mathematical learning.

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