

THE META-ANALYSIS OF PROBLEM BASED LEARNING (PBL) LEARNING MODEL TO IMPROVE STUDENTS' CRITICAL THINKING SKILL

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ABSTRACT

This research aims at identify the effect of Problem Based Learning towards students' critical skill by implementing meta-analysis method. This research is meta-analysis research. The data of the research are collected from national published scientific research related to Problem Based Learning in the last five years. The finding shows the implementation of Problem Based Learning has a significant effect on students' critical skill in Math with average score of 29% ranging from 14,7% to 60,51%. The gap of pretest and posttest score of this research is 38,5%. The finding of this research offers scientific proof of the effect of Problem Based Learning on students' critical thinking skill. The difference between the average pretest and posttest score of the experiment group shows greater score than the control group on the implementation of Problem Based Learning (PBL) model towards students' critical thinking skill aggregation considering the average of pretest and posttest aggregation.

Keywords: meta-analysis, Problem Based Learning, critical thinking

1. INTRODUCTION

Schools are one of the areas where people can gain the knowledge, skills, and attitudes that everyone needs in this day of globalization. A school is an educational establishment with a specific vision and mission that includes organizing, creating, and overseeing the application of learning in a way that speaks to the true objectives of education. In that manner, a person will be able to overcome a variety of issues that arise in life and are encountered in society thanks to the information and abilities acquired via the educational process at school. Given the significance of the role and objectives of education, it is imperative that the curriculum be implemented in a way that is appropriate, considers the characteristics of the students, and aligns with the caliber of educational resources in order to accomplish the desired learning outcomes. Nonetheless, the government routinely examines issues that arise in the field of education, including modifications or revisions to the curricula, in an effort to meet the anticipated educational goals. This is being done in an attempt to improve the quality of education in this country.

Education is an important aspect in creating quality human resources. Education will run well if its quality can be improved. To improve quality good education, it is necessary to improve the development of science. Because good scientific development will also have a positive effect on the quality of existing education. Problem solving ability is one of the abilities that is still a concern in mathematics

learning. Problem solving ability can be said to be a basic skill or life skill that must be possessed, because every human being must be able to solve their own problems. Implementing problem-solving skills as an educational goal is very necessary in obtaining knowledge that can be applied and helping students to be trained in dealing with various problems in students' real lives (Yustianingsih., et al 2017).

In the world of education, one of the important subjects to be taught at every level of education is mathematics. This is because mathematics lessons provide many benefits when related to everyday life and can be applied in various areas of life. Mathematics is a science in which a person's thinking process is reasonable so that they are able to obtain concepts (Isrokatun and Amelia, 2018). Mathematics has the elements of problems, notation, rules, designs, opinions, and theoretical tools (Font et al., 2010). So in learning mathematics, of course, various efforts are needed from teachers and students to achieve the goals of each lesson carried out. Mathematics is also a scientific discipline that is considered capable of improving thinking and argumentation skills, which makes mathematics able to contribute to solving problems in everyday life. Mathematics subjects have one goal, namely that students have the ability to design mathematical models, understand problems, solve models, and interpret solutions obtained by them.

Since mathematics education cannot be divorced from daily life, it is extremely helpful for students. Consequently, teachers must design meaningful curricula to ensure that mathematical objectives are met to the best of their abilities. In addition, the teaching of mathematics at the educational level benefits students by equipping them with the critical, logical, and rational thinking skills necessary to respond to the ever-changing nature of the world (Damayanti, 2017). Permendikbud (2014:325) states that the goal of mathematics instruction is to enable students to comprehend mathematical ideas, articulate how ideas relate to one another, and apply ideas or algorithms in a flexible, precise, accurate, and efficient manner when resolving issues. One method by which educators can help students solve problems successfully and develop their critical thinking skills is by choosing a learning model that relevant with the learning material.

One of the learning models that is able to improve students' critical thinking is the problem-based learning (PBL) model. The PBL model is also one of the recommended models in the 2013 curriculum. Problem-based learning (PBL) is a learning model where the learning process starts with a problem and students are required to solve the problem in order to solve it (Permatasari, 2020). In PBL, in the learning process, students are mostly given problems that can be solved through discussions in class with their classmates. The problem-based learning (PBL) model, according to Erwin (2018), is a sequence of teaching and learning activities that focuses on solving problems that actually occur in everyday life. The problem-based" learning model is closely related to the reality of students' daily lives. In learning, you feel directly about the problems being studied, and the knowledge gained by students does not only depend on the teacher.

Problem-based learning is a model that focuses on bridging students to gain learning experience in organizing, researching, and solving complex problems in everyday life (Torp and Sage in Abidin, 2014: 160). The problem-based learning model (Problem-Based Learning) is a model that directs students to compile their own knowledge, can develop higher skills and inquiry, is able to increase self-

confidence, and requires students to collaborate with other students to solve a problem (Pratiwi and Eunice, 2020). The problem-based learning model directs students to actively explore a problem, and the teacher acts as a facilitator. Problem-based teaching can develop student independence through solving problems that are meaningful for students' lives, forming higher-order thinking skills, and improving critical thinking skills.

The sources of research on the problem-based learning model to improve critical thinking skills include research conducted by Nova Nadila Saputri Sitompul (2021), who conducted research with the title *The Influence of the Problem-Based Learning Model on Improving the Mathematical Critical Thinking Ability of Class IX Middle School Students*. The data from this research were obtained from pre- and post-test scores, which showed an increase in students' mathematical critical thinking abilities. Based on the table above, the value of sig is obtained. (2-tailed) is $0.000 < 0.05$, so it can be concluded that there is a difference in the average mathematical critical thinking of class IX junior high school students in Bilah Hulu between students who receive the problem-based learning model, which is better compared to students who use conventional learning models. Relevant research was conducted by Dian Soraya et al. (2018) with the title *The Influence of Problem-Based Learning (PBL) Learning Models Based on Local Wisdom on Social Attitudes and Critical Thinking in Mathematics Subjects*. The results of the research show that there are significant differences in students' social attitudes and critical thinking, both partially and simultaneously, with a significance level of $0.000 < 0.05$. Thus, the problem-based learning (PBL) learning model based on local wisdom has a positive effect on students' social attitudes and critical thinking in mathematics subjects. Fifth grade students at Gugus Singosari Elementary School, Pekutatan District, Jembrana Regency, Academic Year 2018–2019 Suggestions for further research: it is hoped that the results of this research will be reused in other lessons.

2. RESEARCH METHOD

This research uses a type of research with meta-analysis techniques. Meta-analysis is a systematic review method accompanied by statistical techniques to calculate conclusions from several research results. Meta-analysis research uses the dimension of influence size or effect size of the results of studies that have been combined and then collected and analyzed.

The method used in this research is meta-analysis. Meta-analysis has several stages, namely: 1) Aiming at the theme; 2) Creating an overall design; 3) Looking for research samples; 4) Collecting data; 5) Analyzing data. The meta-analysis process is carried out as follows: First, explain and determine the problem to be studied regarding the influence model.

Problem-Based Learning to Improve Students' Critical Thinking. Second, look for data according to the theme that will be used, namely previous articles that have been published in online journals in the 2011–2020 period. Third, understand the articles that have been collected to look for similarities between the articles and the problem that the researcher will use. Fifth, re-analyze the articles that have been collected to draw conclusion. The data collection technique used is to search for articles that have been published in online journals via Google Scholar. The articles that have been collected are then grouped based on the type of research. Next, code each article. The analysis technique used is to compare the value of the

influence of the problem-based learning model on improving students' critical thinking as seen from the scores before and after using PBL.

3. RESULT AND DISCUSSION

There are 10 articles that matched with this research criteria, these article are published around 2016-2022. The articles are published in SINTA accredited journals; related to elementary school research levels; and related to the Problem Based Learning model and Critical Thinking skill. On table. 1, it can be seen that there are 10 articles with the Problem Based Learning model that are used as data in this meta-analysis research.

Table 1. The classification of Problem Based Learning Model Articles

No	Data Code	Research Title	Researchers' Name	Publication Year	Journal
1	1P	Penerapan Problem Based Learning untuk Meningkatkan Kemampuan Berpikir Kritis Siswa	1. Desy Triana Dewi	2020	Jurnal Pendidikan Ekonomi Undiksha
2	2P	Penerapan Model Problem Based Learning Berbantuan Media Audio Visual Untuk Meningkatkan Berpikir Kritis Kelas 4 SD	2. Susilowati	2018	JIPP
3	3P	Pengaruh Model Problem Based Learning Terhadap Kemampuan Berpikir Kritis Siswa Sekolah Dasar	1. Nurul Hasanah 2. Kiki Pratama 3. Insyirah Shafa	2020	Jurnal Pendidikan Guru Sekolah Dasar
4	4P	Penerapan Model Problem Based Learning (PBL) Terhadap Peningkatan Kemampuan Berpikir kritis Matematis Siswa	1. Ari Septian 2. Riki Rizkiandi	2017	Jurnal PRISMA Universitas Suryakencana
5	5P	Kemampuan Berpikir Kritis dan Penguasaan Konsep Siswa dengan Problem Based Learning Pada Materi Sifat Cahaya	1. Rahmah Kumullah 2. Ery Tri Djatmika 3. Lia Yuliati	2018	Jurnal Pendidikan
6	6P	Penerapan Model Problem Based Learning Untuk Meningkatkan Keterampilan Berpikir Kritis Pada Pelajaran IPS SD	1. Indrianty Rahayu 2. Pupun Nuryani 3. Ruswandi	2019	Jurnal Pendidikan Guru Sekolah Dasar

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7	7P	Pengaruh Model Pembelajaran Problem Based Learning Terhadap Peningkatan Kemampuan Berpikir Kritis Matematis Siswa SMP Kelas IX	1. Nova Nadila Saputri Sitompul	2021	GAUSS: Jurnal Pendidikan Matematika
8	8P	Penerapan Model Problem Based Learning Untuk Meningkatkan Berpikir Kritis dan Hasil Belajar Dalam Tema 8 Kelas 4 SD	1. Faisal Miftakhul Islam	2018	Jurnal Mitra Pendidikan
9	9P	Pengaruh Model Problem Based Learning Terhadap Kemampuan Berpikir Kritis Matematis Siswa Kelas VIII SMP	1. Eko Wahyunanto Prihono 2. Fitriatun Khasanah	2020	EDU-MAT: Jurnal Pendidikan Matematika
10	10P	Pengaruh Model Problem Based Learning (PBL) Terhadap Kemampuan Berpikir Kritis Matematis Siswa SMPN 5 Sumbu	1. Aprilita Sianturi 2. Tetty Natalia Sipayung 3. Frida Marta Argareta Simorangkir	2018	UNION: Jurnal Pendidikan Matematika

Based on the chosen 10 Problem Based Learning Model articles above, this is the following results analysis table of the Problem Based Learning model that has been used as the subject of meta-analysis research.

Table 2. The Result of *Problem Based Learning* Model Analysis

No	Data Code	Pre-test Score	Post-test Score	Improvement
1	1P	50,00	87,5	37,5
2	2P	57,00	81,30	24,3
3	3P	43,00	88,20	45,2
4	4P	17,82	78,33	60,51
5	5P	53,63	74,19	20,56
6	6P	59,00	88,00	29
7	7P	65,27	87,41	22,14
8	8P	65,90	89,60	23,7

9	9P	61,50	81,25	19,75
10	10P	66,8	81,50	14,7
Mean		53,9	92,4	29,7

Based on the data obtained from the journals above, the results of data analysis were obtained that the use of problem-based learning models had a significant influence on students' ability to think critically in mathematics learning with an average gain of 29.7% from the lowest increase of 14.7% to the highest increase of 60.51%. The comparison of the measurement results that have been obtained can be seen as follows.

Table 3. Comparison of Measurement Results of Problem Based Learning Models on Critical Thinking Skills

Measurement	Mean Score	
	Model <i>Problem Based Learning</i>	Difference
<i>Pre-test</i>	53,9	38,5
<i>Post-test</i>	92,4	

In the table above, a difference of 38.5 is obtained. This has proven that the use of the Problem Based Learning model has a major influence on students' ability to think critically in mathematics learning.

Research was conducted to prove a major influence in the use of the Problem Based Learning model on students' critical thinking skills in mathematics learning. This research is a meta-analysis research, the first stage is to make problem formulations and collect data in the form of journal articles from various sources such as Google Scholar. In the study, 10 similar journal articles were used, each of which showed different results. The Problem Based Learning model obtained significant influence results on students' ability to think critically in mathematics learning with an average gain of 29.7% from the lowest increase of 14.7% to the highest increase of 60.51%.

Based on the average results of the pre-test and post-test scores, the difference in the experimental group has a greater value than the control group in the application of the Problem Based Learning (PBL) Model in improving students' critical thinking. In accordance with the characteristics of the Problem Based Learning (PBL) model, the problems used are problems in students' daily life that experienced by students (real problems), problem solving makes students gain student knowledge more actively learning, the learning resources used vary greatly so that teachers must be creative, the learning atmosphere is fun, comfortable, and students can develop critical thinking skills through solving the problems used. So that the use of the Problem Based Learning (PBL) model is effective to be applied to learning.

These results prove that the Problem Based Learning (PBL) model is suitable for use in improving students' critical thinking skills. This is also related to the purpose of the Problem Based Learning (PBL) model which stated by Yamin (2013: 63-64) is to make students develop knowledge that can be applied to everyday life. So

that in learning students do not only rely on memory to memorize, but students are required to be critical in problem solving. The Problem Based Learning (PBL) model also requires students to work together, communicate well in groups, and be responsible for solving a problem. Thus, the Problem Based Learning (PBL) model provides students with opportunities to hone critical thinking skills very large.

4. CONCLUSION

Based on the findings and the analysis of meta-analysis research that has been carried out, it can be concluded that the PBL learning model is able to improve students' critical thinking skills by obtaining the lowest number of 14.70% and the largest number of 60.51% so that 29.7% is the average number. The average pretest rate is 53.9%, and the average posttest rate is 92.4%. So, the use of the PBL model can increase students' critical thinking by 38.5%. From these conclusions, researchers have suggestions, namely; (1) It is expected that teachers can make materials, media and teaching materials well, (2) For students must actively participate in learning to improve critical thinking, (3) For schools are expected to support learning activities by providing completeness of materials used for teaching so that learning objectives can match, (4) Researchers should study learning models other than PBL, in order to provide recommendations to teachers on effective learning models to be applied in learning.

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