Literature Review: Application of Problem Based Learning Model to Improving Problem Solving Ability and Student Mathematics Learning Outcomes in Elementary School

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Abstract. Problem solving is one of the skills that students must have after learning mathematics. Learning mathematics that develops problem solving skills gets less attention from the teacher so that students lack problem solving skills. Learning that combines knowledge, skills and creative thinking, emphasizing student experience and active participation in problem solving. The purpose of this study was to conduct a literature review on improving mathematical problem solving skills and learning outcomes using the PBL learning model. This research is qualitative in nature and the method used in this research is SLR (Systematic Literature Review). Data collection was carried out by reviewing all articles and journals related to the application of problem-based learning models to improve problem-solving abilities and students' mathematics learning outcomes in elementary schools. After the data is collected, the data found is verified and compared. Data analysis techniques were carried out qualitatively by quoting relevant opinions. Based on the results of the literature review, it can be concluded that the problem-solving abilities and mathematics learning outcomes of elementary school children can be improved through the problem-based learning model.

Keywords: Problem based learning, problem solving abilities, mathematics learning outcomes.

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INTRODUCTION

Learning mathematics in elementary schools is not only aimed at increasing students' abilities in arithmetic or applying formulas/procedures in solving problems, but also at increasing students' abilities in problem solving, both mathematical problems and other problems that use mathematics to solve them. Learning mathematics is the formation of a learning environment that can help students to build mathematical concepts or principles based on their own abilities through an internalization process (Siroj, 2003). The expected goals in learning mathematics by NCTM (in Widodo. S & Kartika Sari, 2017) are: (1) Problem solving ability; (2) Ability to argue; (3) Ability to communicate; (4) Ability to make connections; and(5) representation ability. Problem solving is one of the abilities that students must master after learning mathematics.

Problem solving is one of the skills that students must master after learning mathematics. Students need these skills, which relate to student needs, to solve everyday problems and to be able to develop further. According to Hendriana et al (2017) basically the ability to solve mathematical problems is an important mathematical ability and needs to be mastered by students who study mathematics. The ability to solve mathematical problems is very important for students not only to make it easier for students to learn mathematics, but in other learning and in everyday life. Therefore, problem solving abilities need to get special attention in the process of learning mathematics from the most basic education level, namely in elementary school. This statement is supported by the National Council of Supervisors of Mathematics (NCSM, 1977) that "learning to solve problems is the principal reason for studying mathematics". The teacher's lack of attention to the development of problem-solving skills in the process of learning mathematics results in students lacking problem-solving skills.

One of the results of research from Pratiwi, Daffa Tasya and Fitri Alyani (2022) which shows that there are three categories of student problem solving abilities, namely the high category with a percentage of 16.67%, the medium category with a percentage of 26.67% and students in the low category with a percentage of 56.67%. Based on these results it can be

concluded that students' abilities in the Problem solving process are classified as different and tend to be in the low category. According to Polya (in Mawaddah. S & Hana Anisah, 2015) mathematical solving steps consist of understanding the problem, planning a solution, carrying out the plan and checking again.

One of the causes of the teacher's lack of attention to the development of problem- solving skills in the process of learning mathematics is the lack of non-routine problems in source books, besides that teachers are accustomed to adopting questions contained in source books. The use of learning approaches or models in each lesson, such as learning that places more emphasis on delivering lesson content and algorithms for solving problems also causes students to lack problem-solving skills. Teachers need to carry out learning innovations as an effort to improve the quality of learning, especially by paying attention to the skills or competencies needed by students. One of the learning innovations that can be carried out by the teacher is by selecting an effective and appropriate learning model for use in the teaching and learning process. Selection of an effective and appropriate learning model can improve the creative abilities of elementary school students.

The learning model as one of the learning innovations in learning the quality of work. The learning model is a model that describes a detailed process in creating environmental situations that allow learning interactions to occur so that changes or self- development of students occur (Sukmadinata, Syaodih, 2015: 151). The use of learning models has a significant impact on the success of teaching and learning in schools.

METHOD

This study used the SLR (systematic literature review) method. This study uses a literature study with a descriptive method, which is a form of exploratory research, describing, with the aim of being able to explain and predict a phenomenon that applies on the basis of data obtained in the field (Sukardi, 2003). Data collection techniques are carried out by continuously reviewing several books, articles, literature and other documents that are considered in accordance with the above studies until they are deemed sufficient (Huberman & Miles, 2002).

The first stage of literature study is problem identification, namely the process and results of identifying or inventorying problems. Then filtering the data is used to select research problems that are in accordance with the research. After that, the articles are analyzed to obtain a theoretical basis that can support solving the problem being studied. The last process is the conclusion of the research. The data used in this study is secondary data from research conducted by previous researchers. The stages of data analysis are: 1) data collection, 2) data reduction), 3) data presentation, 4) drawing conclusions.

RESULTS

The results of previous research on the application of the Problem Based Learning Model are useful for getting an overview of the research results. The articles analyzed are as follows:

Table 1. Literature Mapping of Scientific Articles Problem Based Learning Model

No	Author (Year)	Research Title	Research purposes	Research result	Journal/ Proceeding
1	(Fauzia, 2018)	Application of Problem Based Learning Learning Models to Improve Elementary Mathematics Learning Outcomes	Knowing the difference in improving student learning outcomes between those who apply the Problem Based Learning learning model and those who apply conventional	There is an increase in better student learning outcomes in classes that apply the Problem Based Learning learning model (experimental class)	Primary
2	(Suryafitri, 2017)	Application of the Problem Based Learning Learning Model to Improve Mathematics Learning Outcomes for Grade IV Students at SDN 016 Langgini, Kampar Regency	Improving Mathematics Learning Outcomes of Grade IV Students at SDN 016 Langgini	Improving student mathematics learning outcomes in solving problems involving money	Jurnal Pendidikan Matematika
3	(Setyosari, 2017)	Model Deployment Problem Based	Increase motivation and student learning outcomes	The Problem Based Learning model can increase student motivation and learning outcomes	Jurnal Pendidikan: Pengembangan (2017) 2(9) 1188-1195
4	(Nugraha, 2018)	Mastery of Science Concepts for Elementary Students Using Problem Based Learning Model	Improving students' critical thinking skills and mastery of science concepts at SD Negeri Cisomang 2 by using the Problem Based Learning model	Both critical thinking skills and mastery of concepts experienced a significant increase	EduHumaniora | Jurnal Pendidikan Dasar Kampus Cibiru (2018) 10(2) 115-127

No	Author (Year)	Research Title	Research purposes	Research result	Journal/ Proceeding
5	(Ratnaningsih, 2017)	The Analisys of Mathematical Creative Thinking Skills and Self Efficacy of High Students Built Through Implementation of *Problem Based Learning* and Discovery Learning	Develop students' creative thinking skills and creative attitudes through the visionary Green Chemistry Problem- Based Lecture (PBL) model	Students mathematical creative thinking abilities with problem-based learning increased compared to students' mathematical creative thinking abilities with discovery learning	JPMI (Jurnal Pendidikan Matematika Indonesia) (2017) 2(2) 42
6	(Nuswowati & Taufiq, 2015)	Developing creative thinking skills and creative attitude through problem based green vision chemistry environment learning	To build creative thinking skills and creative attitude of students through a model of Problem Based Lectures Environmental Chemistry (PBL) Green Chemistry visionary	Environmental chemistry lecture questions with green chemistry insight can improve students' thinking skills and creativity	Jurnal Pendidikan IPA Indonesia (2015) 4(2) 170-176
7	(Maskur et al.,2020)	The Effectiveness of Problem Based Learning and Aptitude Treatment Interaction in Improving Mathematical Creative Thinking Skills on Curriculum 2013	To see which results are more effective in improving students' thinking skills between the Problem-Based Learning (PBL) and Skilled Treatment-	Students' creative thinking skills increased with the Aptitude Treatment Interaction (ATI) model compared to mathematical creative	European Journal of Educational Research (2020) 9(1) 375-383

No	Author (Year)	Research Title	Research purposes	Research result	Journal/ Proceeding
			Interaction (ATI) models	thinking with the Problem Based Learning (PBL) model.	
8	(Eviyanti, Surya, Syahputra, & Simbolon, 2017)	Improving the Students' Mathematical Problem Solving Ability by Applying Problem Based Learning Model in VII Grade at SMPN 1 Banda Aceh Indonesia	To find out the growth of students' mathematical problem-solving abilities taught by problem-based learning models is better than the growth of students' mathematical problem-solving abilities taught by traditional learning.	The improvement of students' mathematical problem solving abilities based on the application of the Problem Based Learning model is better than that of students who are given the opportunity to use traditional learning	International Journal of Novel Research in Education and Learning (2017) 4(2)138-144

A literature review of problem-based learning models was conducted for the eight articles mentioned above. Based on research on 8 articles shows that the application of problem-based learning models can improve learning outcomes, motivation, critical thinking, creative thinking and problem solving skills. The applied problem-based learning improves students' understanding of concepts.

Literature on improving problem-solving skills, learning outcomes of mathematics and problem-based learning models.

Table 2. Mapping Literature Review Journals Problem Solving Ability, Mathematics Learning Outcomes and Relevant Problem Based Learning Model

No	Author (Year)	Research Title	Research purposes	Research result	Journal/ Proceeding
1	(Erna Novianti, Putri Yuanita dan Maimunah, 2020)	Problem based learning in improving mathematical problem solving skills	Improving mathematical problem solving skills (KPMM) through the application of the Problem Based Learning (PBL) model	The application of the problem based learning (PBL) learning model can increase the KPMM of class VII-2 students of SMPN 9 Pekanbaru	Journal of Education and Learning Mathematics Reasearch (JELMaR)
2	(Surya fitri, 2017)	Application of the Problem Based Learning Learning Model to Improve Mathematics Learning Outcomes for Grade IV Students SDN 016 Langgini, Kampar Regency	Improving the learning outcomes of fourth grade students at SDN 016 Langgini	Improving student mathematics learning outcomes in solving problems involving money	Education Journal Mathematics
3	(Badrulaini, 2018)	The relationship between problem solving abilities and independent learning towards students' mathematics learning outcomes	The relationship between mathematical problem solving abilities and learning independence with students' mathematics learning outcomes	Problem solving skills and independent learning together has a significant influence on the results of learning mathematics.	Jurnal Pendidikan: Tambusai ISSN: 2614-3097 Volume 2 Nomor 4 Tahun 2018 Halaman 847-855

No	Author (Year)	Research Title	Research purposes	Research result	Journal/ Proceeding
4	(Rini Sri Putri, Mulia Suryani dan Lucky Heriyanti Jufri, 2019)	The effect of applying the Problem Based Learning model to student mathematical problem solving abilities	To determine the effect of the application of problem-based learning models on the mathematical problem solving abilities of Class VII students of SMP Negeri Palembayan based on the level of Basic Mathematics Ability (KAM) of students.	The PBL model can make students' math problem solving abilities better.	Mosharafa: Journal of Mathematics Education e- ISSN: 2527-8827
5	(Triono Djonomiarjo , 2019)	Effect of Problem Based Learning Model on learning outcomes	Knowing about the impact of problem- based learning models on student learning outcomes	There are significant differences in social studies and economics learning outcomes in class X students of SMK Negeri 1 Patilanggio who use the PBL learning model compared to conventional learning model.	Journal of Non-formal Education AKSARA
6	(Agus Robiyanto , 2021)	The effect of problem based learning models on student learning outcomes	Finding differences in student learning outcomes using problem-based learning models.	After conducting classroom action research using problem-based learning models, it increased by 79.09, which means that problem-based	Journal of Elementary School Teacher Education E- ISSN: 2721-7957

No	Author (Year)	Research Title	Research purposes	Research result	Journal/ Proceeding
				learning models can improve student learning outcomes.	
7	(Putu Agus Eka Mastika, Wilibaldus Bhoke, 2018)	The effect of the Problem Based Learning model on mathematics learning outcomes in elementary students	To find out the difference in mathematics learning outcomes between students who study with a problem-based learning model and students who learn with a standard learning model used in elementary school students.	There is a significant difference in the results of learning mathematics	Journal of Education Technology. Vol. 2 (2) pp. 70-75

No	Author (Year)	Research Title	Research purposes	Research result	Journal/ Proceeding
8	(Tia Alfianiawati & Nasrul, 2019)	The effect of using the problem based learning (PBL) model on student learning outcomes in social studies class V elementary school	Describe the impact of problem-based learning (PBL) on student social studies learning outcomes.	From the analysis of data at a significant level of 5% (0.05) it is obtained that $t_{table} < t_{count}$ is $t_{2.00324} < t_{2.994}$. These results prove that Ha is accepted, namely the influence of the use of the Problem Based Learning (PBL) model on student learning outcomes in social studies learning in grade V SD.	e-Jurnal Inovasi Pembelajaran SD Volume 7, Nomor 3, 2019
9	Aisyah Nofziarni, Hadiyanto, Yanti Fitria & Alwen Bentri (2019)	The effect of using the Problem Based Learning (PBL) model on student learning outcomes in elementary schools	To find out student learning outcomes by using the Problem Based Learning (PBL) learning model in elementary schools	The results of the study show that the use of the Problem Based Learning (PBL) model has an effect on learning outcomes on spatial feature recognition material in class V SD Negeri 04 Garegeh. This is indicated by the results of the t-test at a significant level	Jurnal Basicedu Volume 3 Nomor 4 Tahun 2019 Halaman 2016-2024

No	Author (Year)	Research Title	Research purposes	Research result	Journal/ Proceeding
				of 5% (0.05) obtained t-count (7.36) > t-table (1.6694). From this it can be concluded that the learning outcomes of the experimental class students who were taught using the problem-based learning model (PBL) were classified as very high criteria, where the learning outcomes were achieved with a maximum score of 100 and a minimum score of 64, while the experimental class average was 82.30. Thus, the problem- based learning model (PBL) can affect student learning outcomes in class.	

No	Author (Year)	Research Title	Research purposes	Research result	Journal/ Proceeding
10	Hery Setiyawan (2017)	PBL (Problem Based Learning) model of mathematics learning in mathematics subject matter of broad fields in class III elementary school students	To determine the effect of the application of the PBL (Problem Based Learning) model on learning outcomes in mathematics subject area material in class III students.	From the results of the analysis it can be concluded that the Problem Based Learning (PBL) learning model has an effect on learning outcomes in broad fields.	INOVASI (Jurnal Humaniora, Sains, dan Pengajaran) Volume XIX, Nomor 1, Januari 2017

Based on the 10 scientific articles above problem solving abilities, mathematics learning outcomes and relevant problem based learning models, research results were obtained which explained that Problem Based Learning makes learning very active and efficient, thereby increasing problem solving abilities and student mathematics learning outcomes increasing. Model problem-based learning can help students with unusual problem-solving processes by maintaining uncertainty and creative thinking. The implementation of the problem based learning model encourages students to think critically through planning, debating, stating questions about a problem, analyzing and providing solutions to the problem.

DISCUSSION

Previous research on the application of problem based learning models

Based on the results of previous research in the articles that have been collected in this study. Fauziah and Fitri found that the Problem Based Learning (PBL) model could improve student learning outcomes. Increased learning outcomes from the lowest 5% to the highest 40%, with an average of 22.9% (Fauzia, 2018). Satrio and Nugraha explained that PBL can increase motivation and mastery of learning material concepts. Motivation arises because PBL always provides problems that need to be solved together, so that students are active in solving these problems (Nugraha, 2018).

Nuswowati, explained that the application of PBL not only improves critical thinking skills, but also improves creative thinking skills (Nuswowati & Taufiq, 2015). Maskur explained that PBL was not better at increasing creative thinking skills than the Aptitude Treatment Interaction (ATI) model.

Eviyanti, et al explained that PBL has more influence on solving problems in mathematics compared to conventional learning (Eviyanti et al., 2017).

Previous research on increasing problem- solving abilities, mathematics learning outcomes and problem-based learning models

Literature study on improving problem solving skills and learning outcomes through the Problem Based Learning learning model refers to 10 research articles. The discussion includes.

Erna et al. found that the application of problem-based learning (PBL) examples could increase the KPMM of class VII-2 students of SMPN 9 Pekanbaru. Observation sheets for teacher & student activities and KPMM tests are used as data. The data obtained through student observation and the KPMM test were then analyzed using descriptive narrative analysis techniques and narrative statistical analysis. (Erna Novianti, Putri Yuanita and Maimunah, 2020).

Surya Fitri stated that the results of research on the application of a problem- based learning model could improve the mathematics learning outcomes of students at SDN 016 Langgini Kampar IV Kampar Regency in solving problems related to money. (Surya fitri, 2017).

Previous research on increasing problem- solving abilities, mathematics learning outcomes and problem-based learning models

Literature study on improving problem solving skills and learning outcomes through the Problem Based Learning learning model refers to 10 research articles. The discussion includes.

Erna, et al found that the application of the Problem Based Learning (PBL) learning model could increase the KPMM of class VII-2 students of SMPN 9 Pekanbaru. The data collection used was observation sheets of teacher activities and students' activities as well as the KPMM test. Data obtained through observation and students' KPMM tests were then analyzed using descriptive narrative analysis techniques and descriptive statistical analysis techniques. (Erna Novianti, Putri Yuanita and Maimunah, 2020).

Surya Fitri stated that the results of research on the application of a problem- based learning model could improve the mathematics learning outcomes of students at SDN 016 Langgini Kampar IV Kampar Regency in solving problems related to money. (Surya fitri, 2017).

Badrulaini found in the results of the study that problem-solving skills and learning independence together had a significant effect on learning outcomes in mathematics, using subject-related questions and questionnaires. (Badrulaini, 2018).

Rini Sri Putri, et al found that the PBL model can make students' math problem solving skills better by giving tests in the form of essays. (Rini Sri Putri, Mulia Suryani and Lucky Heriyanti Jufri, 2019).

Triono found that there were significant differences in social studies and economics learning outcomes for class X students of SMK Negeri 1 Patilanggio who used the PBL learning model and the traditional learning model. According to him, the problem-based learning model is a cooperative learning model that requires students to be active and motivated to support and help each other in mastering the subjects they are studying. (Triono Djonomiarjo, 2019)

Agus Robiyanto found that after conducting classroom action research with the application of the problem based learning model there was an increase to 79.09 which means that the problem based learning model can improve student learning outcomes. (Agus Robiyanto, 2021).

Putu Agus, et al found that there were significant differences in mathematics learning outcomes between groups of students using conventional learning models. This can be seen from the average mathematics learning outcomes of the experimental group which is greater than the average mathematics learning outcomes of the control group. (Putu Agus Eka Mastika, Wilibaldus Bhoke, 2018).

Tia Alfianiawati, et al found that from data analysis at a significant level of 5% (0.05) it was obtained ttable < tcount of t2.00324 < t2.994. These results prove that Ha is accepted, namely the influence of the use of the Problem Based Learning (PBL) model on student learning outcomes in social studies learning in grade V SD. (Tia Alfianiawati & Nasrul, 2019).

Aisha et al. noted that the results of the study showed that the use of problem-based learning (PBL) models had an impact on learning outcomes in recognizing spatial features in Class V material at SD Negeri 04 Garegeh. This is indicated by the results of the t-test at a significant level of 5% (0.05) obtained tcount (7.36) > ttable (1.6694). From this it can be concluded that the learning outcomes of the experimental class students who were taught using the problem-based learning model (PBL) were classified as very high criteria, where the learning outcomes were achieved with a maximum score of 100 and a minimum score of 64, while the experimental class average was 82.30. Thus, the problem- based learning model (PBL) can affect student learning outcomes in class (Aisyah Nofziarni, Hadiyanto, Yanti Fitria & Alwen Bentri, 2019).

Hery Setiyawan found that from the results of the analysis it can be concluded that the Problem Based Learning (PBL) learning model has an effect on learning outcomes in broad fields. (Hery Setiyawan, 2017).

In the discussion section, there is a link between the results obtained and the basic concepts and/or hypotheses, and there is a match or conflict with the research results of other researchers. It can also be written the implications of the research results from both in theory and implementation.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that problem-based learning models can improve elementary school students' problem-solving abilities and mathematics learning outcomes.learning outcomes of elementary school student

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