



LITERATUR STUDY OF STUDENTS MATHEMATICAL PROBLEM SOLVING ABILITIES ON HIGHER ORDER THINKING SKILL QUESTIONS FROM VARIOUS LEARNING MODELS

Elia Siska¹, Muhammad Amin Fauzi²,

^{1,2}Department of Mathematics, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia

Article Info

Article history:

Keywords:

Literature Study, Problem Solving Ability, Higher Order Thinking Skill Problem Based Learning, Discovery Learning

ABSTRACT

This study aims to determine the results of a literature study on students' mathematical problem solving abilities on higher order thinking skill (HOTS) questions from various learning models. Students' problem solving abilities in identifying elements that are known or needed in solving mathematical problems, formulating mathematical problems, selecting problem solving, and re-examining problem solving to then make solutions in other ways or develop student problem solving when students are faced with math problem. High Order Thinking Skills (HOTS) is a thinking process of students at a higher cognitive level that is developed from various cognitive concepts and methods and learning taxonomies such as problem solving methods, bloom taxonomies, and learning, teaching, and assessment taxonomies. Based on the results of the analysis of the results of the study, it was concluded that students' mathematical problem solving abilities could be improved by applying problem based learning and discovery learning models. And the learning model that is better used is the Problem Based Learning.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Elia Siska,
Department of Mathematics,
Universitas Negeri Medan, Medan, Indonesia
Email: elia.siska74@gmail.com

1. INTRODUCTION

Mathematics is usually considered to be the most difficult subject for both children and adults. At school, many students seem to have become disinterested in mathematics, and often question the relevance of the large amount of time spent teaching this subject. However, research has proven its importance, mathematics in everyday life of adults. The process of solving mathematical problems is one of the basic mathematical abilities that must be mastered by students. Mathematical problem solving is one of the important goals in learning mathematics even the process of solving mathematical problems is the heart of mathematics.

Student problem-solving ability is defined as the ability to understand student problems in identifying elements that are known or needed in solving mathematical problems, formulating mathematical problems, selecting problem-solving options, and re-examining problem-solving to then make solutions in other ways or develop solutions. student problems when students are dealing with math problems. The current conditions in learning mathematics at school show that students' mathematical problem solving abilities are still considered lacking and have not been specifically emphasized (Kemendikbud, 2016). This can be seen

from the results of a survey conducted by the Program for International Student Assessment (PISA) which shows the low average mathematical scores of students in Indonesia are still low.

2. RESEARCH METHODE

This research is library research or what is also called library research. Library research or literature study is a series of activities related to methods of collecting library data, reading and recording and processing research materials. While the approach used is qualitative. This type of research is qualitative research, where this research is library literature so that the data collection method used is documentation, namely tracing written sources that contain the themes and topics discussed. Arikunto (2010: 201) explains that documentation comes from the word document, which means goods - written items. Then Sukardi (2004: 34) explains the various documents or literature sources including, journals, research reports, scientific magazines, newspapers, relevant books, seminar results, unpublished scientific articles, sources, letters decisions and so on. The data that has been collected is then analyzed using descriptive methods describing what is being investigated. In this literature study research, the authors used various written sources such as books, articles, journals and documents relevant to the study in this study. According to Vigih (2017), there are 5 stages in the process of research stages for literature studies, namely: Collecting literature and then reviewing some important terms in the research. Several literatures were obtained from various reference sources. Important terms defined in this study are Problem Based Learning and Mathematical Reasoning Collect relevant research literature. Relevant research results are obtained and used to enrich the analysis process, so that the analysis results are able to bring up objective conclusions Conduct an in-depth analysis based on all the literature that has been obtained by compiling the discussion. The discussion was carried out to conclude about increasing students' mathematical reasoning abilities through the application of Problem Based Learning Develop conclusions based on the results of the analysis. The conclusions obtained are statements that are in accordance with the research objectives Submit suggestions based on the findings obtained. The findings obtained based on the analysis process can be used as input, which will be useful for researchers and readers.

2.1. Problem Based Learning Model (PBL)

The problem-based learning model is learning that uses a variety of thinking skills from students individually and in groups as well as the real environment to solve problems so that they are meaningful, relevant and contextual. The purpose of PBL is to improve the ability to apply concepts to new/real problems, integrate the concepts of Higher Order Thinking Skills (HOTS), desire to learn, direct self-learning and skills. Through the Problem Based Learning (PBL) approach, students present their ideas, students reflect on their perceptions, argue and communicate to other parties so that the teacher understands students' thinking processes, and the teacher can guide and intervene in new ideas, concepts and principles. According to Hamzah (in Rusman, 2012: 246) The teacher's role is to lead students to understand concepts and prepare situations with the subject being taught. Furthermore, students construct as many problems as possible to increase the development of understanding of concepts, rules and theories in solving problems.

2.2. Discovery Learning Learning

Discovery Learning is a learning model presented by the teacher by providing stimulation or triggers to students so that students' reasoning and thinking power are optimized. According to Saefuddin and Berdiatif (2014: 56), states that the Discovery Learning Learning Model is defined as a learning process that occurs when the learner is not presented with a lesson in its final form, but through a process of finding. The teacher acts as a guide by providing opportunities for students to learn actively, as the opinion of the teacher must be able to guide and direct student learning activities in accordance with the objectives. Discovery learning according to Hosnan (2014, 282) is a model for developing an active way of learning students by finding themselves, investigating themselves, then the results obtained will be long lasting in memory, students will not easily forget. By learning discovery, children can also learn to think analytically and try to solve their own problems.

3. RESULT AND ANALYSIS

In this literature study research, the authors used various written sources such as books, articles, journals and documents relevant to the study in this study. According to Vigih (2017), there are 5 stages in the process of research stages for literature studies, namely: Collecting literature and then reviewing some important terms in the research. Several literatures were obtained from various reference sources. Important terms defined in this study are Problem Based Learning and Mathematical Reasoning Collect

relevant research literature. Relevant research results are obtained and used to enrich the analysis process, so that the analysis results are able to bring up objective conclusions. Conduct an in-depth analysis based on all the literature that has been obtained by compiling the discussion. The discussion was carried out to conclude about increasing students' mathematical reasoning abilities through the application of Problem Based Learning. Develop conclusions based on the results of the analysis. The conclusions obtained are statements that are in accordance with the research objectives. Submit suggestions based on the findings obtained. The findings obtained based on the analysis process can be used as input, which will be useful for researchers and readers.

Table 1. Summary of Research Findings

Code	Data source name	Research Summary
X1	Marojahan Panjaitan	The average score of students' ability to understand problems on the problem solving ability test cycle I was 6.43 with a percentage of 80%. The average score of students' ability to plan problem solving on the problem solving ability test cycle I was 8.77 with a percentage of 73.10%. The average score of students' ability to carry out problem solving on the problem solving ability test cycle I was 8.86 with a percentage of 73.81%. The average score of students' abilities in re-examining problem solving on the problem solving ability test cycle I was 4.69 with a percentage of 58.57%. The average score of students' ability to understand problems on the problem solving ability test cycle II was 7.29 with a percentage of 91.07%. The average score of students' ability to plan problem solving on the problem solving ability test cycle II was 9.34 with a percentage of 77.95%. The average score of students' ability to carry out problem solving on the problem solving ability test cycle II was 10.74 with a percentage of 89.52%. The average score of students' abilities in re-examining problem solving on the problem solving ability test cycle II was 6.85 with a percentage of 85.64%.
X2	Wira Lidia, H. Pandiangan, Edy Surya	The average score of students' ability to understand problems on the problem solving ability test cycle I was 76.44 with a percentage of 76.44%. The average score of students' ability to plan problem solving on the problem solving ability test cycle I was 60.15 with a percentage of 60.15%. The average score of students' ability to carry out problem solving on the problem solving ability test cycle I was 61.30 with a percentage of 61.30%. The average score of students' abilities in re-examining problem solving on the problem solving ability test cycle I was 64.37 with a percentage of 64.37%. The average score of students' ability to understand problems on the problem solving ability test cycle II was 94.25 with a percentage of 94.25%. The average score of students' ability to plan problem solving on the problem solving ability test cycle II was 84.67 with a percentage of 84.67%. The average score of students' ability

			to carry out problem solving on the problem solving ability test cycle II was 81.99 with a percentage of 81.99%. The average score of students' abilities in re-examining problem solving on the problem solving ability test cycle II was 75.29 with a percentage of 75.29%.
X3	Ummu Raudah Fahda Damanik, Muhammad Amin Fauzi		Students who took the pretest for the experimental class and control class totaled 24 and 27 respectively. The average result of the pretest score in the experimental class was 58.23 and the average result of the pretest score in the control class was 57.59. At the end of the meeting, students were again given a post-test. From the results of the post-test, it was found that the average posttest score for the experimental class was 87.92 and that for the control class was 77.59. The average calculation results on the posttest-pretest difference value data for the experimental class is 29.69 and the control class is 20.
X4	Mora Unni Marlina Lubis, Ani Minarni		By taking a sample of two class students, namely class XI TP 1 as experimental class I consisting of 34 students and class XI LP 1 as experimental class II consisting of 34 students. This study uses a problem based learning model for the experimental class I and the discovery learning model for the experimental class II.
X5	Jarwan		In this study, 4 meetings were held, followed by a posttest. After doing this, it is known that the average result of the students' pretest is 54.94 and the students' posttest is 78.12.
X6	Thasyia Indira		From the 6 meetings held, the experimental class score for the first meeting was 1.76. the second meeting 2.44. the third meeting 2.88 fourth meeting 3,2 the fifth meeting 3.52 sixth meeting 4 (good). For the control class, the average of the first meeting is 1.64 second meeting 2.22 the third meeting 2.48 the fourth meeting 2.74 the fifth meeting 2.91 sixth meeting 3.08 (enough).
X7	Nurhasanah Dede Eti		The increase in problem-solving ability can be seen from the average problem-solving ability of students who, before taking action, obtained an average score of 58.2 with a 0% completeness percentage increasing to 78.8 with an 80% completeness percentage in cycle I, and increasing again to 93. 6 with a percentage of 100% completeness in cycle II. The increase in the curiosity aspect of students also increased from the percentage of 40% in cycle I increased to 70% in cycle II, besides that the self-confidence aspect increased from

		the percentage of 50% in cycle I to 85% in cycle II, and also aspects of student responsibility also increased from the percentage of 60% in cycle I to 85% in cycle II. So it is concluded that discovery learning can improve students' mathematical problem solving abilities,
X8	Hendri Sherlyane	The increase in problem-solving ability can be seen from the average problem-solving ability of students who, before taking action, obtained an average score of 58.2 with a 0% completeness percentage increasing to 78.8 with an 80% completeness percentage in cycle I, and increasing again to 93.6 with a percentage of 100% completeness in cycle II. The increase in the curiosity aspect of students also increased from the percentage of 40% in cycle I increased to 70% in cycle II, besides that the self-confidence aspect increased from the percentage of 50% in cycle I to 85% in cycle II, and also aspects of student responsibility also increased from the percentage of 60% in cycle I to 85% in cycle II. So it was concluded that discovery learning can improve students' mathematical problem solving abilities.

3.1. Overview Of Research Results Conducted By Data Sources

The research conducted showed positive results. From the research conducted, it was seen that the learning model had an effect on students' interest in the learning process using problem based learning and discovery learning models. Research conducted in the first meeting, the learning process did not run smoothly due to lack of student interest during the learning process. The learning model influences whether students' interest is running well or not. Because the problem-based learning and discovery learning models demand student activity and independence in learning, the lack of student interest in learning will affect the success of the learning model and increase students' abilities in solving students' math problems. Vice versa. But with the application of models carried out by data sources, then with problem-based learning and discovery learning models can improve students' mathematical problem solving abilities. The successful use of problem-based learning and discovery learning based on the results of research conducted by data sources depends on students' interests and students' initial understanding. Research conducted by data sources achieves different success depending on the object studied. However, after several meetings held, an increase in students' mathematical problem solving abilities was found. This increase occurred because the implementation of Problem Based Learning and Discovery Learning learning models encouraged students to be active by finding themselves, investigating themselves, so the results would not be easily forgotten by students. Problem-based learning and discovery learning models also help students improve and improve cognitive skills. The knowledge acquired through this model is highly personal and powerful because it enhances understanding, retention, and transfer. Can improve students' ability to solve problems. Helping students strengthen their self-concept, because they gain trust in working with others, encourage active involvement of students, encourage students to think intuitively and formulate their own hypotheses. Train students to learn independently and students are active in teaching and learning activities, because they think and use their abilities to find the final result. Thus, based on the review conducted based on the results of research conducted by data sources, the problem based learning and discovery learning models can improve students' mathematical problem solving abilities.

4. CONCLUSIOON

Based on the results of the analysis of the results of the research described in the previous chapter, it is concluded that students' mathematical problem solving abilities can be improved by applying problem-based learning and discovery learning models. 1. Based on the analysis of several sources of literature with the Problem Based Learning learning model can improve students' mathematical problem solving abilities by using classroom action research or experimental research. 2. Based on the results of analysis from several

sources of literature with the discovery learning model, by applying the discovery learning model students' mathematical problem solving abilities can be improved. From the results of data analysis from various research and the linkage of the steps for implementing the Discovery Learning learning model with each indicator of students' mathematical problem solving abilities. Based on the results of the analysis of the results of the study, it was concluded that students' mathematical problem solving abilities could be improved by applying problem based learning and discovery learning models. And the learning model that is better used is the Problem Based Learning learning model.

REFERENCES

- [1] X. S. Li, *et al.*, "Analysis and Simplification of Three-Dimensional Space Vector PWM for Three-Phase Four-Leg Inverters," *IEEE Transactions on Industrial Electronics*, vol. 58, pp. 450-464, Feb 2011.
- [2] Abdurrahman, M. (2015). *Pendidikan Bagi Anak Berkesulitan Belajar*. Jakarta: Rineka Cipta
- [3] Arikunto, S. (2012). *Dasar-dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara
- [4] Fahda, R, U, & Fauzi, M, A. (2019). Pengaruh Model Problem Based Learning Terhadap Peningkatan Kemampuan Pemecahan Masalah Matematis Pada Materi Program Linier Di Kelas XI SMKN 1 Meranti. *Karismatika*, 5 (2)
- [5] Hosnan. (2014). *Pendekatan Saintifik dan Konstekstual dalam Pembelajaran Abad 21*. Ghalia Indonesia : Bogor.
- [6] Hudojo, H. (2015). *Pengembangan kurikulum dan Pembelajaran Matematika*. Malang : UM Press
- [7] Husna, N.R.dkk. (2019). *Kemampuan Pemecahan Masalah Matematis pada Problem Based Learning (PBL) Berdasarkan Self Regulation Siswa, Proseding Seminar Nasional Matematika 2019*. Universitas Negeri Semarang, Semarang.
- [8] Indira, T, Zulkardi, & Sanova, Y. (2019). Peningkatan Kemampuan Pemecahan Masalah Pada Materi Persamaan Garis Singgung Lingkaran Melalui Pembelajaran Discovery Learning. *Jurnal Riset Pendidikan Matematika*, 2 (2)
- [9] Jarwan. (2018). Pengaruh Discovery Learning Terhadap Kemampuan Pemecahan Masalah dan Komunikasi Matematis Siswa. *Jurnal Penelitian Matematika dan Pendidikan Matematika*, 1 (2) : 77-89
- [10] Kemendikbud. (2012). *Kemampuan Matematika Siswa Smps Indonesia*. Jakarta : Pusat Penelitian Pendidikan Badan Penelitian dan Pengembangan Kementerian Pendidikan dan Kebudayaan.
- [11] Nurhasanah, D,E, Kania,N, & Sunendar,A. (2018). Penggunaan Model Pembelajaran Discovery Learning untuk meningkatkan Kemampuan Pemecahan Masalah pada Siswa SMP. *Jurnal Didactical Mathematics*, 1 (1) : 21-3