

The Effectiveness of Problem-Based Learning and Problem-Solving to Mathematics in Primary Schools

Puja Fijriyani ^{1,*}, Mustiningsih ¹, Agus Timan ¹, M. Kurniawan H. ¹, Mutmainnah ¹,
 Ressa Nada Perdana ¹

¹ *Department of Educational Management, Universitas Negeri Malang, Malang 65145, Indonesia*
 *Corresponding author. Email: puja.fijriani@gmail.com

ABSTRACT

The purpose of writing this article is to find out the problems and provide solutions in the learning process, how the learning model can be interesting, and make it easy for students to understand the material presented by the teacher. This article is compiled using a literature study approach regarding theories that can be studied following the appropriate learning model to be applied in the learning process, namely problem-based learning and problem-solving models. So based on the study conducted, that the problem-based learning and problem-solving learning model is one of the solutions in the learning process to deal with problems in mathematics in elementary schools. Under the results of review articles by researchers getting 93% results with 28 samples saying that the problem-based learning model is more effective than problem-solving.

Keywords: problem-based learning, problem-solving, mathematics

1. INTRODUCTION

Education is a process of transferring knowledge as a teacher explains knowledge to students. In the world of education, there are also many components involved, among them are resources, both human resources, financial resources and facilities, and infrastructure resources. Everything is competitive related to the success of the learning process to achieve educational goals. Education is also the main principle in a country to shape the nation's generation so that it can become the successor of the nation's fighters. So that culture and natural preservation are also maintained. Especially in academics, a good learning process is a teaching and learning process that can activate students in learning so that students are more interested and motivated in learning [1].

The national curriculum currently applied in Indonesia is the 2013 curriculum. What leads to the 2013 curriculum is the activeness of students in participating in learning. In this case, the basis for the 2013 curriculum is to increase the creativity of students and be able to be innovative in the classroom. So that it supports the ability of students to hone their knowledge. The 2013 curriculum has been implemented at the school level by integrating thematic subjects. Thematic is a unifying subject from several other subjects by minimizing meetings [2]. Where previously with various subjects it

could become several meetings with thematic integrative learning that could be reached in one meeting.

Mathematics is one of the subjects that must be taken by all students in both primary, secondary, and tertiary education institutions. Learning to count, add and others is a small part of mathematics. Where students must be able to master it to make it easier to add or anything else regarding mathematics. Learning discovery following the active search for knowledge carried out by students will get better results. Students with the knowledge they have, try to solve problems to produce meaningful knowledge. Either in counting, adding up, or otherwise, students must try independently so that what is obtained can become meaningful knowledge.

Many students, especially in elementary schools, are still unable to count. This is a fundamental problem in the world of education that must be resolved immediately. Because counting is a key element in the learning process in mathematics. Here the teacher must be more creative and innovative in planning a learning process that is appropriate and following the needs of students at this time. For this problem, several learning models can be an alternative or solution in solving this problem, including by applying problem-based learning and problem-solving learning models. Problem Based Learning is a learning model that provides challenges to students to explore a problem with the knowledge they have to find

solutions or problem-solving. Meanwhile, Problem Solving is a learning model that enables students to make mathematical knowledge relevant in everyday life.

2. METHOD

The research study in this article uses a qualitative approach with the case study method, which writes down facts in the field as a description of the research used to meet the objectives of the research being carried out. The data in these two articles examine the effect of 2 different learning models in Mathematics. The model in question is Problem Based Learning and Problem Solving, but it has differences in the variables or subjects studied, namely, the first article examines Class 4 while the second article examines Class 5. In this case study, the thing under study is oriented towards thinking skills to solve problems. in solving problems and difficulties in understanding the material on Mathematics subjects.

The data collection technique in this article uses a case study, where this literature study examines the previous articles to find the formulation of the problem that was initiated in achieving the objectives of this study. Literature studies mean that the research we do does not have to research directly on subjects related to the formulation of the problem of the articles made, through case studies, researchers can get various sources of research results from articles, journals, theses, and so on.

This study uses descriptive data analysis in which the discussion includes facts in the field to be explained and explained in detail so that the depth of the data from the research is very clear and must be clear. The data analysis itself has described systematically so that it has a neat sequence and pattern from planning to the results of the research in 2 articles as literature material. In describing these 2 articles some conclusions can be drawn from these articles, namely having similar variables with different subject differences so that they can be concluded the problem formulation is that the Problem Based Learning and Problem Solving learning model which is used to test the thinking ability to solve problems in Mathematics learning has a greater influence on Problem Based Learning than Problem Solving with the percentage of success to test the thinking ability to solve problems in Mathematics learning.

3. RESULTS

In accordance with the results of the application of research methods, there are two learning models being compared, namely problem based learning and problem solving. In accordance with the two articles that became a literature study, the following results were obtained: in the first research subject, researchers took many ways to draw conclusions to compare between Problem Based Learning and Problem Solving which is more effective to be applied to Mathematics learning, the researcher took 28 samples. students in grade 4. And the result 93% refers

to more effective Problem Based Learning than Problem Solving. Then in the second article we also found in the results of the study that the Problem Based Learning Model had more impact or influence on increasing students' critical thinking in learning with the results of experimental class 1 research of 0.59 and experimental class 2 of 0.50.

4. DISCUSSION

4.1. *Mathematical Problems in Primary Schools*

Mathematics teacher requires a teaching method, so that teaching is a process of giving students more enthusiasm. Regularity in teaching is necessary if learning objectives are effective and efficient. For the application of learning methods must be adapted to the characteristics of students . The suitability of the methods used in learning with the material and characteristics of students that can make the learning process easier for students to be more enjoyable, so that learning is more effective, which in the end students get good achievements [3]. Mathematics learning can be caused by factors from students and teachers [4]. One of the factors that can lead to mathematics learning is the lack of mastery of appropriate learning methods and approaches to be used in each different class.

Mathematics is a compulsory subject in the Indonesian curriculum. Mathematics is a difficult subject and this is a negative impression for students and has an impact on students' learning motivation in mathematics subjects [5]. This makes students bored and finds it difficult to do math problems. Even though when a student understands and understands mathematics, students will find it easy to count, add up, divide and so on. Where students can build creativity in analyzing problems and generating ideas as a form of problem solving procedure.

Mathematics is a field of science that trains humans to be able to think logically and systematically in solving problems [6]. That is the importance of mathematics, at the primary level (primary school) mathematics has been applied in the learning process up to tertiary institutions. It is in line with Kline's statement [7] which states that mathematics for level primary school is very necessary and useful in dealing with their environment. Where mathematics is something that is oriented to everyday life. However, the majority of students complain about learning mathematics, where students consider mathematics a difficult and abstract subject. Based on the results of the study of primary school teachers, students experience anxiety when faced with learning mathematics, this is interpreted as a feeling of fear that students cannot solve problems and also students' displeasure with mathematics which is considered abstract [8].

At the primary school level (primary school) mathematics has been applied in the learning process. The majority of students complain about learning mathematics, where students consider mathematics a difficult and abstract subject. This is a reference for teachers in isolation to apply learning models that can develop students' learning motivation in increasing creativity and innovation of students in mathematics, especially in solving problems related to mathematics and achieving learning goals. There is a need for an approach or model that can be used to be able to change the learning process which aims to improve students' abilities in mathematics. The use of the right learning model needs to be considered in a learning process.

Less satisfactory student learning outcomes are a picture of the prominent problems in learning mathematics in general [9]. Meanwhile, the learning outcomes of students are still below the standard of competencies, students are less active in learning, in groups students do not cooperate, lack of interaction between teachers and students and students are less skilled in solving a problem [10]. So that the motivation and independence of students are low and students still rely on information or material from the teacher rather than motivating themselves to read the material first [11].

4.2. The Effectiveness Of Problem Based Learning And Problem Solving To Mathematics In Primary Schools

The learning model is a pattern that explains a process of mentioning and an environmental situation that causes students to interact so that special changes occur in themselves [12]. Meanwhile, the learning model refers to the learning approach that will be used, including teaching objectives, stages in learning activities, learning environment, and class management [13]. So it can be concluded that a learning model is a form of activity pattern in explaining something with appropriate approaches in order to create an interaction between teachers and students that aims to develop their potential. The learning model that is suitable and effective for solving the above problems.

4.2.1. Problem Based Learning

Problem-based learning model is a learning process by presenting a problem, there is a process of asking questions, providing facilities for investigations and providing opportunities for dialogue/discussion [14]. Then Problem Based Learning is also a learning model that leads to the skills of students in solving a problem so that they can gain new knowledge of the problem and train students to be able to think highly [2]. This learning model encourages students to be able to train thinking in solving a problem. The problem-based learning model is a learning model that trains students to be able to solve

problems with concrete problems so as to gain knowledge and concepts from the subject matter. What refers to the problem-based learning model is that this model provides support to be able to move actively in the learning process by improving students' 'critical thinking skills based on students' understanding behavior. In the research results found several conclusions that make problem-based learning and problem solving an alternative in solving students' problems in mathematics in elementary schools. In numeracy problems students can use problem-based learning and problem solving as a solution in increasing student learning achievement.

According to Aha (2020) explains that the use of problem solving learning models can familiarize students to solve a problem using the right concept and using systematic and structured stages. Meanwhile, Tai, et al (2019) explained that the application of the problem-based learning model provides opportunities for students to construct their potential and knowledge. In line with the statement of Jaya, et al. (2019) which states that the Problem Based Learning Model is a model that focuses on contextual problems, where students can solve problems with their knowledge either independently or in groups. So seeing the explanation above, it can be concluded that these two learning models can be an alternative or solution for students to be able to deepen and make it easier to understand the material on mathematics subjects.

Problem-based learning is learning that is equally effective because learning has characteristics that can help students, both characteristics expressed by Arends (2008). These characteristics include: (1) authentic or (real-world) problems are the beginning of learning that can generate student motivation; (2) solve the problems of students who are required to use learning resources; (3) students carry out discussions and investigations in completing their learning; (4) in the problem-based learning process, guide students to carry out evaluations in carrying out their learning tasks. the steps in implementing problem-based learning are: (1) orienting problems towards students; (2) organizing students in learning; (3) facilitating group or individual investigations; (4) develop and present the form of the work of students; and (5) analyze and evaluate the results of problem solving.

It is important to apply a problem-based learning model so that students can solve problems and deepen their knowledge of mathematics [15]. However, after seeing and understanding how the implementation of the Problem Based Learning model is implemented, here will also explain the strengths and weaknesses of the Problem Based Learning model, to follow up for improvements in the future. A learning model, of course, has its advantages and disadvantages. In the Problem Based Learning Model there are strengths and weaknesses in it [14]. The advantage for students using problem based

learning include are lack of confidence with low enough interest, requires a bit of time to prepare, and unresolved problems make students less motivated to learn.

4.2.2. Problem Solving

Problem solving is learning based on problem solving. Where students are required to be able to solve problems given by the teacher. Problem-solving is a process of learning to solve problems that aim to train students' thinking skills at the level of students so that they can take new experiences based on the results of solving the problem itself [2]. In this learning model, it provides opportunities for students to be able to solve a problem under the rules and realities that exist in everyday life. These skills can make it easier for students when faced with a problem so that students can study the problem and be able to solve the problem.

Problem solving makes it easier for students to get and collect information from various sources in compiling answers to problems they experience [16]. Problem-solving steps, namely: (1) identifying the problem (identifying the problem), (2) representation of the problem (problem representation), (3) planning the solution (planning the solution), (4) executing the plan (realizing the plan), and (5) evaluating the plan In this learning process, it will help students to be more courageous in taking solutions or answers according to the knowledge and experience they have experienced. The teacher must be able to provide a reflection on the learning process that has been carried out by students in order to strengthen and sharpen the knowledge that has been achieved by students [17].

In the Problem Solving model, there are strengths and weaknesses. Some of the strengths and weaknesses of the problem solving model. The advantages for students in problem solving learning models train in dealing with problems that are spontaneous, train activeness and be responsible for answering problems, problems that exist in school are relevant to everyday life, and determine problems that are relevant to the abilities of students [14]. The advantages for students in problem solving learning models are takes a long time, passive learners will have difficulty following the learning, and it is difficult to organize materials to be applied in learning.

5. CONCLUSION

Based on the description of the results of the study in the first article, it is concluded that the Problem Based Learning Model shows that 93% is more effective than the Problem Solving Model with 91%. This shows that there is a difference of 2% to prove the effectiveness of these two learning models with 28 students as the research sample. Therefore, the effectiveness of the two learning models shows that it can improve students' problem-solving abilities. Whereas in the second article

it shows that experiment 1 with the Problem Based Learning Model is 0.59 and the experimental class 2 with the Problem Solving Model is 0.50. This also shows that the two learning models can improve students' critical thinking skills. From the analysis of the two articles, it shows that the two learning models are effectively applied in mathematics learning.

Problem-based learning and problem-solving learning models can be a reference for the workforce to be applied in learning with the aim of increasing students' thinking patterns in solving problems. Both of these models can support the activeness of students so as to create optimal and fun learning. So that it can achieve the goals of a lesson.

REFERENCES

- [1] S. Sutomo, "Pembelajaran Aktif, Kreatif, Efektif Dan Menyenangkan (Pakem) Dengan Metode Tim Kuis Untuk Meningkatkan Motivasi Dan Hasil Belajar Siswa Kelas X Kky 1 Materi Menyiapkan Proses Konstruksi Kayu Pada Smk Negeri 1 Wonoasri Semester 2 Tahun Pelajaran 2016/2017," *El-Wasathiya J. Stud. Agama*, Vol. 5, No. 2, Pp. 191–226, 2017.
- [2] E. P. Afifah, W. Wahyudi, And Y. Setiawan, "Efektivitas Problem Based Learning Dan Problem Solving Terhadap Kemampuan Berpikir Kritis Siswa Kelas V Dalam Pembelajaran Matematika," *Must J. Math. Educ. Sci. Technol.*, Vol. 4, No. 1, Pp. 95–107, 2019.
- [3] N. Agustyaningrum And S. Suryantini, "Hubungan Kebiasaan Belajar Dan Kepercayaan Diri Dengan Hasil Belajar Matematika Siswa Kelas Viii Smp N 27 Batam," *Jipmat*, Vol. 1, No. 2, 2016.
- [4] W. N. Shanti And A. M. Abadi, "Keefektifan Pendekatan Problem Solving Dan Problem Posing Dengan Setting Kooperatif Dalam Pembelajaran Matematika," *J. Ris. Pendidik. Mat.*, Vol. 2, No. 1, Pp. 121–134, 2015.
- [5] S. Susilawati, "Upaya Meningkatkan Kemampuan Pemecahan Masalah Matematika Dan Kreativitas Siswa Melalui Model Pembelajaran Problem Based Learning," *Pedagogia*, Vol. 17, No. 1, Pp. 67–79, 2019.
- [6] Y. Arnidha And N. Noerhasmalina, "Model Problem Based Learning (Pbl) Pada Pembelajaran Matematika," *J. E-Dumath*, Vol. 4, No. 2, Pp. 46–51, 2018.
- [7] N. T. Renda, "Penerapan Model Problem Solving Untuk Meningkatkan Hasil Belajar Matematika," *J. Ilm. Pendidik. Profesi Guru*, Vol. 2, No. 3, Pp. 248–257, 2019.
- [8] Y. Dwi Kurino, "Problem Solving Dapat Meningkatkan Hasil Belajar Siswa Pada Materi Operasi Penjumlahan Dan Pengurangan Bilangan Bulat Di Kelas V Sekolah Dasar," *J. Cakrawala Pendas*, Vol. 4, No. 1, 2018.
- [9] F. A. Andri, T. Septia, And A. Yunita, "Pengaruh Penerapan Model Pembelajaran Problem Based Learning Disertai Teknik Kepala Bernomor Terhadap Hasil Belajar Matematika Siswa Smp Kelas Viii," *J. Pelangi*, Vol. 9, No. 1, 2017.
- [10] A. J. Kumala, S. B. Waluyo, And B. Siswanto, "Implementasi Model Problem Based Learning Untuk Meningkatkan Kemampuan Komunikasi Matematis Dan

- Percaya Diri Siswa Kelas X Sma Negeri 4 Semarang,” In *Prisma, Prosiding Seminar Nasional Matematika*, 2019, Vol. 2, Pp. 410–415.
- [11] H. Suhendri, “Pengaruh Metode Pembelajaran Problem Solving Terhadap Hasil Belajar Matematika Ditinjau Dari Kemandirian Belajar,” *Form. J. Ilm. Pendidik. Mipa*, Vol. 3, No. 2, 2015.
- [12] H. Darwis, “Manajemen Laba Terhadap Nilai Perusahaan Dengan Corporate Governance Sebagai Pemoderasi,” *J. Keuang. Dan Perbank.*, Vol. 16, No. 1, 2012.
- [13] M. P. Trianto, “Mendesain Model Pembelajaran Inovatif-Progresif,” *Jakarta: Kencana*, 2009.
- [14] S. Fahmi, S. Syahrir, And A. Kurniawan, “Penerapan Metode Pembelajaran Problem Solving Untuk Meningkatkan Motivasi Dan Kemampuan Pemecahanmasalah Matematika Siswa Kelas Viii B Smp Negeri 3 Batukliang Tahun Pelajaran 2016/2017,” *Media Pendidik. Mat.*, Vol. 5, No. 1, Pp. 6–10, 2018.
- [15] R. N. Farida, D. P. Utomo, And Z. Zukhrufurrohman, “The Effectiveness Of Problem Based Learning In Terms Of Creativity And Learning Outcomes,” *Mej (Mathematics Educ. Journal)*, Vol. 4, No. 2, 2020.
- [16] N. Wahyuningtyas And F. A. D. Rosita, “Pengembangan Multimedia Interaktif Berbasis Android Pada Materi Kehidupan Sosial Masyarakat Indonesia,” *Sej. Dan Budaya J. Sej. Budaya Dan Pengajarannya*, Vol. 13, No. 1, Pp. 34–41, 2019.
- [17] S. U. Smith, S. Hayes, And P. Shea, “A Critical Review Of The Use Of Wenger’s Community Of Practice (Cop) Theoretical Framework In Online And Blended Learning Research, 2000-2014,” *Online Learn.*, 2017.
- [18] Gunawan, I. (2017, September). Indonesian Curriculum 2013: Instructional management, obstacles faced by teachers in implementation and the way forward. In 3rd International Conference on Education and Training (ICET 2017). Atlantis Press.
- [19] Sobri, A. Y., Bafadal, I., Nurabadi, A., & Gunawan, I. (2018, October). Development of Mentoring Modules Based on Self-Reflection for Beginner Principal. In 3rd International Conference on Educational Management and Administration (CoEMA 2018). Atlantis Press.
- [20] Gunawan, I. (2018). The Implementation of Lesson Study Based Learning Management and the Effect toward Students’ Activeness in Lecturing. *JPP (Jurnal Pendidikan dan Pembelajaran)*, 24(2), 51-63.
- [21] Kusumaningrum, D. E., Sumarsono, R. B., & Gunawan, I. (2019). Professional Ethics and Teacher Teaching Performance: Measurement of Teacher Empowerment with a Soft System Methodology Approach. *International Journal of Innovation, Creativity and Change*, 5(4), 611-624.
- [22] Pertiwi, A. K., Cahyani, S. S. A., Diana, R. C., & Gunawan, I. (2018, October). The Leadership of Kyai: A Descriptive Study. In 3rd International Conference on Educational Management and Administration (CoEMA 2018). Atlantis Press.
- [23] Bafadal, I., Nurabadi, A., Sobri, A. Y., & Gunawan, I. (2019). The Competence of Beginner Principals as Instructional Leaders in Primary Schools. *International Journal of Innovation, Creativity and Change*, 5(4), 625-639.
- [24] Kusumaningrum, D. E., Sumarsono, R. B., & Gunawan, I. (2018, October). Empowering the Principal of Boarding House-Based Junior High School in East Java Province Indonesia. In 3rd International Conference on Educational Management and Administration (CoEMA 2018). Atlantis Press.
- [25] Nurabadi, A., Sucipto, S., Juharyanto, J., & Gunawan, I. (2018, October). The Implementation of Education Management Standards in the School Laboratory State University of Malang for Improving Educational Quality. In 3rd International Conference on Educational Management and Administration (CoEMA 2018). Atlantis Press.
- [26] Hardika, H., Aisyah, E. N., & Gunawan, I. (2018, October). Facilitative Learning to Improve Student Learning Creativity. In 3rd International Conference on Educational Management and Administration (CoEMA 2018). Atlantis Press.
- [27] Agustina, N. E., Sumarsono, R. B., & Gunawan, I. (2018, September). Implementation of School and Community Relationship Techniques (A Case Study in SDN Karangbesuki 2 Malang, Indonesia). In 1st International Conference on Early Childhood and Primary Education (ECPE 2018). Atlantis Press.
- [28] Sultoni, S., Gunawan, I., & Ningsih, S. O. (2018, October). Descriptive Study of Efforts Integrates Character Values to Students. In 3rd International Conference on Educational Management and Administration (CoEMA 2018). Atlantis Press.
- [29] Bafadal, I., Juharyanto, J., Nurabadi, A., & Gunawan, I. (2018, October). Principal Leadership and its Relationship with Student Learning Achievements: A Regression Analysis. In 3rd International Conference on Educational Management and Administration (CoEMA 2018). Atlantis Press.