

Application of Problem-Solving Learning to Improve Mathematics Learning Outcomes in Elementary Schools

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ABSTRAK

Penerapan pembelajaran “*problem solving*” pada materi pelajaran matematika di sekolah dasar terbukti dapat meningkatkan hasil belajar siswa. Melalui pendekatan penelitian tindakan, metode pengumpulan data didasarkan pada penilaian yang mengukur hasil belajar siswa. Temuan penelitian ini menunjukkan bahwa paradigma pembelajaran pemecahan masalah dapat menjadi alat yang efektif dimana siswa kelas IV dapat meningkatkan hasil belajar matematika khususnya pada subbidang pecahan. Hanya 36,36% pelaksanaan prasiklus dari sebagian besar tujuan pembelajaran siswa yang tercapai, faktanya proporsi hasil belajar siswa yang meningkat pada setiap siklus menjadi salah satu indikatornya. Meskipun masih lebih rendah dari rata-rata siklus sebesar 69,69%, namun terjadi peningkatan hasil belajar siswa sepanjang Siklus I. Pengenalan pada Siklus II menyebabkan peningkatan hasil belajar siswa secara keseluruhan sebesar 90,90% dari seluruh siswa.

Keywords: *problem solving*; pelajaran matematika; hasil belajar; sekolah dasar

ABSTRACT

The application of learning "problem solving" to the subject matter of mathematics in elementary schools has been proven to improve student learning outcomes. Through the action research approach, the data collection method is based on an assessment that measures student learning outcomes. The findings of this study indicate that the problem-solving learning paradigm can be an effective tool in which fourth grade students can improve their mathematics learning outcomes, especially in the sub-field of fractions. Only 36.36% of the pre-cycle implementation of most of the student learning objectives that have been achieved, the fact that the proportion of student learning outcomes that increase in each cycle is an indicator of this. Although still lower than the cycle average of 69.69%, there was an increase in student learning outcomes throughout Cycle I. The introduction of Cycle II led to an overall increase in student learning outcomes of 90.90% of all students.

Keywords: *problem solving; math; learning outcomes; elementary school*

INTRODUCTION

The fundamental goal of any learning program is to master and understand how things happen. But it also provides mastery and understanding of why things happen. Given this problem, training in problem solving skills is very important. The ultimate goal of education is to equip students with the knowledge and skills they need to address the challenges currently being faced by society as a whole. Produce students with problem solving skills that should be utilized in the classroom. The ability to practice applying what they have learned to new situations and making use of the skills they already have makes problem solving an important component of the mathematics curriculum. This is because problem solving provides opportunities for students to practice applying what they have learned to new situations.

According to Tanjung (2018), students' mathematical abilities are school resources and assets that must be developed so that students can think clearly, logically, methodically, and creatively, as well as equip students with self-discipline and problem-solving skills needed to meet the challenges of the modern world. Important math skills, such as applying rules to unknown problems, finding new ways to combine ideas, and communicating mathematical concepts, can be honed through this teaching. The role of teachers as professional educators cannot be overstated, and teachers' pedagogical skills are an important aspect of their overall competence (Tanjung & Nababan, 2018).

For students and their future, problem solving skills are very important. The majority of educators believe that students can acquire some problem-solving abilities through disciplinary studies. Problem solving is more than just a teaching method, but also a way of thinking, up to how students are able to solve certain problems. The question of how to teach problem solving will always be an interesting question, because problem solving often requires the ability to use a variety of techniques, from initial data collection to final analysis (Burkhardt & Bell, 2007; Hamdan & Saud, 2013; Schoenfeld, 1983). Teaching materials need to prepare challenging problems as a starting point for discussing, analyzing, comparing, and drawing conclusions so that students find appropriate solutions. These problems can be brought up by teachers, students, or by the students themselves, and can be used as topics of discussion and open up learning opportunities for students.

Based on observations in several elementary schools, the results of measuring student achievement in mathematics were mostly still low. Factors that cause include a lack of student participation in class learning, the strategies used by teachers in the teaching and learning process are boring, discussion and lecture techniques are less varied, which in turn causes students to become disinterested in the learning process, and the teaching and learning process has no effect significantly to student learning outcomes.

In order to achieve the stated goals of increasing human resources and producing generations of positive personality, self-control, intelligence, noble character, and skills for themselves, every teacher must understand that education is essentially a conscious, planned effort to develop knowledge and potential within the individual (Meyer & Norman, 2020; Peterson, 1985). This goal can be achieved through the development of knowledge and individual potential through education, both in terms of religion and nation. The aim of the education system is to create citizens who are intelligent and able to compete in their field.

"Mathematics is related to abstract ideas and concepts arranged hierarchically, as well as deductive reasoning" (Hudojo, 1990). Although mathematics is not a perfect science by itself, it exists to help people understand and solve social, economic, and environmental problems (Rosa & Orey, 2015). Therefore mathematics lessons for elementary school students are very useful in terms of the ability to deal with their environment, to grow their mindset, and to study science in the universe (Isoda, 2007). Especially given the rapid progress made in science and technology in the modern era, it is no longer necessary to investigate whether teaching elementary school students mathematics is beneficial or not because it is self-evident and requires no further investigation. Teachers need to be motivated so that they can use various strategies to communicate mathematics subject matter so that it is easier for students to understand and realize the relevance of mathematical knowledge to their lives (Moschkovich, 1999; Wachira et al., 2013). This is important so that basic education has better standards, both the process and learning outcomes, including the mastery of mathematical concepts.

The desired achievement is that students participate in an educational process that is fun, creative, and useful. However, the reality shows that mathematics is less attractive to students while they are in school, and in both elementary and secondary schools, there are still many misconceptions about mathematics as a difficult and boring subject. The reality is that mathematics is not very attractive to students when they are in school. Students often report feeling bored due to a variety of factors, including a lack of hands-on experience with other students and very challenging material. Based on interviews with math teachers who also teach as well as homeroom teachers for grade 4 at SD Negeri 07 Sungai Soga, several problems were found.

Educators have come to the conclusion that mathematics is the most challenging topic to teach students in its entirety, taking into account all aspects of education. Observational findings indicating a lack of desire and involvement of students in the process of learning mathematics are in line with this. This is because students only act as passive recipients of concepts or material from teachers, learning is dominated by teachers, and teachers tend to adopt conventional learning methods. This lack of motivation and student activity is due to conventional learning methods requiring students to passively receive information from the teacher. The problems that arise during the course of learning ultimately affect the results of the learning process for students. It can be seen that the minimum completeness criteria (MCC) requirement of 70 has not been met in terms of obtaining the class average score. Given these issues, it is clear that it is the responsibility of the educator to find answers to the educational challenges faced by the participants in these activities.

Because in essence this problem can be overcome by creating efficient alternative problem-solving techniques to overcome learning barriers, especially by adopting appropriate learning models, which can increase student enthusiasm for learning. Make learning more meaningful by teaching students the value of cooperation to achieve common goals in facing competition besides equipping them with academic knowledge. One learning model that can be used to improve student learning outcomes in mathematics is a problem solving learning model (Mubarroq & Santosa, 2021; Saniya et al., 2020; Santosa, 2022). Learning mathematics is a subject that fits this model, considering that mathematics students are often faced with problems that have been developed from mathematical concepts. In addition, mathematics can

be utilized in the process of finding solutions to problems related to daily activities. To put this into practice, you must be able to apply mathematical concepts to a variety of different scenarios. This is necessary so that the scenario can be reconstructed as a mathematical problem, which must then be solved. Students will gain a better appreciation for the educational value of mathematics as a result of this, and be able to develop their rational thinking skills, especially students' abilities to assess events, apply their knowledge to new situations, solve problems, and understand the relationships between what they have learned (Sanjaya, 2006).

METHOD

This type of research is class action research (CAR), is research conducted by a teacher or certain people in the class with the aim of improving the learning process carried out by the teacher, so that student learning outcomes can be further improved. The results of one cycle are perfected in the next cycle, and so on until the right strategy is found to help learning, and students can successfully master mathematics with pleasure. Each cycle consists of four steps, namely: (1) planning, (2) action or action, (3) observation, and (4) reflection. This research was conducted at SD.N Jatisawit, Sleman Regency, Yogyakarta. The subjects of this study were 33 grade IV students. The factors examined in this study were student factors consisting of increasing students' mathematical understanding in learning fraction material, and how students' efforts to solve problems. The research procedure used in this study was a class action research procedure which was carried out in two cycles. Each cycle follows the stages of (1) planning, (2) action or action, (3) observation, and (4) reflection. Cycle I material includes sets, cycle II material includes determining subsets and determining the number of subsets. The instruments used in this study include tests for each cycle, observation sheets for each cycle, and journals. As for data collection techniques with quantitative data by analyzing the value of each cycle on the average value, classical uptake and learning completeness, while qualitative data by analyzing observation sheets and journals.

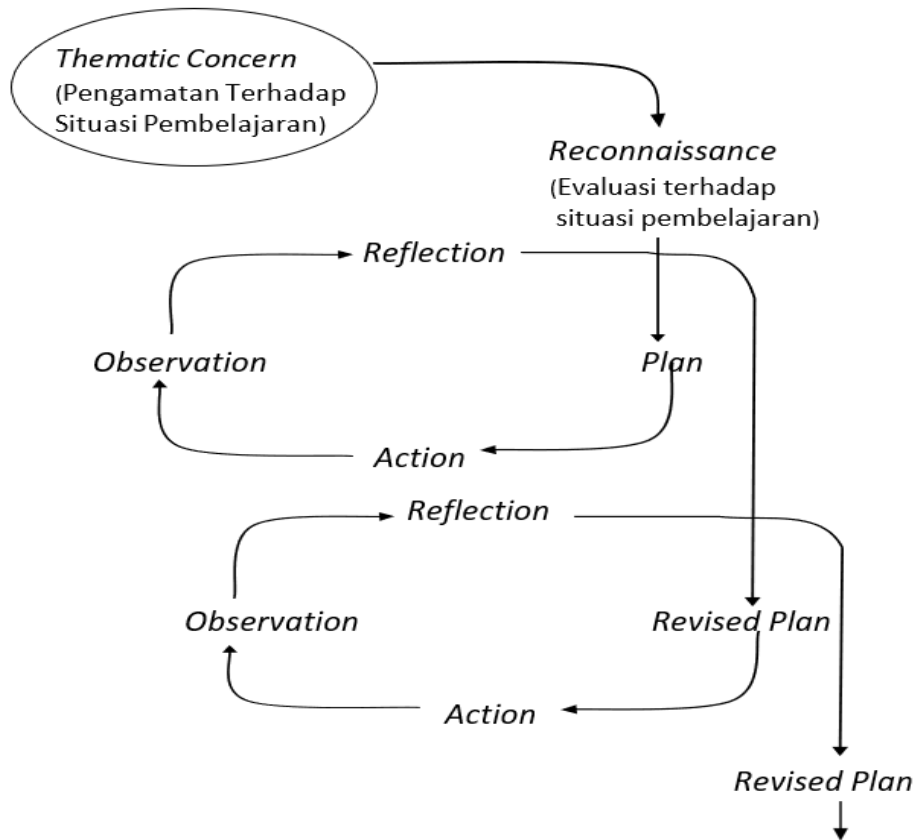


Figure 1
The Action Research Spiral
 Sumber: Kemmis, S., McTaggart, R. (1988)

RESULT AND DISCUSSION

The findings of observations that have been made are presented to determine the extent to which the learning outcomes of each cycle have been fulfilled. The pre-test was given to students before data collection, each cycle started to determine how far they had mastered the material. The results obtained are:

Table 1. Pre-Cycle Student Learning Outcomes

Student	Score	MCC	Completeness
Student 1	30	70	Not Completed
Student 2	30	70	Not Completed
Student 3	50	70	Not Completed
Student 4	30	70	Not Completed
Student 5	70	70	Complete
Student 6	50	70	Not Completed
Student 7	50	70	Not Completed
Student 8	70	70	Complete
Student 9	70	70	Complete
Student 10	50	70	Not Completed
Student 11	70	70	Complete

Student 12	70	70	Complete
Student 13	50	70	Not Completed
Student 14	30	70	Not Completed
Student 15	70	70	Complete
Student 16	50	70	Not Completed
Student 17	60	70	Not Completed
Student 18	50	70	Not Completed
Student 19	50	70	Not Completed
Student 20	80	70	Complete
Student 21	50	70	Not Completed
Student 22	30	70	Not Completed
Student 23	50	70	Not Completed
Student 24	80	70	Complete
Student 25	50	70	Not Completed
Student 26	50	70	Not Completed
Student 27	60	70	Not Completed
Student 28	50	70	Not Completed
Student 29	70	70	Complete
Student 30	30	70	Not Completed
Student 31	50	70	Complete
Student 32	70	70	Complete
Student 33	70	70	Complete
Amount	1.790		
Average	54,24		Not Completed

Table 2. Percentage of Pre-Cycle Results

No	MCC	Frequency (F)	Percentage (%)	Results
1.	70	12	36,36 %	Complete
2.	< 70	21	63,63 %	Not Completed

Based on table 2, the average student score is 54.24, with 12 students or 36.36% completing, and 21 students not completing or 63.63%. Based on the results of pre-cycle learning, it is known that students' scores have not reached completeness. This shows that students have a lower level of motivation to participate in the mathematics learning process, and as a result the participating students are less focused on the subject delivered by the teacher. This is because the teaching techniques carried out by the teacher do not attract students' interest and even make them feel uncomfortable participating in class learning. It is very important to apply learning strategies that can increase student engagement and achievement so that the teaching and learning process is more effective. After that the researcher conducted cycle I as a follow-up.

CYCLE I

Cycle I took place on November 28, 2022, and fraction material was used.

During this phase, the researcher engages in the following tasks:

In the planning step, the teacher prepares a learning implementation plan (RPP), prepares a 10-question essay exam sheet. After that, prepare the learning process and make observation sheets for teachers and students. During the implementation phase, the researcher plans based on the lesson plan, the teacher uses a problem-solving approach, the teacher compiles the main problems, and the teacher draws conclusions about the problem at the end of the lesson. The teaching and learning activities carried out by researchers during Cycle I were still relatively low, with many aspects of learning activities falling into the "good enough" category. Where the teacher failed to involve students, structure problems, and failed to connect previous lessons, which are prerequisites for the next topic in the curriculum, failed to explain learning objectives, and failed to provide corrective or enrichment activities quickly.

Table 3. Learning Outcomes in Cycle I

Student	Score	MCC	Completeness
Student 1	50	70	Not Completed
Student 2	50	70	Not Completed
Student 3	70	70	Complete
Student 4	70	70	Complete
Student 5	80	70	Complete
Student 6	50	70	Not Completed
Student 7	70	70	Complete
Student 8	80	70	Complete
Student 9	80	70	Complete
Student 10	50	70	Not Completed
Student 11	80	70	Complete
Student 12	80	70	Complete
Student 13	70	70	Complete
Student 14	50	70	Not Completed
Student 15	80	70	Complete
Student 16	70	70	Complete
Student 17	80	70	Complete
Student 18	50	70	Not Completed
Student 19	70	70	Complete
Student 20	90	70	Complete
Student 21	70	70	Complete
Student 22	50	70	Not Completed
Student 23	70	70	Complete
Student 24	100	70	Complete
Student 25	50	70	Not Completed
Student 26	70	70	Complete
Student 27	80	70	Complete
Student 28	70	70	Complete
Student 29	90	70	Complete
Student 30	50	70	Not Completed
Student 31	50	70	Not Completed

Student 32	90	70	Complete
Student 33	90	70	Complete
Amount	2.300		
Average	69,69		Not Completed

Table 4. Percentage of Cycle I Result Score

No	MCC	Frequency (F)	Percentage (%)	Results
1.	70	23	69,69%	Complete
2.	< 70	10	30,30%	Not Completed

Based on table 4, there are still some children who have not mastered the fraction material taught by the teacher. However, when compared with the data in the pre-cycle, the student mastery achieved in cycle I was higher with an average total score of 69.69. The number of students who successfully completed were 23 people which was equivalent to 69.69%, while the number of students who did not successfully completed were 10 people which was equivalent to 30.30%. Improvements are needed to enhance the learning process as a result of students in Cycle I not reaching their full potential in their academic endeavours. This is because the expected classical completeness rate of SD.N Jatisawit, namely 85% of all students which has become a school regulation, has not been fulfilled.

Reflection:

Based on research findings regarding the results of applying problem-solving methods to learning fractional material, classical student completeness has not been achieved. The failure of the action (implementation) in the first cycle is indicated by the findings of the learning reflection carried out in the first cycle. The findings include learning outcomes and the learning process. Because some students did not listen to the teacher's explanation, there were still students who were too shy to voice their ideas, and some were unable to draw conclusions until the end of the meeting. Therefore, the researcher drew the conclusion that learning in cycle I was not successful. Consequently, further action needs to be taken.

CYCLE II

During Cycle II, researchers took several actions, including:

Arousing students' curiosity and motivation, and being able to connect with previous lessons as a premise for continuing to the next topic, educators must function as facilitators, must be able to develop problems of student difficulties, and must direct students through the process of drawing conclusions from learning at the end of the meeting. The second cycle was conducted on Tuesday, November 29, and the exam was held at the end of class. During the second cycle, the researcher participated in various activities designed to encourage the learning process.

The teacher makes lesson plans, teacher and student observation sheets, and ten test questions during the planning stage. At the implementation stage, the researcher implements plans based on lesson plans, the teacher uses problem solving techniques, the teacher compiles the main problems, and the teacher concludes the problem at the end of the lesson. Based on the research findings, it can be stated that there was a significant increase in student learning

activities during the teaching and learning process, as evidenced by the increasing number of students who completed the learning outcomes of Cycle II. Students are shown to be more involved in learning materials related to fractions, thereby increasing student engagement.

Cycle II learning outcomes were evaluated with a written posttest consisting of 10 additional questions that were presented after the initial test questions were completed. The following table presents information about student learning outcomes.

Table 5. Student Learning Outcomes in Cycle II

Student	Score	MCC	Completeness
Student 1	70	70	Complete
Student 2	50	70	Not Completed
Student 3	70	70	Complete
Student 4	70	70	Complete
Student 5	90	70	Complete
Student 6	70	70	Complete
Student 7	70	70	Complete
Student 8	90	70	Complete
Student 9	90	70	Complete
Student 10	70	70	Complete
Student 11	90	70	Complete
Student 12	90	70	Complete
Student 13	70	70	Complete
Student 14	50	70	Not Completed
Student 15	90	70	Complete
Student 16	70	70	Complete
Student 17	80	70	Complete
Student 18	70	70	Complete
Student 19	70	70	Complete
Student 20	100	70	Complete
Student 21	70	70	Complete
Student 22	70	70	Complete
Student 23	70	70	Complete
Student 24	100	70	Complete
Student 25	70	70	Complete
Student 26	70	70	Complete
Student 27	80	70	Complete
Student 28	70	70	Complete
Student 29	90	70	Complete
Student 30	50	70	Not Completed
Student 31	70	70	Complete
Student 32	90	70	Complete
Student 33	90	70	Complete
Amount	2.510		
Average	76,06		Complete

Table 6. Percentage of Cycle II Result Score

No	MCC	Frequency (F)	Percentage (%)	Results
1.	70	30	90,90%	Complete
2.	< 70	3	9,09%	Not Completed

It can be seen from Table 6 that the level of completeness of students has increased, with 90.90% of 30 students having completed and 9.09% of 3 students not completing. The success of Cycle II students has been ideal or very successful.

Reflection:

From the data obtained about learning outcomes it can be concluded as follows that students are able to solve problems effectively. The test results show that 85% of students achieve learning outcomes. Indicates that a student's classical mastery has been achieved. By applying the problem-solving method, fourth grade students at SD.N Jatisawit were able to understand fraction facts that varied according to the results of the analysis. Mastery is achieved through improving the teacher's approach to students and each cycle to ensure that learning goes as intended. This shows that the learning activities carried out during Cycle II produced results.

This research is actually only a preliminary activity to carry out the pre-cycle by giving pre-tests to students to find out the level of students' knowledge of mathematics, especially the sub-field of fractions. The results of this test are used to determine whether pre-cycle needs to be done or not. According to the initial findings on this exam, the level of student achievement is still quite low. Only 36.36% of SD.N Jatisawit students scored 70 and above, referring to the established and determined MCC, while 63.63% scored below 70. This shows that achievement has not been completed. This is caused by the inability of teachers to motivate students to learn. The conventional method is the method most widely used by teachers for learning, and the learning that is applied is more teacher-centered, as a result students are only passively involved in the learning process, so students get bored quickly with the learning process.

Based on the results of the pre-cycle test, the researcher conducted cycle I. In this cycle, the researcher used problem solving methods in the teaching and learning process. After learning, student achievement increased more than before learning was carried out. The percentage of students who successfully completed it was 69.69% or 23 out of 33 students, while the percentage of students who did not complete it was 10 students or 30.30%. This shows that the teaching and learning process in cycle I did not go according to plan, and classical completeness did not reach the required criteria. Students were not familiar with applying many of the tactics the teacher used to solve problems, which resulted in low achievement during the first cycle. So that students still cannot adjust to the learning activities carried out in class. On the other hand the teacher does not continue the previous lesson which is a prerequisite for continuing to the next topic, the teacher has not been able to develop students' thoughts, the teacher has not acted as a facilitator, the teacher has not guided students, and the teacher has not directly provided remedial activities to students who get low scores. In cycle II, student learning outcomes experienced a significant increase as a direct result of the application of a problem-solving methodology that was developed specifically to improve student learning

outcomes. This is indicated by an increase in student achievement which can be seen from the increase in the percentage of students who achieved completeness to 30 students or 90.90%, and many students who achieved an MCC score of 70. Only 3 out of 33 students or 9.09% did not meet the score requirements MCC.

In this cycle, the influence of students' understanding of the application of problem solving is what boosts student learning outcomes. In the previous discussion, the application of problem solving techniques has been proven to improve student learning outcomes in fractional material so as to increase students' motivation and interest in mathematics.

CONCLUSION

From the findings of the classroom action research conducted, the following conclusions can be drawn, namely that problem solving strategies have the potential to improve learning outcomes for fourth grade students at SD.N Jatisawit. This is indicated by the percentage of student learning outcomes that increase in each cycle. During the pre-cycle implementation, most of the student learning outcomes were still below the minimum completeness criteria (MCC), and only 36.36% of the 33 students were considered complete. Student learning outcomes increased during Cycle I, although the increase was not optimal because only 69.69% of students achieved the MCC. After Cycle II, the proportion of students who successfully completed the exam increased to 90.90% of the total number of students.

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