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Student Activeness in Problem Solving Ability Based Learning on Magnet Material

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Abstract: Education is a conscious and planned effort to create a learning and teaching atmosphere so that students actively develop their potential to have spiritual religious strength, self-control, personality, intelligence, noble morals, and the skills needed by themselves, society, nation and state. Education has a major role in achieving success in child development. Education is a process that is carried out consciously and planned in order to develop the abilities and potential that exist within a person. This study aims to see the effect of implementing the PBL model on students' learning activities and problem-solving abilities on the material of magnetic force in elementary schools. This study uses a quantitative approach with a quasi-experimental design with a pretest-posttest non-equivalent control group design. The results showed that the experimental group that implemented the PBL learning model experienced a significant increase compared to the control group that used conventional learning. The increase in learning activities in the experimental group was recorded at 22.39%, while the increase in problem-solving abilities reached 31%. In contrast, the control group that used conventional methods also showed an increase, but in a lower percentage, namely 20.11% for learning activities and 21.26% for problem-solving abilities. The application of the PBL model is more effective in improving both aspects compared to conventional learning methods.

Keywords: Learning activity; Magnet; Problem based learning; Problem solving skills

Introduction

Education plays an important role in making the nation smarter and at the same time encouraging the transformation of the country from backward to advanced, by building basic abilities that include thinking, intellectual, emotional, and interpersonal skills. Through education, individuals and society can experience significant transformation, both in mindset, attitude, and behavior (Aprima & Sari, 2022; Nainggolan & Daeli, 2021; Yanuardianto, 2019). This process takes place through teaching that provides understanding and training that builds skills. With quality education, people not only gain knowledge, but are also equipped with the ability to adapt, think critically, and make wise decisions, thus accelerating the progress of the country as a whole (Yuli et al., 2023).

In the current Independent Curriculum, there is a differentiated learning method which is the result of developments in the world of education and presents student-centered learning (Citraningrum & Hima, 2022; Ikhsan & Febrianta, 2023; Nastiti & Citraningrum, 2021; Rante et al., 2023). Differentiation is an action that changes a process, designs various activities to support students' understanding of the material, modifies products, and provides opportunities for students to demonstrate their understanding or learning outcomes in various ways (Andarika et al., 2023; Maulidia & Prafitasari, 2023).

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Effective learning is learning that is able to involve students actively in the process. Through this involvement, students can gain direct experience both in the classroom and in the school environment that helps them develop the ability to find and understand knowledge independently (Amini et al., 2021; Supriatna et al., 2024). Ideally, learning is not limited to lecture methods where teachers speak and students take notes, followed by exercises. Instead, learning models should encourage active participation from students, allowing them to interact, experiment, and explore the material in greater depth to improve their understanding (Fajar, 2021; Ningsih et al., 2023).

One of the learning models that has the advantage of involving students in critical thinking and problem solving is Problem Based Learning (PBL). Critical thinking skills must be trained in the learning process (Fitria et al., 2018). PBL is a learning model that involves students with real problems that are relevant to their experiences (Widiasworo, 2018). Whereas, Ummah (2019) stated that problem-based learning is applied to create an innovative learning atmosphere while encouraging students' creativity in solving learning problems. The problems are given before learning begins to encourage students to research, analyze, and find solutions (Ardianti et al., 2021). The learning process can also emphasize providing direct experience to develop competencies to explore and understand the natural environment scientifically. The learning process must provide direct experience to develop student competencies, while creating effective, creative, innovative, and enjoyable activities (Aprima & Sari, 2022; Fitria, 2017).

Problem solving ability is an effort to find a way out of a difficulty to achieve a goal, because most of the problems faced by students are limited knowledge (Rahmi et al., 2024; Suwarma, 2023). Problem solving is still considered the most difficult thing in science learning, especially in magnet material, both for teachers and students. These difficulties arise because finding answers is seen as the only goal to be achieved, because they focus on the answers, sometimes students make mistakes in choosing the appropriate solution.

The results of observations on March 4-May 20, 2024 showed that students with very low learning achievement and had difficulty in answering questions, understanding story problems, and recognizing elements such as known, asked, and answers in science learning on magnet material. Teacher-centered learning creates a passive atmosphere, inhibits problem-solving skills, and makes students hesitate to participate actively. The transition from online to face-to-face learning post-COVID-19 is also an obstacle, because students have difficulty understanding material that was previously only delivered via WhatsApp groups without direct practice.

During face-to-face learning, students' activities in visual, motoric, oral, and emotional aspects are still less than optimal. For example, students rarely practice teacher demonstrations, only a few give their opinions, and feel nervous during presentations. Most of the students' activities are limited to writing, listening, and solving problems, without any significant individual or group problem-solving process. To overcome these problems, researchers designed learning with the Problem-Based Learning (PBL) method to improve students' learning achievement in the material on magnetic force in science lessons. This material includes the process of magnet formation, the history of magnets, types of magnets, magnetic and non-magnetic objects, how to make magnets, eliminate magnetic properties, and methods for making magnets.

Method

This research is a quantitative research using numbers and definite facts to answer questions. This research uses an all-experimental method. The research was conducted at SD Negeri 03 Alai Timur, Padang City. The research was conducted in grade IV of elementary school registered in the odd semester of the 2024/2025 academic year. This research requires 2 samples, namely the experimental class sample and the control class sample. Sampling in this study used the Probability Sampling technique. Probability Sampling is a sampling technique that provides an equal opportunity for each member of the population to be selected as part of the sample members (Sugiyono, 2017; Sudaryono 2021). The research instrument is a tool used to measure research variables. According to Sugiyono (2017) Research instruments are tools used by researchers to measure natural or social phenomena that are observed or studied. In this study, the variables are student learning activities and student problem-solving abilities.

The instrument used in this study was a Questionnaire Sheet, a questionnaire is a technique or method of collecting data indirectly where researchers do not directly ask and answer questions with respondents (Sudaryono; 2021). Furthermore, the Test Sheet, the Test Sheet is a research instrument used to determine the effect of the Problem Based Learning (PBL) learning model onabilityproblem solving is a test sheet in the form of questions. The data collection techniques in this study are interviews, observations, questionnaires, tests, and documentation. To collect initial data, researchers use data collection techniques through interview activities, observations, questionnaires, and documentation. Data Analysis Techniques in this study are Data analysis in this study

is a t-test which is carried out after the prerequisite test for t-test analysis has been met.

Result and Discussion

Information on student engagement in active learning during science teaching was collected through pretest and posttest evaluations. The experimental and control groups received a 25-question learning activity questionnaire for assessment. Pretest and posttest data will be analyzed to see how the Problem Based Learning (PBL) learning model affects problem-solving skills in magnet material. This study uses 8 learning activity indices: visual, auditory, motoric, oral, drawing, emotional, mental, and writing activities.

Table 1. Student Learning Activity Data

Information	Experiment		Control	
	Pretest	Posttest	Pretest	Posttest
Minimum Score	62	75	52	75
Maximum Score	72	93	62	80
Standard Deviation	4.75	3.5	4.14	2.91
Mean	64.25	86.64	59.53	79.42
N-Gain		0.62		0.48

The table shows that both the experimental group and the control group increased their activity learn differently. The experimental group obtained an average pretest of 64.25 and a posttest of 86.64. The average increase in learning activity in the experimental group increased by 22.39%, from the original 64.25 (65%) to 86.64 (87%). The average for the questionnaire work on the learning activities of students in the experimental group increased significantly after receiving therapy in the form of the Problem Based Learning (PBL) learning model. The table also shows the average learning activity of the control group. The average pretest and posttest of the control group were 59.53 and 79.42. The average increase in learning activity in the control group increased by 20.11%, from 59.53 (60%) to 79.42 (80%).

The pretest and posttest tests measure problem-solving skills in science learning. This assessment uses a descriptive test instrument that contains 30 objective questions each, which was given to the experimental and control groups. Pretest and posttest data will be studied to see how the paradigm of the Problem Based Learning (PBL) learning model affects problem solving in learning science material magnet. Data on student problem solving are presented in the table 2.

Table 2. Problem Solving Ability Data

Information	Experiment		Control	
	Pretest	Posttest	Pretest	Posttest
Minimum Score	35	60	40	75
Maximum Score	75	100	65	80
Standard Deviation	12.81	11.08	12.87	12.72
Mean	58.75	85.54	61.6	82.86
N-Gain		0.7		0.6

The experimental and control groups had different average problem-solving abilities, as seen in the table. The experimental group obtained an average pretest of 58.75 and a posttest of 85.54. While the average control class experimental learning activity increased by 31%, from 53.98 to 85.16. Treatment based on the Problem Based Learning (PBL) learning model greatly increased the problem-solving abilities of the experimental group students. The table shows the problem-solving abilities of the control group. The average pretest and posttest of the control group were 61.60 and 82.86. Students in the control group experienced an increase in problem-solving abilities of 21.26%, from 61.60 (61%), to 82.86 (83%).

This study tested whether the average scores of learning activity and problem-solving ability changed significantly between pretest and posttest using the Independent Sample T-test. The Independent Sample t-test uses significance values to make decisions. If the significance value is less than 0.05 then H0 is rejected and Ha is accepted. The hypothesis was tested using the independent sample t-test.

Table 3. Independent Sample T-Test Hypothesis Testing Learning Activities

Group Statistics					
	class	N	Mean	Std. Deviation	Std. Error Mean
Mark	posttest control class	28	79.43	2,911	.550
	posttest experimental class	28	86.64	3,509	.663

Table 4. Hypothesis Testing Independent Sample T-Test Problem Solving Ability

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	before being given treatment	58.75	28	12,811	2,421
	after being given treatment	85.54	28	11,084	2,095

The table compares the learning activities and problem-solving abilities of students in the experimental and control classes. The experimental group experienced an increase in learning activities of 86.64

while the control group experienced an increase in learning activities of 79.43. Hypothesis 1 (H0) is rejected and Ha is accepted because the Independent Sample t Test produces 0.000 for the learning activity variable. These data indicate that the experimental group and the control group have different average student learning engagement. Problem-solving abilities increased by 85.16 in the experimental group and 58.75 in the control group. Hypothesis 2 (H0) is rejected and Ha is accepted because the Independent Sample t Test shows a significance value of 0.000 on problem-solving abilities. These data reveal that the average problem-solving abilities of the experimental and control groups are different. The results of the research hypothesis test indicate that the Problem Based Learning (PBL) learning model has an effect on students' learning activity and problem-solving abilities in science.

This study aims to determine the impact of the Problem Based Learning (PBL) learning model on student involvement in learning and their problem-solving abilities in the field of science.

The Influence of the Problem Based Learning (PBL) Learning Model on Student Learning Activity in Science Learning

This hypothesis was developed to assess the effect of the Problem Based Learning (PBL) learning model on active learning. Data collection was carried out by conducting a 25-item questionnaire test with learning activity markers before and after the use of the Problem Based Learning (PBL) learning model therapy in this study. The Problem Based Learning (PBL) learning model approach has an effect on student learning activities. When learning occurs, this model has been shown to have an impact on student engagement and the level of active learning. The application of this strategy can change the attitude of learning from focusing on the teacher to focusing on the students. This study uses five indicators as a reference: visual, auditory, motoric, oral, and mental activities. The application of the Problem Based Learning (PBL) learning model in science education has been shown to have a positive impact on student engagement in learning. The effect of the Problem Based Learning (PBL) learning model on student learning activities is supported by the results of the Independent Sample T-Test which shows a statistically significant p-value of 0.000. There is a difference in student learning engagement before and after using the Problem Based Learning (PBL) learning model. The increase in student learning activities is inseparable from the use of the Problem Based Learning (PBL) learning model during learning activities. The Problem Based Learning (PBL) learning model applied in science learning makes students more enthusiastic because students are involved in every process. Direct student involvement in learning using the Problem Based Learning (PBL) learning model makes students more active in asking or answering questions and interested in exploring further the information obtained (Nurhalimah et al., 2023). The Problem Based Learning (PBL) learning model in education involves students actively participating in data collection through investigative activities, both individually and in groups. Students ask questions, put forward ideas, and the teacher facilitates and monitors their involvement in the data collection process. Active learning in the classroom is facilitated by peer interaction (Ana et al., 2021).

The Influence of the Problem Based Learning (PBL) Learning Model on Students' Problem Solving Abilities in Science Learning

This hypothesis aims to assess the impact of the Problem Based Learning (PBL) learning model on problem-solving skills. This study collected data using written tests, namely pretest and posttest, each consisting of 30 objective questions. The objective questions given to students were designed to focus on the indicators of problem-solving skills used in this study. Methodology The Problem Based Learning (PBL) learning model requires students to develop critical thinking skills, solve problems, participate in individual learning, and engage in teamwork. Four indicators were used in this study: understanding the issue, developing a plan, implementing a strategy, and retrospective analysis. The Problem Based Learning (PBL) learning model requires students to conduct in-depth exploration thoroughly by searching for and collecting as much information as possible about the problems that have been given. Simple exploration thoroughly instills in students the importance of careful action, thoroughness, and critical thinking. This approach serves as a means to stimulate active involvement of students in problem-solving efforts.

The Influence of the Problem Based Learning (PBL) Learning Model Simultaneously on Learning Activity and Problem Solving Ability of Students in Science Learning

The use of learning models in the teaching process is considered important because it ensures that learning is in line with the intended objectives. The Problem Based Learning (PBL) learning model has several advantages as an alternative approach in science learning. Among them is its ability to create a learning atmosphere where the involvement of each student increases their individual thinking and fosters active learning and skills in building their own understanding while solving problems (Lestari et al., 2023). The results of the study showed that the application of the Problem Based Learning (PBL) learning model in the

experimental class had a major impact on learning activity and problem-solving skills in science learning.

Conclusion

This conclusion is based on the analysis of data presented in the previous chapter. The results of the study indicate that the Problem Based Learning (PBL) learning model approach has an impact on active learning and students' problem-solving abilities in the field of science. The findings of the study are explained below, the Problem Based Learning (PBL) learning model has a positive and significant effect on students' learning activeness in science for grade IV of elementary school, the Problem Based Learning (PBL) learning model has a positive and significant effect on students' problem-solving abilities in science for grade IV of elementary school, and the Problem Based Learning (PBL) learning model simultaneously has an impact on active learning and students' problem-solving abilities in science education for grade IV of elementary school.

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