



The Impact of Problem-Based Learning on Creative Thinking and Learning Motivation of Elementary School Students

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Abstract: This study aims to examine the effect of the Problem-Based Learning (PBL) model on elementary school students' creative thinking skills and motivation to learn mathematics. The background of this research is based on findings from several elementary schools in Cluster 2 of Jatinom Subdistrict, which indicate low levels of learning motivation, creative thinking ability, and suboptimal mathematics learning outcomes. Low participation in discussions, difficulty solving word problems, and lower mathematics scores compared to other subjects are key indicators of the issue. This research employed a quantitative approach with a quasi-experimental nonequivalent control group design. The population consisted of all fourth-grade students, totaling 224 students. The sample was drawn from four classes, two experimental and two control classes, using purposive cluster random sampling. Data were collected through tests, observations, and documentation. The research instruments were tested for content and construct validity, and their reliability was calculated using Cronbach's Alpha. Data were analyzed using normality and homogeneity tests, as well as hypothesis testing through paired sample t-tests and independent sample t-tests using SPSS 30. The results showed that both the PBL model and the expository method had a positive impact on improving students' creative thinking skills and learning motivation in mathematics. However, there was a significant difference between the two, with the PBL group consistently demonstrating higher improvement. The effectiveness of PBL is attributed to a learning process that actively engages students in contextual problem-solving, encourages collaboration, and fosters understanding through direct experience. Its emphasis on student-centered inquiry, deeper cognitive engagement, and active problem-solving likely contributes to its superior outcomes. Thus, PBL is proven to be more effective than the expository method in enhancing both aspects among elementary school students.

Keywords: problem-based learning, creative thinking, learning motivation.

▪ INTRODUCTION

Education plays a strategic role in national development because it is the main factor in enhancing the nation's intelligence. This aligns with the national goals stated in the Preamble of the 1945 Constitution, which is to educate the nation's life. Therefore, the improvement of education quality must be continuously pursued to keep pace with the times. The regulation of the Minister of Education, Culture, Research, and Higher Education of Indonesia No. 16 year 2022 states that the standards for the learning process must be effective, efficient, and encourage students' potential, creativity, and independence. At the elementary school level, education plays a strategic role in laying the foundations of students' thinking abilities and learning attitudes. This period is a crucial phase in the cognitive and affective development of children, where students begin to understand various fundamental concepts and form their mindset and attitude towards the learning process. Proper learning at this level can have a long-term impact on how students absorb information, solve problems, and make decisions in everyday life. Mathematics education, as one of the mandatory subjects at every level of education,

plays an important role because it trains logic and systematic thinking and is highly relevant in daily life (Iksan, Zakaria, & Daud, 2013).

The results of interviews, observations, and documentation in several elementary schools in Cluster 2, Jatinom District, including Public Elementary School 1 Bengking, Public Elementary School 1 and 2 Tibayan, Public Elementary School 1 & 2 Mranggen, indicate three main issues in mathematics learning: Low student motivation, characterized by a lack of participation in discussions and low assignment results. Low creative thinking ability, especially in solving word problems that require understanding, application of formulas, and creative thinking. Low mathematics achievement, evident from students' scores being lower compared to other subjects, with most only reaching scores of 70–85. The study conducted by Barrows (2020) shows that the implementation of the PBL model significantly enhances students' mathematical creative thinking abilities. These findings reinforce that low creative thinking skills in mathematics are a common challenge faced in elementary education, and they can be addressed through student-centered and problem-solving-based learning approaches.

Conventional teaching methods, which rely heavily on one-way lectures and rote memorization, often fail to stimulate students' motivation and creativity. This is largely due to the lack of active student engagement and limited opportunities to think critically or explore ideas. Students tend to become passive recipients of information, with little connection between what they learn and real-world applications. As a result, learning becomes monotonous and less meaningful, leading to decreased interest, lower motivation, and hindered creative development. These issues indicate the need for solutions that can enhance both student motivation and creative thinking abilities. This research focuses on the implementation of the Problem-Based Learning (PBL) model that aligns with the principles in the 2022 Curriculum Process Standards and Content Standards, which encourage contextual, creative, and meaningful learning.

Learning motivation is the drive or force that arises from within the individual or from external influences that direct, maintain, and guide a person's behavior in learning activities. Motivation plays an important role in determining the intensity, direction, and persistence of a person's learning. Without motivation, the learning process will feel bland and less meaningful because students do not have a strong drive to achieve learning goals. Thus, this study aims to determine the impact of implementing the PBL model on the creative thinking abilities and mathematics learning motivation of elementary school students in Jatinom District. In PBL, students are required to actively solve real problems through the processes of information search, discussion, creative thinking, and solution formulation. All of these activities require a strong internal drive so that students can engage actively and consistently. Without good learning motivation, students will struggle to follow the independent challenging learning path required in the PBL model.

The syntax of the PBL model is systematically aligned with the development of students' creative thinking and learning motivation. In the first stage, orienting students to the problem, learners are provided with real-life contextual issues, which spark curiosity and initiate intrinsic motivation. The second stage, organizing students for learning tasks, promotes collaborative discussion and planning, which cultivates engagement and responsibility-key components of learning motivation. During the investigation and information gathering stage, students actively seek data and explore solutions, thereby exercising analysis, interpretation, and reasoning skills essential for

creative thinking. In the fourth stage, developing and presenting solutions, students must synthesize information and articulate their reasoning, reinforcing their creative thinking through communication and reflection. Finally, the evaluation and reflection stage encourages metacognitive thinking and self-assessment, helping students become more aware of their thought processes while reinforcing their motivation through a sense of accomplishment and personal growth. Through these stages, PBL directly contributes to enhancing both creative thinking and learning motivation among elementary school students.

Creative thinking is the ability to generate new, original, and valuable ideas in solving a problem. Students who think creatively are able to view an issue from various perspectives, develop unconventional solutions, and combine different pieces of information into innovative new ideas. This ability is essential in the world of education because it encourages students not only to memorize information but also to understand and develop it into something more meaningful. Creative thinking includes aspects such as flexibility, fluency, elaboration, and originality in thinking. PBL is a learning model that greatly supports the development of students' creative thinking. In PBL, students are faced with contextual problems that require them to find solutions through exploration, discussion, and collaboration. Through the stages in PBL, such as formulating problems, seeking information, and devising solutions, students actively develop creative ideas to solve those problems.

The main essence of PBL is to make problems the starting point of learning to encourage active student engagement in the thinking and problem-solving process. In PBL, students no longer merely receive material from the teacher, but instead take on the role of problem solvers who are challenged to search for, analyze, and formulate solutions to the presented problems. Thus, learning becomes more meaningful because it starts from real situations that are close to the students' daily lives. However, PBL has many benefits, but its implementation in the field is not without various challenges. One of the main challenges is the readiness of teachers to design and facilitate problem-based learning. Not all teachers have sufficient experience or training to develop relevant problem scenarios and guide students effectively through the exploration process. Teachers are also required to have skills in managing a dynamic and student-centered classroom, which is different from traditional lecture methods. Research shows that the implementation of PBL can enhance students' creative thinking abilities and learning outcomes, especially when supported by valid and practical modules or teaching materials. Thus, PBL becomes an effective active learning strategy to create innovative and meaningful learning.

Based on the observations in the fourth-grade class at Public Elementary School 1 Bengking during mathematics lessons, it was found that the students' creative thinking abilities still vary. Some students can demonstrate new ideas in solving problems, especially in topics that allow for exploration, such as measurement, flat shapes, or number patterns. They can create alternative methods for answering questions, for example, by drawing illustrations or creating their counting strategies. However, there are still students who tend to fixate on the examples given by the teacher and show less initiative in seeking alternative solutions. In further observation, the factor of learning motivation greatly influences the emergence of student creativity. Students who have high motivation, both intrinsic and extrinsic, appear more active in the learning process. They

are not only enthusiastic about answering questions but also brave in expressing their opinions, trying new methods, and not afraid of making mistakes. On the other hand, less motivated students tend to be passive, waiting for the teacher's instructions, and quickly give up when faced with challenging problems. The researcher is interested in applying the Problem-Based Learning (PBL) model in mathematics education as an effort to enhance students' creative thinking abilities and learning motivation. Based on these conditions, this study is focused on answering the question of how the implementation of the Problem-Based Learning (PBL) model affects the creative thinking abilities and mathematics learning motivation of elementary school students in Jatinom District.

▪ METHOD

Participants

The population of this study consisted of all fourth-grade students from 16 public and private elementary schools in Cluster 2 of Jatinom District, totaling 224 students. The sampling procedure was conducted in several stages. First, four schools were selected based on specific criteria, including comparable academic environments, teacher qualifications, and adequate class sizes. This selection was carried out using purposive sampling, aligned with the objectives of the study.

Second, from each selected school, one intact fourth-grade class was chosen as the unit of analysis. Two of these classes were assigned to the experimental group, and the other two to the control group. The assignment of classes to either the experimental or control condition was done randomly to minimize placement bias. Thus, the sampling technique used was a combination of purposive sampling at the school selection stage and random assignment at the group allocation stage. All students in the selected classes were included in the sample, approaching a form of class-based cluster sampling.

To minimize threats to internal validity, several measures were taken. Both experimental and control groups were selected from schools with relatively similar academic environments and teacher qualifications. Pre-tests were administered to ensure initial equivalence between groups. Additionally, the same teacher conducted instruction in both groups using the designated teaching model (PBL or expository) to reduce the variability caused by teaching style. However, as the study was conducted in a real classroom setting, some limitations remain, such as the possibility of external influences (e.g., students' prior experiences, home environment) and uncontrolled interactions between groups that might affect the results.

Research Design and Procedures

This research uses a quantitative research method. This study uses a quasi-experimental design in the form of a nonequivalent control group with two groups: the experimental group and the control group. The study was conducted in fourth-grade elementary school classes within Cluster 2 of the Jatinom District Education Coordination, Klaten Regency. The implementation took place during the 2024/2025 academic year, specifically in the even semester (April-May 2025), during scheduled Mathematics lessons.

To maintain internal validity, several potential threats were considered and addressed. First, selection bias was minimized by ensuring that the experimental and control groups were chosen from schools with similar academic environments, teacher qualifications, and student characteristics. Although random assignment at the individual

level was not possible due to school settings, random assignment at the class level was applied to allocate classes into experimental and control groups.

Second, to reduce the threat of maturation or differences due to natural development over time, both groups participated in the study simultaneously within the same academic calendar and over the same instructional period. Third, testing effects were managed by ensuring that the pretest and posttest were aligned with the learning objectives and administered under consistent conditions. Fourth, efforts were made to reduce instructional differences by assigning the same teacher to both groups, using different instructional models but maintaining consistency in classroom management, assessment procedures, and content scope. However, implementation fidelity was not formally monitored using observation checklists or external evaluators, which remains a key limitation of the study. This could affect the consistency of PBL implementation and the interpretation of its impact.

Instruments

The data collection techniques used in this study were through three main methods, namely tests, observation, and documentation. Tests are used to obtain data regarding students' creative thinking abilities. Through a series of questions that have been prepared, researchers can measure the extent to which students are able to think creatively in solving the given problems. The type of validity used in the research is content validity and construct validity. Content validity is given to instrument expert validators and subject matter experts. Then, for construct validity, the product-moment correlation formula is used with the help of SPSS 30. Meanwhile, the reliability used in this study is calculated using the Cronbach's alpha method.

The normality test is conducted to study whether the data is normally distributed or not. The normality test used in this research is the Kolmogorov-Smirnov test with a significance level of 5%, with the decision-making based on the consideration that the data is said to be normal if the significance value is > 0.05 . The homogeneity test in this study is used to determine the level of homogeneity of the obtained data. The homogeneity test used is the one-way ANOVA test on the control class and the experimental class. The calculation of homogeneity is based on the hypothesis with the decision-making criteria that data is said to be homogeneous if the significance value is > 0.05 .

One of the main limitations of this study is the absence of a systematic procedure to ensure the fidelity of the PBL intervention, meaning whether it was implemented consistently as planned. This study did not involve independent observations, implementation checklists, or other instruments to monitor the adherence of the teacher to the intended PBL design. As a result, there may have been variations in how the intervention was carried out, which could affect the internal validity of the findings. This limitation should be considered when interpreting the results, and it serves as an important recommendation for future research to include stricter fidelity evaluation mechanisms.

Data Analysis

A paired sample t-test was employed to examine the difference between pre-test and post-test scores (students' creative thinking ability and learning motivation) among the experiment and control groups. Data were processed using SPSS 30 software, with the significance criterion being < 0.05 ; then H_0 is rejected, and H_1 is accepted.

▪ RESULT AND DISCUSSION

Data Description of Creative Thinking Skills with PBL

Before the treatment or pre-test, the creative thinking ability of the fourth-grade elementary school students in group 2 Jatinom in the experimental class (PBL) was assessed. The number of students in the Jatinom fourth-grade experimental group was 53. The lowest score for the students' creative thinking ability before the treatment was 56, and the highest was 85, and the average score was 70.58 ± 6.71 . Thirty-one students (58.5%) have an average score between 62 and 75.

Learning begins with greetings, prayers, and checking students' readiness. The teacher connects the previous material to real life through three papers shaped like three-dimensional and two-dimensional figures, then poses triggering questions about perimeter, area, and volume. Students identify problems and explore solutions with the help of concrete tools. They were divided into eight groups, received worksheets and practice materials, and then worked together to complete the tasks. The teacher guided the investigation, and each group presented its results. Other groups provided feedback, and the teacher assessed and gave feedback. Finally, the students summarize the material, reflect, answer evaluation questions, and discuss to deepen their understanding.

After the treatment or post-test, the creative thinking ability of the 4th-grade elementary school students in group 2, Jatinom district, in the experimental class (PBL) was assessed. The number of students in the experimental group of 4th-grade elementary school students in Jatinom was 53 students. The lowest score for students' creative thinking ability after being given treatment (PBL) was 70, and the highest was 96. The average score was 86.02 ± 6.98 , with 57.1% students receiving scores between 85 and 95.

The improvement in students' creative thinking skills through PBL can be explained through the cognitive mechanisms inherent in this approach. In PBL, students are presented with open-ended problems that do not have a single correct answer, encouraging them to explore various possible solutions. This process cultivates divergent thinking, the ability to generate multiple ideas in response to a problem. Additionally, group discussions, which are an integral part of PBL, allow for the exchange of ideas and perspectives, enriching understanding and stimulating flexible thinking. The investigative and reflective activities involved in formulating solutions also require students to synthesize information from various sources, build connections between concepts, and construct logical arguments, all of which are essential elements of creative thinking. In other words, it is not merely the subject matter that makes PBL effective, but the structure of its activities, which facilitates exploration, collaboration, and elaboration of ideas in an active manner.

Data Description of Creative Thinking Ability with Expository

Before the treatment or pre-test was conducted, the creative thinking ability of the fourth-grade students in Jatinom in the control class (expository) was assessed. The number of students in the control group of the fourth grade in Jatinom was 56 students. The lowest score for the students' creative thinking ability before the treatment was 58, and the highest was 84. The average score is 69.66 ± 6.81 . Out of 56 students, the majority scored between 67 and 72, with 24 students (42.9%).

The lesson begins with greetings, prayers, checking neatness, cleanliness, and student attendance. The teacher conducts an aperception, conveys the objectives and

benefits of the material, and then explores the students' prior knowledge. The material is delivered conventionally with explanations and example problems. The teacher draws flat and spatial shapes on the blackboard to reinforce understanding. Students work on problems, receive guidance if they encounter difficulties, and together with the teacher, correct their answers. At the end, the teacher summarizes the material, gives directions for independent study, and concludes the lesson with a farewell.

After the treatment or post-test, the creative thinking ability of the fourth-grade students in Jatinom in the control class (expository) was assessed. The number of students in the control group of the fourth grade in Jatinom was 56 students. The lowest score for the students' creative thinking ability after the treatment (expository) was 62, and the highest was 94. The average score is 81.75 ± 8.48 . Out of 56 students, the majority scored between 74 and 88, with 38 students (67.86%).

Data Description of Learning Motivation with PBL

Before the treatment or pre-test, the learning motivation of fourth-grade students in Jatinom in the experimental class (PBL) was assessed. The number of students in the experimental group in Jatinom was 53. The lowest score for students' learning motivation before the treatment was 74.29, and the highest was 82.86. The average score was 78.38 ± 2.00 . Out of 53 students, the majority received scores between 78.57 and 80, with 29 students (51.8%).

After the treatment or post-test, the learning motivation of fourth-grade students in Jatinom in the experimental class (PBL) was measured. The number of students in the fourth-grade experimental group at Jatinom was 53. The lowest score for students' learning motivation after the treatment (PBL) was 77.14, and the highest was 88.57. The average score was 81.91 ± 2.63 . Out of 53 students, the majority received scores between 80 and 82.86, with 31 students (54.4%).

Data Description of Learning Motivation with Expository

Before the treatment or pre-test was conducted, the learning motivation of the fourth-grade students in Jatinom in the control class (expository) was measured. The number of students in the control group IV in Jatinom was 56 students. The lowest score for student learning motivation before treatment was 70, and the highest was 80. The average score was 77.45 ± 2.43 . Out of 56 students, the majority scored between 75.71 and 80, with 47 students (84%).

After the treatment or post-test, the learning motivation of the 4th-grade students in the Jatinom control class (expository) was measured, with a total of 56 students in the Jatinom control group. The lowest score for student learning motivation after being given the treatment (expository) was 72.86, and the highest was 82.86. The average score was 78.80 ± 2.26 . Of the 56 students, the majority scored between 80 and 81, with 29 students (51.8%).

Prerequisite Testing

Data Normality Test

Based on the normality test of the data using the Kolmogorov-Smirnov test, the results show that the pre-test data (scores) of students' creative thinking ability in the experimental group is $0.072 > 0.05$, and in the control group is $0.200 > 0.05$. The post-

test data (scores) of creative thinking ability in the experimental group is $0.077 > 0.05$, and in the control group is $0.087 > 0.05$. The pre-test data (scores) of learning motivation in the experimental group is $0.059 > 0.05$, and in the control group is $0.070 > 0.05$. The post-test data (scores) of learning motivation in the experimental group is $0.082 > 0.05$, and in the control group is $0.074 > 0.05$. Thus, all data are normally distributed, so the Independent t-test was used to compare the two treatment groups, and the Paired t-test to determine the effect of PBL or expository on students' creative thinking ability and learning motivation.

Homogeneity Test of Creative Thinking Ability Data

Based on the homogeneity test of the data using the Levene test, it was found that the p-value of the ANOVA between the pre-test scores of students' creative thinking abilities in the experimental group and the control group of class IV Jatinom is $0.477 > 0.05$. Therefore, the creative thinking abilities of students between the experimental group and the control group are homogeneous or come from the same population.

Homogeneity Test of Learning Motivation Data

Based on the homogeneity test of the data using the Levene test, the result obtained was that the p-value. The ANOVA between the pre-test scores of student learning motivation in the 4th-grade SD class in the Jatinom district group 2, experimental group, and control group is $0.086 > 0.05$. Therefore, the learning motivation of students between the experimental group and the control group is homogeneous and comes from the same population.

Hypothesis Testing

In this section, the results of hypothesis testing using the Paired t-test to determine the effect of PBL and expository learning on students' creative thinking ability and learning motivation, and the Independent t-test to determine the difference in students' creative thinking ability and learning motivation between those given PBL and expository learning, are presented.

The Influence of PBL on Creative Thinking Skills

PBL affects students' creative thinking abilities, as indicated by a t-value of - 26.756 and a p-value of $0.000 < 0.05$. This is because before being given PBL, the average score of students' creative thinking abilities was 70.58 ± 6.71 , and after being given PBL, the average score of students' creative thinking abilities increased to 86.02 ± 6.98 .

PBL has a positive and significant impact on students' cognitive learning outcomes. Through PBL, students role-play experiences to formulate ideas and develop reasoning skills to improve their learning achievements (Purwanto, 2022; Yew & Goh, 2016). The application of the inquiry method in integrative thematic learning can foster creative thinking skills, creativity, and learning achievements in the cognitive, affective, and psychomotor domains (Tomlinson, 2023). The integrative thematic learning module with an effective problem-based learning model aims to maximize student learning independence and learning outcomes. There is a significant difference in learning outcomes between students who receive instruction using the method. PBL with students who receive instruction using the expository method. The learning outcomes in terms of

affective, cognitive, and psychomotor aspects in the PBL class have a higher average than in the expository class (Chrisyarani, 2021).

Sutiyono (2022) states that creative thinking which requires perseverance, personal discipline, and attention involves psychic activities such as asking questions, analyzing existing data or information, and generating new and unusual ideas with an open mind, making connections, especially between different things, freely linking one with another, applying imagination to every situation that sparks new and different ideas, and paying attention to intuition. Meanwhile, according to Simanjuntak & Simorangkir (2022), creative thinking is a skill to utilize intelligence based on experience, not a talent but an ability that can be learned and trained. PBL increases student engagement by enabling the sharing of knowledge and information as well as discussions. The use of the PBL approach from the initial process to practical implementation is oriented towards supporting students through dialogue and question-and-answer activities, which is a role that must be played by the teacher (Alqahtani, 2022). PBL is able to encourage students to engage in communication and problem-solving with each other, thereby enhancing students' creativity.

The Influence of Expository on Creative Thinking Ability

Expository learning affects students' creative thinking abilities, as indicated by a t-value of -22.023 and a p-value of $0.000 < 0.05$. This is support by the average score of students' creative thinking abilities before treatment was 69.66 ± 6.81 , and after being given expository learning, the average score of students' creative thinking abilities increased to 81 ± 8.48 .

The Difference in Creative Thinking Ability between those Given PBL and Expository (Posttest)

Based on the Independent t-test between two groups of data (scores) on students' creative thinking abilities in the experimental and control classes, the results are presented in the table below.

Table 1. Results of the test for differences

	Code	N	Mean	Std. Deviation	Std. Error Mean
post_creative	PBL	53	86.019	6.982	0.9591
	Ekspositori	56	81.000	8.483	1.134

Based on the results of the descriptive analysis in Table 1, it was found that the group taught using the PBL model had an average creative thinking score of 86.02 with a standard deviation of 6.98. Meanwhile, the group taught using the expository learning model had a lower average score of 81 with a higher standard deviation of 8.48. This difference in standard deviation indicates that the distribution of scores in the expository group was more varied compared to the PBL group.

A high standard deviation suggests that the students' creative thinking abilities in the expository group were not evenly distributed. Some students showed high ability, while others scored very low. This reflects the inconsistency in the effectiveness of expository learning across the entire class. In contrast, the lower standard deviation in the

PBL group indicates that students' creative thinking abilities were more evenly distributed. The PBL model provides opportunities for all students to actively engage in the learning process through contextual problem-solving, thereby encouraging more comprehensive development of creative thinking skills.

Thus, not only was the average creative thinking score higher in the PBL group, but the achievements were also more evenly spread among students. This shows that the PBL model has the potential to improve the quality of learning more fairly and inclusively for all students.

The Influence of PBL on Learning Motivation

Based on the analysis results, the outcome is as shown in the table below.

Table 2. Results of the PBL influence test on student learning motivation

Pair	Paired Differences					t	df	Sig. 2 Tailed
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Before and after using PBL	32.4092	5.5734	1.1925	17.9012	24.3733	14.8456	52	< 0.001

In Table 3 above, it can be seen that PBL affects students' learning motivation, as indicated by the t-count result of 14.8456 and a p-value of $0.001 < 0.05$. This is because the average student learning motivation before and after being given PBL is 32.4092, with the Standard Deviation 5.5734, and the standard error mean is 1.1925. Sardiman (2018) explains that motivation is the driving force of students that causes learning activities to occur, ensures their continuity, and directs them to achieve the objectives of the subject matter. According to Hartini & Sumardi (2023), students need both internal and external encouragement at the stage of making behavioral changes during learning, and this encouragement is most effective when accompanied by several supporting indicators or elements.

The increase in learning motivation using PBL is evident from the difference in students' learning motivation levels between internal and external. This means that the treatment for each group is effective in maximizing students' learning motivation. However, the treatment using PBL in the experimental group is better or more effective compared to the treatment using expository methods, as evidenced by: (1) the average post-test learning motivation scores of students in the experimental group being higher than the learning motivation scores of students in the control group, (2) there being a significant difference between the post-test learning motivation scores of students in the experimental group and the learning motivation scores of students in the control group.

Taufik (2024) explains that the teacher's role as an intrinsic motivator for students involves creating students' interest in something, maintaining their curiosity, using various presentation methods, and encouraging students to contribute their ideas. Motivation itself comes from motives, which are internal factors within individuals that drive them to engage in certain activities, either consciously or unconsciously, in order to achieve specific goals (Yusoff, 2014). Learning motivation, as a driving force to engage

in learning activities sourced from within oneself as well as external factors, plays an important role in fostering a learning spirit (Aufa et al., 2020). Learning motivation is not only a drive to achieve better performance but also reflects efforts to achieve learning objectives (Rillero & Camposeco, 2022). Lou, S. & Shih, R. C. (2020) This motivation encompasses drives that motivate, direct, and influence individual attitudes and behaviors. Therefore, it can be concluded that motivation plays an important role in determining the level of student learning effort and, consequently, contributes to learning success (Tatar & Tatar, 2017).

The presence of learning motivation within students plays a vital role in achieving success during the learning process. This also emphasizes that one of the key elements in achieving learning objectives is being motivated to learn. The level of interest and motivation of students towards a subject can significantly influence the quality of learning in that subject. A person's learning ability can be negatively affected if their level of motivation is low (Ridwan et al., 2022). Motivating students to engage and benefit from learning activities plays an important role in providing a sense of security and responsibility for their success (Sungur & Tekkaya, 2020).

The Influence of Expository on Learning Motivation

Based on the analysis results, the output is as shown in Table 3.

Table 3. Results of the expository influence test on student learning motivation

Pair	Paired Differences					t	df	Sig. 2 Tailed
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Before – After using Expository	34.5121	4.6173	1.1586	20.9926	22.0874	15.7146	55	< 0.001

In the table above, it is shown that Expository affects students' learning motivation, indicated by the t-count result of 15,7146 and a p-value of $0.001 < 0.05$. This is because before and after being given the expository method, the average student learning motivation score is 34.5121 with a standard deviation of 4.6173, while 1.1586 is the standard error of the mean. Learning motivation can be influenced by several factors.

Based on the source of origin, motivation is divided into two types: 1) Extrinsic motivation, which is learning motivation that comes from external factors outside the student and functions due to external stimuli. An example of negative extrinsic motivation is the fear of punishment from the teacher that drives students to do their homework. Meanwhile, positive extrinsic motivation arises when students are encouraged to complete tasks because they want to receive praise from the teacher. 2) Intrinsic motivation is learning motivation that comes from within the student themselves without the need for external stimuli, because the drive to do something comes from within the individual themselves. This motivation is influenced by internal factors, especially the student's awareness of the importance of the lesson material for themselves (Sasmito, 2023; Nurlatifah et al., 2021)

Those two types of motivation, some can be learned and some cannot; both have their advantages and disadvantages. Therefore, every educator must pay attention to this so that the teaching activities are carried out as expected. Learning motivation is the entirety of impulses within students that drive learning activities, ensure the continuity of the learning process, and provide direction so that these activities proceed towards the expected goals (Budiarti & Haryanto, 2023). Motivation is a change in energy within a person characterized by the emergence of feelings and initiated by a response to a goal (Nurhayati et al., 2022). Susilowati (2020) argues that "motivation is the force that drives learning, and this force can take the form of enthusiasm, desire, curiosity, attention, will, or ambition." Motivation serves as a driving force for students in learning. The intensity of students' learning is certainly influenced by motivation. Students who want to understand something from what they are learning have a goal they want to achieve during their studies. Because students have the goal of wanting to understand something, they are ultimately motivated to learn it (Çalışkan & Selçuk, 2010).

Differences in Learning Motivation Between PBL and Expository Method (Posttest)

Based on the Independent t-test between two groups of data (scores) on students' learning motivation in the experimental and control group, the results are presented in Table 4 below.

Table 4. Results of the learning motivation difference test

Pair	Paired Differences			t	df	Sig. 2 Tailed
	Mean	Std. Deviation	Std. Error Mean			
Experiment – Control Group	33.4606	5.09535	1.1756	15.2801	107	< 0.001

In the table above, it can be seen that PBL and Expository have effects on students' learning motivation, as indicated by the t-count result of 15.2801 and a p-value of $0.001 < 0.05$. This is because the average student learning motivation in the experiment and control group is 33.4606. The standard deviation is 5.09535, and the standard error mean is 1.1756 with df 107. So, the level of student learning motivation in the experimental group and the control group after being given treatment showed a significant difference.

This means that the experimental group students who were taught using PBL and the control group students who were taught using the expository methods showed significantly different average learning motivation scores. Therefore, the use of PBL is more effective or better compared to using expository methods in improving students' learning motivation, as evidenced by the higher level of learning motivation in the experimental group compared to the control group.

Nevertheless, the group taught using the expository method also showed an increase in learning motivation, although not as significant as the group that used PBL. This may be attributed to several advantages of the expository method itself, such as the structured, clear, and direct delivery of material by the teacher, which helps students understand basic concepts more easily. Additionally, this method provides certainty and clear direction in the learning process, which can offer a sense of comfort to students who are accustomed

to conventional teaching approaches. Thus, although it is not as active and interactive as PBL, the expository method can still foster improved learning motivation when delivered engagingly and combined with variations such as the use of visual media or relevant practice exercises.

The Creative Thinking Ability of Students Taught with Problem-Based Learning is Better Compared to Expository Learning

Based on the research results, it is known that the level of creative thinking ability of fourth-grade elementary school students in the experimental and control groups after being given treatment produced significant variations. This means that the experimental group students who were given PBL and the control group students who were given expository teaching showed significantly different average scores, with the experimental group students who were given PBL having higher average scores. Therefore, the use of PBL is more effective than the expository model in maximizing students' creative thinking skills, as evidenced by the greater creative thinking ability of students in the experimental group compared to those in the control group.

Dağyar & Demirel (2016) state that PBL has a significant impact on students' learning outcomes, motivation, and creativity in science education. These findings contribute to the existing literature on PBL and its impact on student learning outcomes, creativity, and motivation in science education (Hmelo-Silver, 2020). These results underscore the importance of integrating PBL as a practical teaching approach in elementary school classrooms to foster creativity and enhance student motivation. Educators and policymakers can use these insights to promote innovative teaching methods that encourage active participation, creative thinking, and creative problem-solving skills in elementary science education (Hamid et al., 2022).

The findings of this study generally align with previous research, such as Hamid et al. (2022), which showed that PBL has a significant impact on students' learning outcomes, motivation, and creativity in science education. However, this study expands the application of PBL into the context of elementary mathematics education, which has been relatively less explored in existing literature. While most studies emphasize the effectiveness of PBL in science subjects, this research demonstrates that the same approach can also be effectively applied in mathematics learning to foster creative thinking and enhance learning motivation. Moreover, this study adds a new nuance by showing that although expository learning also has a positive impact, its effectiveness is not as strong as PBL in developing higher-order thinking skills. This contrast suggests that the success of a teaching approach depends not only on the subject matter but also on how the approach encourages students to engage with real-world problems and deeper thinking processes. Thus, this study enriches the literature by showing the flexibility and potential of PBL in the context of mathematics education and highlights the importance of instructional design in shaping the quality of learning outcomes.

The implementation of PBL impacts students by providing them with inclusive, in-depth, and sustainable learning experiences that enable them to understand material concepts in a more meaningful way. They can also connect new material with the knowledge they already possess, which contributes to the development of their brain's physical structure in responding to the surrounding environment, especially culture. In addition, students will develop a positive outlook and attitude towards learning

mathematics. This is supported by research results showing that there are various levels of students' creative thinking abilities between the beginning and the end of the expository method implementation. This means that both have their own effective groups to maximize students' creative thinking abilities. However, the treatment using PBL in the experimental group is better or more effective compared to the treatment using expository methods, as evidenced by: (1) the mean post-test scores of students' creative thinking abilities in the experimental group being higher than the scores of students' creative thinking abilities in the control group, (2) there is a significant difference between the post-test scores of students' creative thinking abilities in the experimental group and the scores of students' creative thinking abilities in the control group.

The Learning Motivation of Students in the Group Taught with Problem-Based Learning is Better Compared to Expository Learning

Based on the research results, it is known that the level of learning motivation of students in the experimental group and the control group after being given treatment shows a significant difference. The experimental group students were given PBL and had a higher average. Therefore, the use of PBL is more effective or better compared to using expository methods to improve students' learning motivation, as evidenced by the higher level of learning motivation among students in the experimental group compared to those in the control group.

PBL has significant potential to enhance students' active engagement and learning motivation (Hwang & Embi, 2016). It can increase students' learning motivation because it provides meaningful learning experiences that enable students to actively engage in solution-oriented thinking with their peers (Wahyuni, 2020). PBL is an effective strategy in teaching when viewed from the perspective of motivation (Dolmans & Van Der Vleuten, 2005; Hung, 2020). Intrinsic motivation of individuals is divided into two types, namely intrinsic and extrinsic. Intrinsic motivation is the motivation to learn where the drive comes from within oneself. It originates from the spirit of the student in completing their tasks without any coercion to receive rewards, appreciation, or sanctions. Intrinsic motivation is without external influence (Duda & Newcombe, 2020).

Extrinsic learning motivation is primarily driven by external factors due to an individual's initiative and needs, which are not entirely related to their learning activities (Masek & Yamin, 2011). This learning motivation comes from external encouragement for students in completing their tasks because they are influenced by rewards, gifts, and punishments (Parnawi, 2019). Motivation can determine the success or failure in achieving goals, so the greater the motivation, the greater the success in learning (Eroğlu & Güven, 2021). Someone who has high motivation will diligently strive to continuously learn new things. Conversely, if someone has low motivation, the tendency to fail and the feeling of giving up will increase (Lita, 2023).

▪ CONCLUSION

This study aims to determine the effect of problem-based learning models and expository learning on the ability to think creatively and student learning motivation in learning mathematics in grade IV elementary school in Jatinom District. The results showed that the two learning models had a positive influence on improving the ability to think creatively and student learning motivation. However, PBL was proven to have a

more significant impact than expository learning. This finding confirms that the learning approach that emphasizes problem solving, collaboration, and reflection, such as PBL, is able to encourage the development of students' cognitive and affective aspects more comprehensively. The main contribution of this study lies in strengthening empirical evidence regarding the effectiveness of PBL in the context of mathematics learning at the elementary school level.

However, this research has several limitations that need attention. This study was only conducted in one school group in Jatinom District, so the results could not be widely generalized to different educational contexts. In addition, the duration of the implementation of the intervention is relatively short, so that the long-term impact of the application of PBL on creative thinking skills and student learning motivation cannot be observed as a whole. This study also has not explored in depth other external factors that can affect learning outcomes, such as student background, teacher teaching style, or learning environment support at home and school.

Therefore, the important direction for further research is to expand the object of study to various other subjects to obtain a more comprehensive picture of the relationship between the ability to think creatively and learning motivation, as well as further exploring how innovative approaches such as PBL can be optimized in various learning contexts in the 21st-century education era. In the end, this finding confirms that education is not just conveying information, but rather creating space for students to think, feel, and grow through meaningful challenges.

The implications of this study: For teachers, this study encourages the consistent use of PBL to enhance students' creative thinking and learning motivation. Teachers should design learning activities that promote exploration, discussion, and reflection, while shifting their role from information providers to learning facilitators. Continuous professional development and peer collaboration are key to optimizing PBL implementation in the classroom.

For school Principals, the findings highlight the importance of institutional support for innovative teaching. Principals should provide training opportunities, promote a reflective teaching culture through academic supervision, and create a supportive school environment that enables active, student-centered learning. Providing resources and flexible schedules will also help sustain PBL practices.

For future researchers, this study opens up opportunities to examine the effects of PBL in different subjects, grade levels, and student backgrounds. Longitudinal studies are recommended to assess the long-term impact of PBL, and future research should also consider contextual factors such as teacher readiness, classroom climate, and parental support to gain a deeper understanding of PBL effectiveness.

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