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Differences in Geography Learning Outcomes with PBL (Problem Based Learning) and PjBL (Project Based Learning) Models at SMA Negeri 10 Medan

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Abstract

This research aims to determine the significant differences in geography learning outcomes for students taught using the PBL (Problem-based Learning) model compared to PjBL (project-based Learning). This research is a quasi-experimental research with a Pretest Posttest Control Group design. The data collection method uses t-tests to analyze the results. This research was conducted in class XI IIS SMAN 10 Medan. The study showed that student learning outcomes using the PBL learning model were 83.529 ± 6.801, while student learning outcomes using the PjBL model were 82.794 ± 7.092. Even though the learning outcomes obtained are different, the results of statistical tests show no significant difference between the learning outcomes of students taught with the PBL and PjBL models $\alpha = 0.05$, where Ha is rejected while H0 is accepted. Although there were substantial improvements in both models, statistical analysis showed no significant differences in student learning outcomes between PBL and PjBL. This indicates that both models are equally effective in improving students' understanding and learning outcomes in Geography.

Keywords: Learning Outcomes, Problem-Based Learning, Project Based Learning

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1. Introduction

Current developments require human resources (HR) to be highly quality and able to compete. So, education becomes a forum for producing individuals with the abilities and qualities needed to face the various challenges of the times (Alpian, 2019). National education functions to develop skills and shape the nation's character and civilization, which helps make the nation's life more intelligent. Therefore, the role of schools and effective and efficient learning is needed both internally and externally so that the goals of national education can be realized. Through education, humans can achieve intellectual and social maturity and develop their potential to the maximum

(Cahyani et al., 2021). Education will influence growth and provide change in each participant. These changes include developing personal potential, including knowledge, skills, and attitudes in everyday life (Pristiwanti et al., 2022).

Improving the quality of education must be optimized because education will determine the nation's progress. This optimization can be done through several efforts, such as improving the curriculum, providing training for educators, providing adequate learning resources, and using appropriate learning models so that learning becomes exciting and students can be actively involved. Learning outcomes are benchmarks achieved by students after undergoing learning. This is to the view (Yandi et al., 2023) that learning outcomes are achievements students have obtained through conscious efforts to change knowledge, skills, and attitudes. These learning outcomes refer to students' abilities through teaching and learning activities and training, which are reflected in changes in behavior as a result of their learning experiences at an educational institution (Wicaksono & Iswan, 2019).

The achievement of learning outcomes for each student will vary depending on the causal factors. Internal factors or factors within the student's intelligence, namely, attitudes, habits, talents, interests, motivation, or learning styles. External factors or factors from outside, such as family, community, school, use of learning media, and approaches applied by educators in the learning process (Astiti et al., 2021). Therefore, educators are expected to be able to choose appropriate and effective teaching methods according to learning objectives.

According to (Lestari & Handayani, 2023), in education, the school environment has a big responsibility in forming and developing students' abilities to experience positive changes in behavior, development of thinking, and knowledge. In the classroom, a teacher is expected to be able to manage the class effectively, master the material well, and direct students innovatively and creatively (Minsih & D, 2018). Teachers are also likely to understand how to choose and apply learning models so that the learning process is more exciting and not monotonous, and students can participate actively in learning.

However, the world of education is currently faced with various problems, including a need for teacher innovation in implementing various learning models where learning is only teacher-centered, without involving the active participation of students (Rusmiati et al., 2023). Many teachers still need to rely on traditional methods such as lectures, causing students to become passive and lose enthusiasm and creativity. In the independent learning curriculum, teachers must be more creative in creating or designing the learning process so that learning runs as determined by the minister of education. The impact is low student learning achievement and a lack of motivation or interest to achieve optimally (Windayanti et al., 2023).

Geography learning is experiencing significant changes that better reflect the needs and challenges of the modern world. The main focus has shifted to sustainable development issues, such as climate change, land degradation, and social justice (Yli-Panula et al., 2020). The approach in geography acts as a bridge between natural and social sciences. (Ananda & Nofrion, 2019) Students must understand geographic concepts and develop communication, critical thinking, problem-solving, and collaboration skills. Learning while playing outside the classroom is an exciting new

trend. In this way, students listen to the teacher's explanation and immediately try to experience what is being studied. The aim is for students to understand the lesson better and feel closer to their surroundings. This shift reflects the evolution from traditional geography learning approaches towards more dynamic models. The aim is not only to provide geographical knowledge but also to prepare students to become responsible global citizens who understand and respond to the complex challenges of the contemporary world. With this approach, modern geography learning seeks to develop a generation that understands its world and is ready to contribute positively to sustainable development (Goga & Roșu, 2021).

Geography learning at SMAN 10 Medan shows the same problem. Based on interviews with class XI geography teachers, it was revealed that conventional methods, especially lectures, still dominate the learning process. As a result, students' active involvement in learning is minimal, the ability to solve real problems related to geographical phenomena could be higher, and the development of students' critical and creative thinking skills needs improvement. Students also need more opportunities to collaborate and communicate in the learning context and have minimal practical experience applying geographic concepts, especially in Natural Disaster Mitigation material. The impact of this problem is visible on student learning outcomes. More than 60% of students cannot achieve the Minimum Completion Criteria (KKM) set at 70, especially in Natural Disaster Mitigation material. This shows a significant gap between applied teaching methods and students' learning needs.

Facing this situation, a more innovative and student-centered learning approach is needed. Two potential learning models to overcome this problem are Problem-Based Learning (PBL) and Project-Based Learning (PjBL). PBL can improve students' problem-solving abilities by exposing them to real natural disaster scenarios encouraging critical thinking and decision-making in the context of disaster mitigation. Meanwhile, PjBL allows students to design and implement practical projects related to disaster mitigation, develop collaboration skills, and increase understanding through hands-on experience (Rahardjanto et al., 2019).

The PBL (Problem-Based Learning) model is a model that, in its application, places students as the main focus, requiring them to use critical and logical thinking in solving problems based on their knowledge (Nurhidayah et al., 2021). This model emphasizes students' active participation in solving problems, which involves the skills of identification, analysis, creation, and presentation of learning products based on experience (Ulger, 2018). PBL aims to develop students' critical thinking skills and invite students to become active actors who can face various problems in the learning process (Nofziarni et al., 2019).

Apart from that, there is also the PjBL (Project Based Learning) model, namely learning that pays attention to student involvement, allowing them to carry out investigations, solve problems, and produce natural products through projects (Simbolon & Koeswanti, 2020). This model creates an interactive, communicative, supportive learning environment to help students develop their potential (Pratiwi & Setyaningtyas, 2020). This model encourages students to solve problems through projects, providing hands-on experience in real-life project planning (Made et al., 2022).

The PBL and PjBL models can improve student learning outcomes, according to research (Handhika et al., 2021) that revealed an increase in student learning outcomes after implementing the PBL and PjBL models. Correspondingly (Fiana et al., 2019) , it also stated that the learning outcomes of the two classes that applied PBL and PjBL had increased. Still, the t-test results showed no significant differences in learning outcomes when applied to the PBL and PjBL models. (Rahayu & Sutarno, 2021) It also proves an increase in learning outcomes after implementing the PBL and PjBL models, where the value of PBL learning outcomes is higher than the PBL model. Therefore, this research aims to determine the significant differences in Geography learning outcomes of students taught using the PBL model compared to PjBL.

2. Method

This research uses a quasi-experimental design with a pretest-posttest-control-group design. The research design was to determine experimental class I and experimental II, then give different treatments to the groups, where experimental class I used the PBL model. In contrast, experimental class II used the PjBL model. Before learning begins, a pretest is given to measure initial abilities. Then, after implementing the learning model, the two experimental groups were given a final test (posttest) to see the differences due to treatment. This research hypothesizes that there is a significant difference between the Geography learning outcomes of students taught using the Problem-Based Learning (PBL) model and those taught using the Project Based Learning (PjBL) model at SMA Negeri 10 Medan. The null hypothesis (H0) states no significant difference between the two learning models, while the alternative hypothesis (H1) states a considerable difference. Testing this hypothesis will help researchers determine whether one learning model is more effective in improving student Geography learning outcomes at SMA Negeri 10 Medan.

The research population was all students of the class. The research sample was selected using the cluster random sampling method, where classes were randomly chosen as sampling units. This process obtained two classes as samples: class XI IIS 1 (experimental class I), with 34 students who would apply the PBL model and class. With this method, all students in the selected class become research participants. The data collected was in the form of geography learning outcomes scores from the pretest before treatment and post-test after implementing the PBL and PjBL models. The data collection method uses multiple-choice tests. Data analysis was carried out quantitatively using the t-test, but normality and homogeneity tests were previously performed as a prerequisite. Research procedures include sample selection, pretest implementation, learning model implementation, posttest implementation, data analysis, and conclusion. This research aims to compare the effectiveness of the PBL and PjBL models in improving student geography learning outcomes at SMAN 10 Medan. To carry out the quasi-experimental method, the researcher carries out the steps as stated in the experimental framework below:

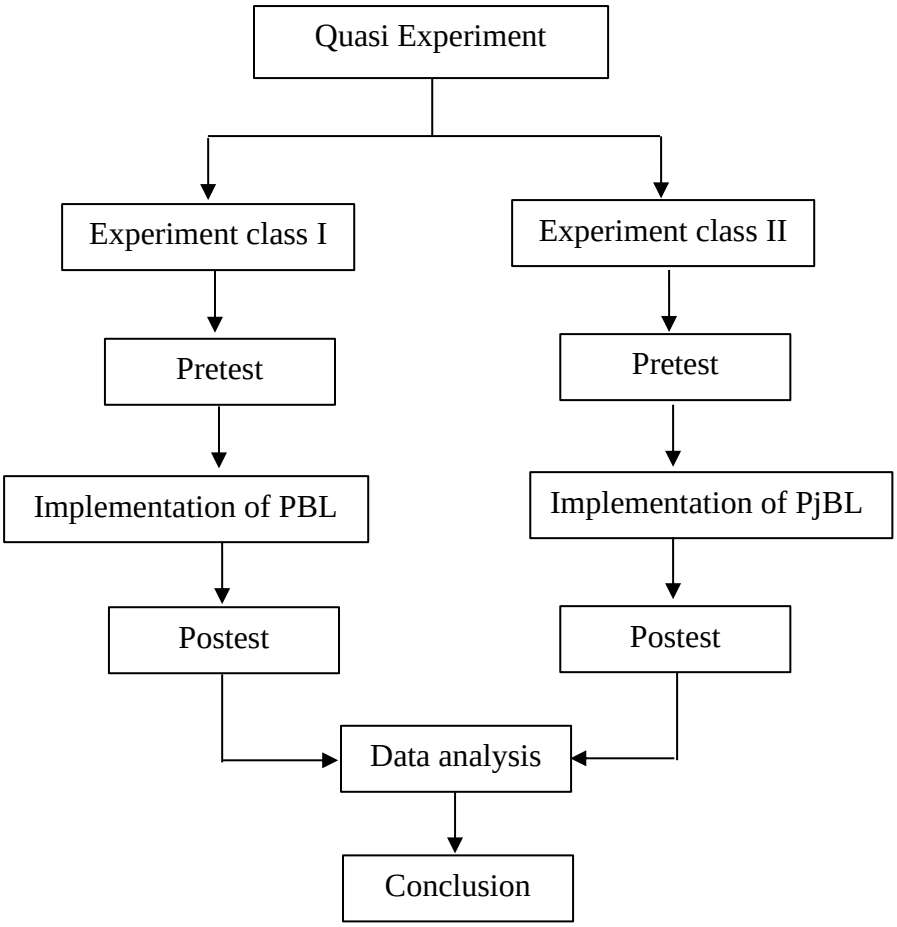

Figure 1. Research Framework

3. Result and Discussion

Results were obtained from the pretest and posttest of the two sample groups (experimental classes I and II). The purpose of the Pretest is to see the homogeneity of the two sample classes. The average pretest score for experimental class I was 53.088, while the average pretest score for experimental class II was 51.176. This means that the initial abilities of students in the two sample classes are said to be the same. The posttest was given to see student learning outcomes in each experimental class after being given treatment. The posttest average for experimental class I was 83.529, and the posttest average for experiment II was 82.794.

The collected student learning results are then tabulated, and the mean, standard deviation, and variance of the pretest and posttest results for experimental classes I and II are obtained.

Table 2. Mean, Standard Deviation, and Variance of Pretest and Posttest Data

Class	Average value		Deviasi Standar		Variance	
	Pretest	Posttes	Pretest	Posttes	Pretest	Posttes
Test I	53.088	83.529	14.303	6.801	204.568	46.257
Test II	51.176	82.794	16.425	7.092	269.786	50.290

In calculating the Shapiro-Wilk normality test, the PBL class obtained a pretest score of 0.673 while the posttest score was 0.061 > 0.05, so the scores were normally distributed. Meanwhile, the PjBL class obtained a pretest of 0.151 and a posttest of 0.069 > 0.05, so the scores were normally distributed.

Table 3. Normality Test Results

Data	Statistic	Penting	Conclusion
Experimental Class I Pretest	0,977	0,673	Normal
Experimental Class I Postest	0,940	0,061	Normal
Experimental Class II Pretest	0,953	0,151	Normal
Experimental Class II Posttest	0,942	0,069	Normal

Furthermore, the homogeneity test results in the two experimental classes (PBL and PjBL models) were homogeneous, where sig > 0.05 for the pretest and posttest data. In the pretest, PBL and PjBL classes sig = 0.451 > 0.05. Meanwhile, in the posttest for PBL and PjBL classes sig = 0.675 and Ftable > 0.05, it is concluded that the variance of experimental class I and experimental class II is homogeneous.

Table 4. Homogeneity Test Results

Data	Statistik Levene	Penting	Conclusion
Experimental Class I Pretest	0,576	0,451	Homogen
Experimental Class II Pretest			
Experimental Class I Posttest	0,178	0,675	Homogen
Experimental Class II Posttest			

After confirming the homogeneity of scores between the two sample groups, a hypothesis test will be carried out to determine how student learning outcomes differ in the two treatments. Hypothesis test calculations obtained a sig level calculation = 0.664. The test criteria are to reject H0 if sig < 0.05 and accept H0 if significance > 0.05. From the hypothesis test, it is known that the difference in the average posttest scores for classes XI IIS 1 and So it was concluded that there was no significant difference between the geography learning outcomes of class XI IIS 1 and XI IIS 3 students.

Table 5. Hypothesis Test Calculation Results

Data	Class	Average value	tanda tangan. (2-ekor)	Conclusion
Postes	XI IIS 1	83.529	0,664	H0 Accepted (No difference)
	XI IIS 3	82.794	0,664	

The research and data analysis results showed that the average pretest score for the PBL class was 53.088, while for the PjBL class, it was 51.176. This means that the initial ability level of the two experimental classes before learning was relatively the same and quite low due to a lack of preparation for learning material about natural disaster mitigation. However, after learning using the PBL and PjBL models, it was found that there was an increase in learning outcomes, where the average posttest for the PBL class was 83.529, indicating an increase of 57.341%, while the average posttest

for the class that implemented PjBL was 82.794, indicating an increase of 61.782%. Even though the average posttest result of the PBL model is higher than the PjBL model, this difference is not statistically significant where the value is significant. < 0.05 (0.664 > 0.05). This research shows no significant difference between the geography learning outcomes of students taught using the problem-based learning (PBL) model and project-based Learning (PjBL).

Problem-Based Learning (PBL) and Project Based Learning (PjBL) are two learning models that are effective in improving students' thinking and problem-solving abilities but differ in their approaches. PBL focuses on solving specific problems presented to students, encouraging them to analyze and find solutions relatively quickly. On the other hand, PjBL involves students in more complex long-term projects, where they have to plan, design, and produce a final product or presentation. Research conducted by (Putri et al., 2021) fourth-grade elementary school students in Tingkir District showed that these two models positively impacted learning outcomes. Still, PjBL tended to provide higher results, with an average posttest score of 94.2288, compared to PBL, which had an average score of 82.6263. This difference may be due to the nature of PjBL, which provides more time for students to explore the material, develop collaboration skills, and produce accurate work so that their understanding of the learning material becomes deeper and lasts longer.

Learning outcomes in classes that use the PBL and PjBL models have increased. This increase is because the PBL model has many advantages (N.K. Mardani et al., 2021), namely: (1) developing or improving critical thinking skills, (2) creating active learning, and (3) developing communication skills. After all, students are directly involved in learning; (4) practicing group work skills; (5) hone problem-solving skills; (6) provide meaningful learning and instill long-term knowledge; (7) contribute positively to concept development and overcome student misconceptions; (8) develop personal and group initiative and responsibility skills; (9) increasing interest and motivation to learn; (10) stimulate students' ability to ask questions; and (11) expanding creative thinking abilities.

Likewise, the PjBL model has many advantages (Rineksiane, 2022), namely: (1) increasing students' skills and innovation in managing resources; (2) increasing student collaboration for problem-solving; (3) training students' communication skills; (4) encouraging students to be more active and responsive to problems related to learning; (5) encouraging students to be more critical in solving problems and finding answers to solve complex problems; (6) helps increase student learning motivation; (7) creating pleasant learning conditions so that students are enthusiastic about learning; (8) provide learning experiences for students that are involved in a complex manner and are designed in such a way as to be applied in real life; (9) provide students with experience of the learning they have gained in organizing problems, as well as making time allocations to complete their assignments.

Seeing the increase in learning outcomes between the two research groups, the two models are suitable for application in learning natural disaster mitigation material. Applying these two models in geography and learning about natural disaster mitigation is expected to establish effective communication between students. This allows students to share ideas, views, and understanding through creativity and active participation,

making it easier to express thoughts, ideas, and solutions to understand the material. Apart from that, active participation of students in the teaching and learning process is also expected by training them in critical thinking.

4. Conclusion

Based on the results of the analysis that has been carried out, it can be concluded that the two learning models, namely Problem-Based Learning (PBL) and Project-Based Learning (PjBL), have proven to be effective in improving students' Geography learning outcomes. The PBL model showed significant improvement, with students' average score increasing from 53.088 on the pretest to 83.529 on the posttest, indicating an increase of 57.341%. Likewise, the PjBL model shows similar effectiveness, with an increase in the average score from 51.176 on the pretest to 82.794 on the posttest, which means an increase of 61.782%. Although both models show substantial improvements, statistical analysis indicates no significant difference between student learning outcomes using the PBL and PjBL models. This indicates that the two learning models are equally effective in improving students' understanding and learning outcomes in Geography subjects, providing equal alternatives for teachers in choosing learning strategies that suit students' needs and class characteristics. For future research, it is recommended to add qualitative analysis by exploring students' and teachers' opinions about their experiences using these two methods.

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