Differences in Learning Outcomes of Class VIII Students of SMP Negeri 3 Tondano on The Material of Building Flat Side Spaces Given the Implementation of The PjBL Model

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Abstract
This study investigates the disparities in students' mathematical learning achievements when using the Flat-Side Building material in conjunction with the PjBL model compared to students who use the DI model. This study employs an experimental research approach utilizing a post-test-only control group design. The participants in this study consisted of two groups: an experimental group, comprising 25 students from class VIII-C, and a control group, comprising 24 students from class VIII-B at SMP Negeri 3 Tondano for the academic year 2023/2024. The selection of participants was done randomly from the two classes. The post-test research yielded an average score of 79.44 for the experimental class and 75.0208 for the control class. The hypothesis test analysis results indicate that the value of $t_{\text{count}}$ is 2.302 and the value of $t_{\text{table}}$ is 1.678. Since the value of $t_{\text{count}}$ is greater than the value of $t_{\text{table}}$, we can infer that the null hypothesis ($H_0$) is rejected, and the alternative hypothesis ($H_1$) is accepted. This study determines that there is a discernible disparity in student learning outcomes when the subject of Building Flat Side Spaces is taught utilizing the Project-based Learning (PjBL) model as opposed to the Direct Instruction (DI) model in the eighth grade of SMP Negeri 3 Tondano.

Keywords: Learning Outcomes, Building Flat Side Spaces, Learning Models, PJBL.

INTRODUCTION
Education is one of the primary needs of every citizen and is an indicator of a country's progress. With education, science and technology will become more advanced, bringing humans into the era of globalization (Mangelep, 2013; Amarullah, 2019; Marbun et al., 2022). Education is essential in creating quality human resources (Amelia, 2023; Mangelep et al., 2024). Therefore, the quality of education must continue to be considered and improved (Arifin, 2018; Warsini, 2019; Mangelep et al., 2020).
A person's abilities can develop through a learning process, one of which is learning Mathematics. Almost all levels of education in Indonesia study Mathematics (Domu & Mangelep, 2024). This is because mathematics is a subject that plays a role in forming logical, critical, and systematic ways of thinking (Fathurrahman, 2015; Mangelep, 2017).

Based on the result of observations at SMP Negeri 3 Toanda, West Tondano District, Minahasa Regency, North Sulawesi Province, there needs to be a greater understanding of learning concepts in the material Building Flat Side Spaces. This is seen from the mean student learning outcomes in the 2022/2023 academic year, which is 50, falling below the school's minimum completion criteria (KKM) of 70. Furthermore, there is still room for improvement in the learning results of class VaIII pupils in the subject of Building Flat Side Spaces. The average is determined based on the KKM attainment of 40%.

The low level of students' understanding of the Flat-Side Building material, which results in low-class average scores not being achieved, is thought to be caused by 1) Teachers tend to use the Direct Instruction (DI) model using the lecture method where teachers are more active, and students tend to be less active (Fathurrahman, 2015; Mangelep et al., 2023). 2) students need more understanding of the properties of flat-sided structures (Fathurohman, 2016; Mangelep et al., 2023). 3) lack of students' skills and creativity in solving contextual problems in the material Building Flat Side Spaces (Fathurohman, 2016; Mangelep et al., 2023).

One effective approach to enhance student learning results in the subject is constructing a room with flat walls. Another viable method to address this issue is implementing project-based learning (PjBL) as a teaching paradigm. According to Maulyaasa (2014), PjBL is a learning approach that directs students' attention towards complicated problems that need them to undertake investigations. Saefudin (2014) defines PjBL learning as a methodology that utilises issues to gather and incorporate new information derived from real-life experiences and activities. PjBL learning focuses on real-life challenges that students may encounter firsthand (Mangelep, 2017; Judijanto et al., 2024).

The notion of Project-based Learning (PjBL) provides significant and favourable advantages for students. This model also aims to enable students to engage in a collaborative project that integrates multiple curriculum subjects, provides students with opportunities to explore content using various methods that are personally significant to them, and conduct experiments in a collaborative fashion (Ilmiyah & Sumbawati, 2019; Widya, 2023).

**METHOD**

This type of research is quasi-experimental. It was done because it was not possible to randomly select research subjects from the existing population. After all, the subjects were naturally formed into one group, so all subjects in the complete group were used to be given treatment. The research design used was a posttest-only control group design. The research design can be describes to follow:
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Table 1. Research Design

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Post Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>E₁</td>
<td>X₁</td>
<td>O₁</td>
</tr>
<tr>
<td>E₂</td>
<td>X₂</td>
<td>O₂</td>
</tr>
</tbody>
</table>

Information:
E₁ : Experimental Class
E₂ : Control class
X₁ : Treatment with the Project Based Learning Model
X₂ : Direct Instruction Model Treatment
O₁ : post-test experimental class
O₂ : post-test control class
O₁ = O₂

The research location was planned at SMP Negeri 3 Tondano. This school was chosen to assist the school in the face-to-face learning process and help students more easily understand the concept of mathematics learning well, to improve the quality of students' mathematics learning, especially in the material Building a Flat-Side Rooms. This research is planned to be carried out in the even semester of FY 2023/2024.

The subjects in this research were class VIII students at SMP Negeri 3 Tondano, which consisted of 2 classes chosen randomly from 3 classes to determine the experimental class and the control class. The variables examined in this research were the results of learning to Build Flat Side Spaces, which were applied using the Project-Based Learning model in class VIII of SMP Negeri 3 Tondano.

In this research, the instrument used is the final test (posttest), namely questions in the form of descriptions of the material for Building a Flat-Side Room, where the instrument will be tested for validity and reliability. The data collection technique in this research is a test. The learning outcomes test given is in the form of a description and will be used in the final test (posttest) to determine the learning outcomes achieved by students. Data analysis techniques use normality tests, homogeneity tests, and hypothesis tests.

RESULT AND DISCUSSION

Data Description

This research was conducted at SMP Negeri 3 Tondano, West Tondano, North Sulawesi Province, in the 2023/2024 academic year. Research data was obtained from class VIII-B, which had a total of 24 students, and class VIII-C, which had a total of 25 students. In this study, the data taken were student learning outcomes in the form of post-test data from both classes, namely the experimental class and the control class.
Result

Data analysis was carried out after all respondents and other data were collected. The analysis carried out in this study was the mean difference test analysis. Below is described the analysis:

1. Analysis of Mean Difference Test

Posttest data analysis is used to process data collected from the experimental class and control class to examine student learning outcomes in that class, aiming to show acceptance or rejection of the hypothesis proposed by the researcher. Analysis of posttest data aims to determine the conditions of the experimental and control classes after receiving different treatments, regardless of whether the two classes are homogeneous. This final analysis is based on the posttest scores given to students in the experimental class and control class. The posttest scores are in Table 2.

<table>
<thead>
<tr>
<th>Table 2. Table of Posttest Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental class</strong></td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Average</td>
</tr>
<tr>
<td>Variance</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
</tbody>
</table>

2. Normality test

The normality test is carried out to determine whether the data that has been collected is normally distributed or not. The normality of data is essential because normally distributed data is considered to represent a population. In Microsoft Excel 2013, the validation test is often used as the Liliefors test. This detail can be seen in Table 3. This normality test is used in the post-test covering student learning outcomes after being given treatment.

<table>
<thead>
<tr>
<th>Table 3. Normality Test Results of Students' Mathematics Learning Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control</strong></td>
</tr>
<tr>
<td>Experiment</td>
</tr>
<tr>
<td>Control</td>
</tr>
</tbody>
</table>

From table 3 the results of the normality test for the experiment class were obtained $L_{count} = 0.15763$, $L_{table} = 0.1801$, and the control class $L_{count} = 0.08298$, $L_{count} = 0.1766$, with a significance level of 0.05. This means the post-test mathematics learning results of students from a population with normal distribution.

3. Homogeneity Test

After the two class samples were declared normal, a homogeneity test was then carried out. The homogeneity test is used to measure the equality of variance between the groups being compared. In this research, the research used the Fisheal test with a significance level of 0.05. The calculation result can be seen in table 4.
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<table>
<thead>
<tr>
<th>Table 4. Homogeneity Test Results</th>
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</thead>
<tbody>
<tr>
<td>Class</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Experiment</td>
</tr>
<tr>
<td>Control</td>
</tr>
</tbody>
</table>

Based on the calculation results table above, the value $F_{count} < F_{table}$ is obtained, so accept Ho. meaning that the sample data is concluded to come from a homogeneous population.

4. Hypothesis Testing

Hypothesis testing is carried out when both requirements have been met using the t-test. The t-test is carried out to determine whether there was an influence of Project-Based Learning on students' mathematics learning outcomes. The results of calculating the hypothesis test using the t-test are as follows:

<table>
<thead>
<tr>
<th>Table 5. Hypothesis Test Results</th>
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</thead>
<tbody>
<tr>
<td>Class</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Experiment</td>
</tr>
<tr>
<td>Control</td>
</tr>
</tbody>
</table>

Discussion

Based on the data analysis described above, students' mathematics learning outcomes regarding Building a Flat-Side Room can be obtained by conducting a post-test. Data on student learning outcomes obtained in the experimental class that applied the Project-Based Learning model showed better learning outcomes compared to the control class that used the direct learning method. Based on the data obtained, the average final test (post-test) result in the control class was 75.0208, and the experimental class, it was 79.44.

The improvement in learning outcomes was better in the experimental class than in the control class because the Project-Based Learning model was implemented in the experimental class. Learning using the Project-Based Learning model is centered on students, not teachers. Students are allowed to manage their own activities or task completion activities so that they train students to become independent, provide a deeper understanding of concepts or knowledge, and students become more active during learning activities. The Project Based Learning model can help students find the material being studied and relate it to real conditions that can be applied in everyday life.

In project-based learning, students are grouped randomly; one group consists of 4-5 people. During the lesson, the teacher explains the materials, and then the students discuss in groups and complete the questions the teacher gave. Project-based learning will stimulate students to develop their thinking abilities by providing opportunities to discuss ideas and train them to live in collaboration with other students. Moreover, the fun part is creating an active and enjoyable learning
atmosphere in the teaching and learning process. Students who work on something together in one team. Thus, in learning, they can communicate and interact socially with friends to achieve learning goals. Meanwhile, students in the control class who are taught using the direct instruction model need help understanding the material. This is because the teacher only explains the material; students take notes and do questions and answers after the material has been explained, which causes students to not be active in learning, and students need more opportunities to communicate their ideas.

The results of the hypothesis test analysis obtained by applying the t-test or testing using two averages show that applying the Project-Based Learning mode effectively affects student Mathematics learning outcomes in the experimental class of SMP Negeri 3 Tondano for the 2023/2024 academic year. This research aligns with previous research that implemented project-based learning model, which was more effective in improving student learning outcomes, and there was an increase in the experimental class. Based on the data obtained from Table 5 of the t-test calculations, the results obtained are $t_{\text{count}} = 2.302$ and $t_{\text{table}} = 1.678$ with degrees of freedom ($\alpha$) 0.05, where $d_k = n_1 + n_2 - 2 = 47$. Because $t_{\text{count}} > t_{\text{table}}$, reject $H_0$ and accept $H_1$. Therefore, it may be inferred that the educational achievements of students instructed through the Project-Based Learning approach surpass those of students instructed using the direct instruction approach. The findings of this study align with the research conducted by Malrbuln (2022), which suggests that learning observations are more effective when they consider the student's personality and the module being studied. This conclusion was supported by the results of a t-test, $t_{\text{count}} = 1.6962$ while $t_{\text{table}} = 1.6759$.

Based on the description above, it can be said that learning with the Project-Based Learning model is better than the direct instruction mode. Therefore, the Project-Based Learning model is suitable for application in mathematics subjects, such as Building Flat Side Rooms for class VIII students at SMP Negeri 3 Tondano in the academic year 2023/2024.

CONCLUSION

Based on the results and discussion, it was concluded that there were differences in student learning outcomes in the materials Building Flat Side Spaces taught using the PjBL model compared to learning outcomes taught using the DI model in class VIII of SMP Negeri 3 Tondano, West Tondano, North Sulawesi Province, in the academic year 2023/2024. Therefore, the author suggests that teachers can find innovations in learning so that in teaching and learning activities, students do not feel bored that the material provided can be received by students well and can be used as a consideration for teachers to be able to apply the PjBL model in learning. Mathematics, especially in the material on Building Flat Side Spaces. It is also recommended that researchers continue this research so that it is helpful for mathematics learning.

REFERENCES
Amarullah, M. A. (2019). Efektivitas Model Pembelajaran Project Based Learning Berbantu Media
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