The Project Method and Its Effect on the Ability to Recognize Geometric Shapes in Early Childhood in the Era of Merdeka Belajar

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Abstract. One of the learning methods promoted in the independent curriculum is the project method. This research explores the impact of the project method in the context of early childhood education related to geometry shape recognition. This study aims to investigate how the use of the project method in learning can affect young children's ability to recognize and understand geometric shapes. The project method was implemented in a learning environment that provided children with practical and interactive experiences, while measurements of their ability to identify and utilize geometric concepts were conducted before and after the application of this method. This study used an observational approach to the control group and the group involved in project-based learning. The results showed that the children involved in the project method showed a significant improvement in their ability to recognize geometric shapes compared to the control group. This indicates that the project method has a positive influence in facilitating the understanding of geometry concepts at an early developmental stage. This finding has important implications for designing early childhood education curricula that focus on developing geometry skills. The implementation of the project method can be an effective alternative in improving children's ability to recognize and understand geometric shapes, strengthening an important foundation for their future mathematical development.

1 Introduction

The foundational development of cognitive skills, particularly the understanding of mathematical concepts, is significantly influenced by early childhood education [1]. Amid global education transformation and curriculum implementation that emphasizes freedom of learning, as reflected in the independent curriculum era in Indonesia, there is a passion for finding innovative and effective learning methods [2–4]. A crucial element in early childhood mathematical education involves grasping the concepts of geometric shapes [5]. The presentation of fundamental shapes like circles, squares, triangles, and others, is an

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important foundation that influences children's ability to understand more complex mathematical concepts later in life [6].

In order to optimize the geometry learning process in early childhood, interesting and effective educational approaches are the focus of attention [7,8]. One interesting approach to explore is the project method [9]. This concept offers a practical, collaborative, and holistic learning experience, where children engage in real projects that allow them to contextually apply geometry knowledge [10,11].

In the framework of a self-directed curriculum that prioritizes the freedom to learn and explore, it is essential to assess how the project method influences children's capacity to identify and comprehend geometric shapes [12,13]. Earlier research has established a solid groundwork for comprehending the advantages of employing this method in the early stages of childhood education [14]. Nevertheless, given the ongoing shift in the educational paradigm, there is a requirement for a more comprehensive investigation to assess the pertinence and efficacy of the project method within the framework of the independent curriculum [15].

The objective of this study is to investigate the correlation between the application of project methods in education and the capacity of early childhood learners to identify geometric shapes within the context of an independent curriculum era. Through careful research and in-depth analysis, it is hoped that this research can provide valuable insights for educators, policymakers, and educational practitioners to improve mathematical learning at the early developmental stage of children. The independent curriculum emphasizes freedom of learning and the use of local contexts to improve the quality of education [16]. Research on the project method provides insight into how this approach can provide more contextualized and relevant learning for early childhood in understanding geometric shapes [17].

Geometry is an important part of mathematics [18]. Early children's ability to recognize and understand geometric shapes will affect their understanding of more complex mathematical concepts in the future [19]. This research can help improve and enhance the quality of mathematical learning from an early age [20].

This research can serve as a foundation for innovation in learning approaches. By exploring the effectiveness of the project method, educators can enrich their learning strategies, enabling the use of more interactive, practical, and engaging approaches for early childhood [21]. By gaining a more profound insight into how the project method influences the learning of geometry, this study can offer valuable insights for developing a curriculum that is adaptable and attuned to the requirements of early childhood education within the independent curriculum era.

The project method not only teaches mathematical concepts, but also helps in the development of 21st century skills, such as critical thinking, collaboration, and problem-solving skills [22]. These are important in preparing the younger generation for future challenges [23]. With a better understanding of effective learning methods, this research can help ensure that children from different social and economic backgrounds have equal access to quality mathematical learning. To strengthen the foundation of mathematical learning in the early stages of life, research on the project method and its effect on the ability to recognize geometric shapes in early childhood in the era of the independent curriculum is crucial as a foothold for positive transformation in early childhood education [24].

The focus of this research on the independent curriculum era is a new and important aspect. The independent curriculum emphasizes freedom of learning and exploration [25], so this research will highlight the relevance and influence of the project method in an educational context that emphasizes freedom of learning. The use of the project method in early childhood education is still a relatively new concept [26]. This research will explore
how the application of the project method in the context of an independent curriculum can affect early childhood's ability to recognize geometric shapes in a concrete and applicable manner.

This research will provide specific measurements and examination of the impact of the project method on children's outcomes ability to recognize geometric shapes. It can provide deep insight into the extent to which the project method can influence geometry learning outcomes in early childhood. The approach proposed by the project method brings together theoretical learning with practical application. Its novelty lies in this integrated approach that allows children to learn through direct experience and real application of geometry concepts.

The results of this study carry considerable potential to shape the formulation of forthcoming curricula for early childhood education. By highlighting the effectiveness of the project method, this research can provide a basis for curriculum development that is more adaptive and responsive to the needs of early childhood in the era of an independent curriculum. Through this innovative approach, research on the project method and its effect on the ability to recognize geometric shapes in early childhood in the era of the independent curriculum brings a sense of novelty by combining revolutionary learning concepts with the need for more adaptive and relevant education.

2 Methods

The outcomes of this research have the significant potential to influence the design of future curricula for early childhood education, comprising three classes: B1 with 15 students, B2 with 15 students, and B3 with 20 students. The sampling method employed was cluster random sampling, selecting class B1 as the experimental group and class B2 as the control group. Data collection involves observation and documentation. The analysis utilizes t-tests for hypothesis testing. The normality of data is assessed through the Kolmogorov-Smirnov formula, determining whether the data follows a normal distribution. Subsequently, the Homogeneity test, using the Kolmogorov-Smirnov formula, is performed to ascertain data homogeneity.

3 Results and Discuss

3.1 Results

The study took place at State Kindergarten 2 in Bandar Lampung, involving two distinct groups: the control group and the experimental group. Class B1 is the sample experimental class, and class B2 is the sample control class. Measurements were taken to determine the extent to which the ability to recognize children's geometry during learning took place. Instrument data collection is done based on the results of the pre-test and post-test and supporting data in the form of observation and documentation.

This research instrument is an observation guideline to measure the ability to recognize early childhood geometry and consists of 25 questions. The observation guide has been validated. After doing the calculation by measuring the validity of this reliability, there can be 20 observation questions that are feasible to use in measuring the ability to recognize geometric shapes in early childhood. The samples used in this study were two classes, namely class B1 (experimental class) using the project method and class B2 (control class) using assignments. And the results of this study obtained early childhood observation data.

Non-test instruments must fulfill better criteria so that the steps to get the right data for the instrument must be validated first. The next step is for the researcher to use the
instrument to be tested first. The validation test is employed to assess the validity of the questionnaire instrument. The decision-making criterion is that if the r count is greater than the r table, the instrument is considered valid. Conversely, if the r count is less than the r table, the questionnaire instrument is deemed invalid. Utilizing the correlation formula, specifically the product moment correlation formula, was the method employed in assessing the validity of the 20 question items during the trial, observation results that meet the valid criteria can be used in questions' recognition compared to the results of the validation analysis of the observation question's ability to recognize early childhood geometry. From the results of the analysis, we obtained the correlation between the r count, which we compared with the r table and sought a significance value of 0.05 with the amount of data (n) = 30, then obtained the r table of 0.444. Derived from the research data, it is evident that out of the 20 questionnaire items validated for 30 children, 5 items are considered invalid due to their correlation values falling below r table < 0.444. Specifically, these are items numbered 6, 12, 14, 18, and 20. Conversely, the remaining 20 items are deemed valid, exhibiting correlation values above r table > 0.444. Submission of instrument reliability is carried out after the validity test is carried out with the aim of knowing whether the instrument is consistent or not in providing measurement results. The reliability test in this study used the Cronbach's Alpha formula, if the Alpha value is greater than r table, the question items used are declared reliable or consistent. Conversely, if the Alpha value is smaller than r table, the question items used are declared unreliable or consistent. The instrument can be said to be reliable if the Alpha value is greater than r table (0.404).

Table 1. Reliability Test Results

<table>
<thead>
<tr>
<th>Cronbach’s Alpha</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.911</td>
<td>20</td>
</tr>
</tbody>
</table>

Data source: SPSS 25

The presented output indicates an Alpha value of 0.911. This value is then compared to the r table value, which is sought at a significance level of 0.05 with a data amount (n) of 30. With a calculated value of 0.911, surpassing the r table value of 0.444, it can be concluded that \( r = 0.911 > r \text{ table} \), affirming the reliability of the questions. The normality test, used to discern the distribution of data in a study as either normal or abnormal, was conducted in both the experimental and control classes. This test aimed to assess the normality of data distribution in terms of geometry recognition within each group. The following summarizes the outcomes of the normality test conducted on the data groups:

Table 2. Normality Test Results

<table>
<thead>
<tr>
<th></th>
<th>Kolmogorov-Smirnov a</th>
<th>Shapiro-Wilk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>Df</td>
</tr>
<tr>
<td>Eksperiment</td>
<td>.184</td>
<td>15</td>
</tr>
<tr>
<td>Control</td>
<td>.168</td>
<td>15</td>
</tr>
</tbody>
</table>

* This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Data Source: SPSS 25
Decision criteria for the Normality Test:
1. If the significance (Sig) value exceeds 0.05, it indicates that the residual values follow a normal distribution.
2. If the significance (Sig) value is below 0.05, it suggests that the residual values do not conform to a normal distribution. Based on the outcomes of the normality test above, it can be inferred that the significance value indicates a normal distribution, specifically with a value of 0.200, which is higher than 0.05.

Following the confirmation of normal data distribution, the next step involves conducting a homogeneity test. This test aims to assess the similarity of sample data originating from the same variant population (homogeneous). The subsequent presentation outlines the outcomes of the homogeneity test computed using the Kolmogorov-Smirnov test technique with SPSS.

**Table 3. Homogeneity Test Results**

<table>
<thead>
<tr>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.980</td>
<td>3</td>
<td>56</td>
<td>.127</td>
</tr>
</tbody>
</table>

* This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Data Source: SPSS 25

Following the completion of normality and homogeneity tests to ascertain the normal distribution and uniformity of the data, parametric statistical analysis tests were conducted. These tests aimed to determine whether there is a significant impact of the project method on the recognition of geometric shapes in early childhood at Tk Negeri 2 Bandar Lampung. To assess this impact, the data results were subjected to a t-test, specifically the independent sample t-test. The primary objective of the t-test was to scrutinize the accuracy and draw conclusions regarding the acceptance or rejection of the research hypothesis. The research hypothesis posited that there is a discernible effect of employing the project method on the recognition of geometric shapes in young children attending State Kindergarten 2 Bandar Lampung. To examine this hypothesis, hypothesis testing was conducted using the independent sample t-test, facilitated by the SPSS software.
Table 4. Independent Sample T-Test Results

<table>
<thead>
<tr>
<th></th>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sig. F, t, df</td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>Kemampuan mengenal bentuk geometri</td>
<td>Equal variance s assumed</td>
<td>3.81, 0.045, 28</td>
</tr>
<tr>
<td></td>
<td>Equal variance s not assumed</td>
<td>5.22, 0.75, 25</td>
</tr>
</tbody>
</table>

Data source: SPSS 25

According to the SPSS test data provided earlier, the results of the independent sample t-test show a sig. (2-tailed) value of 0.000 < 0.05. Based on the decision-making criteria for the independent sample t-test, the results are deemed significant, signifying an impact of utilizing the project method on the recognition of geometric shapes among early childhood at State Kindergarten 2 Bandar Lampung.

3.2 Discuss

The purpose of this study was to examine the effects of employing the project method in introducing geometric shapes to students in early childhood at State Kindergarten 2 Bandar Lampung consisting of three classes, specifically B1, B2, and B3, but researchers only took two classes as samples, namely classes B1 and B2, taking experimental classes and control classes using cluster random sampling techniques, namely techniques for determining research samples with certain considerations or directly to the goal.

In general, the implementation of learning by using the project method in this study was very good. In the sense that children use the project method to interact with each other. Derived from the analysis of pretest data in both the experimental and control groups, the distribution is normal and homogeneous, so it can be said that both groups have the same ability before treatment.
Based on the outcomes of the conducted study, there is an enhancement in the recognition of geometric shapes among children in the experimental group compared to the control group, as observed in the posttest results. This improvement is evident in the average scores observed from the pretest to the posttest. Children who underwent the project method exhibited an average score of 81.73, whereas those engaged in assignment learning had an average score of 74.33. Consequently, the average difference between the experimental and control classes amounted to 7.4.

The implementation of the project method in the learning process has a positive impact on enhancing the ability to recognize geometry. The presence of this influence underscores that the utilization of project methods can contribute to the improvement of geometric shape recognition abilities. This positive effect is attributed to the learning activities facilitated by the project method, which involve early childhood engagement in interactive and cooperative learning experiences with their peers.

In the hypothesis testing using the independent sample t-test, a significance (2-tailed) value of 0.000 was obtained, which is less than 0.05. Therefore, it can be inferred that the test is accepted. Consequently, it can be deduced that the utilization of the project method has an impact on the recognition of geometric shapes among early childhood students at State Kindergarten 2 Bandar Lampung. Several preceding studies of relevance also align with this, suggesting a substantial correlation between the project method and various outcomes in early childhood development.[27–31] Therefore, with the support of teacher skills in choosing activities and building a pleasant learning atmosphere, it can be stated that the project method is an effective method for stimulating various expected developmental outcomes in early childhood in kindergarten.

4 Conclusion

From the findings and analyses conducted, one can deduce that the project method significantly influences the recognition of geometric shapes among early childhood students at State Kindergarten 2 Bandar Lampung. This recognizes means recognize the that by using the project method and improve the ability to recognise the geometric shapes of early childhood. So that it can be compared with learning assignments that were applied before at State Kindergarten 2 Bandar Lampung. The average score for geometric recognition in the experimental group was 81.73, indicating an improvement in geometric shape recognition. In contrast, the control group had an average score of 74.33, resulting in a difference of 7.4 between the two groups. The hypothesis test yielded a significance (2-tailed) value of 0.000, which is less than 0.05. Therefore, it can be inferred that the null hypothesis is rejected, and the alternative hypothesis is accepted. In conclusion, there is an impact of using the project method on the ability to recognize geometric shapes at State Kindergarten 2 Bandar Lampung.

References

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