



The Effect of Project-Based Learning Model on Problem Solving Skills in Coastal PAUD Institutions

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ABSTRACT:

Children's involvement in learning can provide concrete learning experiences for the child's growth and development process. The purpose of this study was to determine the effect of project-based learning model on problem solving skills in PAUD institutions in coastal areas. This study used a quantitative experimental method with the Non-equivalent Pretest - Post Test Control Group Design model. The research subjects consisted of 25 children in classes B1 and B2 of Islamic Kindergarten 01 Kauman Juwana. Data collection techniques using observation, questionnaires and documentation. Data analysis techniques using paired sample t-test. The results of data analysis show that there is an effect of project-based learning models on children's problem solving in coastal PAUD institutions aged 5-6 years. This is indicated by the acquisition of a sig value that is smaller than the predetermined significance level of $0.000 < 0.05$. The results of this study show that although conventional learning methods have an effect, the effectiveness of project-based learning in improving problem solving is much higher. This suggests that a more active and engaged approach, such as project-based learning, can encourage children to think critically and creatively, which is essential in the development of problem solving skills. Project-based learning is important to consider in the development of future curriculum and learning methods, so that children can gain a more optimal learning experience

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1. Introduction

Early childhood education (PAUD) is a level of education that facilitates the healthy and optimal growth and development of children in accordance with the values, norms and expectations of society (Magta et al., 2019). PAUD provides an important foundation for a wide range of skills, including physical, cognitive, language, social-emotional, self-concept, art, creativity, moral and religious values (Nurasih et al., 2022). The development of these aspects is an important foundation for children's future academic and social success (Nakamichi et al., 2021). This is because developing children's skills early on lays the foundation for their readiness to face academic and social challenges (Nilsson et al., 2023).

Sari & Fauziyah, (2022) states that the main task of PAUD is to develop children's potential to be able to adapt to their environment. PAUD education not only prepares children to enter basic education, but also builds the foundations of creative attitudes, knowledge and skills. This process contributes to forming a positive attitude towards learning that is important for children's future development (Meilina et al., 2021). PAUD acts as the main foundation in the formation of children's basic abilities, including physical, cognitive, social-emotional, language

and communication aspects that are in accordance with their age stages (A. M. Sari et al., 2023). Furthermore, PAUD provides a conducive environment to stimulate children's intrapersonal and emotional development, thus creating a generation that is better prepared to face future academic and social challenges (O'Reilly et al., 2022). This emphasizes the importance of innovative and needs-based learning approaches, especially in supporting problem-solving skills.

One of the important skills to develop at an early age is problem-solving ability. Problem-solving skills are important to help children face future challenges (Farida et al., 2021). Kurangnya keterampilan ini dapat dilihat dari respon anak yang kurang logis saat dihadapkan dengan permasalahan (Mahfuddin & Parmin, 2022). This skill involves logical, critical, systematic thinking which is very important to support children's cognitive development and creativity (Suardi et al., 2019 ; Suwatra et al., 2019 ; Amiliya & Dryas, 2020). The process of developing problem solving also allows children to hone their creative and systematic thinking in dealing with challenges (Pollarolo et al., 2023). Early childhood has a high curiosity about its environment, this becomes the main motivation in their learning process (Wahyudi, 2021). However, in some areas, such as coastal areas, this ability is often neglected due to the lack of stimulation from the surrounding environment, family or educational institutions.

The geographical and cultural conditions of coastal areas have a significant influence on children's social and cognitive development. Environmental factors such as climate and geographical characteristics often influence people's social behavior (Mansyur et al., 2019). In coastal areas, children tend to lack manners, like to bully their friends, and have limited social interaction due to the harsh environment (Subekti et al., 2020 ; Saracho, 2023). Children's relationships with family members also play an important role in shaping their attitudes toward others and life in general (Henny et al., 2023). This factor poses its own challenges in shaping positive attitudes and behaviors in children. In addition, local culture such as listening to shalawatan and poetry when putting children to bed and the Quran recitation program create a more religious value-based parenting style (Garzia et al., 2019). However, young children in this area tend to be involved in fishing activities rather than attending school.

Initial observations at several PAUDs in the coastal areas of Pati Regency show that early childhood problem solving skills are often neglected. Children are often considered unable to solve simple problems so they tend to be assisted by adults. These observations also show that the learning process has not fully guided children in developing social-emotional behavior. Most children are seen playing alone and are not used to sharing or collaborating with their friends. This suggests that learning in coastal PAUD needs to be designed to support group interaction and the development of problem solving skills.

Early childhood education in coastal areas requires a more appropriate approach to develop social and problem-solving skills. One method that can be applied is project-based learning (PjBL) which allows children to interact directly with their environment through creative projects that involve problem solving. PjBL can also integrate the use of loose parts, such as sand, shells and stones that are widely available in coastal areas to develop children's creativity and problem solving skills (Puspitasari & Al Baqi, 2022). This learning model can also help children develop social skills such as collaboration, communication and cooperation that are needed in their daily lives (Agustina, 2021 ; Dianita et al., 2020). Through this, children exercise their judgment experimentally, control their hypotheses with reality and analyze, evaluate and interpret the results as well as provide hands-on experience (Bildiren & Kargin, 2019).

The integration of loose parts media can help improve children's creativity and problem solving skills through the exploration of available materials. This media gives children the opportunity to actively explore the surrounding environment, so that they can develop creativity and logical thinking skills in play (Hadiyanti et al., 2021). In addition, teachers can stimulate problem solving with open-ended questions that encourage reasoning and creative thinking (Susetyo et al., 2021).

Based on the above issues, this research aims to examine the application of the Project Based Learning model in improving the problem solving skills of children aged 5-6 years in coastal PAUD institutions, which has not been widely explored before. The focus of this research is to identify the effectiveness of this learning model in improving

children's problem-solving skills, particularly in environments with limited resources and unique socio-cultural challenges. Thus, the formulation of the problem proposed in this study is whether there is an influence and effectiveness of the Project Based Learning model on the problem solving skills of children aged 5-6 years in coastal PAUD institutions.

2. Method

This research is a quasi-experimental quantitative research that aims to see the effect of a treatment. The research design used Non-equivalent Pretest - Post Test Control Group Design, where both experimental and control groups were selected from existing classes without randomization. The research population was all students of Islamic Kindergarten 01 Kauman Juwana and the research sample was selected from two groups, namely groups B1 and B2 which totaled 50 children. The purposive sampling technique was used to determine the sample based on certain criteria relevant to the research objectives, namely children aged 5-6 years.

The treatment was given to the experimental group in the form of applying the Project Based Learning model. This learning approach focuses on providing projects to learners to solve real problems, which are designed to develop critical thinking skills, collaboration and problem solving abilities. Project-based learning is implemented by providing projects that are relevant to the lives of early childhood that aim to improve their ability to solve problems. Meanwhile, the control group followed conventional learning. Data collection was conducted through direct observation of children's problem solving ability, followed by questionnaire collection with two-stage measurement, namely pretest and posttest in problem solving ability.

The data collected were analyzed using statistical tests including normality test with Shapiro-wilk t to test data distribution and homogeneity test with Levene to ensure homogeneous variation between groups. Hypothesis testing was conducted using Paired Sample T-Test to measure the change in pre-test and posttest scores in each group. This test was used to test significant differences in children's problem solving skills before and after the implementation of the Project Based Learning model, both experimental and control groups. All analyses were conducted using SPSS software version 25.

Table 1 Research Design

Group	Pretest	Description	Post-test
Experiment (E)	O1	PJBL (Y1)	O2
Control (K)	O1	Conventional (Y2)	O2

Description :

E = Experiment Class

K = Control Class

O1 = Pre-test (before treatment) in Experiment group and Control group

O2 = Post-test (after treatment) in the Experiment group and Control group

Y1 = Implementation of project based learning for problem solving development in Experiment class

Y2 = Implementation of conventional learning of problem solving development in Control class

3. Result

The research findings completed before starting the treatment were used to first assess the level of reduction. After conducting research, the results of this study are compiled based on data obtained through observation and testing of early childhood problem solving skills. The following are the results of the research: The Shapiro-Wilk normality test was used to assess the normality of the data. (See Table 2)

Table 2 Results of Data Normality Test

Tests Of Normality				
Class		Shapiro-Wilk		
		Statistic	Df	Sig.
Result	Pre_Control	.950	25	.251
	Post_Control	.953	25	.292
	Pre_Experiment	.925	25	.067
	Post_Experiment	.942	25	.168
A. Lilliefors Significance Correction				

Based on the table above, the normality test using Shapiro-Wilk provides information on whether the data from the control group and experimental group are normally distributed. The control group obtained a pretest of 0.950 with a significance value of 0.251 and for the posttest was 0.952 with a significance value of 0.292. Both significance values are greater than 0.05 which indicates the data in the control group is normally distributed. The experimental group obtained a pretest of 0.925 with a significance value of 0.067 and for the posttest was 0.942 with a significance value of 0.168. Both significance values are greater than 0.05 which indicates the data in the experimental group is normally distributed. Because the data is normally distributed, researchers can conduct further statistical analysis. The homogeneity test was used to ensure homogeneous data. (See Table 3)

Table 3 Results of Data Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Outcomes- Learning	Based on Mean	3.564	1	48	.065
	Based on Median	2.907	1	48	.095
	Based on Median and with adjusted df	2.907	1	46.507	.095
	Based on trimmed mean	3.633	1	48	.063

Based on the table above, looking at the mean, the Levene statistic value is 3.564 with a significance value of 0.065. This indicates that there is no significant difference in variance between the two groups at the 0.05 significance level, as the sig value is greater than 0.05. Similar results were obtained when using the median and trimmed mean, with significance values of 0.095 and 0.063 respectively. All values are greater than 0.05 which means there is insufficient evidence to reject the null hypothesis that the variances of the two groups are equal. Thus, the results of this homogeneity of variance indicate that the data from the control group and the experimental group can be considered similar, so one of the conditions (not absolute) of the independent sample t test has been met. Paired Sample T Test to determine the effect and effectiveness of the project-based learning (PjBL) learning model on early childhood problem solving skills in coastal PAUD institutions. (See Table 4)

Table 4 Results of Paired Sample T Test

Group	Pre-test		Post-test		t_{within}	P	Gain Score	
	Mean	SD	Mean	SD			Mean	SD
Experiment	36.4000	3.01386	61.6400	3.10752	-32.469	< 0.01	25.2400	3.88673
Control	34.1600	2.85307	48.4800	4.28291	-15.541	< 0.01	14.3200	4.60724
$t_{between}$	2.699		-				9.058	
P	< 0,05		-				< 0.01	

Based on the table above, it is known that there is an increase in problem solving in the experimental group, ($t = -32.469$, $p < 0.01$). Likewise, in the control group ($t = -15.541$, $p < 0.01$). This shows that project-based learning has an effect on the problem solving ability of early childhood.

Another finding of this study suggests that there is an effectiveness of project based learning model ($M = 61.6400$, $SD = 3.10752$) on the development of problem solving compared to the control group ($M = 48.4800$, $SD = 4.28291$; $t = 9.058$, $p < 0.01$). This shows that project-based learning is effective in improving early childhood problem solving skills. Group statistics to see the improvement from pretest to posttest results. (See Table 5)

Table 5 Results of Group Statistics

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Pre-test	Group Experiment	25	36.4000	3.01386	.60277
	Group control	25	34.1600	2.85307	.57061
Post-test	Group Experimen	25	61.6400	3.10752	.62150
	Group control	25	48.4800	4.28291	.85658

In the table above, problem solving for children aged 5-6 years in the control group before and after conventional learning is 34.16 to 48.48 so that there is an increase of 14.3%. In the experimental group before and after giving project-based learning treatment, 36.40 to 61.64, so that there was an increase of 25.2%. This shows that although the conventional method has a positive impact, the increase is relatively limited. In contrast, in the experimental group that applied the project-based learning method, there was a more significant increase. From the data above, it can be concluded that project-based learning has an influence on improving the problem solving ability of children aged 5-6 years.

4. Discussion

The researcher's findings from the posttest conducted in the control group and experimental group showed significant differences in children's problem solving skills. The control group used conventional learning methods, while the experimental group applied project-based learning. The data from these two groups provide a clear picture of how teaching methods can affect children's problem solving skills. This finding is in line with research conducted by Febiyanti et al., (2024) which states that the project-based learning model significantly improves critical thinking and problem solving skills in early childhood compared to conventional learning methods. In addition, Zahro et al., (2024) also emphasizes that this method can encourage active participation, collaboration, and creative thinking in children which are important elements in the development of problem solving skills.

In the control group, out of 25 respondents, there were no children in the very low category. However, there was 1 child who scored in the low category, while 21 children were in the high problem solving category, and 3 children showed very high problem solving ability. Although most of the children showed positive results, there was one child who still needed more attention. This indicates that conventional methods may not be fully effective for all children.

In contrast, the experimental group's posttest results showed better performance. Of the 25 respondents, only 1 child scored in the high category, while the other 24 children were in the very high category. This shows that 96% of children in the experimental group showed excellent problem solving skills. The results reflect the success of the project-based learning method in improving problem solving skills, where children are actively involved in the learning process. The results of this study are in line with the findings of Husain et al., (2024) also emphasizes that project-based learning is able to develop problem-solving skills in early childhood by showing the effectiveness of this method in improving children's cognitive skills.

To determine whether or not there is an effect of the project-based learning model on the development of problem solving in children aged 5-6 years, it can use the t test. Before the t test is carried out, there is a prerequisite test that must be met. Based on the prerequisite test, normality and homogeneity tests were carried out on the pretest-posttest data of the control group and the experimental group. The results of the normality test can be seen in table 2, the control group obtained a sig value of 0,292 > 0.05 and the experimental group sig value of 0.168 > 0.05, this shows that the data is normally distributed. Furthermore, the homogeneity test can be seen in table 3 which shows the experimental group control group data obtained a value of 0.065 > 0.05, this indicates homogeneous data.

The results of the paired sample t-test in the experimental group obtained a value ($t = -32.469$, $p < 0.01$). This shows that the difference between the mean score of children's problem solving before and after the application of project-based learning method in the experimental group is highly statistically significant. Thus, it can be concluded that this learning method has a significant impact on improving children's problem solving skills.

Based on the results of the paired sample t test analysis, there is a significant difference between the control group and the experimental group in the effect of learning on the development of problem solving in children aged 5-6 years. Results from the control group showed a value of ($t = -15.541$, $p < 0.01$). This means that conventional learning also had a positive effect, although the change was not as great as in the experimental group. This indicates an increase in problem solving ability in the control group, although not as strong as expected.

From these two analyses, it can be seen that although conventional learning methods have an effect, the effectiveness of project-based learning in improving problem solving is much higher. This shows that a more active and involved approach, such as project-based learning, is able to encourage children to think critically and creatively, which is essential in the development of problem solving skills. Therefore, the results of this study support the hypothesis that there is a significant positive influence between the project-based learning model on children's problem solving development in PAUD institutions and the effectiveness of the project-based learning model on the problem solving development of children aged 5-6, especially in coastal areas. These results are important to consider in future curriculum development and learning methods, so that children can gain a more optimal learning experience.

This comparison highlights that project-based learning is more effective in encouraging children to think critically and creatively. In conventional methods, children usually play a passive role, receiving information from the teacher without much interaction. Project-based methods, on the other hand, provide opportunities for students to work together, solve real problems, and apply knowledge in a more relevant and practical context. This agrees with research Almulla, (2020) which states that project-based learning can have a positive impact on children in improving their abilities.

It is important to understand that project-based learning encourages greater child engagement. Children not only learn theory but also apply social, communication and collaboration skills which are important aspects of problem solving. Through these practical experiences, children not only gain knowledge, but also a deeper understanding. Research by Zulkarnaen et al., (2023) She stated that the development of social skills in early childhood can be done by implementing project-based learning which allows children to interact and work together

in completing projects so as to improve social skills. In addition, research by Souisa et al., (2024) shows that the application of project-based learning models in early childhood provides opportunities for children to process their knowledge in each project-based learning, and can stimulate children's abilities to improve their ability to solve a problem.

The implications of these findings are significant for educational practice. Given the effectiveness of project-based learning in improving problem solving skills, educators may consider integrating this method into their curriculum. This will help create a dynamic and interactive learning environment, where children feel more motivated and engaged. This not only has the potential to improve academic learning outcomes, but also creates an enjoyable learning atmosphere (Elok et al., 2023). Along with that, project-based learning also allows teachers to adapt to children's various learning styles and ensure that all individuals receive an optimal education.

In addition, these results reflect the importance of a learning environment that supports the development of problem solving skills. Based on the theory of constructivism, students learn better when they are actively involved in the learning process. This environment that supports social interaction and exploration will facilitate deeper understanding, thus internalizing knowledge in a more meaningful and applicable way. Therefore, the application of methods that encourage cooperation and problem solving in the experimental group has created a conducive learning atmosphere that can provide children with space to explore and apply the concepts learned better.

Various studies support this research finding. Murdy et al., (2024) said that project-based learning has an impact on improving children's abilities. Supported in research Tabun et al., (2024) about project-based learning can improve fine motor skills through playdough. In the research Suci & Fathiyah, (2023) the use of project-based methods can significantly increase the independence of early childhood. Reinforced by research Priantika et al., (2024) In the results of his research, the nature-based project-based learning model has an effect on early childhood creativity. This shows that learning by involving children directly can provide a significant increase in the process of child development.

Overall, the posttest results from the control and experimental groups show that project-based learning is superior in improving children's problem solving skills. This method not only produces better results, but also creates a meaningful learning experience. Therefore, it is crucial to explore and develop innovative learning approaches to improve the quality of education and the skills that children will need in the future. This could lead to further research exploring the specific factors that contribute to such improvements and how similar approaches can be applied in various educational settings.

5. Conclusion

Based on the results of the analysis above, the researcher concluded that the use of the Project-based learning model has an influence on the problem solving ability of children aged 5-6 years and has significant effectiveness in improving problem solving skills in children. Learning that involves children directly can provide real learning experiences, so that meaningful learning is conveyed to children. This confirms that the project-based learning (PjBL) method is effective in developing critical thinking skills and problem-solving abilities in early childhood.

recognized as a valuable tool in various contexts, including education and therapy, due to their capacity to engage attention, promote cognitive development, and address behavioral challenges. The repetitive nature of many puzzles can incrementally extend a child's ability to maintain focus on a single task for extended periods, providing opportunities for progressive improvement. Puzzle games offer a platform for emotional regulation, as children develop strategies to manage frustration when encountering difficulties in puzzle-solving. The problem-solving process allows children to experience trial and error in a controlled environment, fostering persistence through challenges and facilitating the experience of achievement upon successful completion.

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