Pancasila International Journal of Applied Social Science
E-ISSN 2988-0750 P-ISSN 2988-0769
Volume 3 Issue 01, January 2025, Pp. 105-115
DOI: https://doi.org/10.59653/pancasila.v3i01.1382

The Effect of the Application of Project-Based Learning Model on Improving Problem-Solving Skills

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Received: 24-12-2024 *Reviewed: 10-01-2025* *Accepted: 25-01-2025*

Abstract

The learning process is a learning activity designed to provide a learning experience that involves mental and physical processes through interaction between children, teachers, learning environments and other learning resources in achieving basic competencies In child development some several aspects and abilities need to be developed, one of which is the cognitive aspect. The development of cognitive aspects is the ability of thinking that a person has to understand and understand something. The cognitive aspect is that children need to develop their abilities according to their respective ages. One of the skills that needs to be developed in children (5-6) years old is problem-solving skills. Problem-solving skills need to be possessed and developed from an early age. Because, in daily life, of course, children will be faced with various problems. So, every child must be able to solve and overcome this problem. This study aims to determine the effect of the application of the project-based learning model on improving problem-solving skills in children aged 5-6 years. The research method used is quantitative research with the Quasi-experimental method, or pseudo-experimentation. The design form used in this study is Nonequivalent Control group Design, which is a design that provides pre-test before treatment, as well as post-test after applying treatment to each group The results of the study show that: 1) An overview of children's problem-solving skills in the control group aged 5-6 years and an overview of children's problem-solving skills in an experimental group aged 5-6 years with the application of a Project-Based Learning Model so that it can be It was concluded that there was an influence of the project method on the problem-solving ability of children aged 5-6 years.

Keywords: Project-Based Learning, Problem Solving Skills, Children 5-6 Years Old

Introduction

Education is a need for the community in building the nation's generation. Law of the Republic of Indonesia Number 20 of 2003 concerning the National Early Childhood Education System in Article 1 point 14 that early childhood education is an effort or coaching effort given to children from birth to the age of six years is carried out through the provision of educational stimuli to help growth and enter further education (Zhang et al., 2024). Basically, early childhood education includes all efforts made by teachers and parents in the educational process by involving children directly in daily life. The learning process is a learning activity designed to provide a learning experience involving mental and physical processes through interaction between children, teachers, learning environments and other learning resources to achieve basic competencies. Learning experiences can be created through the use of appropriate learning strategies that are purposeful and child-centered.(Alemneh & Gebrie, 2024)

A quality learning process can be realized if children and teachers play an active role in it. In child development, several aspects and abilities need to be developed, including the cognitive aspect (Wu, 2024)v. The development of cognitive aspects is the ability of thinking that a person has to understand and understand something. In the cognitive aspect, children's abilities must be developed according to their ages. One of the skills that needs to be developed in children (5-6) years old is problem-solving skills. Problem-solving skills need to be possessed and developed from an early age. Because, in daily life, of course, children will be faced with various problems. So every child must have problem-solving skills to be able to overcome them. Problem-solving skills are related to cognitive development because solving problems will build children to think critically, logically, and systematically (LeTendre & Gray, 2024). Efforts that can be made to deal with problems related to problem-solving skills in children are to apply methods that are in accordance with the characteristics of students and the learning goals to be achieved. Through the project method, students are directly involved in learning activities so that they can understand the learning material more easily. The project method is a way of teaching that provides opportunities for students to develop various aspects of solving problems related to daily life (Wardhani, 2018).

The project method can also be interpreted as a strategy used in learning by providing various meaningful experiences to develop children's creativity in solving the problems they face (Shekhar et al., 2024). For early childhood, the project method has many benefits for aspects of child development, one of which can develop children's social and problem-solving skills. Given the importance of the ability to solve problems is stimulated, because children are in a golden age that only lasts once in their lives, so that the surrounding environment is a place for children to solve problems. Therefore, the problem-based learning model is applied to provide wide opportunities for children to do something independently so that children gain meaningful experience and knowledge. Indicators of problem-solving ability in early childhood include; 1) observation skills, (2) data and information gathering skills, and (3) information processing skills (communicating), (4) information communication skills.

Literature Review

Early childhood is an important and fundamental initial stage in the range of growth and development of human life, in the National Education System Law No. 20 of 2003 paragraph 1 states that those who are included in early childhood are children who are included in the age range of 0-6 years. Early childhood is a group of children who are in a unique process of growth and development. Early childhood is an individual who is experiencing a very rapid process of growth and development, even said to be experiencing a developmental leap or it can be called a golden age where 80% of the child's brain can begin to work and develop quickly both related to religious development, values and moral, emotional, social, cognitive, art and language. Fadillah, (2014). Early childhood is a child who is in the age range of 0-8 years. According to this definition, early childhood is a group that is in the process of growth and development (Wijana, 2013). Based on the opinion above, it can be concluded that early childhood is a child who is between 0 and 6 years old. At this age is an age that experiences rapid development and growth so that it is easy to be stimulated for the development of their intelligence, both served and unserved in early childhood education institutions. Cognitive cognition comes from the word cognition, which is equivalent to the word knowing.

Based on the theoretical roots built by Piaget, some authors define cognition with different but basically the same redactions, namely mental activity in knowing and knowing about the world (Khiyarusoleh, 2016). Cognitive can be interpreted as the ability to understand something, meaning that understanding shows the ability to grasp the nature, meaning, or information about something and clearly understand it. Cognitive development refers to a child's ability to understand something (Maslihah, 2005). Meanwhile, in the great Indonesian dictionary, cognition is defined as something related to or involves cognition based on empirical factual knowledge (Alwi, et al., 2002: 579). Furthermore, the cognition process is a mental process that refers to the process of knowing something (Berk, 2005). Then Yusuf (2005:10) stated that cognitive ability is the ability of children to think more complex and do reasoning and problem solving, the development of this cognitive ability will make it easier for children to master a wider range of general knowledge, so that they can function reasonably in daily life. Problem-solving skills are the ability to think through gathering facts, analyzing information, developing alternative solutions, and choosing the most effective problem-solving.

Problem-solving skills are one part of the scope of cognitive development consisting of problem-solving, decision-making, critical thinking, and creative thinking. Based on some of the opinions above, it can be understood that problem solving is a process of finding and solving problems based on accurate data and information to provide the right and careful conclusions. Problem-solving skills are the first step in building students' knowledge, understanding, and skills. A person's success in living life is determined by his ability to face and solve problems (Arigiyati and Istiqomah, 2016: 135). Problem solving has several benefits: 1) Arousing children's curiosity, creativity, and motivation. 2) Build knowledge and skills such as counting. 3) Bringing out original and diverse answers can increase the child's knowledge.

4) Improving the application of knowledge and knowledge obtained. 5) Building children's ability to analyze problems and develop problem-solving steps.

Research Method

This type of research is a quantitative research with the Quasi experimental method or also known as a pseudo-experiment, having a control group but not being able to function fully or pseudo-in controlling external variables that affect the results of experimental research. Quasi experiments aim to find out the difference between two or more variables or groups that are the subject of research. The method used to collect data is very important to obtain accurate and significant information and data in a research.

This research uses data collection techniques consisting of observation, tests and documentation. The data collection techniques that will be used in this study are:

1. Observation Observation is defined as observations made on activities, behaviors, and actions in a structured manner. Observers record everything they find while making observations to obtain data.
2. The test includes two stages, namely the pre-test and the post-test. The pre-test was carried out before the treatment, aiming to determine the students' initial ability. While the post-test is carried out after the treatment, the aim is to find out the final result of the student's ability.
3. Documentation study Documentation is the collection of data by examining important notes that are very closely related to the object of research, both in the form of notes and photographs. The researcher uses this method to obtain clear and concrete data about the development of students' problem-solving skills.

   Data analysis techniques are structured data search and preparation activities obtained from field observations and recordings. This study uses descriptive statistics and inferential statistics. Descriptive statistics describe previously collected data without drawing conclusions about the population.

Result

Overview of Children's Problem-Solving Skills in the 5-6 Years Old Control Group

The results of the study in the control group using conventional learning methods in children aged 5-6 years at Satap Balubu Kindergarten, Belopa District, illustrate that children's problem-solving skills have not developed properly. The data in the study was obtained from the results of observations when children were active both during learning and playing.

Children's problem-solving skills are described through observation using an instrument to assess the cognitive ability of learning and problem-solving of children aged 5-6 years based on the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 137 of 2014. The results of *the pre-test* and *post-test* assessments are determined based on

assessment instruments consisting of assessment scales of Not Developed (BB), Starting to Develop (MB), Developing as Expected (BSH), Developing Very Good (BSB).

The results of the observation of the problem-solving ability of children aged 5-6 years were determined by a score of 1-4, where score 1 (the child is not able to do the problem-solving ability indicator), score 2 (the child is able to do the problem-solving ability indicator with help), score 3 (the child is able to do the problem-solving ability indicator without assistance), score 4 (the child is able to do the problem-solving ability indicator and help his friend). The children who took *the pre-test* and *post-test* were 12 children consisting of 6 boys and 6 girls.

The table above shows the results of the assessment of the problem-solving ability of children aged 5-6 years in the control group at Satap Balubu Kindergarten, there seems to be no significant difference *in pre-test* and *post-test scores.* So it can be concluded that learning activities using conventional learning methods do not have a significant influence on children's problem-solving abilities of 5-6 year olds which include the ability to recognize simple concepts in daily life, recognize objects based on their functions, recognize many and few concepts, and observe objects with symptoms of curiosity.

The results of the research in the experimental class before providing treatment in the form of the use of project methods with activities to make works from *plasticine*, and the activity of blending basic colors through colorful tissue experiments in children aged 5-6 years in kindergarten illustrate that children's problem-solving skills have not developed properly. The data in the study was obtained from the results of observations when children were active both during learning and playing.

The table above shows the results of the assessment of the problem-solving ability of children aged 5-6 years in the experimental group there is a difference in the value before and after using the project method, so it can be concluded that the activity of making works from *plasticine* and the activity of mixing basic colors through the colorful tissue experiment applied has an effect on the ability of children to solve problems for children aged 5-6 years which includes the ability to Knowing simple concepts in daily life, getting to know objects based on their functions, about the concept of a lot and a little, and observing objects with symptoms of curiosity.

Indicator 1 includes the ability to recognize simple concepts in daily life, namely the ability to recognize the concept of color and the ability to recognize objects and their properties. Indicator 2 includes recognizing objects based on their functions and grouping and using objects according to their functions. Indicator 3 includes the ability to recognize the concept of a lot of things, sort objects according to their size and recognize heavy and light objects. Indicator 4 includes the ability to observe objects and symptoms of curiosity in listening to activities, expressing opinions, and conducting simple experiments.

Table 1. Descriptive statistical values of pre-test and post-test results

Problem-Solving Skills for Children Aged 5-6 Years

Statistics	Statistical Value	
	Pre-test	***Post-test***
Lowest Rate	14	**29**
Highest Scores	26	**36**
Average Score	18,50	**33,42**
Standard Deviation	**3,873**	**2,275**

The table shows the scores obtained by students before and after being given treatment and it can be concluded that the lowest score in the pre-test is 14 and the highest score is 26 with an average score of 18.50 and the standard deviation obtained is 3.873. The lowest score obtained in the post-test was 29 and the highest score was 36 with an average score of 33.42 and a standard deviation of 2.275.

The results of the study described in the table show differences in children's ability to solve problems before and after using the project method on children's problem-solving skills. The problem-solving ability in children in this study can be categorized into low, medium, and high categories so that the frequency and percentage are obtained after giving pre-test and post-test.

Table 2. Categorization of Pre-test Result Percentages

It	Mastery Level	Category	Frequency	Percentage (%)
1	$X < 15$	Low	1	**8%**
2	$15 \leq x < 23$	Keep	8	**67%**
3	$23 \leq X$	Tall	3	**25%**
Sum			**12**	**100%**

The table shows that the problem-solving ability in children before being given treatment is 1 child in the low category (8%), 8 children in the medium category (67%), and 3 children in the high category (25%) so it can be concluded that the percentage of pre-test results is in the medium category.

Table 3. Categorization of Post-test Result Percentages

It	Mastery Level	Category	Frequency	Percentage (%)
1	$X < 31$	Low	2	**8%**
2	$31 \leq X < 35$	Keep	5	**67%**
3	$35 \leq X$	Tall	5	**25%**
Sum			**121**	**100%**

Based on the table, it can be seen that the children's problem-solving ability after treatment is 2 children (17%) who are in the low category, 5 children (41%) in the medium category, and

5 children (42%) in the high category. The percentage results obtained based on the results of the postest can be concluded that the level of children's ability after treatment is in the high category.

Discussion

Based on the observation results from the results of research that have been conducted through research instruments in the form of observation sheets and interviews, it provides an overview of the Application of Experimental Methods in Science Learning to improve children's thinking skills and supporting and inhibiting factors.

Overview of the Application of Experimental Methods in Science Learning to Improve Children's Thinking Skills

Experimental methods must be integrated more widely into the curriculum to improve the quality of science learning and early childhood thinking skills. Currently, the application of experimental methods is still limited to science learning. Therefore, the development of a more comprehensive curriculum that includes various aspects of experiential learning will greatly help enrich the teaching and learning process. As the most basic level of education, early childhood education is expected to be a strong foundation to improve children's thinking skills in playing experiments.

The application of experimental methods in learning science to improve the thinking ability of early childhood at Raudhatul Athfal UMDI Ujung Baru. Teachers make learning implementation plans, namely: RPPH, assessment and determine the learning goals to be achieved. Teachers prepare planning steps and implement experimental activities to make it easier for teachers to carry out the teaching and learning activities process so that learning runs effectively. Otherwise, teachers do not have preparation before the teaching and learning process will not run effectively.

Supporting Factors and Inhibiting Factors in the Application of Experimental Methods in Science Learning to Improve Early Childhood Thinking Skills

Factors in the application of experimental methods in science learning to improve children's thinking skills, namely:

Supporting factors

Improving teacher competence through training and workshops is very important, especially in mastering science concepts and classroom management skills during experiments. With adequate training, teachers will be more prepared and confident in applying experimental methods effectively.

Teachers' competence and motivation are supporting factors in experimental methods to improve early childhood thinking skills because:

a. The experimental method is an active learning method that emphasizes the formation of children's thinking skills.

b. The experimental method provides an opportunity for children to actively conduct experiments on their own.

c. Experimental methods can develop children's cognitive, affective, and psychomotor abilities.

Experimental methods can help children learn to prove a theory's truth and develop new theories.

Inhibiting Factors

Science learning that is still limited, only from the necessary needs, is an obstacle that needs to be overcome. Provision of more complete facilities, such as simple laboratories and sufficient experimental equipment.

Effective time management also needs to be implemented to overcome the limitations of time allocated for experimental activities. Designing more efficient learning sessions and adjusting learning schedules that allow for all stages of experimentation, including discussion and reflection, are essential to ensure that children's understanding can be well consolidated. In addition, better classroom management is needed by lowering the teacher-student ratio or providing additional training for teachers to improve classroom management skills, especially during experimental activities involving large groups.

Adjusting safety policies is also important to ensure the safety of children during experiments. Better safety procedures will help reduce teachers' concerns about possible incidents, so they are more emboldened to adopt more complex and interesting experiments for children. By implementing these recommendations, it is hoped that the quality of science learning and early childhood thinking skills can be significantly improved.

Conclusion

Based on the research and discussion results, it can be concluded that the application of experimental methods in science learning at RA Umdi Ujung Baru, Parepare City effectively improves early childhood thinking skills, especially in color recognition and color mixing processes. Teachers have made good preparations before applying the experimental method, including compiling RPPH, determining learning objectives, and designing steps to implement activities. The learning process with the experimental method actively involves children, increases their enthusiasm, and helps develop observation skills and critical thinking skills. Through color mixing experiments, children can get to know primary and secondary colors and understand the process of new colors.

Experimental methods help improve children's cognitive abilities, including their thinking, creativity, and imagination. The main supporting factors in the application of this method include teacher competence and motivation, principal support, availability of facilities and infrastructure, and parental involvement. The inhibiting factors encountered included time constraints, high teacher-student ratios, budget constraints, child readiness, and safety-related concerns during the experiment. The application of the experimental method requires good

classroom management skills from the teacher to ensure all children are actively engaged and safe during the learning process.

Declaration of conflicting interest

The authors declare that there is no conflict of interest in this work.

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