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Original Article

Project-Based Learning to Improve Problem Solving Skills in Early Childhood

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Abstract

Problem-solving skills are important for cognitive development in early childhood. At PAUD KB 'Aisyiyah 6 Wagir, many 5-6 year old children rely heavily on teacher guidance and lack initiative. This shows that current learning strategies do not promote independence or critical thinking. Hence, Project-Based Learning is suggested as a way to encourage problem-solving. This study aims to determine the improvement of problem-solving skills in early childhood through the implementation of project-based learning at PAUD KB 'Aisyiyah 6 Wagir. The research employed a Classroom Action Research (CAR) method using the Kemmis and McTaggart model, conducted in two cycles. The subjects of the study were 12 children aged 5–6 years enrolled in Group B at PAUD KB 'Aisyiyah 6 Wagir during the second semester of the 2024/2025 academic year. The research instrument used was an observation sheet based on the indicators outlined in the Regulation of the Minister of Education and Culture No. 146 of 2014, namely: (1) identifying problems, (2) finding alternative solutions, and (3) solving problems independently. The results showed that the average problem-solving ability of the children increased significantly from 57.4% in the pre-cycle, to 71,3% in the first cycle, and reached 97.25% in the second cycle. The implementation of the PjBL model encouraged the children to be more active, independent, creative, and capable of collaborating in solving real problems in their environment. Thus, project-based learning has proven to be effective in gradually and comprehensively enhancing early childhood problem-solving skills.

Keywords: Early Childhood Education, Problem-Solving Skills, Project-Based Learning, Student Independence, Teaching Strategies.

1. Introduction

Early Childhood Education (PAUD) is the main foundation in building children's character, skills, and potential in a comprehensive manner. At this stage, children experience rapid development in cognitive, social-emotional, language, and motor aspects. One of the most important cognitive aspects to be developed from an early age is problem-solving skills. This ability is closely related to independence, critical thinking, creativity, and decision-making, which will equip children to face life's challenges in the future. According to Piaget and Cook (1952) children aged 5–6 years are in the preoperational stage, which is the stage when children begin to be able to use symbols in thinking but are still limited to an egocentric perspective. Therefore, children need real-life experiences that allow them to build knowledge through exploration. Meanwhile, Vygotsky (1978) emphasizes the importance of social interaction in learning through the concept of the Zone of Proximal Development (ZPD), where children can achieve their optimal abilities through guidance from adults or peers.

One approach that is in line with these principles is Project-Based Learning (PjBL). This approach provides space for children to learn actively through real, contextual projects,

allowing them to identify problems, find solutions, and solve problems collaboratively and independently. Problem-solving skills in this study were measured based on three indicators referred to in Permendikbud No. 146 of 2014, namely: (1) Identifying problems, (2) Seeking alternative solutions, and (3) Solving problems independently.

A number of previous studies have shown that PjBL has a significant contribution to the development of problem-solving skills in early childhood. Safitri et al. (2024) emphasize that contextually designed project-based learning can increase children's activity, confidence, and ability to solve simple problems. Thomas (2000), through an international study, found that PjBL can develop higher-order thinking skills, including the ability to analyze and solve problems step by step. Furthermore, research from the Buck Institute for Education (BIE) shows that well-designed projects can increase children's engagement and support social, emotional, and critical thinking development from an early age. Research from Susanta and Susanto (2020) also states that PjBL, when conducted consistently, can stimulate meaningful problem-solving skills, in line with the characteristics of active and exploratory children.

However, most of these studies were conducted at the primary education level or only measured general thinking aspects, without focusing on specific problem-solving indicators in early childhood education. Therefore, this study aims to fill this gap by evaluating the improvement in early childhood problem-solving skills through the systematic and measurable application of PjBL, in accordance with national curriculum indicators. This study is expected to contribute to the development of relevant and innovative learning strategies to optimise the thinking potential of young children, particularly in independently and creatively addressing problematic situations.

2. Literature Review

The theory serves as a conceptual basis that supports research on the development of problem-solving skills in early childhood through project-based learning (PjBL). This section explains the definition of early childhood, problem-solving skills, the concept of PjBL, and the theories that support the application of this learning model, particularly from the constructivist perspective developed by Piaget and Vygotsky.

2.1. Problem-Solving Skills in Early Childhood

Early childhood refers to individuals aged 0–6 years, who experience rapid development in various aspects, including physical, cognitive, social-emotional, and language development. At this stage, children learn actively through direct experience and play, which are natural processes in their development. A learning environment that aligns with the developmental characteristics of children is crucial for optimising their potential and fostering a high level of curiosity and exploration (Susanta & Susanto, 2020). Limbong et al. (2024) emphasise the importance of child-friendly and creative learning strategies to make the learning process more meaningful and aligned with the developmental characteristics of young children.

Problem-solving ability is a cognitive process that includes identifying problems, analysing situations, seeking solutions, selecting the best alternatives, implementing solutions, and evaluating the results (Magdalena et al., 2023). In young children, this ability develops through direct experience and interaction with the surrounding environment, both independently and with adult assistance. This ability is very important as it forms the foundation for developing independence, self-confidence, and critical and creative thinking skills (Polya, 1945; Santrock, 2002). Yuliantina and Puspitasari (2025) demonstrate that the use of PjBL significantly enhances critical thinking skills in young children as part of problem-solving abilities.

Problem-Solving This ability encompasses several key aspects, including: identifying obstacles or problems, understanding the core of the issue, proposing various alternative solutions, evaluating and selecting the best solution, implementing the solution, and evaluating its success. The gradual development of this dimension will help children improve their critical thinking skills, social skills, and independence in solving everyday problems (Hurlock, 2017). Shvets et al. (2024) added that the project method can improve children's social skills through collaborative activities in solving real problems in their environment.

2.2. Project-Based Learning (PjBL)

PjBL learning is a learning model that places students as the main actors in the learning process, through complex and meaningful projects. This approach involves actively engaging children in planning, implementing, and presenting projects that are relevant to their environment. PjBL is highly suitable for early childhood education as it naturally integrates children's interests and experiences into the learning process (Thomas, 2000).

The main characteristics of PjBL include: projects triggered by relevant and interesting questions, children actively seeking and processing information, the development of 21st-century skills such as collaboration and communication, and feedback from educators and peers. Children are also encouraged to present their work creatively and confidently (Thomas, 2000). Piaget emphasises that children actively construct knowledge through direct experience and interaction with their environment. This process occurs through the mechanisms of assimilation and accommodation, enabling children to develop new understandings based on previous experiences. This approach aligns well with the PjBL model as it encourages children to engage in independent exploration and discover solutions to the problems they face on their own (Piaget & Cook, 1952).

Vygotsky added that children's cognitive development is greatly influenced by social and cultural interactions. The concepts of the Zone of Proximal Development (ZPD) and scaffolding show that children can achieve higher levels of development through guidance and collaboration with adults and peers. In PjBL, collaboration and social interaction are key to helping children internalise new knowledge and skills in a meaningful way (Vygotsky, 1978). Recent educational research confirms the relevance of Piaget and Vygotsky's constructivism in modern teaching (Prakash Chand, 2023). The implementation of PjBL supports the comprehensive development of children's problem-solving abilities through direct experiences in identifying problems, conducting explorations, collaborating, thinking critically and creatively, and reflecting on the process and outcomes. The final product of the project and the presentation process provide real-world experiences that strengthen children's understanding and confidence in solving problems in their daily lives (Permatasari et al., 2025).

Indicators of success in project-based learning include: children's ability to choose relevant topics, plan implementation steps, actively carry out activities, reflect on the process and outcomes, and interpret their work creatively and communicatively. These indicators show that children are actively and meaningfully engaged in the learning process (Ministry of Education and Culture, 2014). Effective strategies in implementing PjBL include collaboration among children, the use of real-world problems as learning resources, and the use of technology to support exploration and presentation processes. This approach optimally develops children's social skills, critical thinking, and creativity, in line with their developmental characteristics at an early age (Buck Institute for Education, 2019). The appropriate and consistent implementation of PjBL can enhance young children's problem-solving abilities in a meaningful and comprehensive manner, in line with the principles of

constructivism and the active and exploratory developmental characteristics of children (Susanta & Susanto, 2017; Vygotsky, 1987).

2.3. Previous Studies

A number of previous studies have shown that project-based learning approaches have a positive influence on the development of children's thinking skills, including problem-solving skills. Research by Permatasari et al. (2025) states that the application of Project-Based Learning (PjBL) in early childhood education can significantly improve children's cognitive skills. Children become more active, confident, and able to propose solutions to simple problems in contextual learning activities. A study by Thomas (2000) reviews various international research findings on the effectiveness of PjBL in improving higher-order thinking skills such as analysis and problem solving. This model has been proven to encourage students to build knowledge through exploration and collaboration, rather than simply receiving information passively.

Additionally, research from BIE shows that well-designed project-based learning can increase children's engagement and promote social-emotional development and critical thinking skills from an early age. These studies support the view that PjBL is highly potential to be applied in early childhood education settings to cultivate children's problem-solving skills in a structured and gradual manner. However, most previous research has been conducted in the context of primary schools or has only measured general cognitive aspects without focusing on specific problem-solving skills based on indicators relevant to PAUD. There have been few classroom action studies conducted in PAUD settings with subjects aged 5–6 years and using development indicators in line with Ministry of Education and Culture Regulation No. 146 of 2014. Therefore, this study was conducted to fill this gap by examining the improvement of young children's problem-solving skills through the direct application of PjBL in the PAUD KB 'Aisyiyah 6 Wagir classroom. This study used indicators in line with the national curriculum and applied a contextual classroom action model.

3. Research Method

3.1. Research Approach

This study utilised the Classroom Action Research (CAR) approach developed by Kemmis and McTaggart, which consists of four stages: planning, action, observation, and reflection. CAR was chosen because it provides teachers with the opportunity to evaluate and improve their teaching practices directly and continuously in the classroom (Kemmis et al., 2013).

This research was conducted at PAUD KB 'Aisyiyah 6 Wagir in the even semester of the 2024/2025 academic year. The subjects in this study were 12 children aged 5–6 years who were members of class B. The research was conducted in two cycles, each consisting of a series of project-based learning activities designed to develop children's problem-solving skills. The instrument used was an observation sheet with indicators based on Ministry of Education and Culture Regulation No. 146 of 2014 on the 2013 PAUD Curriculum and referencing the problem-solving thinking approach according to Polya (1945) and Santrock (2002). The problem-solving ability indicators used in this study are as follows:

1. Identifying problems: Children are able to recognise and identify problems that arise in concrete situations.
2. Seeking alternative solutions: Children are able to suggest various possible solutions to solve problems.

3. Solving problems independently: Children are able to choose and apply the selected solution without completely relying on the teacher's help.

Data collection techniques were carried out through structured observation of children's activities during the PBL learning process. Each indicator was assessed using a qualitative assessment scale with a score range of 1–3 (1 = Not Yet Developed, 2 = Beginning to Develop, 3 = Developing as Expected). In addition to observation, documentation of children's activities and work was also used to support the data.

The data obtained were analysed using qualitative descriptive analysis techniques with the Miles and Huberman model approach, namely through the stages of data reduction, data presentation, and conclusion drawing. Data validity was tested through source and technique triangulation, as well as joint reflection with the accompanying teacher as a collaborator. With the classification of the success rate listed in Table 1 as follows:

Table 1. Assessment criteria

Percentage	Description
85% - 100%	Developing as expected
65% - 84%	Starting to develop
<64%	Not yet developed

4. Results and Discussions

4.1. Research Results

4.1.1. Pre-cycle data

Based on the initial observations conducted prior to the implementation of PJBL, the following data was obtained:

Table 2. Summary of Observations of Problem Solving Abilities in Early Childhood

No.	Child's Initials	Identifying Problems	Seeking Alternative Solutions	Solving Problems Independently	Total Score	Average	Percentage (%)
1	DB	1	2	2	5	1.67	55.7
2	KP	2	2	2	6	2	66.7
3	BB	1	1	1	3	1	33.3
4	ME	2	1	1	4	1.33	44.3
5	AN	2	2	2	6	2	66.7
6	AW	2	2	3	7	2.33	77.7
7	VA	3	2	2	7	2.33	77.7
8	AS1	2	2	1	5	1.67	55.7
9	MD	1	2	2	5	1.67	55.7
10	LM	2	2	2	6	2	66.7
11	CN	1	1	1	3	1	33.3
12	AS2	1	2	2	5	1.67	55.7

From the pre-cycle data, it was found that the majority of children (57.4%) still showed poor problem-solving skills, especially in terms of solving problems. This was also supported by the results of interviews with students' parents, which proved that children's problem-solving skills at home were also very poor. This condition became the basis for implementing PJBL learning as a strategy to improve children's problem-solving skills.

4.1.2. Cycle I Data

Implementation of Project-Based Learning in this cycle is as follow:

1) Planning Stage

At this stage, researchers and teachers developed a learning plan by applying a project-based learning model. The theme chosen is 'My Environment,' with a focus on cleanliness issues at school. Children are encouraged to identify conditions in their surroundings, such as litter, and are given the opportunity to design simple solutions. Learning tools are prepared, including lesson plans, media, evaluation tools (observation sheets), and project task guides tailored to the children's developmental stages.

2) Action Implementation Stage

Learning is conducted in groups. Children are introduced to real problems in the school environment, then asked to discuss, design solutions, and create works such as trash bins from recycled materials. Teachers act as facilitators, not direct instructors. The project is carried out over three days: (1) Watching a video about understanding waste and the various types of trash bins, (2) Designing the shape of the trash bin, (3) Starting to make a mini trash bin from used bottles.

3) Observation Stage

Observations were conducted on 12 children using an assessment instrument based on three problem-solving indicators: (1) Identifying problems, (2) Finding alternative solutions, and (3) Solving problems independently. The results of the observations showed an improvement in the children's abilities compared to the pre-cycle stage. The average score reached 71.3%, with some children beginning to show initiative, although some still needed guidance to complete tasks independently.

Table 3. Summary of Observations of Problem Solving Abilities in Early Childhood

No.	Child's Initials	Identifying Problems	Seeking Alternative Solutions	Solving Problems Independently	Total Score	Average	Percentage (%)
1	DB	2	2	2	6	2.0	66.7%
2	KP	2	2	3	7	2.33	77.7%
3	BB	2	2	2	6	2.0	66.7%
4	ME	2	2	2	6	2.0	66.7%
5	AN	2	3	2	7	2.33	77.7%
6	AW	3	2	2	7	2.33	77.7%
7	VA	3	3	3	9	3.0	100.0%
8	AS1	2	2	2	6	2.0	66.7%
9	MD	2	2	2	6	2.0	66.7%
10	LM	2	2	2	6	2.0	66.7%
11	CN	2	2	1	5	1.67	55.7%
12	AS2	2	2	2	6	2.0	66.7%

The data from the observations in cycle I showed an average problem-solving ability of 71.3%, which falls into the Starting to Develop category.

4) Reflection Stage

From the observations and discussions with teachers, it was concluded that the implementation of PjBL in cycle I began to have a positive impact. The children appear to be more active in discussions and collaboration. However, involvement is not yet evenly distributed. Of the 12 children, there are still some who are not yet optimal in expressing their ideas and tend to be passive. Therefore, improvements are needed in Cycle II, such as

clarifying the children's roles in the group, providing more time, and using projects that are more challenging in terms of motor and cognitive skills.

(A) (B) (C)

Figure 1. Learning activities in Cycle 1 of the project

Learning activities:

A. Designing the shape of the trash bin
B. Starting to make mini trash bins from used bottles
C. Exhibition and presentation of the finished products

4.1.3. Cycle II Data

Implementation of Project-Based Learning in this cycle is as follow:

1) Planning Stage

After reflecting on Cycle I, researchers and teachers developed a more structured and challenging learning plan. The project theme for this cycle was 'Building a Mini Garden' in the school environment. This activity was designed to encourage children to identify real challenges, such as determining the types of plants, designing pots from recycled materials, and arranging the garden together as a group. The learning plan, tools, materials, and observation sheets were improved and adjusted to encourage more active child participation.

2) Action Implementation Stage

The children were invited to discuss, design a garden, select tools/materials, and work in groups to create a mini garden. The teacher provided indirect guidance and gave the children space to express their opinions and complete the task independently. The children showed enthusiasm and worked together throughout the process.

3) Observation Stage

The observation was conducted using the same instrument as in the previous cycle. The results showed a significant improvement in all three problem-solving ability indicators. The children were more confident, able to identify problems that arose during the project, propose solutions, and complete group tasks independently. The average observation result was 97.25%, which falls into the category of Developing as Expected. Almost all children were able to complete the project activities with confidence and active participation.

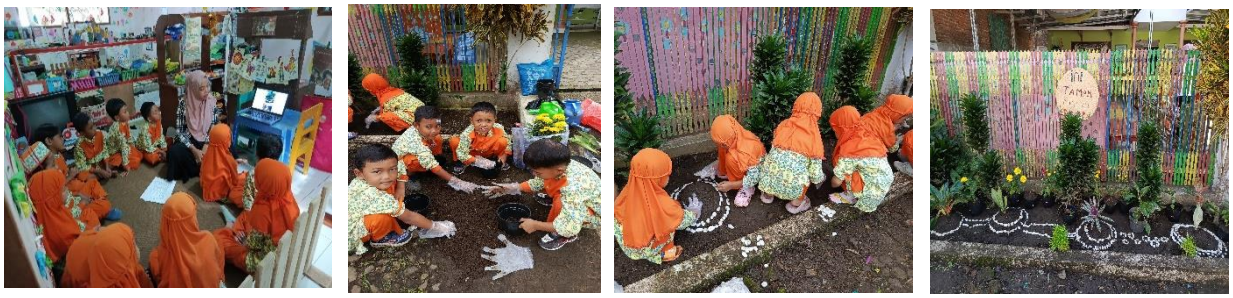
Table 4. Cycle II Observations of Early Childhood Problem Solving Abilities

No.	Child's Initials	Identifying Problems	Seeking Alternative Solutions	Solving Problems Independently	Total Score	Average	Percentage (%)
1	DB	3	3	3	9	3.0	100.0%
2	KP	3	3	3	9	3.0	100.0%
3	BB	3	2	3	8	2.67	89.0%
4	ME	3	3	3	9	3.0	100.0%
5	AN	3	3	3	9	3.0	100.0%
6	AW	3	3	3	9	3.0	100.0%
7	VA	3	3	3	9	3.0	100.0%
8	AS1	3	3	3	9	3.0	100.0%
9	MD	3	2	3	8	2.67	89.0%
10	LM	3	3	3	9	3.0	100.0%
11	CN	3	2	3	8	2.67	89.0%
12	AS2	3	3	3	9	3.0	100.0%

The data from the first cycle of observations showed an average problem-solving ability of 97.25%, which falls into the category of Developing as expected.

4) Reflection Stage

From observations and reflective discussions with teachers, it was found that the PjBL model was very effective in improving the problem-solving skills of young children. Real, meaningful project activities that were tailored to the children's interests were proven to stimulate critical thinking, cooperation, and independence. With the expected results achieved, the research was terminated in Cycle II because the success indicators had been met.



(A) (B) (C) (D)

Figure 2. Learning Activities for Cycle II Projects

Learning activities:
A. Designing a mini garden
B. Building a mini garden
C. Presentation and role-playing in the mini garden
D. Results of the mini garden

Based on the data above, children's problem-solving abilities improved gradually from the pre-cycle to cycle II. In the pre-cycle stage, children still showed passive attitudes and lacked initiative, with an average achievement of 57.4%. After implementing project-based learning in Cycle I, children began to actively identify problems and propose simple solutions, resulting in an increase in achievement to 71.3%. In Cycle II, with more challenging projects that directly involved the children, problem-solving ability reached 97.25%, with nearly all children able to think independently and actively complete tasks.

Table 5. Summary of results per cycle

Stages	Average Score (%)	Category
Pre-Cycle	57,4%	Not yet developed
Cycle I	71,3%	Starting to develop
Cycle II	97,25%	Developing as expected

This improvement indicates that the implementation of project-based learning models provides meaningful learning experiences that facilitate active, exploratory, and reflective thinking processes in early childhood. This model is effective for developing problem-solving skills as suggested by Piaget's theory (concrete experience) and Vygotsky's theory (social support).

4.2. Discussions

The results of the study indicate that the implementation of project-based learning (PjBL) contributes significantly to improving the problem-solving abilities of young children. This can be seen from the increase in the percentage of observation results from the pre-cycle (57.4%), cycle I (71.3%), to cycle II (97.25%). This increase indicates a positive gradual development in three main indicators, namely: identifying problems, seeking alternative solutions, and solving problems independently, as outlined in Ministry of Education and Culture Regulation No. 146 of 2014. In the pre-cycle stage, most children did not show initiative in solving problems. They tended to rely on teacher guidance and were unable to propose ideas to overcome the obstacles they encountered. This aligns with Piaget and Cook's (1952) preoperational stage, where children think concretely and require direct stimulation from their environment to develop their cognitive structures.

In Cycle I, the implementation of a simple project on the theme of 'My Environment,' such as making a trash bin from recycled materials, began to stimulate children's active involvement. They began to recognise real problems (such as the abundance of trash around them) and offer simple solutions. However, some children still needed assistance to complete the task. This situation reflects Vygotsky's (1978) concept of the Zone of Proximal Development (ZPD), where children can develop optimally through structured guidance and social interaction. Further improvement occurred in Cycle II through the 'Building a Mini Garden' project. At this stage, children demonstrated improved critical thinking and cooperation skills. They were able to discuss, divide tasks, make group decisions, and resolve minor conflicts independently.

This indicates that the PjBL approach provides a conducive learning environment for children to develop problem-solving skills in real-world contexts, as emphasised by Thomas (2000) and BIE, who state that project-based learning can encourage engagement, creativity, and higher-order thinking skills. Theoretically, the results of this study are also in line with Polya's (1945) view of the stages of problem solving, which include: understanding the problem, designing a strategy, implementing the solution, and evaluating the results. The children in this study began to be able to go through this process gradually, both individually and collaboratively.

According to J. Santrock (2014), direct experience in completing tasks will help children build logical concepts and make cause-and-effect connections, which are important in problem solving. These findings also support the research by Permatasari (2025), which shows that project-based learning can improve the cognitive abilities of young children. Through contextual projects, children become more active, confident, and independent in their thinking and actions. Thus, PjBL is in line with the constructivism theory proposed by Piaget and Cook (1952) and Vygotsky (1978), and reinforces previous research findings that this

approach is able to improve children's thinking skills comprehensively. It can be concluded that the implementation of project-based learning is effective in improving the problem-solving abilities of young children. This model provides space for children to experience, explore, and reflect on their learning experiences, as well as to balance cognitive and social aspects.

5. Conclusion

Based on the results of research conducted through two cycles of action, it can be concluded that the implementation of project-based learning (PjBL) can effectively improve the problem-solving skills of 5-6 year old children at KB 'AISYIYAH 6 WAGIR. The learning process designed through contextual projects provides children with the opportunity to actively engage in identifying problems, exploring solution ideas, and implementing solutions independently. The improvement in problem-solving skills is evident from the increase in the percentage of observation results, which rose from 57.4% in the pre-cycle to 71.3% in Cycle I and reached 97.25% in Cycle II.

This improvement occurred gradually and evenly across the three indicators used: (1) Ability to identify problems, (2) Ability to seek alternative solutions, and (3) Ability to solve problems independently. This success is closely tied to the fundamental principle of project-based learning, which places children as active participants in the learning process. Children do not only receive knowledge passively, but are also trained to think critically, work together, make decisions, and reflect on their experiences. This study provides recommendations for early childhood educators to further optimise the PjBL approach as an alternative learning method that not only emphasises academic achievement but also the development of children's life skills from an early age, especially in facing and solving various real problems in their environment.

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