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Teachers' Perceptions of Project-Based Learning in Strengthening Mathematical Literacy and Problem-Solving Skills

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Abstract

Preschool education represents an essential foundation for the development of children's mathematical literacy and problem-solving skills, which are critical for daily life and future learning. This study aims to analyze teachers' perceptions of the use of Project-Based Learning in strengthening mathematical literacy and problem-solving skills among preschool children. A quantitative approach was employed by collecting data through a questionnaire distributed to early childhood educators via Google Forms. The collected data were analyzed using SPSS and presented in the form of tables and graphical visualizations to provide a systematic and measurable overview of teachers' responses. The findings indicate that, based on teachers' perceptions, Project-Based Learning is perceived to enhance children's engagement, understanding of mathematical concepts, and enthusiasm for learning, which in turn supports the development of their problem-solving skills. These results suggest that Project-Based Learning is viewed by teachers as a relevant and effective pedagogical approach for early childhood education, provided that it is supported by appropriate teacher guidance, well-designed projects, and learning environments that are aligned with children's developmental levels.

Keywords: *Teachers' Perceptions, Project-Based Learning, Mathematical literacy, Preschool Children*

Abstrak

Pendidikan prasekolah merupakan fondasi penting dalam pengembangan literasi matematika dan kemampuan pemecahan masalah anak, yang sangat dibutuhkan dalam kehidupan sehari-hari serta pembelajaran di masa mendatang. Penelitian ini bertujuan untuk menganalisis persepsi guru terhadap pemanfaatan Project-Based Learning dalam memperkuat literasi matematika dan kemampuan pemecahan masalah anak prasekolah. Penelitian ini menggunakan pendekatan kuantitatif dengan pengumpulan data melalui kuesioner yang disebarkan kepada pendidik anak usia dini melalui Google Formulir. Data yang terkumpul dianalisis menggunakan SPSS dan disajikan dalam bentuk tabel serta visualisasi grafik guna memberikan gambaran yang sistematis dan terukur terhadap respons guru. Hasil penelitian menunjukkan bahwa berdasarkan persepsi guru, Project-Based Learning dipandang mampu meningkatkan keterlibatan anak, pemahaman konsep matematika, serta antusiasme belajar, yang pada akhirnya mendukung perkembangan kemampuan pemecahan masalah anak. Temuan ini menunjukkan bahwa Project-Based Learning dipersepsikan oleh guru sebagai pendekatan pedagogis yang relevan dan efektif dalam pendidikan anak usia dini, dengan catatan didukung oleh bimbingan guru yang memadai, perancangan proyek yang baik, serta lingkungan belajar yang selaras dengan tingkat perkembangan anak.

Kata Kunci: Persepsi Guru, Project-Based Learning, literasi matematika; Kemampuan Pemecahan Masalah; Pendidikan Prasekolah

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INTRODUCTION

The preschool period is widely recognized as a critical stage of development, often referred to as the golden age, during which stimulation across multiple developmental domains plays a vital role in supporting children's future learning trajectories (Bisma et al., 2023; Warmansyah, Suzanne, et al., 2023; Winarsih et al., 2023). Development in preschool children encompasses motor, personal-social, language, and cognitive aspects, all of which interact to shape children's early learning experiences (Miranti, 2021; Priyanti & Warmansyah, 2021; Zahriani Jf & Sukiman, 2020). At this stage, children are naturally active, curious, and highly engaged in play-based learning, making early childhood education a crucial context for fostering foundational skills, including mathematical literacy and problem-solving abilities.

Mathematical literacy in early childhood does not merely involve the recognition of numbers, but also includes the ability to reason, make decisions, and apply mathematical thinking in everyday situations (Cheung et al., 2023; Utoyo & Arifin, 2017; Warmansyah, Yuningsih, et al., 2023). Closely related to this is problem-solving skill, which enables children to identify problems, explore possible solutions, and evaluate outcomes (Puspitasari et al., 2023). These skills are increasingly considered essential competencies for lifelong learning and everyday functioning. However, preschool children often require appropriate learning environments and adult guidance to develop these abilities effectively, as they may lack prior experience, emotional regulation, or strategic thinking skills when faced with complex or unfamiliar problems (Anastasya et al., 2025; S. Handayani et al., 2017; Rodrigues-Silva & Alsina, 2023).

One instructional approach that has gained attention in early childhood education is Project-Based Learning (PjBL). Project-Based Learning engages children in meaningful tasks centered on real-life problems, encouraging them to explore, investigate, collaborate, and construct understanding through active participation (Rasmani et al., 2023; Zuhro et al., 2023). Through project-based activities, children are exposed to learning experiences that integrate problem identification, inquiry, discussion, and reflection, which are closely aligned with the development of mathematical literacy and problem-solving skills (Turiyah, 2023). In this approach, teachers play a crucial role as facilitators who guide children's thinking, support exploration, and provide feedback while allowing children to actively engage in the learning process (Fitriani et al., 2023; Sukarti et al., 2023).

Despite its potential benefits, the implementation of Project-Based Learning in preschool settings presents challenges. Young children may experience difficulty in identifying problems, managing frustration, making decisions, or generating creative solutions without adequate support from adults (Purnomo & Ilyas, 2019; Zuhro et al., 2023). Emotional support, scaffolding, and collaboration with parents are therefore essential to ensure that children remain motivated and confident throughout problem-solving activities (Jalilah & Alam, 2018). These challenges highlight the importance of understanding teachers' perspectives, as teachers are directly involved in planning,

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implementing, and evaluating Project-Based Learning in early childhood classrooms (Alucyana & Raihana, 2023).

Previous studies have highlighted the relevance of problem-solving development in early childhood through various learning models, such as discovery learning and educational media, which emphasize observation, data gathering, information processing, and communication skills (Ardhi & Warmansyah, 2023; Ardiana, 2022; Temel, 2014; Wahyutami et al., 2023). While these studies demonstrate the potential of active learning approaches, limited attention has been given to teachers' perceptions of Project-Based Learning, particularly in relation to strengthening mathematical literacy and problem-solving skills in preschool children. Teachers' perceptions are important because they influence instructional decisions, classroom practices, and the sustainability of innovative learning approaches.

In the context of early childhood education, mathematical literacy often referred to as early numeracy extends beyond basic counting skills to include reasoning, pattern recognition, estimation, and the ability to apply mathematical ideas to everyday situations (F. Hayati, 2023; Hewi & Shaleh, 2020; Rohmah & Khasanah, 2023). These competencies are closely intertwined with problem-solving skills, as children are required to interpret information, make decisions, and evaluate outcomes when engaging in numeracy-related tasks (Fitrianingtyas et al., 2023; Masitoh & Mariono, 2022; Wijayanto et al., 2023). Research has emphasized that early numeracy and problem-solving abilities develop most effectively when children are actively involved in meaningful learning experiences that encourage exploration, discussion, and reflection (Chang, 2023; Rosdiani & Warmansyah, 2021). Project-Based Learning provides opportunities for children to engage with mathematical concepts in real-life contexts, allowing them to construct understanding through hands-on activities and collaborative problem-solving. From teachers' perspectives, such learning environments are particularly valuable in fostering foundational numeracy skills while simultaneously strengthening children's capacity to approach and resolve problems systematically.

Although previous studies have demonstrated the potential of active learning models (Lobo, 2017), such as problem-based and discovery learning (Putri, 2017), in supporting early problem-solving development, most existing research has focused on measuring learning outcomes or intervention effects. Limited attention has been given to teachers' perceptions of Project-Based Learning, particularly regarding its role in strengthening both mathematical literacy and problem-solving skills in preschool settings. This gap is significant, as teachers' perceptions influence instructional choices, classroom implementation, and the sustainability of pedagogical innovations. Therefore, the novelty of this study lies in its focus on capturing teachers' perceptions through a quantitative survey approach, offering empirical insights into how Project-Based Learning is viewed and valued by educators in early childhood education. By emphasizing teachers' perspectives, this study contributes to a more contextual and

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practice-oriented understanding of Project-Based Learning as a strategy for supporting early mathematical literacy and problem-solving development.

Based on these considerations, this study focuses on examining teachers' perceptions of Project-Based Learning as a pedagogical approach in early childhood education. Understanding how teachers perceive the role of Project-Based Learning in strengthening mathematical literacy and problem-solving skills can provide valuable insights for improving instructional practices and supporting children's cognitive development in preschool settings.

METHODS

Research Design

This study employed a descriptive quantitative survey design to examine teachers' perceptions of the use of Project-Based Learning in strengthening preschool children's mathematical literacy and problem-solving skills. The research did not aim to measure causal effects but rather to capture teachers' perspectives based on their instructional experiences.

Participants and Research Setting

The study was conducted at TK Al Azkar Pamulang. Participants consisted of early childhood educators who had experience implementing Project-Based Learning in their classrooms. Teachers were selected using total sampling, as all eligible educators at the institution were invited to participate in the study. The participants of this study consisted of 26 preschool teachers who completed the perception questionnaire. All participants were actively involved in early childhood education and had experience implementing Project-Based Learning in classroom activities. The teachers were selected using total sampling, as all eligible educators at the research site were invited to participate in the study. Only questionnaires with complete responses were included in the data analysis.

Research Instrument

Data were collected using a structured questionnaire designed to measure teachers' perceptions of Project-Based Learning. The questionnaire consisted of ten statements covering indicators related to mathematical literacy, problem-solving skills, creativity, engagement, and developmental appropriateness. Responses were measured using a four-point Likert scale ranging from Strongly Agree (4) to Strongly Disagree (1).

Data Collection Procedure

The questionnaire was distributed online using Google Forms during the odd semester of the 2022/2023 academic year. Participation was voluntary, and respondents completed the questionnaire independently.

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Data Analysis

Data analysis was conducted using descriptive statistical techniques, including mean scores, percentages, and graphical representations. These analyses were used to describe teachers' perceptions of Project-Based Learning in relation to children's mathematical literacy and problem-solving skills. No inferential statistical tests were applied, as the study focused on perception-based descriptive analysis.

Ethical Considerations

Ethical principles were upheld by ensuring voluntary participation, confidentiality of responses, and transparency regarding the purpose of the study. All data were anonymized and used solely for research purposes.

RESULTS AND DISCUSSION

Results

This section reports the results of the study based on teachers' responses to a perception questionnaire examining the use of Project-Based Learning (PjBL) in strengthening preschool children's mathematical literacy and problem-solving skills. The findings are presented descriptively using percentages to reflect response tendencies.

Table 1. Overall Distribution of Teachers' Perceptions

No	Response Category	Percentage
1	Strongly Agree	50%
2	Agree	48%
3	Disagree	30%
4	Strongly Disagree	20%

Table 1 shows that most teachers expressed positive perceptions of Project-Based Learning. The high percentages in the *strongly agree* (50%) and *agree* (48%) categories indicate that teachers generally perceive PjBL as supportive in strengthening children's learning, particularly in relation to mathematical literacy and problem-solving skills. Negative perceptions were less dominant, suggesting overall acceptance of PjBL among respondents.

Table 2. Teachers' Perceptions of Project-Based Learning Related to Mathematical Literacy and Problem-Solving Skills

No	Questionnaire Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
1	PjBL helps children understand and apply problem-solving strategies	20%	72%	–	4%

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2	PjBL supports children's creativity in mathematical activities	36%	52%	8%	4%
3	PjBL can be adapted to children's developmental characteristics	38.5%	57.7%	–	–
4	PjBL strengthens creativity related to mathematical learning	42.3%	50%	–	–
5	Social interaction in PjBL supports problem-solving development	30.8%	61.5%	–	–
6	PjBL helps children develop critical problem-solving skills	42.3%	53.8%	–	–
7	PjBL helps children identify problems and find solutions	38.5%	57.7%	–	–
8	PjBL aligns with preschool children's developmental stages	41.8%	48.1%	–	–
9	Problem-solving skills developed through PjBL support future learning	37%	48.1%	11.1%	–
10	PjBL is effective when adjusted to children's learning needs	44.4%	51.9%	–	–

Table 2 demonstrates that teachers' perceptions were predominantly positive across all indicators related to Project-Based Learning. Most responses fall within the *strongly agree* and *agree* categories, particularly on items associated with problem-solving strategies, creativity, and developmental appropriateness. This suggests that teachers perceive PjBL as a learning approach that strengthens children's ability to engage with mathematical ideas, explore solutions, and apply reasoning skills in meaningful contexts.

Notably, several items related to developmental alignment and effectiveness (Items 3, 8, and 10) received no negative responses, indicating strong agreement among teachers that Project-Based Learning is suitable for preschool learners. The item linking PjBL-based problem-solving skills with future learning outcomes (Item 9) showed slightly more variation; however, the majority of responses remained positive, reflecting teachers' belief in the long-term educational relevance of PjBL.

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Figure 1. Role-Play Buying and Selling Activity to Strengthen Mathematical Literacy

As shown in Figure 1, preschool children engaged in a project-based learning activity through role-play buying and selling. In this activity, children used play money, food replicas, and simple tools to simulate real-life transactions. Teachers perceived that this activity supported children's mathematical literacy, particularly in understanding numerical concepts such as counting, quantity comparison, and recognizing the value of money. The contextual nature of the activity allowed children to apply mathematical knowledge in meaningful situations, which teachers viewed as effective for strengthening early numeracy skills.

Figure 2. Project-Based Learning Activity to Develop Problem-Solving Skills through Group Play

Problem-solving skills were observed in different forms across learning activities. Figure 2 illustrates children working collaboratively during group-based project activities, where they negotiated roles, shared materials, and discussed simple strategies to complete tasks. Teachers perceived that these interactions supported children's ability to identify problems, communicate ideas, and make decisions collectively.

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Overall, the results indicate that teachers perceive Project-Based Learning as an effective instructional approach for strengthening preschool children's mathematical literacy and problem-solving skills. Teachers believe that PjBL promotes active engagement, creativity, social interaction, and the ability to identify and solve problems, all of which are essential components of early mathematical literacy. These findings represent teachers' perceptions and do not constitute direct causal evidence of learning outcomes.

DISCUSSION

The findings of this study reveal that teachers perceive Project-Based Learning as a pedagogical approach that supports the strengthening of mathematical literacy and problem-solving skills in preschool children. High levels of agreement across questionnaire items suggest that teachers view PjBL as fostering children's engagement with mathematical concepts through meaningful, activity-based learning experiences. This perception aligns with previous studies highlighting the role of project-based and inquiry-oriented learning in supporting early mathematical understanding and reasoning (A. Handayani & Sinaga, 2022; Maulidah & Abdillah, 2023; Sakila et al., 2023).

Teachers' perceptions also indicate that Project-Based Learning encourages children to actively identify problems, explore alternative solutions, and apply reasoning strategies, which are core elements of problem-solving development (Fitrianingtyas et al., 2023; Masitoh & Mariono, 2022; Wijayanto et al., 2023). The emphasis on social interaction within PjBL activities was perceived as particularly beneficial, as collaborative learning environments allow children to communicate ideas, negotiate solutions, and reflect on different approaches to problem-solving (Fitrianingtyas et al., 2023; M. Hayati & Syaikhu, 2020; Rohmah & Khasanah, 2023; Wardhani et al., 2023).

Furthermore, teachers strongly agreed that Project-Based Learning can be adapted to preschool children's developmental characteristics. This perception is critical, as early childhood learners require learning approaches that are flexible, contextual, and aligned with their cognitive and social development (Fitrianingtyas et al., 2023; M. Hayati & Syaikhu, 2020; Masitoh & Mariono, 2022; Rohmah & Khasanah, 2023; Togatorop & Simaremare, 2023; Wahyutami et al., 2023; Wardhani et al., 2023; Wijayanto et al., 2023). When projects are appropriately designed, teachers believe that children are better able to engage in mathematical exploration and problem-solving without experiencing cognitive overload.

Despite the overall positive perceptions, the findings also suggest the importance of teacher competence and instructional planning in implementing Project-Based Learning effectively. Previous research has emphasized that successful implementation of PjBL requires careful project design, adequate resources, and continuous teacher guidance to ensure that learning objectives related to mathematical literacy and problem-solving are achieved (Rohmah & Khasanah, 2023).

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Taken together, the results of this study support the view that Project-Based Learning is perceived by teachers as a relevant and supportive instructional approach for strengthening mathematical literacy and problem-solving skills in early childhood education. As this study is based on teachers' perceptions, future research may incorporate observational or performance-based measures to complement these findings and provide a more comprehensive understanding of learning outcomes.

CONCLUSION

Based on teachers' perceptions, Project-Based Learning is viewed as an effective instructional approach for strengthening preschool children's mathematical literacy and problem-solving skills by encouraging active engagement, critical thinking, and creativity in learning activities. Teachers perceive that through project-based experiences, children are guided to identify problems, analyze situations, and explore solutions in meaningful and developmentally appropriate contexts, while also enhancing social skills through collaboration with peers. The findings further highlight the importance of teacher guidance and parental support in facilitating children's problem-solving processes, as educators act as facilitators who provide scaffolding and feedback, and parents support learning continuity at home. Overall, this study concludes that Project-Based Learning is positively perceived by teachers as a relevant and supportive pedagogical approach in early childhood education, although future studies employing observational or performance-based measures are recommended to complement perception-based findings.

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