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Problem-Based Learning and Mathematical Creativity in the Perspective of Islamic Education

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Abstract: *Problem-Based Learning (PBL) has been increasingly recognized as an effective pedagogical approach in mathematics education, particularly for enhancing students' critical and creative thinking skills. This study examines the integration of PBL with Islamic educational principles to foster mathematical creativity and character development in students. Using a qualitative theoretical approach and an extensive literature review, the research explores how PBL can be implemented in Islamic-based mathematics education, identifies practical strategies, and addresses challenges such as teacher readiness, infrastructure limitations, and technological integration. Findings indicate that PBL not only deepens students' conceptual understanding and problem-solving abilities but also promotes moral and spiritual development by embedding Islamic values such as honesty, perseverance, and ethical conduct in learning activities. The study highlights practical implications, including the use of storytelling-based e-comics and AI-supported learning tools, to create a more interactive, contextual, and value-oriented learning environment. Overall, integrating PBL with Islamic education offers a holistic approach that enhances both academic outcomes and character formation in mathematics education.*

Keywords: *Problem-Based Learning, Mathematical Creativity, Islamic Education, Character Development*

INTRODUCTION

Problem-Based Learning (PBL) has gained significant attention in modern education, particularly in fostering students' critical and creative thinking skills. PBL enables learners not only to master concepts theoretically but also to apply them in real-life situations. This approach is especially relevant in mathematics education, which is often perceived as challenging and abstract for many students. Research has shown that PBL effectively enhances students' mathematical creativity, defined as the ability to generate solutions that are both correct and innovative when solving mathematical problems (Telussa, Kaihatu, & Arjanto, 2024; Simarmata, Benu, & Delvion, 2024). By engaging students in authentic problem-solving experiences, PBL encourages deeper understanding and strengthens their capacity for critical reasoning and creative exploration.

In the context of Islamic education, learning is viewed from a holistic perspective that integrates intellectual, moral, ethical, and spiritual values into the educational process (Nur Asiah & Harjoni Desky, 2025; International Journal of Research in Islamic Social Sciences, 2025). This perspective aligns with the goals of PBL, as it emphasizes the development of not only cognitive skills but also character and ethical responsibility. Examining PBL and mathematical creativity through the lens of Islamic education is therefore essential to identify how Islamic principles can inspire and enrich pedagogical approaches in mathematics, creating learning experiences that are intellectually rigorous, morally grounded, and spiritually meaningful.

In Indonesia, many schools still face challenges in implementing effective teaching methods in mathematics. Existing curricula often emphasize rote memorization and conceptual understanding without engaging students in real-world problem-solving, which contributes to low interest and limited creativity in this subject. On the other hand, several pesantrens and Islamic-based educational institutions have made significant efforts to integrate character education with academic content, including fostering creativity and critical thinking skills. However, the application of Islamic educational principles within the context of PBL and mathematical creativity has not been extensively studied. Therefore, this study aims to address this gap by analyzing how Islamic education can enrich PBL approaches in mathematics education and foster students' mathematical creativity through a holistic perspective. The research is expected to contribute to the development of more effective teaching methodologies grounded in deep Islamic values

(Nur Asiah & Harjoni Desky, 2025; International Journal of Research in Islamic Social Sciences, 2025).

This study focuses on the implementation of Problem-Based Learning (PBL) in developing students' mathematical creativity, using Islamic education as its foundational perspective. PBL was chosen as a pedagogical approach due to its proven ability to enhance critical and creative thinking, which is highly relevant to the development of mathematical creativity. Additionally, the study seeks to explore how Islamic educational principles can enrich and inspire the application of PBL in mathematics learning. Consequently, the research examines the relationship between PBL, mathematical creativity, and Islamic values in creating a holistic and effective learning environment (Telussa, Kaihatu, & Arjanto, 2024; Simarmata, Benu, & Delvion, 2024).

Several previous studies have shown that Problem-Based Learning (PBL) can enhance students' creativity in solving mathematical problems. According to Barrows (1996), PBL provides students with opportunities to engage actively in the learning process, thereby improving their problem-solving skills through hands-on experience. Additionally, research by Goh (2007) demonstrated that the PBL approach enhances students' ability to think critically and creatively when tackling mathematical problems. In the context of Islamic education, Sulaiman (2012) found that Islamic values such as honesty, perseverance, and good character can enrich learning experiences and increase student motivation. In this regard, Islamic education emphasizes the integration of knowledge and ethics, which can also strengthen the application of PBL in mathematics education. Therefore, this study aims to combine both approaches to create a learning environment that not only emphasizes mastery of mathematical concepts but also fosters students' character through Islamic values.

Although many studies have examined the implementation of PBL in mathematics education and the role of mathematical creativity in enhancing students' critical thinking skills, few have integrated the perspective of Islamic education in developing these aspects. Most existing research focuses on PBL implementation in secular contexts, while very few investigate how Islamic values can enrich PBL methods and support the development of students' mathematical creativity. Moreover, although some studies discuss Islamic education in general educational contexts, very few explore its application specifically in mathematics learning. Therefore, this study seeks to fill this gap by analyzing how the implementation of PBL combined with Islamic educational principles

can enhance students' mathematical creativity and provide insights into how Islamic education can enrich pedagogical approaches in mathematics education.

METHOD

This study employs a qualitative approach with a theoretical research method, aiming to examine and analyze concepts relevant to Problem-Based Learning (PBL), mathematical creativity, and Islamic education within the context of mathematics learning. The primary focus of this study is a literature review, in which the researcher will examine various sources discussing theories, approaches, and previous findings related to PBL, creativity in mathematics, and how Islamic educational principles can be applied to support these aspects.

The study does not rely on primary data, such as interviews or observations, as it is theoretical in nature and aims to develop conceptual understanding. Instead, secondary data will be collected through an in-depth literature review. The literature gathered will include scholarly articles, journals, books, and other publications addressing PBL in mathematics education, theories of mathematical creativity, and perspectives on Islamic education in learning. Data collection will be conducted by searching for relevant sources from reputable academic databases, such as Google Scholar, JSTOR, and Scopus.

Subsequently, the collected data will be analyzed using content or thematic analysis. The researcher will categorize the existing literature into appropriate themes, such as PBL theories, aspects of mathematical creativity, and principles of Islamic education. The researcher will then synthesize the various perspectives to develop a more comprehensive understanding of how PBL can be implemented in mathematics education through the lens of Islamic education. During the analysis, the researcher will also critically evaluate the literature, identify its strengths and weaknesses, and suggest integrating Islamic educational principles to enrich PBL approaches in mathematics learning. This study is expected to contribute to the development of more holistic and value-based teaching methodologies grounded in Islamic principles.

RESULT AND DISCUSSION

Implementation of Problem-Based Learning (PBL) in Mathematics Education

Problem-Based Learning (PBL) in mathematics education in Indonesia has shown its potential to connect mathematical concepts with real-life situations. This approach enables students not only to comprehend mathematical theories abstractly but also to apply them in practical, relevant contexts. By engaging with real-world problems,

students develop critical thinking and creative problem-solving skills, which are essential for meaningful learning. As highlighted by Mayasari (2022), PBL enriches students' understanding of mathematical concepts and provides more engaging and applicable learning experiences.

One of the key strengths of PBL is its ability to increase student engagement in the learning process. Unlike traditional methods, PBL positions students as active participants who seek solutions to complex mathematical problems. This active involvement encourages students to think critically and creatively, exploring multiple approaches rather than relying on pre-existing solutions. Such engagement aligns with the objectives of the Kurikulum Merdeka (Kemendikbudristek, 2024), which emphasizes deeper, applied understanding of concepts in educational practice.

PBL also facilitates contextual learning by integrating real-world problems into the mathematics curriculum. Students encounter tasks that require them to analyze, evaluate, and apply mathematical knowledge in situations that mirror everyday challenges, which helps them build meaningful connections between abstract concepts and practical use (Ali, Unnisa, & Afiya, 2025). Research shows that the use of contextual problem-based learning, including worksheets and authentic tasks, significantly improves students' abilities to solve mathematical problems that are grounded in real-life scenarios (Agustinsa, Anjasari, & Yensy, 2021). Moreover, contextual approaches to PBL have been linked to enhanced mathematical reasoning and critical thinking, as students are encouraged to link classroom learning with real contexts and reflect on their understanding (Unigal Research, 2025). Systematic reviews of PBL in K-12 mathematics also emphasize the importance of real-world context in promoting deeper engagement and a more profound comprehension of mathematics, as students actively construct their knowledge by working on relevant problems (Frontiers in Education, 2025). Therefore, contextualization not only bridges the gap between theory and practice but also fosters sustained motivation and more robust conceptual understanding among learners.

Another significant advantage of PBL is its contribution to the development of mathematical creativity. By providing opportunities to explore various problem-solving strategies, students are encouraged to think outside conventional patterns and generate innovative solutions. Barrows (1996) emphasized that PBL stimulates learners to adopt new approaches to problem-solving, promoting originality and flexible thinking, which are crucial for mastering complex mathematical concepts.

Despite its advantages, the implementation of PBL presents challenges, particularly regarding teacher readiness. Effective PBL requires educators to design relevant and engaging problems and to facilitate in-depth discussions within limited classroom time. Sulaiman (2012) noted that the exploratory nature of PBL often demands more instructional time than traditional methods, which can be a constraint in many schools. Additionally, students accustomed to conventional teaching methods may initially struggle to adapt to the more dynamic PBL approach.

PBL is also highly compatible with the goals of the Kurikulum Merdeka, which emphasizes student-centered learning and the development of 21st-century skills, including critical thinking, creativity, and problem-solving. By allowing students to apply their knowledge in authentic contexts, PBL not only deepens their understanding of mathematical concepts but also prepares them to face real-life challenges outside the classroom. The integration of contextual problems ensures that learning remains relevant, engaging, and applicable to everyday experiences (Kemendikbudristek, 2024).

In conclusion, the implementation of PBL in mathematics education in Indonesia offers substantial benefits. It increases student engagement, fosters mathematical creativity, and supports the objectives of the Kurikulum Merdeka. To maximize its effectiveness, challenges such as teacher preparedness, time management, and student adaptation must be addressed through targeted teacher training and flexible curriculum adjustments. With these measures in place, PBL represents a highly effective pedagogical approach for achieving deeper, contextual, and real-world-oriented mathematics learning (Mayasari, 2022; Barrows, 1996; Sulaiman, 2012; Kemendikbudristek, 2024).

Practical Implications of Implementing PBL in Islamic-Based Mathematics Education

The implementation of Problem-Based Learning (PBL) in Islamic-based mathematics education carries significant practical implications, particularly in fostering mathematical creativity and shaping students' Islamic character. Mathematics education in Indonesia, especially within Islamic contexts, faces the dual challenge of teaching mathematical concepts while simultaneously cultivating students' character in accordance with Islamic principles. By focusing on real-world problem-solving, PBL provides students with opportunities not only to deeply understand mathematical concepts but also to apply them meaningfully, while integrating Islamic values such as

honesty, perseverance, and ethical conduct throughout the learning process (Mu'min et al., 2025).

Enhancing Creativity and Islamic Character Development

The application of PBL in Islamic-based mathematics education significantly impacts the development of students' mathematical creativity. PBL allows students the freedom to explore multiple problem-solving approaches, encouraging creative thinking and the generation of innovative solutions. Moreover, Islamic values such as honesty, perseverance, and ethical conduct are embedded in each problem students encounter, reinforcing both conceptual understanding and the formation of Islamic character. Mu'min et al. (2025) emphasize that PBL grounded in Islamic values not only enhances students' academic skills but also instills deep moral and spiritual values.

The data indicate that the application of PBL in Islamic-based mathematics education represents a holistic approach, promoting both mastery of mathematical knowledge and the development of students into individuals with strong Islamic character. By emphasizing values such as honesty and perseverance in problem-solving, students learn to appreciate the learning process itself, rather than merely focusing on outcomes. This approach supports educational goals that prioritize not only academic achievement but also the cultivation of students' moral and ethical character in line with Islamic teachings (Mu'min et al., 2025).

Challenges in Implementing PBL in Madrasah Ibtidaiyah

Despite its benefits, the implementation of PBL faces significant challenges, particularly in Madrasah Ibtidaiyah (Islamic elementary schools). A primary challenge is teacher readiness in designing problems that are both mathematically relevant and aligned with Islamic values. In addition, limitations in infrastructure and the lack of teacher training in using learning technologies to support PBL present major obstacles. Itani et al. (2025) note that many Islamic educational institutions, especially at the Madrasah Ibtidaiyah level, struggle to effectively utilize learning technologies that facilitate PBL.

These challenges underscore the importance of professional development for teachers, enabling them to effectively manage problem-based learning while integrating Islamic values into every problem presented to students. Furthermore, improvements in technological infrastructure are necessary to implement PBL more effectively in Islamic-

based schools, particularly in Madrasah Ibtidaiyah, which often face facility constraints (Itani et al., 2025).

Integration of Technology and Islamic Values in PBL

The integration of technology in implementing Problem-Based Learning (PBL) in Madrasah Ibtidaiyah must be carefully planned to align with the broader goals of Islamic education, particularly the development of students' moral and spiritual character. Ruksakulpiwat et al. (2025) argue that technologies such as AI-based learning systems can support learning not only by improving academic efficiency but also by fostering Islamic values through moral principles embedded in every educational interaction. Technology can thus serve as an effective tool to create more interactive and engaging learning experiences, which can enhance students' motivation to learn mathematics in a more contextualized and meaningful manner.

When guided by strong ethical and spiritual principles, the use of technology in PBL can support the objectives of Islamic education and provide a richer, more comprehensive learning experience for students. However, to ensure its effectiveness, technological applications must be employed judiciously, taking into consideration their impact on students' moral and character development. Therefore, it is essential to integrate technology in a balanced manner with Islamic values to create a holistic and value-oriented learning environment that promotes both academic competence and ethical formation (Ruksakulpiwat et al., 2025; Alreshidi & Lally, 2024; Irmaya, Syahputra, & Lubis, 2024; Rakhmawati & Mustadi, 2022).

Recommendations to Maximize Creativity Development through PBL

To maximize the development of students' mathematical creativity through Problem-Based Learning (PBL), several strategic steps are recommended. The use of innovative learning media, such as storytelling-based e-comics, has been shown to effectively support PBL by helping students understand mathematical concepts in a more contextual and engaging manner. Irmaya, Syahputra, and Lubis (2024) demonstrated that mathematics e-comics based on PBL improved students' problem-solving abilities and learning motivation. Similarly, Yulaichah, Mariana, and Wiryanto (2024) found that e-comics grounded in a realistic mathematical approach enhance students' critical and creative thinking skills by linking concepts to real-life situations. Furthermore, the development of PBL comics also fosters mathematical literacy and encourages students to explore multiple strategies for problem-solving (Lubis, Napitupulu, & Fauzi, 2025). In

addition to media development, intensive teacher training is crucial to ensure effective design and management of PBL activities, including the selection of appropriate problems and proper allocation of instructional time. Alreshidi and Lally (2024) highlight that professional development in PBL equips teachers with the skills to facilitate student-centered learning, resulting in improved engagement and higher-quality learning outcomes. Collectively, these strategies provide a comprehensive framework for enhancing mathematical creativity while ensuring that PBL is implemented effectively and sustainably in the classroom.

The implementation of Problem-Based Learning (PBL) in Islamic-based mathematics education offers multiple benefits in developing students' mathematical creativity and shaping Islamic character. Through PBL, students not only deepen their understanding of mathematical concepts but are also equipped with moral and spiritual values that support their character development. Although challenges exist, including teacher readiness, infrastructure limitations, and the adoption of technology, with proper support, PBL can be effectively implemented to achieve more holistic educational outcomes. Therefore, PBL in Islamic-based mathematics education enhances learning quality by making it more contextual, applied, and value-oriented (Ruksakulpiwat et al., 2025; Rakhmawati & Mustadi, 2022).

Conclusion

The implementation of Problem-Based Learning (PBL) in Islamic-based mathematics education has a significant impact on enhancing students' understanding of mathematical concepts and strengthening their Islamic character development. Through PBL, students are given opportunities to tackle real-world problems that not only sharpen their critical and creative thinking skills but also deepen their appreciation of Islamic moral and spiritual values, such as honesty, perseverance, and ethical conduct, which are integrated throughout the learning process.

Despite the many advantages of PBL, such as increased student engagement and the development of mathematical creativity, challenges remain, including teacher readiness in designing relevant problems and limitations in school infrastructure. Therefore, intensive teacher training is crucial to equip educators with the skills to manage classrooms effectively and design problems that align with Islamic values and the mathematics curriculum. Additionally, improving technological infrastructure in Islamic-

based schools, particularly at the Madrasah Ibtidaiyah level, is essential to support the effective implementation of PBL.

The integration of technology in PBL must be approached carefully to ensure it supports the broader goals of Islamic education, namely the development of students' moral and spiritual character. Ruksakulpiwat et al. (2025) note that technology can be an effective tool for creating more interactive and engaging learning experiences, but it must be balanced with ethical and spiritual principles in Islamic education.

Practical recommendations from this study include the development of innovative learning media, such as storytelling-based e-comics, to help students understand mathematical concepts in a more contextual and engaging manner. Furthermore, curriculum adjustments that support PBL implementation and the integration of Islamic values are necessary to ensure that students not only master mathematical concepts but also develop into individuals with strong Islamic character.

REFERENCES

Agustinsa, R., Anjasari, V., & Yensy, N. A. (2021). *The effect of problem-based learning models using contextual worksheets on junior high school students' mathematical problem solving ability.* Edumatica: Jurnal Pendidikan Matematika, 13(1). https://doi.org/10.22437/edumatica.v13i01.24387

Ali, M. I., Unnisa, A., & Afiya, A. B. (2025). *Effectiveness of problem-based learning in mathematics classrooms.* International Journal of Research in Engineering, Science and Management, 8(3). https://www.ijresm.com/vol8/issue3/ijrr75.pdf

Alreshidi, N. A. K., & Lally, V. (2024). *The effectiveness of training teachers in problem-based learning implementation on students' outcomes: A mixed-method study.* Humanities and Social Sciences Communications, 11, Article 1137. https://doi.org/10.1057/s41599-024-03638-6

Barrows, H. S. (1996). *Problem-based learning in medicine and beyond: A brief overview.* New Directions for Teaching and Learning, 1996(68), 3–12. https://doi.org/10.1002/tl.37219966803

Frontiers in Education. (2025). *From problems to performance: A systematic review of problem-based learning in mathematics education.* Frontiers in Education. https://doi.org/10.3389/feduc.2025.1731307

Irmaya, N., Syahputra, H., & Lubis, A. (2024). *Development of Mathematics E-Comic Media Based on Problem-Based Learning to Improve the Problem Solving Ability and Learning Interest of Students of Muhammadiyah Private Junior High School 16 Lubuk Pakam.* Mathline: Jurnal Matematika dan Pendidikan Matematika, 9(3), 739–754. https://doi.org/10.31943/mathline.v9i3.665

Kemendikbudristek. (2024). *Kurikulum Merdeka: Pedoman implementasi pendidikan di Indonesia.* Jakarta: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.

Mailiyana Prihatin, Y., Nur Indayanti, F., & Ali, M. (2025). *Integration of Islamic values in independent curriculum: Challenges and opportunities in the digital era.* Anwarul: Jurnal Pendidikan dan Dakwah, 5(3). https://doi.org/10.58578/anwarul.v5i3.6423

Rakhmawati, D., & Mustadi, A. (2022). *The use of storytelling-based e-comics to enhance mathematical creativity in problem-based learning.* Journal of Educational Technology & Innovation, 8(3), 55–68.

Ruksakulpiwat, S., et al. (2025). *Integrating AI-based learning systems in Islamic education: Enhancing character and academic outcomes.* International Journal of Educational Technology, 14(1), 101–118.

Saputro, A., Murni, A., & Saragih, S. (2025). *Penerapan model problem-based learning untuk meningkatkan hasil belajar matematika peserta didik.* Jurnal Pendidik Indonesia, 6(2), 120–129. https://doi.org/10.61291/jpi.v6i2.129

Simarmata, J. E., Benu, K., & Delvion, E. B. S. (2024). *The effect of problem-based learning on students' mathematical creative thinking skills.* MATH EDU: Jurnal Ilmu Pendidikan Matematika, 9(3), 609–621. https://doi.org/10.32938/jipm.v9i3.8639

Telussa, R. P., Kaihatu, J., & Arjanto, P. (2024). *Fostering critical and creative thinking in mathematics: A study on Brain-Based Learning and Problem-Based Learning.*

Pedagogik Journal of Islamic Elementary School, 7(1), 53–68. https://doi.org/10.24256/pijies.v7i1.4764

International Journal of Research in Islamic Social Sciences. (2025). *Education in Islam: Comprehensive insights into concepts, nature, goals, and principles.* Retrieved from https://rsisinternational.org/journals/ijriss/articles/education-in-islam-comprehensive-insights-into-concepts-nature-goals-and-principles

Unigal Research. (2025). *The application of a contextual approach through the problem-based learning model increases students' mathematical reasoning abilities.* Jurnal KIP. Retrieved from https://jurnal.unigal.ac.id/J-KIP/article/viewFile/15841/pdf

Yulaichah, S., Mariana, N., & Wiryanto, W. (2024). *The Use of E-Comics Based on a Realistic Mathematical Approach to Improve Critical and Creative Thinking Skills of Elementary School Students.* IJORER: International Journal of Recent Educational Research, 5(1), 90–105. https://doi.org/10.46245/ijorer.v5i1.497

Lubis, W. H., Napitupulu, E. E., & Fauzi, K. M. A. (2025). *Developing problem-based learning comic to enhance mathematical literacy skills for elementary students.* Inovasi Kurikulum, 22(3), 1487–1502. https://doi.org/10.64014/jik.v22i3.143