



Comparative Analysis of Islamic Religious Education Teaching Methods and Their Impact on Mathematical Thinking Skills

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Abstract: This study aims to analyze the differences in Islamic Religious Education (PAI) learning methods and their impact on students' mathematical thinking skills at SMK Roudlotul 'Ulum, which operates under the Roudlotul 'Ulum Islamic Boarding School Foundation in West Bandung. The population of this study includes all students at SMK Roudlotul 'Ulum, with a sample consisting of two classes: Class X1 with 33 students and Class X2 with 28 students. The study employs a mixed-method approach with an embedded design in a comparative study. The sampling technique used is non-probability sampling with purposive sampling. Data analysis includes both quantitative and qualitative approaches. The findings reveal that the data are not normally distributed and not homogeneous; therefore, the nonparametric Mann-Whitney U-Test was conducted. Statistical analysis indicates a significant difference between the two classes, with a significance value of 0.008 ($p < 0.05$). Interviews with students support these findings, showing that the problem-based learning approach used in Class X2 was more effective in integrating religious values with mathematical thinking skills compared to the lecture-based method used in Class X1. This study highlights the importance of innovation in Islamic Religious Education teaching methods to holistically develop students' logical and critical thinking skills. The practical implications of this research can serve as a guide for educators in designing more contextual and relevant learning methods, as well as for policymakers to encourage the implementation of problem-based learning approaches in schools, particularly in Islamic Religious Education subjects.

Keywords: Islamic Religious Education, Mathematical Thinking Skills, Problem-Based Learning, Lecture Method

INTRODUCTION

Mathematical thinking is one of the essential skills in modern education, as it involves critical, analytical, and logical thinking processes that help students solve problems systematically (Al Ayyubi, Bukhori, et al., 2024; Al Ayyubi, Hayati, et al., 2024; Al Ayyubi, Rohaendi, et al., 2024; Al Ayyubi, Rohmatulloh, et al., 2024). Education systems across the globe continue to emphasize the strengthening of this skill, not only through mathematics subjects but also through the integration of values in other disciplines. In the context of Indonesia, mathematical thinking plays a significant role in meeting the demand to nurture a generation that is not only intellectually competent but also morally grounded. According to (Tamphu et al., 2024) mathematical thinking is an essential ability that enables students to comprehend, analyze, and solve complex problems



systematically. This skill is not only important for mathematics but also serves as a foundation for logical thinking applicable to everyday life. In education, various approaches have been utilized to develop students' mathematical thinking, including the integration of non-mathematics subjects, such as Islamic Religious Education (PAI).

As an integral part of Indonesia's education curriculum, PAI primarily aims to shape students' personalities based on Islamic values. PAI is not only a subject designed to build students' character and morals but also has the potential to influence their way of thinking, including mathematical thinking. The learning process in PAI often involves logical examination of religious concepts, analysis of Quranic and hadith texts, and solving life problems requiring a systematic approach. This raises an intriguing question: to what extent can PAI learning contribute to the development of students' mathematical thinking?

Several previous studies have demonstrated that value-based learning in religious education has significant potential in enhancing students' cognitive skills. For example, research by (Wulandari & Machromah, 2024) showed that a problem-based learning approach in PAI could improve students' critical thinking skills. Another study by (Mandasari & Rosalina, 2021) found that integrating religious values with general subjects could enhance students' systematic thinking abilities. However, most of these studies focused more on critical, moral, or systematic thinking skills, while the impact of PAI learning on students' mathematical thinking remains underexplored. Nurhikmah (2024) highlighted a relationship between Islamic value-based learning and problem-solving abilities but did not explicitly examine its influence on mathematical thinking. Moreover, quantitative comparative studies comparing the mathematical thinking skills of students receiving PAI with those who do not are still rare, leaving a significant gap in the literature.

This study offers novelty by specifically examining the differences in the impact of Islamic Religious Education (PAI) teaching methods on students' mathematical thinking patterns. The focus on comparing the problem-based learning approach with the lecture method provides a significant contribution to the literature on Islamic education, particularly in relation to the development of students' cognitive skills (Monalisa et al., 2019). Furthermore, previous research primarily employs descriptive or qualitative approaches, highlighting the need for more focused studies to test the differences in mathematical thinking skills developed through PAI compared to other subjects.



Based on this context, this study aims to conduct a comparative analysis of how PAI learning influences students' mathematical thinking skills compared to other subjects. This research is expected to fill the existing gap in the literature and expand the understanding of the integration between religious education and students' mathematical thinking abilities.

METHOD

This study employs a mixed-method approach with an embedded design in comparative research (Sugiyono, 2021). This approach integrates one primary method either qualitative or quantitative with the other serving as a supporting or complementary tool to enhance the research outcomes. In the context of comparative analysis, this methodology is applied to examine the differences between two independent groups based on specific criteria. The research was conducted at SMK Roudlotul 'Ulum, under the management of the Roudlotul 'Ulum Islamic Boarding School Foundation in West Bandung. The population comprises all students of SMK Roudlotul 'Ulum. A purposive sampling technique was employed to select two classes: Class X1 with 33 students and Class X2 with 28 students, representing groups exposed to different Islamic Religious Education (PAI) teaching methods. The problem-based learning approach was implemented in Class X2 using carefully designed lesson plans. Each session began with a real-world problem related to Islamic values, requiring students to work collaboratively to find solutions. Specific activities included group discussions, problem analysis, and presentations of their findings. For example, one problem scenario involved calculating zakat distribution using basic mathematical operations, integrating religious concepts with logical thinking. Teachers facilitated the process by guiding students through structured inquiry and reflection phases, ensuring alignment with both the curriculum and cognitive skill development goals.

Data collection involved both quantitative and qualitative methods: 1) Quantitative Data, a standardized test was used to assess mathematical thinking skills. The test was developed based on established frameworks for mathematical reasoning and adapted to include Islamic contextual scenarios. The validity of the test was ensured through expert judgment involving two mathematics education specialists and one PAI educator. Reliability was tested using Cronbach's Alpha, yielding a coefficient of 0.85, indicating high reliability. 2) Qualitative Data, data were collected through semi-structured interviews, classroom observations, and analysis of student work. A total



of eight students (four from each class) were interviewed, with guiding questions focusing on their learning experiences, problem-solving approaches, and perceptions of the teaching methods. Classroom observations were documented using a structured observation sheet to capture interaction patterns and student engagement.

Data Analysis: 1) Quantitative analysis, data were analyzed using the independent sample t-test for normally distributed and homogeneous data. The Kolmogorov-Smirnov test was applied to test normality, while the homogeneity test was conducted to ensure equal variance between groups. If the normality and homogeneity assumptions were not met, a non-parametric statistical test, the Mann-Whitney U-test, was employed. All analyses were conducted using SPSS version 26. 2) Qualitative analysis, thematic analysis was utilized to identify, analyze, and report patterns within qualitative data (Creswell, 2010). This method involved coding data from interviews and observations, categorizing themes such as “student engagement,” “problem-solving strategies,” and “integration of Islamic values.” This approach provided deeper insights into the effectiveness of the problem-based learning method compared to the traditional lecture-based method used in Class X1. By integrating these methods, this study seeks to provide a comprehensive understanding of how different PAI teaching approaches impact students’ mathematical thinking skills, while ensuring rigor through the validation of instruments and systematic data collection.

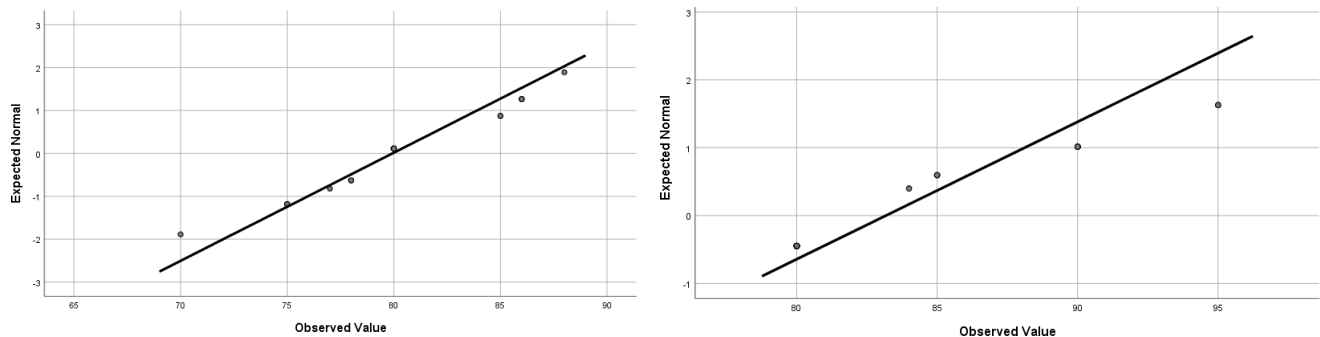
RESULT AND DISCUSSION

Results

Table 1. Tests of Normality

Kelas	Statistic	Sig.
X1	.282	.000
X2	.383	.000

Based on the statistical output above, the significance value for classes X1 and X2 is $0.000 < 0.05$. According to the decision-making criteria, this means that H_0 is rejected, indicating that the data is not normally distributed. Additionally, this can also be observed from the Normal Q-Q plot shown below.



Picture 1. Normal Q-Q Plot of Class X1 and X2

From the Normal Q-Q plot, it is evident that the data on Islamic Religious Education (PAI) learning and students' mathematical thinking skills does not align with the diagonal line. Most of the points in the plot are dispersed far from the line, confirming that the data is not normally distributed. Consequently, a non-parametric statistical test using the Mann-Whitney U-Test was conducted to determine whether there is a significant difference between classes X1 and X2. However, before proceeding, the data homogeneity was examined to assess whether the data distribution has equal variance.

Table 2. Test of Homogeneity of Variance

	Levene Statistic	Sig.
Based on Mean	4.069	.048

The statistical output for the homogeneity test indicates a significance value of $0.048 < 0.05$. Based on the decision-making criteria, H_0 is rejected, suggesting that the data is not homogeneous or does not have equal variance between class X1 and class X2.

Tabel 3. Test Statistics^a

	Nilai
Mann-Whitney U	295.000
Wilcoxon W	856.000
Z	-2.661
Asymp. Sig. (2-tailed)	.008



Furthermore, the statistical output for the Mann-Whitney U-Test shows a significance value of 0.008, which is less than 0.05. Based on the decision-making criteria, it can be concluded that there is a significant difference between class X1 and class X2 in terms of the influence of Islamic Religious Education learning on students' mathematical thinking skills. This highlights the importance of understanding patterns and abstract semiotics in Islamic education, which can enhance the effectiveness of learning.

Dicsussion

Based on the findings presented above, it can be concluded that the data obtained does not follow a normal distribution. Consequently, the analysis was conducted using the non-parametric Mann-Whitney U-Test. The results revealed a significant difference in Islamic Religious Education (PAI) learning between Class X1 and Class X2 in terms of students' mathematical thinking abilities, with a significance value of 0.008 (less than 0.05). Additionally, the homogeneity test indicated that the data lacked equal variance, as evidenced by a significance value of 0.048 (less than 0.05). These results highlight a notable variation in learning approaches between the two classes.

The findings of this study are consistent with previous research that examined the impact of different teaching methods on cognitive skills development. For example, a study by (Yunitasari & Hardini, 2021) found that problem-based learning (PBL) significantly enhanced students' problem-solving and critical thinking abilities compared to traditional lecture-based methods in similar educational contexts. Similarly, research by (Helmi Al Hafid Fauzi, Wahyu Hidayat, Ibnu Imam Al Ayyubi, Nurhikmah, 2025) reported that students exposed to interactive learning approaches demonstrated better logical thinking and analytical skills than those in lecture-based settings. The alignment of this study's findings with previous studies reinforces the conclusion that PBL, when integrated into Islamic Religious Education, effectively fosters the development of students' mathematical thinking abilities.

These findings contribute to the growing body of literature suggesting that innovative teaching strategies, such as PBL, offer considerable advantages in developing both cognitive and religious competencies in students. The contrasting outcomes between the two classes emphasize



the importance of adopting student-centered, inquiry-based learning methods in enhancing students' mathematical and logical thinking skills.

To strengthen the quantitative findings, interviews were conducted with students from both classes. Students in Class X1 reported that PAI learning often utilized lecture methods and guided discussions. One student remarked:

"We are often encouraged to understand the meaning of Quranic verses related to daily life, but we are rarely challenged to connect them with patterns or mathematical logic."

James and James (Nurhikmah, 2024a) as cited in Ruseffendi, explain that mathematics is the science of logic concerning forms, structures, quantities, and interrelated concepts divided into three areas: algebra, analysis, and geometry. Mathematics is characterized by axioms, definitions, lemmas, and theorems, requiring logical reasoning and emphasizing deductive thinking. However, teaching typically begins with real-world examples and observable facts (Chityadewi, 2019).

Effective mathematics teaching involves applying strategies and models that enable students to build knowledge through observation and collaboration, based on their experiences and phenomena in everyday life (Dian Fitra, 2019). Mathematics holds vital importance both in daily life and in the advancement of science and technology. Its curriculum aims to prepare students to adapt to rapidly evolving knowledge and technologies, emphasizing comprehensive preparation by educators (Marta, 2018). Teaching mathematics through Qur'anic sources aims to develop students' mathematical understanding while incorporating Islamic values. Such lessons typically begin with Qur'anic recitations, followed by exploring relevant contexts and developing mathematical problems from them (Hartoyo et al., 2019)

Mathematics is known for its structured, systematic, and logical nature. Sumardi, Rahman & Gustini (2017) Symbolic thinking encompasses the ability to recognize, articulate, and utilize number concepts, identify letters, and represent various objects and imagination. Mathematics education is often regarded as challenging. Educators can implement various engaging strategies to ensure students do not easily lose interest in learning mathematics (Bongga & Listiani, 2020)

Mathematics learning is indeed considered difficult, which makes it crucial to employ effective teaching strategies to help students grasp concepts effectively. Utilizing strategies such as conceptual, illustrative, contextual, and experiential approaches can enhance learning. Critical thinking is a skill that needs to be developed in mathematics education (Wathon, n.d.).



Mathematics education is an essential aspect of developing students' critical and analytical thinking skills (Karim, 2011). However, in practice, mathematics learning often faces relevant challenges, particularly regarding students' difficulties and low interest in the subject. Conventional and static teaching methods frequently fail to capture students' interest. By incorporating interactive elements, simulations, and educational games, technology can create an engaging learning environment for students. This highlights the significant role and benefits technology provides in the learning process (Widayat & Darmawan, 2024).

While mathematics is commonly perceived as a difficult subject, employing methods such as fun thinkers math media can address learning challenges. This tool facilitates the learning process by providing aids that make mathematics more accessible and engaging for students. The issue of inadequate understanding in mathematics often stems from low literacy and numeracy skills due to students' limited interest in reading. In the era of Society 5.0, mathematics education must adapt to rapid technological advancements. These advancements can positively impact learning, including increasing students' interest in mathematics. By adopting innovative and modern teaching methods, educators aim to motivate students (Saputra et al., 2023) and develop holistic learners by considering their physical, emotional, social, and spiritual well-being. Teaching models that incorporate the Qur'an as a source can inspire students to connect with their faith while understanding mathematical concepts.

This approach fosters a deeper relationship with God while enhancing academic understanding. Conversely, students from Class X2 reported that their learning experience was more interactive and involved a problem-based learning (PBL) approach.

This method integrates abstract concepts from Islamic Religious Education (PAI) with mathematical contexts. One student shared:

"We are often given cases or problems that require an understanding of the Qur'an and Hadith, but we are also asked to solve them with logical thinking patterns, such as calculating or creating relevant diagrams."

This interview result indicates that the difference in teaching approaches has a significant impact on students' mathematical thinking skills. The approach in Class X2 appears to be more effective in fostering mathematical thinking, as it integrates religious values with abstract logic, such as semiotics and patterns. Inclusive Islamic education aims to develop a comprehensive



understanding of Islam, including values of tolerance, justice, and moderation. These three approaches involve student-centered learning, with greater attention to cultural, social, and intellectual differences within the classroom. In Islamic education, teaching the values of moderation can be achieved by involving the concept of the middle path in understanding religion, emphasizing the importance of balancing religious, social, and personal aspects. Observing the life of Prophet Muhammad (SAW), who demonstrated a moderate stance in various situations, can encourage reflection and critical discussions on extremist and radical understandings. Tolerance education is a fundamental value in Islam, teaching respect for differences. Radicalism and extremism have become very serious issues in various countries worldwide. To address this challenge, holistic education is an effective solution.

Holistic education involves a comprehensive approach. In the context of combating radicalism and extremism, holistic education can help develop broader understanding, tolerance, respect for diversity, and critical thinking skills among students. The challenge of radicalism can be overcome through several holistic understandings, such as understanding Islam in the modern era. Education, which is becoming increasingly complex, sees holistic understanding as an essential part of individual development. Holistic education is not just about transferring knowledge, but also about shaping balanced and responsible individual personalities. One relevant approach in Islamic education is to integrate religious values with the development of the whole individual, intellectually, spiritually, and socially (Al Ayyubi, Noerzanah, et al., 2024; Mutaqin et al., 2024; Pancawardana et al., 2023).

Holistic understanding in intellectual development in Islamic education involves students' intelligence and knowledge through an approach based on Islamic education principles. Spiritual development in holistic Islamic education also focuses on the spiritual growth of students. In this context, holistic understanding involves religious education, teaching Islamic principles and values, increasing spiritual awareness, and fostering a connection with Allah SWT. Holistic education encourages students to worship Allah SWT. Social development in Islamic education also places great importance on students' social aspects. Holistic understanding in the social context involves the formation of good character, ethics, and the ability to interact socially. Holistic Islamic education teaches values such as honesty, compassion, tolerance, and mutual respect.



The integration of Islamic educational values in learning within the context of holistic understanding also involves incorporating Islamic values into all aspects of learning (Alfulana, 2023; Asari et al., 2020; Hastasari et al., 2022; Malla et al., 2022; Qornain et al., 2022). In this holistic understanding, the focus is more on teaching students to deepen their understanding of the greatness of Allah SWT and improve their own lives as well as the lives of others. Holistic understanding in intellectual development views intellectual growth as a key aspect in shaping a balanced individual. Holistic education also places emphasis on critical thinking, analytical skills, and problem-solving, enabling students to better understand and analyze information in depth.

Holistic understanding emotionally focuses on the emotional development of students. This holistic approach involves learning about emotional management, building healthy relationships, and developing students' emotional intelligence. In this context, holistic education can help students understand, recognize, and manage their emotions well, which allows them to cope with problems like stress, conflict, and building positive relationships with others. Holistic understanding in the context of physical health and well-being gives serious attention to students' physical and health aspects. This context also involves education about the importance of healthy eating habits, exercise, and maintaining personal and environmental cleanliness.

Holistic understanding in social and moral development involves teaching universal values such as honesty, respect, empathy, and cooperation. In this context, holistic education encourages students to better understand and appreciate cultural diversity and to build good communication skills. Holistic education, in the context of education, brings a comprehensive approach to developing the whole individual. Holistic education can create an environment that supports balanced and responsible individual development through various aspects of growth. From these developments in holistic education, Islamic education plays a very important role in addressing radicalism and extremism (Nurhikmah, Mariati, Nursalam, 2024). In tolerant, moderate, and critical Islamic education, it is possible to build a correct understanding of religion while promoting interfaith tolerance. Through inclusive education, based on balanced religious teachings and critical understanding, the Muslim generation of today can become strong, tolerant, and capable of facing challenges. Contextual holistic education can create a Muslim with civilization who is also a holistic learner (Nursalam et al., 2019). Islamic education that promotes values of



tolerance, justice, and moderation can shape a correct understanding of Islam and encourage students to become agents of peace in their communities.

Holistic understanding in the context of Islamic education is important for the overall development of the individual, whether intellectually, spiritually, or socially. This holistic education integrates Islamic educational values with a learning process that encompasses all aspects of students' lives. This education can create students who are morally upright, have broad knowledge, and are capable of applying Islamic values in their daily lives. By implementing proper holistic education, Islam promotes a moderate, tolerant, and critical understanding (Primarni, 2024)

The holistic approach in Islamic education refers to a comprehensive approach that integrates various aspects of life, knowledge, and spirituality in educating individuals as a whole. Several key points in the holistic approach to Islamic education include. This holistic approach combines academic learning with the development of ethics or morality. In this context, educators aim to teach material while connecting it with Islamic values such as honesty, compassion, and hard work. The Qur'an itself contains nearly 1,500 verses discussing the importance of ethics, which are further reinforced by the hadiths of Prophet Muhammad SAW, including his words and actions. Not only does this approach emphasize academics, but it also fosters spirituality (Rahim et al., 2024). This approach teaches the importance of building balance in life. Students are taught how to balance academic activities, social engagement, and religious practices, ensuring no aspect of life is neglected. Holistic education acknowledges that every individual has unique potential. Thus, educators must help develop the potential of each student. As long as it does not contradict Islamic law, holistic education also allows for the integration of technology and contemporary knowledge in the educational process (Utomo & Rizqa, 2024).

Islamic education philosophy is a holistic medium that covers knowledge comprehensively.

According to holistic philosophy, humans are part of nature. The concept of stability includes aspects of emotion, spirituality, intuition, and individual imagination (Sudrajat & Sufiyana, 2020).

Historically, the term "holistic," when referring to the understanding of balance and the integration of reason and heart, was introduced by Imam Al-Ghazali. Al-Ghazali argued that the learning process is essentially an exploration of knowledge that leads to behavioral changes. The implementation of holistic Islamic religious education is an effort to achieve comprehensive



educational goals, particularly in Islamic education. To create an active, innovative, creative, effective, and enjoyable learning environment, it is essential to apply appropriate teaching strategies and models (Yenni fitria, 2022)

Holistic understanding in the context of Islamic education plays a vital role in the overall development of the individual, both intellectually, spiritually, and socially. By using this approach, it is possible to shape a generation with noble character, instilling Islamic values in their daily lives. Additionally, embedding Islamic values in education helps combat radicalism and extremism, leading to the creation of holistic learners who focus not only on academics but also on emotional and spiritual development (Primarni, 2024). This research emphasizes that relevant, contextual, and problem-based teaching methods are more effective in enhancing students' mathematical thinking abilities. This is an important note for the development of the Islamic Education curriculum, which should not only focus on the spiritual aspect but also sharpen students' critical and logical thinking skills.

CONCLUSION

Based on the research results, it can be concluded that there is a significant difference in the Islamic Religious Education (PAI) teaching methods between classes X1 and X2 in relation to students' mathematical thinking abilities. The statistical test results show a significance value of 0.008, which is less than 0.05, supporting the hypothesis that different teaching methods have a significant impact on students' mathematical thinking abilities. The data, which is not normally distributed and not homogeneous, as indicated by a significance value of 0.048, suggests that the variance in the teaching methods between the two classes is notably different. This emphasizes that the approach to teaching significantly affects students' learning outcomes, especially in terms of mathematical abilities.

In-depth interviews with students indicate that the lecture and guided discussion methods used in class X1 tend to be less effective in developing mathematical thinking. Students are more focused on understanding the PAI material textually, without a strong connection to logical concepts or patterns. In contrast, the problem-based learning (PBL) approach in class X2 was found to effectively integrate religious values with mathematical thinking. This approach not only



enhanced spiritual understanding but also helped students develop critical and logical thinking skills that are highly relevant to learning mathematics.

Overall, this study highlights the importance of innovation in PAI teaching to not only focus on religious aspects but also develop students' thinking skills holistically, including their mathematical thinking abilities. As a next step, further research could explore the application of the PBL method in various other subjects to assess the extent to which this approach can enhance cognitive skills more broadly. Additionally, longitudinal studies that involve monitoring the development of students' mathematical thinking skills over the long term would provide deeper insights into the long-term effects of problem-based learning methods. Furthermore, research examining the influence of various teaching techniques within the context of Islamic education in a more comprehensive manner could provide broader insights into the development of a more effective and relevant curriculum for religious education.

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