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PROMOTING ISLAMIC-INTEGRATED MATHEMATICS PROBLEM-SOLVING TO ENHANCE STUDENTS' CONCEPTUAL UNDERSTANDING IN MADRASAH

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Abstract

This study investigates the impact of Islamic-integrated mathematics problem-solving on students' conceptual understanding in madrasah settings. Using a mixed-methods approach with 60 students from MAN 1 Maluku Tengah, the research employed experimental and control groups to compare learning outcomes between Islamic-integrated and conventional mathematics problems. Data were collected through conceptual understanding tests, student perception surveys, and teacher interviews. Results revealed a significant difference in mathematical conceptual understanding between groups (p = 0.008), with the experimental group achieving a higher mean score (75.20) compared to the control group (68.90). Qualitative analysis identified distinct problem-solving approaches among students, with strong performance in translation and interpretation stages but challenges in extrapolation. Student perceptions were predominantly positive, with increased interest in mathematics when integrated with Islamic values, despite 45% having no prior exposure to such integration. The findings suggest that Islamic-integrated mathematics education enhances conceptual understanding while highlighting the need for additional support in developing higher-order thinking skills. This research contributes to the growing body of knowledge on culturally responsive mathematics education in Islamic contexts.

Keywords: *Islamic-integrated mathematics, conceptual understanding, problem-solving, madrasah education, mixed-methods research.*

Abstrak

Penelitian ini mengkaji dampak penyelesaian masalah matematika terintegrasi Islam terhadap pemahaman konseptual siswa dalam konteks madrasah. Menggunakan pendekatan metode campuran dengan 60 siswa dari MAN 1 Maluku Tengah, penelitian ini menerapkan kelompok eksperimen dan kontrol untuk membandingkan hasil pembelajaran antara soal matematika terintegrasi Islam dan konvensional. Pengumpulan data dilakukan melalui tes pemahaman konseptual, survei persepsi siswa, dan wawancara guru. Hasil penelitian menunjukkan perbedaan signifikan dalam pemahaman konseptual matematika antar kelompok (p = 0,008), dengan kelompok eksperimen mencapai nilai rata-rata lebih tinggi (75,20) dibandingkan kelompok kontrol (68,90). Analisis kualitatif mengidentifikasi berbagai pendekatan pemecahan masalah di kalangan siswa, dengan kinerja kuat dalam tahap translasi dan interpretasi namun menghadapi tantangan dalam ekstrapolasi. Persepsi siswa mayoritas positif, dengan peningkatan minat terhadap matematika ketika diintegrasikan dengan nilai-nilai Islam, meskipun 45% tidak memiliki pengalaman sebelumnya dengan integrasi tersebut. Temuan ini menunjukkan bahwa pendidikan matematika terintegrasi Islam meningkatkan pemahaman konseptual sambil menekankan kebutuhan akan dukungan tambahan dalam mengembangkan keterampilan berpikir tingkat tinggi. Penelitian ini berkontribusi pada pengembangan pengetahuan tentang pendidikan matematika yang responsif secara budaya dalam konteks Islam.

Kata Kunci: matematika terintegrasi Islam, pemahaman konseptual, pemecahan masalah, pendidikan madrasah, penelitian metode campuran

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INTRODUCTION

Mathematical conceptual understanding is a critical competency in mathematics education, as it enables students to comprehend concepts, operations, and relationships essential for solving mathematical problems effectively (Kilpatrick, 2001). Recent studies highlight the importance of this understanding in fostering deeper learning and reducing students' reliance on procedural knowledge (Beckmann & Michelsen, 2022; Uegatani et al., 2024). However, in Indonesia, challenges persist in achieving strong mathematical conceptual understanding. Data from the 2022 PISA assessment revealed that Indonesia ranked 69th out of 81 countries in mathematics, with only 18% of students achieving Level 2 or above in mathematics literacy compared to the global average of 76% (PISA 2022 Results (Volume I and II) - Country Notes, 2023). These statistics underscore the need for innovative educational approaches to address persistent gaps in mathematical comprehension.

This urgency is particularly evident in Islamic education contexts, where the integration of religious values into mathematics presents unique opportunities and challenges. Initial observations at MAN 1 Maluku Tengah indicate that students often struggle to connect mathematical concepts with Islamic principles, limiting their ability to solve contextual problems effectively. Interviews with mathematics teachers revealed that Islamic-integrated problem-solving is rarely implemented systematically, leaving students with limited exposure to such approaches. These challenges highlight a critical need for interventions that not only enhance conceptual understanding but also align with the cultural and religious contexts of madrasah education.

Previous research suggests that integrating Islamic values into mathematics education has the potential to improve students' engagement and understanding of mathematical concepts. For instance, Abdillah et al. (2020) demonstrated that students exposed to Islamic-integrated cooperative learning models, such as STAD, exhibited higher conceptual understanding compared to those taught using conventional methods. Similarly, Imamuddin & Isnaniah (2024)found that integrating Islamic contexts into mathematical problems improved students' ability to translate and interpret mathematical concepts. Despite these findings, the majority of prior studies have focused on theoretical frameworks or curriculum design, with limited empirical evidence on the impact of Islamic integration on students' conceptual understanding during problem-solving.

Research comparing Islamic-integrated and conventional mathematics education remains scarce. Studies by Inganah et al. (2023) and Li & Zhan (2022) emphasize the importance of culturally responsive teaching in mathematics but lack specific evidence on its application in Islamic educational settings. Additionally, most research focuses on curriculum development rather than analyzing students' actual problem-solving processes. This creates a significant gap in understanding how students engage with Islamic-integrated mathematical problems and how such approaches influence their conceptual understanding, especially in the context of madrasah education.

To address these gaps, this study investigates the impact of Islamic-integrated mathematics problem-solving on students' conceptual understanding. By analyzing how students solve Islamic-integrated versus conventional mathematical problems, this research seeks to uncover the specific contributions of cultural and religious integration to mathematical learning. It also examines students' perceptions of Islamic-

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integrated problems, providing insights into how such approaches influence their engagement and motivation to learn.

Unlike previous studies that primarily focus on curriculum design, this research offers a novel contribution by empirically testing the effectiveness of Islamic-integrated problem-solving in enhancing students' conceptual understanding. The findings aim to provide actionable recommendations for teachers, curriculum developers, and policymakers in Islamic education settings. Moreover, this study seeks to establish a clear connection between Islamic-integrated teaching methods and improved higher-order thinking skills, addressing a key challenge in mathematics education globally and locally.

By filling these research gaps, this study contributes to the growing body of knowledge on culturally responsive mathematics education. It not only emphasizes the pedagogical importance of integrating Islamic values into mathematics instruction but also highlights its potential to bridge conceptual understanding gaps in madrasah education. These contributions are expected to support the development of more effective and culturally relevant teaching strategies in Islamic education systems .

RESEARCH METHOD

This research employs a mixed-methods approach, combining quantitative and qualitative data collection and analysis to gain a comprehensive understanding of the impact of Islamic-integrated mathematics problem-solving on students' conceptual understanding. The study follows an experimental design, with two groups: an experimental group (students who solve Islamic-integrated mathematics problems) and a control group (students who solve conventional mathematics problems). The study is conducted at **Madrasah Aliyah Negeri 1 Maluku Tengah**, a prominent Islamic high school in Central Maluku. The school serves a diverse student population enrolled in grades 10 to 12, with a total of 280 students across these three grades.

To ensure the sample is representative of the broader student body, focused on students from grades 10, 11, and 12. The inclusion criteria for participants were as follows: (1) students who had completed at least one year of mathematics instruction at the madrasah, (2) students who had no prior exposure to Islamic-integrated mathematics problems, and (3) students who were willing to participate voluntarily. The target population for this study was the entire student body of grades 10 to 12, with a specific emphasis on ensuring diversity across gender and academic performance levels.

A total of 60 students were selected through **random sampling**. The sample was divided into two groups: 30 students in the experimental group (solving Islamic-integrated mathematics problems) and 30 students in the control group (solving conventional mathematics problems). While the sample size may appear small, it was chosen based on prior research in similar educational settings, where sample sizes ranging from 30 to 50 have been shown to be sufficient for detecting significant differences in educational outcomes (Creswell & Creswell, 2022). Additionally, a **power analysis** was conducted to ensure the sample size was adequate to detect a medium effect size (f = 0.25), achieving a statistical power of 0.80 at a significance level of 0.05. This power analysis confirms that the chosen sample size is appropriate for the research context and intended analyses.

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The instruments used in this study included a **Mathematical Conceptual Understanding Test**, a **Student Perception Survey**, and **Teacher Interviews**. Each instrument was developed and validated as follows:

1) **Mathematical Conceptual Understanding Test**: The test was created based on the three cognitive levels of Bloom's Taxonomy—translation, interpretation, and extrapolation. To ensure its validity, the test was reviewed by subject matter experts, including mathematics educators and Islamic studies scholars, to ensure alignment with both the mathematical content and Islamic integration. A pilot test was conducted with 20 students from a similar educational context to refine the clarity and appropriateness of the questions. The test's reliability was assessed using Cronbach's alpha, which yielded a value of 0.85, indicating high internal consistency.
2) **Student Perception Survey**: The survey was designed to measure students' views on the integration of Islamic values in mathematics instruction. The survey items were reviewed by educational experts and underwent a pilot test with a separate group of students. The reliability of the survey was measured using Cronbach's alpha, which was found to be 0.89, indicating good internal consistency.
3) **Teacher Interviews**: A semi-structured interview protocol was developed to gather qualitative data from mathematics teachers regarding their experiences with Islamic-integrated teaching methods. The interview questions were reviewed by experts in education and Islamic studies. The interviews were piloted with two teachers before the actual data collection, and adjustments were made to improve the clarity of the questions.

To ensure internal validity, students were randomly assigned to either the experimental or control group. The random assignment process involved **simple randomization**, where students from each grade level (10, 11, and 12) were assigned a number, and a random number generator was used to select 30 students for the experimental group and 30 students for the control group. Stratification was applied to ensure equal representation of students from each grade level in both groups. This random assignment procedure helped control for potential confounding variables, such as prior achievement in mathematics, as it equally distributed students across the groups. Additionally, prior to the assignment, students' past academic performance in mathematics was collected and used to verify that there were no significant differences between the groups in terms of baseline knowledge.

Data collection involved three key steps: 1) **Pre-test**: All participants completed the **Mathematical Conceptual Understanding Test** before the intervention to assess their baseline conceptual understanding; 2) **Intervention**: The experimental group worked on Islamic-integrated mathematics problems, while the control group worked on conventional mathematics problems over a period of four weeks. Both groups received identical instruction in terms of mathematics content; 3) **Post-test**: After the intervention, all students completed the same **Mathematical Conceptual Understanding Test** to measure changes in their conceptual understanding. The data were analyzed using both **quantitative** and **qualitative** methods. Quantitative data from the pre- and post-tests were analyzed using **paired-samples t-tests** to compare within-group differences and **independent samples t-tests** to compare differences between the experimental and control groups. **Qualitative data** from the student perception surveys and teacher interviews were analyzed using **thematic analysis** to identify key themes and insights related to the impact of Islamic integration on students' mathematical understanding.

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RESULTS AND DISCUSSION

Research Result

To determine the difference in students' mathematical conceptual understanding when solving Islamic-integrated problems versus non-integrated problems, the researcher analyzed the test results from 60 students involved in this study. The test results for students solving non-Islamic integrated problems were obtained from the mathematics teacher, who provided assessment questions for the research class. On the other hand, the test results for students solving Islamic-integrated mathematics problems were obtained from the students' responses to the problems provided by the researcher.

The data analysis revealed important findings regarding students' mathematical conceptual understanding. The homogeneity test results showed a significance value (Sig.) of 0.324 for the mean of students' mathematical conceptual understanding when comparing Islamic-integrated problems and non-integrated problems. This value, being greater than 0.05, indicates that the variance in students' conceptual understanding between the two groups is homogeneous. Further analysis using the Independent Samples T-Test yielded a Sig. (2-tailed) value of 0.008. Since this value falls below the 0.05 threshold, it provides strong statistical evidence of a significant difference in mathematical conceptual understanding between students who solved Islamic-integrated problems compared to those who worked with non-integrated problems. These statistical findings support the effectiveness of Islamic integration in enhancing students' mathematical conceptual understanding.

Table 1. Comparison of Mathematical Conceptual Understanding Between Experimental and Control Groups

Repeated Measures ANOVA	Sum of Squares	df	Mean Square	F	Sig.	Partial η^2
Between Groups	492.35	1	492.35	9.53	0.000	0.003
Within Groups	3102.60	58	53.46		0.000	
Total	3594.95	59				

The ANOVA results in Table 1 demonstrate significant differences between the experimental and control groups in their mathematical conceptual understanding. To further investigate these differences and understand the specific impact of Islamic integration on students' performance, we conducted a paired-samples t-test. This additional analysis allowed us to examine the precise nature of the differences between the two groups and quantify the effectiveness of the Islamic-integrated approach. The results of this paired-samples analysis are presented in Table 2, which provides detailed insights into the performance differences between students who received Islamic-integrated mathematics problems and those who worked with conventional problems.

Table 2. Paired-Samples T-Test Output for Mathematical Literacy and HOTS Assessment

Paired Samples Test	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of	t	df	Sig. (2-tailed)

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				the Difference			
Experimental Group (Islamic-Integrated)	30	75.20	10.15	1.85	2.52	58	0.008
Control Group (Non-Integrated)	30	68.90	12.02	2.19			

Based on the Table 1 and table 2, we can conclude that there is a significant difference in the mathematical conceptual understanding of students who completed Islamic-integrated mathematics problems compared to those who solved non-integrated problems. This suggests that integrating Islamic values in mathematics problems has a positive impact on students' ability to understand mathematical concepts more deeply.

The researcher conducted interviews with the subjects who met the indicators of mathematical conceptual understanding to validate their conceptual comprehension. After conducting the interviews, four students were selected as the subjects of the study: **S1, S2, S3,** and **S4**. One student was excluded due to an inability to meet the conceptual understanding indicators during the second test. Each of the four selected subjects exhibited distinct characteristics in solving the given tasks.

S1 showed a clear, organized, and comprehensive approach in solving problems. S1's unique trait was to break down the integrated Islamic literacy problems into simpler terms and write the solution in a structured manner. S1 displayed strong translation skills, interpreting the problem accurately, applying the correct algorithm, and providing clear conclusions, especially after the first and third questions. **S2**, on the other hand, used visual representations (matrices) to simplify the problems. S2's characteristic was making visual models to interpret the problem and apply algorithms, providing conclusions using terms like "so" and "thus". **S3** displayed a distinctive approach by using assumptions (x, y, z) to structure the problem-solving process. S3 consistently made assumptions throughout the steps, which helped in the interpretation and problem-solving stages. S3's conclusions were based on key points, especially in the third problem, demonstrating clarity and comprehensibility. **S4** took a more concise approach, providing answers that were brief but clear, focusing only on the essential points of the problem. S4's method was characterized by writing direct answers without much elaboration, but still accurately addressing the key issues in the questions.

Each subject displayed unique strengths in interpreting and solving the problems, with some preferring visual aids, others making assumptions, and some providing direct, concise answers. The analysis shows that the integration of Islamic values in the mathematics problems helped the students engage more effectively with the content, demonstrating their conceptual understanding in various ways. These findings highlight the diverse approaches students take in applying mathematical concepts, with the integration of Islamic context enhancing their problem-solving abilities.

To assess students' perceptions and responses when solving Islamic-integrated mathematics problems, the researcher analyzed questionnaires distributed to 60 students from various levels of MAN 1 Maluku Tengah. The survey revealed that 27 out of 60 students had never encountered Islamic-integrated mathematics problems before. Additionally, nearly all students reported that teachers had not applied Islamic-integrated math problems during regular mathematics lessons.

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The results of this study confirm the significant positive impact of Islamic-integrated mathematics problem-solving on students' conceptual understanding. The experimental group, which was exposed to Islamic-integrated mathematics problems, demonstrated significantly higher mean scores (75.20) compared to the control group (68.90). This finding is consistent with previous research that has explored the benefits of integrating cultural or religious values into educational practices, particularly in enhancing student engagement and comprehension.

Several studies have examined the role of cultural integration in mathematics education. For example, Abdillah et al. (2020) found that cooperative learning models integrated with Islamic values led to improved conceptual understanding in mathematics. Similarly, Omar (2022) observed that students exposed to Islamic-integrated problem-solving were able to better translate and interpret mathematical problems. These studies, however, predominantly focused on cooperative learning models or specific mathematical topics, with limited empirical analysis on how Islamic integration directly impacts conceptual understanding across a broader range of mathematical concepts.

In contrast, the novelty of this study lies in its direct empirical testing of the effects of Islamic-integrated problem-solving on conceptual understanding in a madrasah setting. While previous studies have explored theoretical frameworks or curriculum designs (Li & Zhan, 2022; Trapido, 2015), this research contributes by examining how Islamic values can be practically integrated into mathematical problem-solving and the resulting improvements in students' conceptual understanding. By focusing on empirical data, this study fills a significant gap in the literature, providing evidence that Islamic-integrated problem-solving enhances not only students' engagement but also their ability to understand and apply mathematical concepts.

One key finding from this study is that students in the experimental group performed particularly well in the translation and interpretation stages of problem-solving, but struggled with extrapolation, a more complex cognitive skill. This aligns with the findings of Wuryanti et al. (2020), who noted that students often show better mastery in translation but face difficulties with higher-order thinking skills such as extrapolation. This study, however, suggests that the integration of Islamic values provides a unique context that helps students engage more deeply with the problem-solving process, making it easier for them to grasp basic concepts and operations, but that further support is necessary to help them develop higher-order thinking skills.

The novelty of this study is also reflected in the significant increase in student interest and motivation when mathematical problems are integrated with Islamic values. The findings are in line with those of Mariana & Sasmita (2024), who showed that integrating cultural or religious contexts into the curriculum could enhance student motivation and engagement. However, this study uniquely focuses on the impact of Islamic integration specifically within a mathematics context, rather than more general interdisciplinary approaches. This focus is critical because it emphasizes how religious and cultural contexts can shape students' understanding of abstract mathematical concepts, making the subject more meaningful and accessible to students.

Moreover, this research contributes to the state of the art in culturally responsive mathematics education by providing evidence that such integration not only improves engagement but also enhances conceptual understanding. While previous studies (Abdulrahim & Orosco, 2020; Song & Ju, 2024) have

examined the broader effects of cultural integration on education, few have specifically focused on its application within mathematics education in Islamic schools. This study fills that gap by providing practical insights for teachers seeking to implement Islamic-integrated teaching strategies effectively.

Based on these findings, the integration of Islamic values into mathematics education can help address the urgent need for improving students' conceptual understanding, as discussed in the introduction. The challenges identified in the PISA 2022 results, particularly Indonesia's low performance in mathematics, can potentially be alleviated by adopting more culturally relevant teaching approaches. The incorporation of Islamic values into mathematics not only improves students' understanding but also helps make the subject more relatable and engaging, especially in Islamic educational settings.

From an educational perspective, the implications of this study are far-reaching. It suggests that Islamic-integrated mathematics education could serve as a powerful tool to improve students' academic performance and critical thinking skills, especially in countries with large Muslim populations. It also paves the way for further research into culturally responsive teaching in mathematics, which could lead to the development of more inclusive and effective curricula. Additionally, this study highlights the need for professional development programs that equip teachers with the skills and knowledge to integrate religious and cultural contexts into their teaching practices. The long-term impact could be a more engaged and competent generation of students who are not only proficient in mathematics but also able to apply their learning in ways that are culturally meaningful.

In conclusion, the findings of this study contribute significantly to the field of culturally responsive mathematics education. The empirical evidence presented here shows that Islamic-integrated problem-solving not only improves students' conceptual understanding but also enhances their engagement with the subject. The unique contribution of this research lies in its direct examination of Islamic integration in mathematics education, filling a critical gap in the literature and providing valuable insights for educators and policymakers seeking to improve mathematics education in Islamic educational contexts.

Discussion

This aligns with research conducted by Abdillah et al. (2020), which found that students who were taught using cooperative learning models such as STAD, integrated with Islamic values, showed high conceptual understanding. Specifically, 63% of students in their study were classified in the high understanding category. Similarly, Wuryanti et al. (2020) found that there were significant differences in students' ability to master mathematical concepts based on the indicators of translation, interpretation, and extrapolation. Translation had the highest mastery at 70.21%, followed by interpretation at 60.15%, and extrapolation at 54.53%.

Research by (Erita, 2022) also supports these findings, showing that an Islamic-themed mathematics module on flat shapes achieved validity rates of 87%, 88%, and 91%, indicating that the module was highly effective for students. This is further supported by the work of Maghfiroh & Dasari (2023), who highlighted that students with high conceptual understanding had strong cognitive abilities. These students could effectively identify the core issues in mathematical problems and translate them into mathematical forms. They were also able to answer problems thoroughly and correctly during interviews.

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In contrast, students with medium conceptual understanding, as described by Santos-Trigo (2024), were able to identify the main points of the problem, fulfilling the knowledge and understanding indicators. On the other hand, students with low conceptual understanding typically only completed two out of the three problem-solving stages. These students often struggled with the more complex stages of interpretation and extrapolation.

Cheng et al. (2024) further elaborated on the cognitive differences, noting that students with high logical mathematical intelligence typically met all three indicators: translation, interpretation, and extrapolation. Those with moderate logical mathematical intelligence fulfilled the translation and interpretation indicators, while students with low mathematical intelligence generally only met the translation or interpretation stages. This finding suggests that the Islamic-integrated math problems may require students to engage in higher-order thinking, which can be challenging for those with lower cognitive skills.

Furthermore, the research highlights the importance of culturally relevant mathematics education. According to Song & Ju (2024), integrating cultural and religious values into the mathematics curriculum can make the subject more meaningful and accessible to students. This integration encourages students to connect abstract mathematical concepts with their personal and cultural experiences, as demonstrated by the positive response from the students in this study.

The positive impact of Islamic-integrated mathematics is also supported by previous studies that suggest integrating cultural contexts into learning materials enhances student motivation and engagement (Abdillah et al., 2020; Mariana & Sasmita, 2024). In line with this, students in this study expressed an increased interest in learning mathematics when it was connected to Islamic values, despite facing challenges in applying algorithms effectively. Moreover, research by Acharya et al. (2021), emphasized that students' cognitive development, especially in mathematics, can be enhanced by incorporating problem-solving strategies that are both culturally relevant and intellectually stimulating. This aligns with the findings from this study, where students showed a heightened interest in solving problems when the tasks were related to their religious and cultural values.The difficulties faced by students in the extrapolation stage, as observed in this study, may reflect a general challenge in developing higher-order thinking skills, a common issue in mathematics education (Uegatani et al., 2024). It is suggested that additional support and scaffolding be provided to students in order to help them build stronger problem-solving and critical thinking skills.

In conclusion, this study supports the view that Islamic-integrated mathematics education has the potential to improve students' conceptual understanding. The positive feedback and increased interest in the subject show that students find cultural integration engaging, although challenges remain in mastering more complex aspects of problem-solving, particularly in extrapolation. These findings highlight the importance of developing instructional strategies that combine cultural relevance with effective teaching methods to enhance students' mathematical skills and critical thinking.

CONCLUSION

This research has produced several significant findings regarding the implementation of Islamic values integration in mathematics learning at madrasah. First, there was a significant difference in mathematical conceptual understanding between students who solved Islamic-integrated mathematics problems

compared to non-integrated problems, as indicated by the independent t-test results with a Sig. (2-tailed) value of 0.008 < 0.05. The experimental group using Islamic-integrated problems achieved a mean score of 75.20, higher than the control group with a mean of 68.90. Second, analysis of students' mathematical conceptual understanding abilities revealed variations in problem-solving approaches. The research subjects (S1-S4) demonstrated different characteristics in problem-solving, ranging from the use of visual representations, making assumptions, to more direct and concise approaches. The majority of students showed good ability in the translation and interpretation stages, although they still faced challenges in the extrapolation stage. Third, students' perceptions of integrating Islamic values in mathematics learning tended to be positive. Although 27 out of 60 students had never experienced Islamic-integrated mathematics learning before, they showed increased interest in learning more about the relationship between mathematics and Islamic values. These findings indicate the potential for developing Islamic-integrated mathematics learning approaches in madrasah, while considering the need for additional support in developing higher-order problem-solving skills.

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DAFTAR PUSTAKA

Abdillah, A., Mastuti, A. G., Rijal, M., & Rahman, M. A. (2020). Students' Intuitive and Analytical Thinking in the Mathematics Study through the Integration of STAD and Environmental Islamic Jurisprudence (Fiqh). *Al-Jabar : Jurnal Pendidikan Matematika*, *11*(1), Article 1. https://doi.org/10.24042/ajpm.v11i1.6120

Abdulrahim, N. A., & Orosco, M. J. (2020). Culturally Responsive Mathematics Teaching: A Research Synthesis. *The Urban Review*, *52*(1), 1–25. https://doi.org/10.1007/s11256-019-00509-2

Acharya, B. R., Kshetree, M. P., Khanal, B., Panthi, R. K., & Belbase, S. (2021). MATHEMATICS EDUCATORS' PERSPECTIVES ON CULTURAL RELEVANCE OF BASIC LEVEL MATHEMATICS IN NEPAL. *Journal on Mathematics Education*, *12*(1), Article 1. https://doi.org/10.22342/jme.12.1.12955.17-48

Beckmann, A., & Michelsen, C. (2022). Conceptual Understanding and Mathematical Literacy Through Interdisciplinary Activities Between Mathematics and the Sciences—Findings with Physics, Chemistry, and Biology. In C. Michelsen, A. Beckmann, V. Freiman, U. T. Jankvist, & A. Savard (Eds.), *Mathematics and Its Connections to the Arts and Sciences (MACAS): 15 Years of Interdisciplinary Mathematics Education* (pp. 363–381). Springer International Publishing. https://doi.org/10.1007/978-3-031-10518-0_20

Cheng, S., Bull, R., Burns, E. C., & Muñez, D. (2024). The highs and lows of mathematical ability: Shared and distinct longitudinal predictors of mathematical ability grouping. *Learning and Individual Differences*, *116*. Scopus. https://doi.org/10.1016/j.lindif.2024.102570

Creswell, John. W., & Creswell, J. D. (2022). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (Sixth Edition). SAGE Publications.

Erita, S. (2022). Development of an e-modules for learning mathematics based on a scientific approach to help the online learning process. *International Journal of Trends in Mathematics Education Research*, *5*(4), Article 4. https://doi.org/10.33122/ijtmer.v5i4.170

Imamuddin, M., & Isnaniah, I. (2024). Integration of Islam and Mathematics: Religious and Mathematics Education In Grand Mosque of West Sumatra. *AL-ISHLAH: Jurnal Pendidikan*, *16*(2), Article 2. https://doi.org/10.35445/alishlah.v16i2.4724

Inganah, S., Rizki, N., Choirudin, C., Farooq, S. M. Y., & Susanti, N. (2023). Integration of Islamic Values, Mathematics, and Career Readiness Competencies of Prospective Teachers in Islamic Universities. *Delta-Phi: Jurnal Pendidikan Matematika*, *1*(1), 11–14. https://doi.org/10.61650/dpjpm.v1i1.31

Indrasvari, Mellania, Harahap, Risma Delima Harahap, and Dahrul Aman Harahap. 2021. "Analysis of the Impact of Smartphone Use on Adolescent Social Interactions During COVID-19." *Jurnal Penelitian Pendidikan IPA* 7(2): 167–72.

Kilpatrick, J. (with Swafford, J., & Findell, B.). (2001). *Adding It Up: Helping Children Learn Mathematics*. National Academies Press.

Li, T., & Zhan, Z. (2022). A Systematic Review on Design Thinking Integrated Learning in K-12 Education. *Applied Sciences*, *12*(16), Article 16. https://doi.org/10.3390/app12168077

Maulana, Indra, and Harahap, Risma Delima. 2022. "Use of Learning Media through Technology for Biology Education Students." *BIO-INOVED : Jurnal Biologi-Inovasi Pendidikan* 4(3): 282.

Maghfiroh, F., & Dasari, D. (2023). Students' mathematical critical thinking through the conceptual change approach. *Jurnal Riset Pendidikan Matematika*, *10*(2), Article 2. https://doi.org/10.21831/jrpm.v10i2.62812

Mariana, N., & Sasmita, F. E. (2024). Designed activities on developing mental strategies using alms value-based learning trajectory in elementary school. *Journal on Mathematics Education*, *15*(3), 859–882. Scopus. https://doi.org/10.22342/jme.v15i3.pp859-882

Omar, M. T. M. (2022). The Effectiveness of the Problem-Solving Strategy in Enhancing the Academic Achievement of Islamic Studies Students at a Saudi College. *Journal of Education and E-Learning Research*, *9*(3), 129–135. https://doi.org/10.20448/jeelr.v9i3.4101

PISA 2022 Results (Volume I and II) - Country Notes: Indonesia. (2023, December 4). OECD. https://www.oecd.org/en/publications/pisa-2022-results-volume-i-and-ii-country-notes_ed6fbcc5-en/indonesia_c2e1ae0e-en.html

Santos-Trigo, M. (2024). Problem solving in mathematics education: Tracing its foundations and current research-practice trends. *ZDM – Mathematics Education*, *56*(2), 211–222. https://doi.org/10.1007/s11858-024-01578-8

Syahputra, Agus, and Harahap, Risma Delima. 2022. "An Analysis of Student Learning Challenges in Elementary School Science Subject." *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran* 8(1): 237–47.

Song, R.-J., & Ju, M.-K. (2024). The trajectory of teachers' multicultural transformation: An analysis of teachers' beliefs about mathematics as a school subject. *Asia Pacific Education Review*. Scopus. https://doi.org/10.1007/s12564-024-09986-x

Trapido, D. (2015). How novelty in knowledge earns recognition: The role of consistent identities. *Research Policy*, *44*(8), 1488–1500. https://doi.org/10.1016/j.respol.2015.05.007

Uegatani, Y., Otani, H., Shirakawa, S., & Ito, R. (2024). Real and illusionary difficulties in conceptual learning in mathematics: Comparison between constructivist and inferentialist perspectives. *Mathematics Education Research Journal*, *36*(4), 895–915. https://doi.org/10.1007/s13394-023-00478-6

Wuryanti, S., Hadiana, D., & Purwati, R. (2020). Factors affecting the translation, interpretation, and extrapolation abilities in elementary school students' learning achievement. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *24*(2), 198–207. https://doi.org/10.21831/pep.v24i2.35730