Analysis of the Impact of Using Science, Technology, Engineering, Arts, and Mathematics (STEAM) and Its Influence on Islamic Education Learning Outcomes in High School Students

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Abstract: Analysis of the Impact of Using Science, Technology, Engineering, Arts, and Mathematics (STEAM) and Its Influence on Islamic Education Learning Outcomes in High School Students
Objective: This study aims to analyze the impact of using the Science, Technology, Engineering, Arts, and Mathematics (STEAM) approach on student learning outcomes in Islamic education at the senior high school level. Methods: The research design used a survey approach. The sample was taken using a stratified random sampling technique, totaling 300 students. Data collection using questionnaires. Data analysis using analysis of variance (ANOVA). Results: The STEAM approach improves students' understanding of Islamic education materials and increases their motivation to learn. Conclusion: Applying the STEAM approach in Islamic education can improve learning outcomes and positively impact by creating a more relevant, interesting, and contextualized learning experience. Contribution: This research contributes to local governments and schools' formulation of educational policies toward the widespread use of the STEAM approach at the high school level.

Keyword: STEAM Approach; Learning Outcomes; Islamic Religious Education; Senior High School

Abstrak: Analisis Dampak Penggunaan Science, Technology, Engineering, Arts, and Mathematics (STEAM) dan Pengaruhnya terhadap Hasil Belajar Pendidikan Agama Islam pada Siswa Sekolah Menengah Atas
Tujuan: Penelitian ini bertujuan untuk menganalisis dampak penggunaan pendekatan Science, Technology, Engineering, Arts, and Mathematics (STEAM) terhadap hasil belajar siswa dalam Pendidikan Agama Islam (PAI) di tingkat Sekolah Menengah Atas. **Metode:** Desain penelitian menggunakan pendekatan survei. Sampel diambil menggunakan teknik stratified random sampling, berjumlah 300 siswa. Pengumpulan data menggunakan angket. Analisis data menggunakan analysis of variance (Anova). **Hasil:** Pendekatan STEAM meningkatkan pemahaman siswa tentang materi pendidikan Islam dan meningkatkan motivasi mereka untuk belajar. **Kesimpulan:** Penerapan pendekatan STEAM dalam PAI dapat meningkatkan hasil belajar dan memberikan dampak positif dengan menciptakan pengalaman pembelajaran yang lebih relevan, menarik, dan kontekstual. **Kontribusi:** Penelitian ini berkontribusi sebagai bahan pertimbangan bagi pemerintah daerah dan sekolah dalam merumuskan kebijakan pendidikan terhadap penggunaan pendekatan STEAM secara luas di tingkat SMA.

Kata Kunci: Pendekatan STEAM; Hasil Belajar; Pendidikan Agama Islam; Sekolah Menengah Atas

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A. Introduction

Islamic education plays a crucial role in shaping students' character and morals, serving as the foundation of spiritual values that equip them to face the challenges of the modern world (Kurniati & El-Yunusi, 2023). However, in the digital era, marked by the rapid advancement of technology, conventional Islamic education teaching methods are often considered less responsive to the needs of a generation with unlimited access to information and exposure to modern knowledge (Pai, 2024). This challenges Islamic education to remain relevant in content and teaching methods to keep up with the evolving ways of thinking and students' increasingly dynamic cognitive needs (Slavich & Zimbardo, 2012).

Islamic Education learning faces challenges that significantly affect learning outcomes. One of the main problems is the low competence of educators and ineffective teaching methods. Many educators do not yet have sufficient skills to manage learning optimally, and the methods used are often monotonous and lack variety (Sivarajah et al., 2019). Traditional approaches focusing on memorization without in-depth understanding also dominate, thus failing to encourage students to think critically and actively participate in the learning process. (Amaly et al., 2023). In addition, the learning environment and media used are often unsupportive. The lack of interactive learning media variations hinders students from understanding the material contextually and attracting their interest in learning Islam. This mismatch worsens learning outcomes because students lose motivation to learn important religious values (Omar, 2022).

Integrating the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach is a potential solution (Fauzi & Fajrin, 2022). STEAM is an interdisciplinary approach combining five disciplines to create more contextual learning and focuses on developing 21st-century skills such as critical thinking, creativity, communication, and collaboration (Wilson et al., 2021). Implementing STEAM in Islamic education learning can bring innovation to how students perceive and understand Islamic values not merely as a set of rules or dogmas but as principles that can be integrated with real-world problem-solving, including complex global challenges.

The STEAM approach in Islamic education can bridge the gap between religious knowledge and modern science (Adiyono et al., 2024). For example, the concept of tauhid (the oneness of Allah Swt., can be integrated into scientific learning to demonstrate the universe's orderliness as a sign of Allah's greatness (Al Faruqi, 2021). Technology learning can be connected to Islamic ethics regarding the responsible use of technology (Kumar et al., 2022). Art in STEAM can be combined with the expression of Islamic values through calligraphy or visual designs that reflect the moral messages of the Qur'an (Hillenbrand, 2022). Thus, this integration enriches the learning content and expands students' exploration of the relationship between religion and modern knowledge.

From a pedagogical perspective, STEAM can transform Islamic education teaching dynamics from passive lecture-based approaches to more active and collaborative ones (Fisher, 2021). Students are encouraged to participate in problem-based learning projects that allow them to apply Islamic values in real-life contexts (Kholidah, 2022). For instance, students could be tasked with designing eco-friendly technology projects to implement Islamic teachings on environmental conservation (Albar et al., 2024). Activities like these enhance students' emotional and intellectual engagement while deepening their understanding of the essence of Islamic teachings (Huda et al., 2017).

Moreover, integrating STEAM into Islamic education can address the challenge of maintaining Islamic education, which is relevant in students' eyes in the digital era. Technology can make learning more interactive through Qur'an-based educational apps or digital simulations that teach Islamic moral concepts. This can also help shape students' character, enabling them to understand Islamic teachings cognitively and apply them

practically in an increasingly interconnected global world. However, implementing STEAM in Islamic education learning requires significant effort. Islamic education teachers must have adequate skills and knowledge about STEAM and the ability to integrate various disciplines into the curriculum. Continuous training and policy support from schools and the government are essential to ensure this integration is effective and has a significant impact.

Research on the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach in education has developed rapidly, particularly in science and technology subjects. This approach is known to enhance students' critical thinking, creativity, and problem-solving skills (Khan et al., 2023; Mubarok et al., 2024; Robikho et al., 2024; Khoirunnisa & Isdaryanti, 2024; Khotimah et al., 2024; Muntamah et al., 2024; Tajqiyah et al., 2024; Fauzi & Fajrin, 2022; Pramudyani & Indratno, 2022; Rahman et al., 2023; Sanusi et al., 2022). The STEAM approach is generally applied in mathematics and science, while its implementation in Islamic education remains limited. Previous studies have explored technology integration in religious education. Still, they have not specifically examined how STEAM can be applied to improve learning outcomes in Islamic education at the high school (SMA) level.

The gap analysis found that most STEAM research focuses on enhancing conceptual understanding in science and technology, while its impact on value-based religious education is rarely studied. Additionally, there is a lack of research investigating how the STEAM method can help students understand concepts in Islamic education in a more applicative, innovative, and problem-solving-based manner. There is still a gap in understanding how this approach can improve students' cognitive, affective, and psychomotor learning outcomes in Islamic education subjects.

This study offers a new perspective by exploring how the integration of STEAM in Islamic education learning can enrich teaching methods, enhance students' understanding, and make religious education more contextual and relevant to modern developments. This approach focuses on the theoretical transfer of religious knowledge and links it to technological innovation, artistic exploration, and real-life problem-solving. Furthermore, this study contributes to designing more interdisciplinary learning strategies for teaching Islamic values through a project-based, experimental, and creative arts approach. Thus, this research expands insights into Islamic education theory and presents an innovative learning model that can improve the quality of religious education at the high school level.

B. METHOD

This research is quantitative and uses a survey method to collect data. The population of this study was all high school students in Depok City for the 2023-2024 academic year who participated in Islamic education, which is estimated to be around 20,000 students based on the latest educational data. To obtain a representative sample, the study employs stratified random sampling.

This method ensures that the sample reflects variation within the population by dividing students into strata based on school and grade level and then randomly sampling from each stratum. The sample size for this study is set at 400 students, which is sufficient to obtain valid and reliable results.

The research instruments include a questionnaire, learning tests, and classroom observations. The questionnaire collects students' perceptions of STEAM learning and its impact on understanding Islamic values. The learning tests assess students' knowledge of Islamic education material after applying the STEAM method. At the same time, classroom observations are conducted to observe student engagement during the learning process. Research procedures include designing and testing instruments, distributing questionnaires, implementing learning tests, and classroom observations.

The collected data are then processed and analyzed using statistical techniques such as linear regression to determine the contribution of STEAM to learning outcomes and Analysis

of Variance (ANOVA) to compare learning outcomes between groups of students receiving Islamic education instruction with and without the STEAM approach. This approach aims to provide a clear picture of the effectiveness of integrating STEAM into Islamic education learning in the digital era.

C. Results and Discussion

Result

The results of the research indicate a significant difference in students' average learning outcomes before and after the implementation of the STEAM approach in Islamic Religious Education (PAI). Before the application of STEAM, the average learning outcome score was 72.3 with a standard deviation of 8.5. After the implementation of STEAM, the average score increased significantly to 81.7 with a standard deviation of 7.2. This change signifies a substantial improvement in students' understanding of PAI material after applying the STEAM approach.

Table 1. Comparison of Students' Learning Outcomes Before and After the Implementation of the STEAM Approach in Islamic Religious Education (PAI)

Learning Outcome	Mean Score	Standard Deviation (SD)
Before STEAM	72.3	8.5
After STEAM	81.7	7.2

In addition to improving learning outcomes, students' motivation to learn significantly increased. The motivation scores measured using a questionnaire revealed an average motivation score of 65.4 before the application of STEAM, which rose to 78.1 after the STEAM implementation. This indicates that the STEAM approach contributes to enhancing students' learning outcomes and effectively boosts their motivation to learn. This increase demonstrates that the STEAM approach, with its integration of science, technology, engineering, arts, and mathematics, can significantly impact students' understanding of the material and their motivation in PAI learning.

Table 2. Comparison of Students' Motivation Scores Before and After the Implementation of the STEAM Approach in Islamic Education

Measurement Time	Average Motivation Score
Before STEAM Implementation	65.4
After STEAM Implementation	78.1

The results of this research provide strong support for the initial hypothesis that applying the STEAM approach in Islamic Religious Education (PAI) can enhance student learning outcomes and motivation. The increase in the average learning outcome score from 72.3 to 81.7 after implementing STEAM indicates that this approach effectively improves students' understanding of PAI material. This improvement can be attributed to the interdisciplinary nature of the STEAM approach, which integrates elements of science, technology, engineering, arts, and mathematics. This integration creates a more holistic and contextual learning experience, helping students relate PAI concepts to real-life applications. As a result, students understand PAI theory and see its relevance in a modern context.

The rise in motivation, reflected in an average score increase from 65.4 to 78.1, reinforces these findings. Enhanced motivation indicates that STEAM improves cognitive abilities and influences students' affective domains. A high level of motivation is strongly linked to increased engagement and a heightened eagerness to learn, which key indicators of an effective teaching approach are. STEAM helps overcome the boredom and passivity commonly found in traditional teaching methods by making learning more meaningful and engaging.

Table 3. Summary of Learning Outcomes and Motivation Scores Before and After STEAM Implementation in Islamic Religious Education (PAI)

Measurement Time	Average Learning Outcome Score	Average Motivation Score
Before STEAM Implementation	72.3 ± 8.5	65.4
After STEAM Implementation	81.7 ± 7.2	78.1

These findings align with previous studies demonstrating the benefits of the STEAM approach in various learning contexts. Research by Mubarok et al. (2024) shows that STEAM can improve conceptual understanding in physics education, while Khoirunnisa and Isdaryanti (2024) confirmed the effectiveness of STEAM in enhancing students' critical thinking skills in science subjects. These results affirm the strength of the STEAM approach in improving understanding and motivation across different subjects.

In the context of PAI, the application of STEAM offers an innovative solution to bridge the gap between spiritual values and modern technological demands (Shatunova et al., 2019). By integrating STEAM elements into PAI learning, teachers can make the teaching material more relevant to current challenges and realities faced by students (Domenici, 2022). This integration allows students to connect Islamic principles with current technology and innovations, making them more understandable and acceptable (Adi, 2020). Furthermore, this approach helps students develop skills needed in the digital era, such as critical thinking, creativity, and problem-solving, which are essential components of holistic and relevant education.

Overall, the results of this study indicate that integrating the STEAM approach into PAI education at the high school level improves student learning outcomes and motivation. This underscores the importance of adopting an interdisciplinary approach in religious education to address the challenges of the digital age and prepare students with the skills and knowledge necessary for future success.

Discussion

The STEAM approach, by integrating various disciplines such as science, technology, engineering, arts, and mathematics, creates a more holistic and contextual learning experience. This helps students understand Islamic education theory and relate it to real-life applications. For example, applying Islamic education concepts in scientific or technological contexts can show the relevance of religion in the modern world. Integrating these disciplines creates a more engaging and meaningful way of learning, preventing boredom in lessons focused solely on theory without practical connections.

The improved outcomes and motivation can be attributed to the interdisciplinary nature of STEAM. Integrating science, technology, engineering, arts, and mathematics bridges the gap between abstract spiritual principles in Islamic education and practical, real-world applications. For example, students can explore ethical questions related to technological advancements, linking Islamic values to contemporary challenges (Shatunova et al., 2019).

The increase in motivation is closely related to increased student engagement in learning. Higher motivation encourages students to be more active, ask questions, and participate in class discussions, which are important indicators of the effectiveness of the teaching method. With its interdisciplinary nature, STEAM successfully addresses the challenges often faced in conventional learning, such as boredom and student indifference toward the material. Additionally, research by Mubarok et al. (2024) and Khoirunnisa & Isdaryanti (2024) supports the benefits of STEAM in fostering critical thinking and conceptual understanding in various disciplines, reinforcing the findings in this study. Domenici (2022) further emphasizes the relevance of STEAM in modern education, enabling students to connect traditional learning with 21st-century skills like creativity and problem-solving.

Applying STEAM in Islamic education enhances cognitive outcomes and affects the affective domain by boosting motivation and engagement. By contextualizing Islamic principles through STEAM, educators provide students with a holistic learning experience that is both spiritually enriching and practically applicable. This integration aligns with the demands of the digital era, equipping students with critical skills necessary for navigating modern challenges while remaining grounded in Islamic values. Implementing the STEAM approach in Islamic education can enhance learning outcomes and student motivation. This approach positively impacts by creating a more relevant, engaging, and contextual learning experience. Additionally, integrating disciplines in STEAM allows students to see the relationship between religion and the scientific world, which can enrich their understanding of both fields.

In Islamic education, the application of STEAM offers an innovative solution to bridge the gap between spiritual values and modern technological demands (Shatunova et al., 2019). By integrating STEAM elements into Islamic education learning, teachers can make the teaching material more relevant to current challenges and realities faced by students (Domenici, 2022). This integration allows students to connect Islamic principles with current technology and innovations, making them more understandable and acceptable (Adi, 2020). Furthermore, this approach helps students develop skills needed in the digital era, such as critical thinking, creativity, and problem-solving, which are essential components of holistic and relevant education.

The study confirms the hypothesis that the STEAM approach significantly improves learning outcomes and motivation in Islamic Religious Education. By fostering a more interactive and engaging learning environment, STEAM enables students to relate Islamic education concepts to real-life scenarios, thus ensuring a more meaningful and impactful educational experience. Future research could explore broader applications of STEAM in different religious and cultural educational contexts to further validate its efficacy.

This study presents integrating the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach into Islamic education as a novel contribution to educational practices. The research highlights significant improvements in student learning outcomes and motivation by combining traditional religious teachings with modern interdisciplinary methods. This approach equips students with essential 21st-century skills, such as critical thinking, creativity, and problem-solving, while grounding them in Islamic values. The novelty lies in addressing the gap between religious education and the demands of the digital age, demonstrating how STEAM can make Islamic education more relevant, engaging, and applicable to real-world contexts (Khoirunnisa & Isdaryanti, 2024; Shatunova et al., 2019). Adopting STEAM in religious education can better prepare students for future challenges while enhancing their academic and spiritual growth.

D. Research Implications and Contributions

1. Research Implications

This research has important implications in the educational context, particularly in improving the quality of Islamic education at the Senior High School level. Applying the STEAM approach demonstrates that integrating various disciplines of science, technology, engineering, arts, and mathematics into Islamic education learning can enhance students' understanding of the material being taught. This approach allows students to see the relevance of religion in the modern world and increases their engagement in the learning process. Furthermore, the significant increase in motivation also shows that this method benefits not only the cognitive aspects but also the affective aspects of students, such as their interest and enthusiasm for learning. Therefore, applying STEAM in Islamic education can be an effective alternative to replace conventional approaches, which are often less engaging and relevant for today's students.

2. Research Contribution

This study contributes in several areas. First, from a theoretical perspective, it enriches the body of knowledge regarding integrating STEAM disciplines in religious education, specifically Islamic Religious Education. Second, this research provides empirical evidence of the positive impact of the STEAM approach on students' learning outcomes and motivation, which educators can use to design more effective teaching strategies. Third, the study emphasizes the importance of an interdisciplinary approach in religious education, which focuses on religious aspects and connects scientific concepts with religious principles. Thus, the findings of this study can serve as a reference for the development of more modern and relevant religious education curricula in schools, as well as provide new insights for policymakers to adopt more innovative and holistic teaching methods.

E. Recommendations for Future Research Directions

Future research is expected to contribute more broadly and deeply to the development of the STEAM approach in Islamic Education, both theoretically and practically. Examine the effect of using digital applications or devices in supporting STEAM learning for Islamic Education and Research the extent to which educational policies at the local level support the application of STEAM in religious learning.

F. Conclusion

This study demonstrates that integrating the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach in Islamic education significantly improves students' learning outcomes and motivation. Before applying the STEAM method, the average learning score was 72.3, with a standard deviation 8.5. After implementing STEAM, the average score increased to 81.7, with a standard deviation of 7.2, indicating a substantial improvement in students' understanding of Islamic education content. Furthermore, students' motivation also saw a significant boost, as the motivation score increased from 65.4 to 78.1, highlighting that the STEAM approach positively impacts cognitive and affective domains, enhancing engagement and the desire to learn.

Integrating STEAM elements in Islamic education offers an innovative solution to bridge the gap between spiritual values and modern technological demands. This approach provides a more holistic and contextual learning experience, allowing students to relate Islamic principles to real-world applications. By incorporating interdisciplinary fields like science, technology, engineering, arts, and mathematics, students gain deeper insights into Islamic education material and develop essential skills such as critical thinking, creativity, and problem-solving, which are key to success in the modern world.

The findings underscore that the STEAM approach effectively improves learning outcomes and motivation at the high school level. It emphasizes the need for an interdisciplinary approach in religious education, which addresses the challenges of the digital age while preparing students with the necessary knowledge and skills for future success. To expand on these findings, future research could investigate the long-term impact of STEAM on student performance and explore its application across different educational stages and cultural contexts. Additionally, studies on the role of teacher training in implementing STEAM could provide further insights into the method's effectiveness in diverse educational settings.

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