

Application of STEAM method in learning in madrasah to improve student understanding

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ABSTRACT

Islamic education in madrasah is important to form a generation of competent Muslims in the era of technology and science. The STEAM method integrates science, technology, engineering, art, and math in holistic learning. This study analyzes the application of the STEAM method in madrasah, focusing on Islamic education. The approach to this study uses qualitative descriptive analysis with data collection through observation, interviews, and document analysis. The madrasah teacher and 30 students who used the STEAM method were sampled. The results showed a positive impact on students' understanding of Islamic education. The integration of STEAM science enables the development of critical thinking, creativity, collaboration, and problem-solving skills. Students' interest and adaptability also increase. Madrasah teachers need to understand the STEAM method to integrate it into Islamic learning. The STEAM method prepares a holistic generation of Muslims for the future.



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INTRODUCTION

Islamic education [Asyafah \(2014\)](#) in madrasah is an integral part of building a generation of Muslims who are competitive and able to face the challenges of the times ([Duderija, 2012](#)). In the era of globalization and rapid technological advancement, madrasah need to adopt innovative and contextual learning methods to improve the quality of Islamic education ([Asadullah & Chaudhury, 2016](#)). One promising approach is the application of the STEAM method, Science, Technology, Engineering, Arts, and Mathematics) in the learning process ([Padwick et al., 2023](#)).

The STEAM method integrates various disciplines such as science, technology, engineering, art, and mathematics in a holistic learning context ([Padwick et al., 2023](#)). This approach encourages students to think critically, creatively, and actively in facing various real problems ([Bedewy & Lavicza, 2023](#)). The integration of Islamic education into the STEM context in the STEAM method not only creates a learning atmosphere relevant to religious values but also enriches the student experience with skills and knowledge in STEM fields placed in the context of Islamic values. Thus, students not only develop as competent individuals in the field of science and technology but also as a generation of Muslims who have a deep understanding of the teachings of their religion, preparing

them to face the challenges of the modern world holistically. By integrating Islamic education into the STEAM method, madrasah can create a learning atmosphere (Setiawan et al., 2021).

This research discusses the application of the STEAM method of learning in madrasahs with a focus on Islamic education. Researchers analyzed the positive impact generated by the application of this method on students' understanding of Islamic education, critical thinking skills, creativity, collaboration, and problem-solving (Kang, 2019). In addition, researchers will also discuss the challenges and implications of implementing the STEAM method in the context of madrasah and provide recommendations for the development of Islamic education based on the STEAM method in madrasah.

The application of the STEAM (Science, Technology, Engineering, Arts, and Mathematics) method in learning in madrasah is relevant because it provides a holistic approach that can increase students' understanding of Islamic education. This method not only explores the disciplines of science, technology, engineering, art, and mathematics but also creates links between these knowledge and skills with Islamic religious values and teachings. By integrating Islamic education into the STEAM method, students not only learn scientific concepts or technical skills but also permeate Islamic moral and ethical values in every aspect of learning. For example, when students undertake a scientific or artistic project, they may reflect on how the concept relates to the principles of justice, truth, or wisdom taught in Islam.

Analysis of the positive impact of applying the STEAM method in the context of madrasah can include increasing students' understanding of religious teachings because students can see the relationship between scientific knowledge and Islamic values. In addition, critical thinking, creativity, collaboration, and problem-solving skills become more meaningful when connected to the application of Islamic principles in everyday life.

However, challenges can arise in combining these two approaches, such as the availability of learning materials that are appropriate to the Islamic context, teachers' understanding of the STEAM method, and support from the madrasah environment. Therefore, recommendations for the development of Islamic education based on the STEAM method in madrasahs need to include teacher training, the development of teaching materials by Islamic values, and increased support from schools and parents. Thus, by combining the STEAM method with Islamic education, madrasah can create a learning approach that produces deeper understanding, diverse skills, and strong character in students in the context of Islam and the development of modern science.

Previous research was conducted to investigate the relationship between cognitive, affective, and psychomotor learning domains and learning intentions in STEAM education (Nafiati, 2021). This study proposes a learning cycle and research framework that integrates Bloom's taxonomy and a moderation model consisting of factors derived from the technology acceptance model (TAM) and the attention, relevance, confidence, and satisfaction (ARCS) model, and considering cognitive load (Lubis & Widiawati, 2020). Through empirical experiments involving college students and elementary school students, the results showed that perceptions of usefulness directly affect learning intentions and ARCS plays an important role in strengthening the relationship between learning attitudes and learning intentions (Sammeng & Marsaoly, 2022). This research provides useful theoretical and educational implications for future instructors in developing effective STEAM education (Wu et al., 2022).

There have been Several studies have been conducted related to the application of the STEAM method in Islamic educational institutions, for example, research conducted by Rohmawati & Prisdiana (2022) discussed the application of STEAM through the medium of animated stories for group B in RA Abdullah Bin Umar Gedangan Malang. This study showed that the application of STEAM through animation media can improve children's thinking power and enable them to adjust the process of growth and development in life (Rohmawati & Prisdiana, 2022).

Research on the implementation of STEAM as an effort to empower biology teachers in Madrasah Aliyah DKI Jakarta which was researched by Sartono et al. In this study, it was produced that there was a significant increase in teacher skills and knowledge related to the STEAM method which is expected to be carried out sustainably (Sartono et al., 2020). Then the research conducted by Ayuningsih et al., (2022), the result of this research is that the application of STEAM-based

learning can foster the creativity of grade XI students of Science 3 Madrasah Aliyah PPMI Assalam Sukoharjo.

Another study evaluated the effects of sequential integration of science and art in STEM education for bilingual and fluent English students. In this study, the STEAM approach first resulted in significant improvements in science learning, especially for bilingual students. Although students who are fluent in English also experience increased learning, the advantages of the STEAM approach first are greater for bilingual students (Sa'ida, 2021). This study concludes that the STEAM approach first followed by STEM provides important learning opportunities for bilingual students and increases equality of learning opportunities between bilingual students and students fluent in English in science (Akmal & Asikin, 2022).

The purpose of this study is to analyze the application of the STEAM method in learning in madrasahs with a focus on Islamic education. This study aims to understand the positive impact produced by the STEAM method on students' understanding of Islamic education, as well as to explore how the integration of science, technology, engineering, art, and mathematics in the context of Islamic education can improve students' critical thinking, creativity, collaboration, and problem-solving skills in madrasah (Hughes et al., 2022).

The research gap that can be identified based on the above research is the lack of research that specifically explores the application of the STEAM method in the context of madrasah and Islamic education. Although there have been studies discussing the application of the STEAM method in learning in public schools (Hasanah et al., 2021), there have been no studies that have specifically evaluated the positive impact produced by the application of this method on students' understanding of Islamic education, critical thinking skills, creativity, collaboration, and problem-solving in the context of madrasah.

In this study, it is known that the average result of an increase in students' understanding of Islamic education is as much as 6% after the application of the STEAM method in the learning process in Madrasah. The average student can understand more deeply about Islamic education after the teacher applies the STEAM method because, through the STEAM method, students will think more creatively in solving a problem, think critically, and have skills in solving problems by applying Islamic principles in everyday life. Integrating the STEAM method in the context of Islamic education in madrasah can be directed by a conceptual framework that combines elements of STEM (Science, Technology, Engineering, Arts, and Mathematics) with the values and principles of Islamic education. Here is the conceptual framework underlying efforts to link STEM with Islamic Education:

1. Theoretical Foundation
 - a. STEM Education: The theoretical basis of STEM education, which emphasizes the integration of science, technology, engineering, arts, and mathematics for the development of critical skills and problem-solving.
 - b. Islamic Education: The theoretical basis of Islamic education, which includes the teachings of Islamic religion, morality, and ethics.
2. Islamic Values in a STEM Context
 - a. Justice and Ethics: Integration of Islamic values of justice and ethics in STEM projects to teach students about social and ethical impact in technology development.
 - b. Environmental Considerations: Teaches students about environmental responsibility by considering the values of sustainability and nature conservation in STEM projects.
3. Students' Understanding of Islamic Education
 - a. Integration of Curriculum Materials: Combining STEM materials with Islamic education concepts to increase students' understanding of religious teachings.
 - b. Application of Islamic Values: Provide practical context for students to apply Islamic values in solutions to real-world problems faced.
4. Critical Thinking Skills and Creativity
 - a. Multidisciplinary Projects: Design projects that involve STEM aspects and require critical thinking and creativity in problem-solving.
 - b. Islamic Reflection: Encourage students to reflect on the impact and relevance of their solutions in the context of Islamic values.

5. Collaboration and Problem Solving
 - a. Multicultural Work Teams: Establish work teams covering various backgrounds and expertise to stimulate collaboration.
 - b. Application of Hikmah Islamiyah: Using hikmah Islamiyah (Islamic wisdom principles) in problem-solving and joint decision-making.Implications and Further Development:
 1. Teacher Training
Competency Development: Training for teachers in integrating STEAM methods and Islamic values in learning.
 2. Learning Materials
Material Development: Creation of learning materials that include STEM elements and are relevant to the Islamic context.
 3. Impact Evaluation
Evaluation Metrics: Development of evaluation metrics that specifically measure the positive impact on students' understanding of Islamic education, critical thinking skills, creativity, collaboration, and problem-solving.
 4. Involvement of Parents and Stakeholders
Effective Communication: Involving parents and stakeholders in the learning process and ensuring effective communication related to the goals of integrating STEM and Islamic education.

In addition, the study has not explored the specific challenges and implications that may arise in implementing the STEAM method in madrasahs and provides relevant recommendations for the development of Islamic education based on the STEAM method in madrasahs. Therefore, further research is needed to understand the potential and challenges of applying the STEAM method in Islamic education in madrasah and to provide practical guidance for developing effective learning approaches in these contexts.

This research is expected to provide significant benefits for the development of Islamic education in madrasah. By applying the STEAM method in learning, madrasah can present an innovative and contextual approach, increase student interest in learning, and expand students' understanding of Islamic education (Fahrurrozi et al., 2022). In addition, this research can also provide practical recommendations for madrasah teachers in integrating the STEAM method into religious learning, as well as for educational institutions in designing educational policies that support the application of the STEAM method in madrasah.

This research has a significant practical and theoretical contribution to the development of Islamic education in madrasah. Here are some identifiable practical and theoretical contributions:

1. Practical Contribution
 - a. Increased Religious Understanding: The integration of the STEAM method in Islamic religious learning can increase students' understanding of religious values through a more contextual and interactive approach.
 - b. STEM-Based Skills Development: Madrasah can produce graduates who not only have a strong understanding of religion but also STEM (Science, Technology, Engineering, and Mathematics) based skills. This can help students prepare for the demands of work and the needs of the modern world.
 - c. Islamic Character Building: The STEAM method can help shape students' Islamic character through a well-rounded learning experience, where Islamic religious values and ethics are integrated with practical knowledge and skills.
 - d. Critical and Creative Thinking Skills: STEM integration can train students to think critically and creatively, linking religious principles with problem-solving and innovation.
 - e. Preparation for Future Challenges: Students trained through the STEAM method in Madrasah will be better prepared to face future challenges, including technological advancement, globalization, and social change.

2. Theoretical Contributions

- a. Contribution to Islamic Education Literature: Adding new insights into Islamic education literature by introducing the STEAM approach as an innovative learning method oriented to the needs of modern society.
- b. Model of Merging STEM and Religion: Forms the basis for the development of a model of merging STEM and religious education that can be adopted by madrasahs and other Islamic educational institutions.
- c. Contextual Curriculum Development: Contribute ideas to the development of a curriculum that is more contextual and relevant to the needs of the madrasah and students.

This research, by embracing the STEAM approach in learning in madrasah, has a real and relevant impact on the development of Islamic education, bridging the gap between traditional needs and the demands of the modern world.

METHOD

This research uses a qualitative approach with a case study design (Kang, 2019). The case study design was chosen because this study aims to describe and analyze in depth the application of the STEAM method in learning in madrasah (Walsiyam, 2021). This case study focuses on several madrasahs that have applied the STEAM method in Islamic religious learning.

Sample selection was carried out by purposive sampling method (Guarte & Barrios, 2006), where madrasahs that have applied the STEAM method are selected based on certain criteria, such as commitment from schools to develop innovative learning, availability of supporting facilities, and willingness of teachers to participate in research (Yati et al., 2023). After the madrasah sample was selected, data collection was carried out through several techniques, including classroom observation, interviews with teachers, and document analysis (Ahmad et al., 2017). The following is a table of research instrument grids, this table includes several instruments that can be used to collect data related to the application of the STEAM method and student understanding:

Table 1. Research Instrument Grid

No.	Instruments	Measured Variables	Instrument Type	Data Collection Methods
1	Observation	Application of the STEAM Method	Checklist	Live Observation in Class
2	Interview with Teacher	Teacher Experience in STEAM Application	Semi-Structure	Individual Interviews
3	Student Portfolio	Student Creative Products	Rubric	Portfolio collection
4	Discussion Group Observation	Student Engagement in Discussions	Checklist	Live Observation in Class
5	Final Examination of Student Comprehension	Students' Final Understanding of the Material	Objective	Written Exam
6	Student Interviews	Student Experiences and Opinions on STEAM Learning	Semi-Structure	Individual Interviews

Table 1 demonstrates that the research includes a variety of data collection methods that are relevant and appropriate to the research objectives. The selected instruments can provide a deep understanding of the application of the STEAM method by teachers, teacher and student perceptions, and student understanding of learning materials.

First, class observations were conducted to gain a deep understanding of the learning process with the STEAM method (Dewi et al., 2021). Observations were made for several different learning sessions, focusing on interactions between teachers and students, the use of technology and tools, and student activities in completing STEAM-based tasks (Papilaya & Tuapattinaya, 2023). Secondly, interviews were conducted with teachers involved in the application of the STEAM method (Agusniatih & Muliana, 2022). This interview aims to gain their perspective on the benefits, challenges, and strategies used in integrating Islamic education with the STEAM method (Yunus, 2022). Interviews were also conducted with students to gain their views on learning with the STEAM

method and its impact on their understanding of Islamic education (Diana & Saputri, 2021). In addition, document analysis was also carried out to collect data on the curriculum used, learning materials, and documents related to the application of the STEAM method in madrasah (Sam & Rahayu, 2022). Data collected from classroom observations, interviews, and document analysis were analyzed qualitatively using a content analysis approach (Hamdi, 2020). The data are categorized, identified patterns, and analyzed to answer research questions and provide a comprehensive picture of the application of the STEAM method in learning in madrasah (Hapidin et al., 2023).

RESULTS AND DISCUSSION

Results

The following are the results of class observations, teacher and student interviews, and document analysis in the form of tables that have been described.

Table 2. Class Observations

No.	Madrasah	Teacher and Student Interaction	Use of Technology	Student Activities
1	Madrasah X	High	Intensive	Active
2	Madrasah Z	Keep	Moderate	Diverse
3	Madrasah Y	Low	Limited	Limited

Table 2 shows the results of class observations in three madrasah that apply the STEAM method. Madrasah X is seen to have a high level of interaction between teachers and students, where students actively participate in learning. The use of technology is also intensive with various tools used. Madrasah Y showed a moderate level of interaction and moderate use of technology. Meanwhile, Madrasah Z has a low level of interaction, limited use of technology, and limited student activities. The benefits of using the STEAM method in madrasah can affect the improvement of students' understanding of Islamic education, teach students to think critically, prepare students to work in their desired fields in the future, encourage students to learn independently, and increase students' desire to collaborate in problem-solving. The use of STEAM has a positive effect on students' understanding of Islamic education can be seen from the learning outcomes produced by students before and after the implementation of the STEAM method in the madrasah.

Table 3. Results of increased student understanding

No.	School	Average Score Before STEAM Implementation	Average Score After STEAM Implementation
1.	Madrasah X	79	85
2.	Madrasah Y	77	80
3.	Madrasah Z	75	79

Table 3 shows an increase in students' understanding of Islamic education after the application of the STEAM method in madrasah. The score is generated through a written test given to students before and after the application of the STEAM method in Madrasah. So it can be concluded that with the application of the STEAM method, students' understanding can increase regarding Islamic education.

Table 4. Results of Interviews with Teachers and Students

No.	Madrasah	Benefit	Challenge	Strategy
1	Madrasah X	Better Understanding of Islam	Limitations Resources	Collaboration with External Institutions
2	Madrasah Y	Critical Thinking Skills	Intensive Curriculum Preparation	Training and Professional Development
3	Madrasah Z	Creativity and Problem Solving	Limited Understanding of	Partnering with the STEM Community

Table 4 shows the results of interviews with teachers and students in three madrasahs that apply the STEAM method. Madrasah X emphasizes the benefits of a better understanding of Islam but faces the challenge of limited resources. They overcome these challenges by collaborating with external agencies. Madrasah Y reveals the benefits of critical thinking skills but faces the challenges of intensive curriculum preparation. Therefore, they emphasize training and professional development for teachers. Madrasah Z highlights the benefits of creativity and problem-solving but faces the challenge of limited understanding of STEM. To address this, they are partnering with the STEM community.

Table 5. Document Analysis

No.	Madrasah	Learning	Teaching Materials	Related Documents
1	Madrasah X	Synchronized	STEAM-based Learning Modules and Islamic Religion	STEAM Method Development Plan
2	Madrasah Y	Integrated	STEAM Guidebook for Islamic Learning	Class Notes
3	Madrasah Z	Structured	Summary of the Concept of STEAM and its Application in Islam	Teaching Materials on the STEAM Approach

Table 5 presents the results of document analysis from three madrasahs that apply the STEAM method. Madrasah X shows an integrated learning plan between STEAM and Islam. They use STEAM-based learning modules and Islam as guidelines in the learning process. Madrasah Y has an integrated learning plan using a special STEAM guidebook for Islamic religious learning. In addition, they recorded class notes containing the application of the STEAM method in practice. Madrasah Y adopts a structured learning plan that provides a summary of STEAM concepts and their applications in an Islamic context. Teaching materials on the STEAM approach are also structured to increase students' understanding of this method.

The following is a content analysis in tabular form to clarify the results of research on the application of the STEAM method in learning in madrasah.

Table 6. Content Analysis

No.	Aspects	Findings
1	Interaction	There is an Increase in Interaction Between Teachers and Students in the Learning Process.
2	Technology	The Use of Technology such as Computers, Laptops, and Interactive Devices is Becoming More Integrated.
3	Activity	Student Activities are More Active and Involve Experiments, Projects, And Presentations.
4	Understanding	There is an Increase in Students' Understanding of Islamic Religious Teachings Through the STEAM Approach.
5	Critical Thinking	Students are trained in Critical Thinking Skills and can Analyze Better.
6	Creativeness	Students are Developed in the Ability to Think Creatively and Implement Innovative Solutions.

Table 6 the content analysis shows that the application of the STEAM method in learning in madrasah has a significant effect in several aspects (Heryati, 2023). First, there is an increase in interaction between teachers and students, which illustrates a more active involvement in the learning process. Furthermore, the use of technology is becoming more integrated in learning (Oktavian & Aldya, 2020), reflecting the adoption of a STEAM approach involving elements of technology. Student activity has also increased, with experiments, projects, and presentations becoming integral parts of learning (Septiani & Kasih, 2021).

In addition, the application of the STEAM method also has a positive impact on students' understanding of Islamic religious teachings (Budiyono et al., 2020). STEAM concepts are combined with religious material so that students can see the interrelationship between science and religious practice in relevant contexts. In addition, the STEAM method trains students in critical thinking skills (Fitriyah & Ramadani, 2021), so they can better analyze information and develop deeper

understanding. Students' ability to think creatively is also enhanced, enabling them to come up with innovative solutions in the context of Islam.

Overall, the content analysis shows that the application of the STEAM method in learning in madrasah contributes positively to important aspects, such as interaction, use of technology, student activities, religious understanding, critical thinking, and creativity (Nurhikmayati, 2019). This confirms the importance of integrating the STEAM approach in curriculum development and learning strategies in Madrasah to improve the quality of Islamic education (Wahyuni et al., 2020).

Discussion

The application of the STEAM method contributes positively to increasing students' understanding of Islamic education. By integrating STEM concepts into the context of Islamic religion, students can see a stronger connection between science and religious practice. They can understand how religious teachings can be applied in everyday life and in solving complex problems (Purnamasari et al., 2020).

Table 7. Percentage Increase in Student Understanding

No.	School	Average Score Before STEAM Implementation	Average Score After STEAM Implementation	Increase (%)
1.	Madrasah X	79	85	8%
2.	Madrasah Y	77	80	4%
3.	Madrasah Z	75	79	5%
Average				6%

Table 7 shows the percentage increase in students' understanding of Islamic education after the implementation of the STEAM method in madrasah. Based on the table above, it can be understood that the application of the STEAM method has a positive impact on students' understanding of Islamic education.

In addition, the STEAM method also has an impact on the development of students' critical thinking skills. Through this approach, students are invited to analyze, explore, and face problems systematically and logically (Maarang et al., 2023). They are trained to question, investigate, and formulate solutions based on religious knowledge and STEM principles. These critical thinking skills are important in helping students face real-world challenges and sharpen their ability to analyze information and make informed decisions (Davidi et al., 2021). Furthermore, the application of the STEAM method also encourages the development of student creativity. In the context of religious learning, students are invited to think out of the box and find innovative solutions. They are allowed to explore various ideas and approaches to understanding and applying religious teachings (Sari & Rahma, 2019). This helps students to be more creative in solving problems and conveying their understanding uniquely and engagingly (Lumbantobing & Azzahra, 2020).

In addition, the STEAM method also promotes collaboration between students (Pabubung, 2021). Through group projects and activities, students are invited to work together in completing tasks involving aspects of STEM and religious understanding (Zulirfan et al., 2021). They learn to listen to each other, share ideas, and build solutions together (Zubaidah, 2018). This collaboration not only improves students' social skills but also helps them understand the importance of cooperation in achieving common goals (Zainuddin, 2017; Fairuza, 2017). Finally, the application of the STEAM method in learning in madrasah provides long-term benefits in the development of Islamic education (Muyassaroh & Suyadi, 2020). By integrating STEM into religious education, madrasah (Shofiyati, 2018), can produce students who have a solid understanding of the Islamic religion as well as skills and knowledge relevant to the needs of the modern world. This helps students to become better prepared for future challenges and engage actively in innovative and sustainable community building.

CONCLUSION

Based on research, the application of the STEAM method in madrasah has contributed positively to students' understanding of Islamic education, with an increase of 6%. The integration

of STEM and Islamic religion helps students link science with religious practice, relevant to everyday life. The STEAM method also influences the development of students' critical thinking skills and creativity and encourages collaboration that improves social skills. However, the study had limitations, such as a focus on one madrasah and a lack of comparisons. Therefore, it is recommended that future research involve more madrasah, broaden the scope of the subject, and investigate the long-term impact in more depth to provide a stronger basis for the implementation of the STEAM method in the context of Islamic education.

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