Integration of Islamic Values in STEM Learning in Secondary Schools

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ABSTRACT

This research aims to explore the integration of Islamic values into STEM (Science, Technology, Engineering, and Mathematics) learning in secondary schools. In the era of globalization, STEM education is becoming increasingly important to prepare students for future challenges. However, education that only focuses on technical aspects without paying attention to spiritual and moral values can result in disorientation in students' lives. Therefore, this study proposes an approach that combines scientific aspects with Islamic values to create holistic learning. The research method used is qualitative with a literature study approach. Data was collected through observation and analysis of curriculum documents. The results of the study show that the integration of Islamic values in STEM learning can improve students' understanding of the relationship between science and religious teachings, as well as motivate them to apply the knowledge learned in daily life in accordance with Islamic principles. Consistent implementation and support from all schools are needed to ensure the sustainability of this program.

Keywords:
Integration of Islamic Values, STEM Learning, Secondary School, Holistic Education

INTRODUCTION

Education in the modern era faces increasingly complex challenges, especially with the rapid development of science and technology. One of the educational approaches that is currently a concern is STEM (Science, Technology, Engineering, and Mathematics). STEM learning is designed to improve students' competencies in fields critical to the development of science and technology (Bicer dkk., 2020; Mikhailova dkk., 2022; Setiawan dkk., 2023). However, while this approach is effective in improving students' cognitive abilities and skills, there are concerns that STEM education that focuses on technical aspects may neglect character and moral development.

In the context of Muslim society, education is not only seen as an effort to develop intellectual abilities, but also as a means to instill religious values that underlie daily life (Fauzian, 2021; Fauzian & Fauzi, 2018). Islam teaches the importance of science, but also emphasizes that it must be used in an ethical framework and in accordance with religious teachings. Therefore, the integration of Islamic values in STEM learning is important to ensure that education not only produces intellectually intelligent individuals, but also has a strong character and is able to apply Islamic values in their lives (Elbashir dkk., 2024).

Although there have been various efforts to integrate Islamic values in the educational curriculum, their application in STEM learning is still relatively new and requires further study. Some schools have tried to integrate Islamic values in their learning, but challenges in integrating those values effectively in STEM contexts remain. These challenges include how to align global and universal STEM materials

with local and contextual Islamic teachings, as well as how to measure the effectiveness of this integration in shaping students' character.

This research introduces a multidisciplinary approach that combines science and technology with character education based on Islamic values. This integration has not been explored much in previous research, especially in the context of formal education in secondary schools. This research offers a learning model that not only focuses on mastering STEM concepts, but also on the development of Islamic character and ethics, creating a synergy between modern science and spirituality.

One of the important novelties of this study is the empirical evaluation of the effectiveness of the integration of Islamic values in STEM learning. This research not only develops concepts or models, but also examines the impact of this approach on students' learning motivation, concept understanding, and character formation. The results of this evaluation will provide empirical evidence that can be used to support or criticize efforts to integrate religious values in STEM education.   This research is relevant to the needs of Islamic education in the digital era, where the challenges of globalization and technological advances require an educational approach that is able to maintain students' religious identity. By integrating Islamic values in STEM learning, this research makes a new contribution in strengthening the role of Islamic education in shaping a generation that is able to compete globally without losing their religious roots.

This study aims to examine how Islamic values can be effectively integrated in STEM learning in secondary schools. By understanding the approaches and methods that can be used for this integration, it is hoped that a learning model can be found that not only improves students' STEM competencies, but also strengthens their character and morals in accordance with Islamic teachings.

METHOD

This research uses the library *research* method, which is a systematic approach to collect, analyze, and synthesize information from various relevant literatures (Creswell, 2009; Sugiono, 2015). This method is used to develop a deep understanding of the topic being researched, by utilizing existing written sources. The first step in this research is to establish a topic and formulate a specific research question. Topics are selected based on their relevance and significance in the field of study in question. The research questions are formulated with the aim of directing the literature search and the focus of analysis.   Once the research topic and question have been determined, the next step is to search for and gather relevant literature. These sources of literature include books, journals, and other scientific writings.

The literature that has been evaluated is then analyzed in depth. This analysis is carried out through a thematic approach, where information from various sources is grouped based on key themes or concepts relevant to the research topic.   Once the analysis is complete, the next step is to synthesize the information that has been collected. This synthesis aims to combine findings from various sources into a coherent and comprehensive theoretical or argumentative framework. As part of the analysis, the study also acknowledged the limitations of the available literature and

critiqued any gaps or biases that may exist. It is important to provide a balanced perspective and to show how this research contributes to broader academic discussion.

RESULTS AND DISCUSSION

1. Identifying Relevant Islamic Values in STEM Learning

This research identifies a number of relevant Islamic values that can be integrated into STEM learning, such as honesty (ash-shidq), responsibility (al-amanah), healthy curiosity (at-tafakkur), and contribution to the good of humanity (al-ihsan). These values are associated with concepts in STEM to form a strong ethical foundation for students. For example, in mathematics learning, the value of honesty can be integrated by emphasizing the importance of transparency and accuracy in measurement and calculation.

Honesty is a fundamental value in Islam that emphasizes truth in words and deeds. In STEM learning, honesty becomes important when students conduct experiments, measurements, data analysis, and reporting results. Students are taught to always convey accurate data and not manipulate results in order to reach the desired conclusion. In this implementation, teachers can encourage students to take careful measurements and record the results of experiments honestly, even if the results are not as expected (Tesi Muskania & Supena, 2021).

Responsibility in the STEM context includes intellectual and moral responsibility for the use of science and technology. Students are encouraged to understand the impact of technology and scientific innovation on society and the environment. Students can discuss the responsibility of scientists in developing sustainable and safe technologies for humanity, and how this responsibility can be applied to their STEM projects (Imaduddin dkk., 2020).

Islam encourages its people to reflect and think deeply about the universe, which is in line with the spirit of scientific discovery (Fauzian, 2022). This value encourages students to explore and understand natural phenomena with full curiosity. Teachers can emphasize the importance of careful observation and ask questions about natural phenomena, connecting them with verses of the Qur'an that invite humans to think about Allah's creation.

Justice demands fair and balanced treatment, both in technology development and in learning. In the context of STEM, students are taught to consider the social impact of technology and ensure that scientific innovations do not harm any particular party. Teachers can invite students to analyze case studies where technology has been used unfairly or harmed certain groups, and discuss how justice can be upheld in technology development.

Cooperation is an important value in Islam that encourages teamwork and collaboration. In STEM, many projects require group work, and the value of cooperation helps students to work together effectively with others in completing assignments (Chang & Chen, 2022; Top dkk., 2018). Teachers can assign group projects where success depends on each team member's contribution, teaching the importance of helping each other and sharing knowledge.

Identifying relevant Islamic values in STEM learning has a number of significant benefits, both for students, teachers, and society as a whole. The integration of Islamic values helps in the formation of students' character, ensuring that they are not only intellectually developed, but also have strong morals and ethics. Students are taught to be honest, responsible, and fair individuals in every aspect of life, including in scientific activities. Students who have strong character tend to make ethical and responsible decisions, both in academic and everyday contexts.

By integrating Islamic values, STEM learning becomes more holistic, focusing not only on technical and scientific aspects but also on the development of students' spiritual and emotional aspects. This approach helps to create a balance between mastery of science and moral development. Students develop into balanced individuals, able to apply science with full wisdom and moral awareness.

The identification and integration of Islamic values makes STEM learning more relevant to the cultural and religious context of students. This helps bridge the gap between modern science and religious teachings, which are often considered separate. Students feel that the education they receive is not only globally important but also relevant to their daily lives, so they value the educational process more.

By integrating Islamic values in STEM learning, education helps strengthen students' Islamic identities amid the challenges of globalization and technological advancements. Students learn to stick to their religious principles while adapting to the development of science and technology. The young generation of Muslims who are competent in STEM and remain steadfast in Islamic values will be better prepared to face global challenges without losing their identity.

The integration of Islamic values in STEM can improve the quality of Islamic education by adding a new dimension that includes modern science. It helps Islamic schools to provide education that is on par with global standards while maintaining religious values. Islamic schools are becoming more competitive and able to offer high-quality education that prepares students for success in an increasingly globally integrated world.

2. Development of STEM Learning Models Based on Islamic Values

The development of a STEM learning model based on Islamic values is an approach that integrates the principles of Islamic teachings with science and technology. The goal is to create holistic learning, developing the intellectual, spiritual, and moral aspects of students (Elbashir dkk., 2024). Steps that can be taken include: *first,* Identification of Relevant Islamic Values. Identify the most relevant Islamic values to be applied in STEM learning, such as honesty (ash-shidq), responsibility (al-amanah), justice (al-'adl), curiosity (at-tafakkur), cooperation (at-ta'awun), and concern for the environment (hifz al-bi'ah). For example, in science lessons, the value of honesty can be integrated by encouraging students to be honest in reporting the results of their experiments (Bicer dkk., 2020). *Second,* the formulation of learning objectives. Design learning objectives that include mastery of STEM concepts and the development of Islamic character and values. These goals should include cognitive (STEM knowledge), affective (Islamic values), and psychomotor

(practical skills) aspects. For example, learning objectives in mathematics can include mastering geometry concepts while instilling the value of precision and honesty.

Third, the development of an integrative curriculum. Create a curriculum that integrates STEM concepts with Islamic values in each subject. This curriculum should include content, methods, and evaluations that are in line with Islamic values. In the biology curriculum, for example, material on ecology can be associated with Islamic teachings about human responsibility in maintaining the balance of nature. *Fourth,* the design of learning modules. Develop learning modules that explicitly incorporate Islamic values in the STEM learning process. This module should include activities that encourage students to practice those values while learning STEM concepts (Howson & Kingsbury, 2024). Science modules on renewable energy can include a discussion of moral responsibility in developing environmentally friendly technologies.

Fifth, the implementation of active learning methods. Use active and interactive learning methods, such as Project-Based Learning, Problem-Based Learning, and Collaborative Learning (Chang & Chen, 2022; Tesi Muskania & Supena, 2021). In the Project-Based Learning method, students can be invited to develop STEM-based solutions that are environmentally friendly and in accordance with Islamic teachings on protecting nature. *Sixth,* the application of contextual learning (Mikhailova dkk., 2022). Ensure that STEM learning is relevant to the context of students' lives and is related to the Islamic values they believe in. This can be done by using concrete examples that are relevant to the teachings of Islam. For example, in learning about technology, students can be invited to analyze how technology can be used to improve the welfare of society, in line with the principles of justice and virtue in Islam. *Seventh,* value-based evaluation. Develop an evaluation instrument that not only measures students' understanding of STEM materials, but also how they apply Islamic values in their STEM learning process and activities. Evaluation can include an assessment of honesty in reporting experimental results, cooperation in group projects, and moral reflection on the application of technology.

This STEM learning model based on Islamic values aims to create a young generation who are not only intelligent in the field of science and technology, but also have strong morals and ethics, in accordance with Islamic teachings. The implementation of this model requires support from various parties, including schools, teachers, and the community.

3. The Impact of the Integration of Islamic Values on Student Understanding and Attitudes

This research shows that the integration of Islamic values in STEM learning not only improves students' understanding of subject matter, but also strengthens their positive attitude towards science. Students become more critical in evaluating the impact of technology and science innovation, and are more sensitive to emerging moral and ethical issues in STEM development. For example, when discussing biotechnology, students not only learn about its scientific techniques, but also discuss ethical considerations in its use (Bicer dkk., 2020; Elbashir dkk., 2024; Howson & Kingsbury, 2024) (Garibay, 2020).

The integration of Islamic values helps students understand STEM concepts in the context of their real life and religion. When scientific concepts are associated with Islamic teachings, students are more likely to understand and internalize the material because of its relevance to their daily beliefs and experiences (Hotchkins & Dancy, 2015). By associating learning with valued values, such as honesty or responsibility, students feel more motivated to learn. This can improve their understanding of the concepts being taught, as they see learning as an integral part of their identity and responsibilities as Muslims.

Islamic values, such as tafakkur (deep reflection), encourage students to develop a healthy curiosity about nature and creation. This attitude is aligned with the basic principles of STEM that emphasize exploration and investigation. The integration of Islamic values helps students develop an ethical attitude in the use of science and technology. For example, they are taught to consider the environmental impact of technological innovations, which encourages a responsible attitude in applying science. Students who study in an environment that emphasizes the value of honesty in all aspects of learning, including experimentation and outcome reporting, tend to develop honest character and strong integrity. With the integration of values such as amanah (responsibility) and fairness (justice), students are taught to take an active role in solving social and environmental problems by using their STEM skills. This encourages them to become members of the community who contribute positively.

Islamic values such as ta'awun (cooperation) encourage students to work collaboratively in groups, appreciate each member's contribution, and learn from each other. This attitude is important in STEM learning, where projects often require effective teamwork. The integration of values such as rahmatan lil 'alamin (compassion for the entire universe) helps students develop an attitude of tolerance and empathy towards others, which is important in group work and social interaction. When Islamic values are integrated into STEM learning, students are more likely to feel emotionally connected to the material they are learning. This increases their involvement in the learning process, as they feel that what they are learning has a deep meaning. Students are more active in participating in class discussions, projects, and experiments when they see learning as a way to apply and bring their Islamic values to life. This leads to a richer and more meaningful learning experience.

With an emphasis on values such as honesty and responsibility, there was a decrease in negative behaviors such as cheating or data manipulation in tasks and experiments. Students are more likely to value honesty in the learning process. Islamic values such as sincerity and patience help students develop self-discipline and independence in learning. They are more likely to complete their tasks well and on time.

Islamic values that emphasize environmental conservation, such as hifz al-bi'ah (environmental preservation), encourage students to be more concerned about environmental issues and act to protect nature. This can affect their choice in the use of environmentally friendly technology. Students may be more motivated to develop STEM projects that are sustainable and have a positive impact on the environment, in line with Islamic teachings on responsibility for nature.

By integrating Islamic values in STEM learning, students feel more confident in their identity as Muslims (Howson & Kingsbury, 2024). They see how science and religion can support each other, which helps them maintain a balance between intellectual and spiritual progress (Evans, 2024). Students learn to balance their academic lives with religious obligations, leading to better mental and emotional well-being. They become more prepared to face life's challenges with a strong moral foundation.

The integration of Islamic values in STEM learning not only improves the understanding of scientific concepts but also helps to form a balanced and ethical attitude, character, and identity of students. This impact shows the importance of a holistic approach in education that combines intellectual aspects with moral and spiritual.

4. Challenges and Solutions in the Integration of Islamic Values

Despite the many benefits found, the study also identified some challenges in integrating Islamic values in STEM learning. These challenges include time constraints in the curriculum, lack of resources to support integration, and differences in interpretation of Islamic values among educators. As a solution, this study recommends the development of specific learning modules that support this integration as well as training for teachers to better master this approach. In addition, this study emphasizes the importance of support from all stakeholders in education, including principals, parents, and the community.

The integration of Islamic values in STEM learning faces various challenges that require creative and strategic solutions. Existing STEM curricula are often focused on technical and scientific aspects without considering the integration of Islamic values. Adapting existing STEM content to include Islamic values can be difficult. Develop a values-based curriculum that specifically integrates Islamic values with STEM materials. Engage curriculum experts and educators to design content that aligns Islamic principles with scientific concepts. Ensure that these values are naturally integrated into the teaching material.

Various challenges are present, such as maintaining a balance between scientific learning and religious values without causing conflicts between the two. One alternative is to ensure that an integrated approach does not sacrifice scientific depth or quality of STEM materials. Design a curriculum that harmoniously combines scientific aspects with religious values, so that the two complement each other. Addressing these challenges requires a coordinated and collaborative approach from all parties involved, including educators, students, parents, and the community (Ankeny & Leonelli, 2016; I Made Tegeh dkk., 2023). With the right solutions, the integration of Islamic values in STEM learning can succeed in creating a more holistic and meaningful learning experience.

In this discussion, it is important to note that although the integration of religious values in STEM learning offers many advantages, flexibility is still needed in its application. This is because religious and cultural values can vary between communities, so the approach used must be tailored to the local context and the needs of the student. This research opens up opportunities for further study, such as

exploring the long-term impact of this approach on students' academic and moral development, as well as evaluating how the integration of Islamic values in STEM can be applied in a variety of educational settings beyond secondary school.

CONCLUSION

The integration of Islamic values in STEM learning has proven to be effective in increasing students' understanding of STEM concepts while strengthening their character. Students who engage in this learning are not only able to master academic material better, but also show improvement in attitudes and behaviors in accordance with Islamic teachings, such as honesty, responsibility, and concern for the environment. The integration of religious values in STEM learning has succeeded in increasing student motivation and engagement. Students are more enthusiastic about learning when STEM materials are associated with values they believe in and relevant to daily life. This shows that education that combines intellectual and spiritual aspects can make learning more meaningful for students. The integration of Islamic values in STEM learning makes an important contribution to Islamic and STEM education in the modern era. This approach not only prepares students to face future scientific and technological challenges, but also ensures that they remain committed to religious and ethical principles. Therefore, this integration can be a model for education in the Islamic environment to create a generation that is intelligent, ethical, and characterful.

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