

STEAM Approach and Qur'anic Values in Enhancing Environmental Awareness of Students at MA Pesantren Modern Tebuireng Bintan

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Abstract. The decline of environmental character among students can be addressed through the integration of Islamic values into the learning process. An effective and meaningful approach, such as STEAM (Science, Technology, Engineering, Arts, and Mathematics) combined with Qur'anic values, can motivate students to strengthen their environmental character. This study aims to examine the effectiveness of integrating Qur'anic values into STEAM learning as an effort to increase environmental awareness among students at MA Pesantren Modern Tebuireng Bintan. One of the Qur'anic values emphasized is the importance of preserving nature as taught in Surah Al-Baqarah: 205, which highlights the importance of preventing damage to the earth. The method used in this research is a quantitative approach with a descriptive design. The sample consisted of 30 students randomly selected from the total population. Data was collected through questionnaires, observation sheets, and interviews with teachers, and analyzed using descriptive statistical techniques. The results showed that the integration of Qur'anic values in STEAM learning significantly improved students' understanding of STEAM concepts and increased their awareness of environmental conservation.

1 Introduction

Education at Madrasah Aliyah (MA) Pondok Pesantren Tebuireng Bintan is increasingly challenged by the need to adapt to 21st-century demands, which necessitate a shift from traditional methods to a more integrative approach like the STEAM model. This model not only enhances academic skills but also emphasizes character and religious values, aligned with the institution's core goals [1,2]. Requires rethinking pedagogical strategies to effectively prepare students for future challenges [3, 4]. This model not only focuses on academic skill development but also incorporates character and religious values, which are essential aspects of Madrasah Aliyah (MA) Pondok Pesantren Tebuireng Bintan.

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Education plays a significant role in shaping students' character and competencies in today's globalized era, where new challenges and opportunities continually arise. It not only instills academic knowledge but also cultivates essential life skills such as critical thinking, communication, and cooperation [5]. Education is a conscious endeavor aimed at advancing the nation's intelligence; through education, young generations are expected to grow into intelligent, skilled individuals with devotion to God Almighty [6]. The globalization of education emphasizes the importance of standards and accountability, as countries strive to improve their educational systems to compete internationally [7]. Through the educational process, students not only acquire academic knowledge but are also trained to develop essential life skills such as critical thinking, communication, and cooperation [8]. Education in Indonesia today is amid the Fourth Industrial Revolution, marked by rapid technological developments, especially in communication and internet networking; this revolution affects various aspects of life, including education, demanding changes in teaching methods and approaches [9]. The quality of education in Indonesia currently faces serious challenges, one of which is the low competency of teachers in terms of both pedagogy and scientific knowledge [10]. Thus, addressing these challenges is crucial to developing a skilled and competent workforce capable of navigating the complexities of modern society.

In the educational context, innovative learning approaches are needed to increase student engagement and prepare them to face the complexities of the modern world. Globalization, technological advancements, and economic dynamics have become dominant factors influencing changes in the educational system [11]. In this increasingly dynamic global era, the education sector must adapt to the latest developments to ensure students acquire skills and knowledge relevant to global demands [12]. Facing the globally competitive information era, students must be equipped with the abilities to survive and thrive in increasingly complex work environments, including critical thinking, adaptability, and collaboration skills with individuals from diverse backgrounds [13]. An effective and inclusive education system plays a crucial role in ensuring every individual has equal opportunities to develop their potential [14]. Innovative strategies are essential to ensure that education not only keeps up with technological developments but also embraces diversity within society [15].

Many schools in Indonesia still ignore the importance of innovative learning approaches in their curricula, resulting in students' lack of motivation to learn. This issue is exacerbated by the relevance and quality of educational curricula that often do not align with the current needs and challenges [16]. In this increasingly complex world, students require learning methods that can enhance critical thinking, creativity, and collaboration skills [17]. Although the STEAM approach has been recognized as an effective approach, its application in various educational institutions, including pesantren, remains very limited. The integration of Qur'anic values in learning is often overlooked in educational practice, preventing students from maximizing the benefits of both approaches. At Pesantren Tebuireng Bintan, there has been no specific research analyzing the impact of implementing a STEAM approach integrated with Qur'anic values on students' understanding and skills. Without comprehensive research, concerns remain that students may not develop the critical and creative thinking skills needed in the modern world due to a lack of holistic teaching that integrates both spiritual and academic values.

The integration of Science, Technology, Engineering, Arts, and Mathematics (STEAM) into Environmental Education at Pesantren shows a shift in current pedagogical perspectives. This combined relationship not only aligns with Islamic culture in the pursuit of knowledge but also equips students with critical skills required for this century, in which people live in a complex, technology-driven world. Teaching quality is an essential element influencing cognitive and non-cognitive development [11]. A student-centered approach in teaching and learning can significantly impact learning engagement and outcomes [12]. One student-centered approach is STEAM, an acronym for Science, Technology, Engineering, Art, and Mathematics [14]. STEAM teaching and learning methods will promote 21st-century literacy skills, allowing students to face the challenges of globalization and engage in modern sciences [21].

The STEAM model is designed to unite the five disciplines of science, technology, engineering, arts, and mathematics in a holistic learning approach. This concept supports more contextual and integrated learning, enabling students to apply their knowledge and skills in real-life situations [22]. The application of the STEAM model at MA allows the integration of religious and moral aspects in the learning process, thereby supporting the development of students' character alongside the enhancement of their academic abilities [23].

Integrating Qur'anic values in education not only strengthens students' academic understanding but also instills moral and ethical principles that guide everyday decision-making. Principles and teachings based on the Qur'an and Hadith become the foundation for shaping students' morality in the school environment [24]. By embedding Qur'anic values in education, it is expected that students will not only excel academically but also possess strong character and high ethical standards [25]. This integration is particularly important in the pesantren context, where Qur'anic values can serve as a moral foundation for students [26].

This study aims to explore how the STEAM approach integrated with Qur'anic values can enhance students' environmental awareness at MA Pesantren Modern Tebuireng Bintan through a learning approach that instills religious values alongside the development of relevant scientific and technical skills.

2 Methodology

This study employs a quantitative research design with a descriptive approach. The population consists of 224 students at MA Pesantren Modern Tebuireng Bintan. A sample of 30 students was selected randomly using simple random sampling. The instruments used include questionnaires and observation sheets to collect data related to students' understanding of STEAM concepts and Qur'anic values. Research has shown that students often perceive a permeable boundary between science and religious education, indicating that a cross-disciplinary approach can enhance understanding [27]. Furthermore, the relationship between religiosity and moral reasoning has been shown to influence students' prosocial behavior, suggesting that values derived from religious teachings can play a significant role in shaping students' ethical framework [28]. The data collected were analyzed using descriptive statistical methods to provide a comprehensive depiction of the results.

The research was conducted in three stages: preparation, implementation, and evaluation. During the preparation stage, learning materials integrated with the STEAM approach and Qur'anic values were prepared and validated by experts. In the implementation phase, the teaching was carried out over six weeks with six sessions, each focusing on a different theme. Observations on student interactions and teaching-learning activities were systematically conducted to evaluate the effectiveness of the applied method. The evaluation was carried out through quantitative data analysis obtained from questionnaires distributed after the teaching sessions.

After collecting the data, an analysis was conducted to identify the impact of the STEAM approach on students' understanding. The results indicated a significant improvement in students' comprehension of science, technology, engineering, art, and mathematics concepts. The correlation between Qur'anic values and learning outcomes was also assessed to provide a clear picture of the success in integrating these two aspects. Using statistical analysis methods, relationships among variables were identified and explained. This study aims to contribute to the development of a more holistic and integrated education in Islamic schools.

3 Results and Discussion

The results indicate that the application of the STEAM approach integrated with Qur'anic values positively impacted the environmental awareness of students at MA Pesantren Modern Tebuireng Bintan. Based on the questionnaire results, 85% of students stated that STEAM-based learning facilitated their understanding of the connection between science and the obligation to care for nature, as taught by Qur'anic values. Specifically, 80% of students felt motivated to care more for the environment, both at school and at home, after exposure to learning that linked scientific concepts with religious teachings. This educational model aligns with Islamic teachings that emphasize ecological responsibility and sustainability, fostering a holistic understanding of environmental issues [29]. The following matrix supports these findings by detailing the percentage of students' understanding of environmental aspects, such as ecological responsibility, the importance of conservation, and eco-friendly practices. Observational results further showed that students also displayed increased participation in environmentally-related activities, such as recycling practices and energy-saving, which they learned throughout the learning process.

Further observational data revealed a unique finding: students tended to be more enthusiastic about practical activities that involve direct interaction with nature than with theoretical activities. This was evident in higher participation rates in activities such as recycling projects and monitoring environmental conditions around the school. Integrating practical activities involving nature significantly increased students' engagement and environmental awareness, as evidenced by the higher participation rates in initiatives such as recycling projects and environmental monitoring [30]. The research also found that students previously less interested in science became more motivated after understanding that these sciences align with their religious teachings. These findings indicate that the integration of Qur'anic values not only helps improve environmental awareness but also strengthens students' academic interests, especially in science subjects. Therefore, the

integration of the STEAM approach and Qur’anic values has proven effective in shaping students' environmentally conscious character and deepening the connection between scientific knowledge and the religious values they believe in.

Table 1. The percentage of students' understanding of environmental aspects

Assessment Aspects	% of Students Understanding	Information
Ecological Responsibility	85%	Increasing understanding of the mandate to protect nature
The Importance of Conservation	80%	Motivation to preserve the environment
Green Practices	75%	Recycling and energy saving activities
The Relationship between Science and Religious Values	85%	Connecting the concept of science with Qur'anic values

4 Conclusion

This study concludes that the STEAM approach integrated with Qur’anic values is effective in increasing the environmental awareness of students at MA Pesantren Modern Tebuireng Bintan. This integration not only deepens students' understanding of science and environmental concepts but also instills moral and religious values that strengthen their motivation to care for nature as a form of trust. The questionnaire and observation results show significant improvements in students’ understanding and participation in eco-friendly practices, particularly in practice-based activities such as recycling and energy conservation. Moreover, students previously less interested in science exhibited greater interest when scientific materials were linked to Qur’anic values. Thus, this approach can serve as a holistic learning model that not only develops cognitive aspects but also shapes students' character and strong environmental awareness. It is hoped that this research can serve as a basis for developing learning programs that integrate science and spiritual values for more meaningful and relevant education in the future.

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