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Analysis of Student Perceptions Regarding the Implementation of the STEM-Quran Approach to Science Subject in Junior High School

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Abstract

STEM (Science, Technology, Engineering, and Mathematics) education has been widely recognized as an effective approach to improve science and technology literacy among students. However, the integration of STEM with Quranic values (STEM-Quran) is a relatively new concept and has not been widely researched. This study aims to determine students' perceptions related to the application of the STEM-Quran approach in science subjects. The quantitative method and a descriptive survey used in this study. The sampling technique using random techniques obtained 80 students from a junior high school in Sidoarjo, Indonesia. The instrument used was a questionnaire of student perceptions related to the application of the STEM-Quran approach in science subjects. Data analysis techniques using descriptive statistical tests with the TCR (Respondent Achievement Rate) method. Based on the results of data analysis, it is concluded that the perceptions of students towards the STEM-Quran approach are generally in the good category. The STEM-Quran approach in schools that have not implemented it is a step forward that has the potential to improve the quality of education, implement a more effective approach, and integrate spiritual and academic aspects in science learning, thereby improving students' learning experiences and outcomes.

Keywords: Perceptions, STEM-Quran, Student

INTRODUCTION

A learning model can be understood as a series of events that include the process and technical steps to be followed to achieve the objectives of the learning process and outcomes. The effectiveness of this learning model depends on the time, location and context of the subject (Karim & Indonesia, n.d.). One of the approaches in the learning model is Science, Technology, Engineering, and Mathematics (STEM), which is then expanded with the addition of “Arts” so that it is known as STEAM (Trivena & Langi, 2021). STEM is an integrated learning approach that incorporates real-world applications through classroom learning activities and covers four disciplines: Science, Technology, Engineering, and Mathematics (Burta, 2018). This approach focuses on combining knowledge and skills in science, technology, engineering, and mathematics to solve problems, with an application-oriented interdisciplinary approach (Suprapto, 2016).

The application of the STEM (Science, Technology, Engineering, and Mathematics) approach in education focuses not only on improving academic achievement, but also on developing student character, especially when moral values contained in religious teachings are included. As stated by Choi and Lee (2020), “STEM education plays an important role in improving academic performance as well as shaping student character, especially when

associated with moral values in the learning process." This shows that education does not only aim to improve academic knowledge, but also to shape individuals who have integrity and a strong understanding of ethics. Moreover, the incorporation of arts in STEM, known as STEAM, allows for a more holistic approach to education, integrating creativity and critical thinking in problem solving (Islam & Islam, 2021). By adding an element of art, STEAM encourages students to think more creatively and innovatively, which is crucial in facing complex challenges in the real world. Koh and Lee (2019) add that "Integrating spirituality in science education helps students to view the natural world scientifically as well as spiritually reflective, offering a more integrated approach to learning". This underscores the importance of the balance between scientific and spiritual aspects in students' personal development, encouraging them to see the connection between science and their faith. Similarly, Mueller and Yang (2020) state that "STEM education can increase students' engagement and academic achievement, especially when they are given opportunities to collaborate and apply their learning to real-world problems."

In this context, collaboration and application of knowledge in real-world situations help students not only understand the theory, but also practical skills that they can apply in their daily lives. The integration of religious values in science education also has a positive impact, as expressed by Norris and Phillips (2018), "Integrating faith-based learning in science education not only enriches students' understanding of scientific concepts, but also aligns them with broader moral and ethical frameworks." This shows that by combining science and faith, students can build a more holistic and moral perspective on learning. Rahim and Azman (2021) also argued that "The integration of Quranic teachings in science education can enhance students' understanding of scientific principles while strengthening their spiritual connection with the universe." This suggests that the teachings of the Quran not only provide scientific insights, but also deepen students' understanding of their relationship with God and His creation. In addition, Rohmawati and Wulandari (2022) added that "STEM-Quran integration can encourage the development of critical thinking and provide students with a balanced perspective, which links scientific exploration with spiritual understanding." This approach invites students to not only explore scientific phenomena but also to reflect on the deeper meaning of God's creation. Samsudin and Ibrahim (2020) also explain that "Quranic verses in the context of STEM education encourage students to see scientific phenomena as signs of divine wisdom, which in turn encourages deeper and more reflective learning." In this case, education not only teaches science, but also introduces students to the greatness of God reflected in the laws of nature. Research by Yulianto and Susanto (2022) shows that

“The integration of STEM and Quranic learning provides students with a comprehensive education, encompassing intellectual growth and spiritual development.” Thus, students are not only intelligent in scientific fields, but also spiritually developed, creating a more whole individual. Finally, Zainuddin and Hassan (2019) state that “By incorporating Islamic principles in STEM education, students are encouraged to pursue science not only for intellectual achievement, but also for the benefit of society in accordance with their faith.” This underscores the main goal of STEM-Quran education, which is to create a generation that is not only knowledgeable but also plays an active role in social progress in accordance with religious values.

Some researchers describe STEM as an approach that connects several subjects to create a problem-based learning process that is relevant to everyday life. Therefore, STEM is often used in learning because it allows students to apply the knowledge taught in school in real-world situations. Research shows that the STEM approach can improve students' academic and non-academic abilities (Lou et al., 2011). Early introduction to STEM aims to increase students' interest in the field. When STEM is applied in learning, students' ability to acquire knowledge, apply knowledge to solve problems, and enhance their creativity to explore new things also increases. These skills are essential to prepare students for the challenges in STEM fields as well as being relevant to the ever-evolving world of work. The integration of these skills in learning can prepare individuals for competent and innovative problem solving (Pasca & Waluya, 2024).

One of the Indonesian government's efforts to cover all subjects in the curriculum, including science, is to aim at improving students' morals and character as reflected in their learning activities. Therefore, synergy between science and religion is needed to improve the character of students. Religious studies in education can have a positive impact, especially in shaping students' attitudes (Asysyifa, Sopyan, & Masturi, 2017). Quran-based learning is easy to implement and fun, so it can help achieve learning objectives well (Yasyakur, 2017). The goal of science education in Indonesia is to help students believe in a rational and precise creative order, as well as the majesty of God Almighty. This is because the Quran is full of verses that invite humanity to contemplate the power and glory of God, such as the creation of the heavens, the earth, and other natural events that take turns (Lathif, Sudarmin, & Hartono, 2019). Research by (Schmidt-Wilk, Heaton, and Steingard, 2000) offers a model that teachers can use to understand & teach spirituality, which focuses on the transcendent awareness of “pure spirituality” derived from the universe and the human mind, and provides evidence of students' emotional, cognitive, and moral development. Looking at the phenomenon in

Indonesian society, the Q (Quran) dimension should be included in STEM learning. Modern education integrates the Quran and science with two main goals: spiritual and moral development and intellectual power (Harahap, 2018). The Quran is a source of knowledge that covers all aspects of life. However, the synergy between the Quran and science has not been given enough attention in the field of education. Given the rapid development of technology and science, the future of education will be very interesting, with the hope of producing thinkers who have a higher level of spirituality. Therefore, the STEM approach can be integrated with verses from the Quran, known as STEM-Quran. The integration of STEM with the Quran links the material with verses of the Quran, so that what Allah has created in this world is meaningful to humans, which in turn fosters gratitude to Allah SWT for all His blessings.

The use of the STEM-Quran approach is still relatively low, as evidenced by the small number of schools that apply it, due to lack of socialization and training, limited resources, as well as inadequate teaching materials and resistance to change. Science requires the ability to use scientific methods of inquiry, which includes determining the evidence needed to answer scientific questions and recognizing problems that can be solved through scientific inquiry integrated with verses from the Quran. The aim of this approach is to uncover the mathematical phenomena contained in God's verses and the motivation behind the mathematical quest to understand God's verses in the universe. The Quran and science are interconnected, so this integration can be conveyed to students when studying science in the classroom (Zamista, Sari, Deswita, & Asrar, 2022).

Based on observations made at a junior high school in Sidoarjo, Indonesia, this school has implemented the STEM-Quran approach in science learning. The implementation of STEM-Quran in this school aims to create a comprehensive educational environment, where students not only develop in the field of science and technology, but also have a deep understanding of religious teachings and strong morality. This STEM-Quran approach is used in science learning through P5 activities, which provides a foundation for education that focuses not only on academic aspects, but also on character development, creativity, social skills, and readiness to face rapid technological developments. It is hoped that this approach can create a generation that is ready to face future challenges. a junior high school in Sidoarjo, Indonesia received socialization on the STEM-Quran approach in theory and practice, which was then implemented in grades VII, VIII, and IX in P5 activities.

The importance of learning based on the STEM-Quran approach, especially in science learning, certainly raises different perceptions. Students' perceptions of the future are

important as they enable educators and policy makers to build relevant curricula and guide career guidance. Overall gaining insight into students' perceptions of the future enables the adoption of relevant and effective approaches in supporting their development and preparation. According to constructivist theory, perception is a fairly active way of linking the processes of evaluation, interpretation and organization. Perception is the end result of the relationship between a stimulus and the observer's assumptions, expectations and internal knowledge (Démuth, 2012). Perception involves the interpretation of objects, symbols, and people from individual or group experiences. Realizing a view or evaluation of a result of learning or experience that invites a person to interact and act with the environment (Puspita & Ridwan, 2017). The various perspectives of individuals towards various environmental phenomena are called perceptions. Previous studies found that 52% of students strongly agreed and agreed with STEM education and modern skills (Widad, 2020). Izzah researchers provide empirical evidence supporting the importance of paying attention to student perceptions in designing and implementing STEM-based learning approaches, positive perceptions can strengthen the effectiveness of STEM learning in improving students' knowledge, skills and attitudes (Izzah, 2021). For this reason, perception is the last step in deciding or interpreting something. Therefore, student perceptions play an important role in how students perceive the implementation of STEM-Quran. Through the STEM-Quran approach, the five aspects are needed together to solve factual problems critically and creatively, during science learning, to create cohesive and active learning. From the background explanation presented, the application of science learning through the STEM-Q approach assisted by science Quran verses needs to be carried out at a junior high school in Sidoarjo, Indonesia which in theory can improve student skills.

Previous research shows that the application of the STEM approach in learning has a positive impact on students' academic and non-academic skills. Lou et al., (2011) stated that the STEM approach can improve problem-solving skills, creativity, and the ability to collaborate among students. However, although the STEM approach has been widely applied, the integration between STEM and religious education, particularly the Quran, is still very rare in educational literature. A number of studies have also revealed the importance of integrating spiritual values in science learning. Asysyifa et al., (2017) argued that the integration of science with religion can strengthen students' character and help them interpret the creation of the universe more deeply. Harahap (2018) also mentioned that education that combines science and spirituality will prepare a generation that is not only intellectually intelligent but also has high morals and ethics. However, despite the recognition of the

importance of combining academic and spiritual aspects in learning, the practical application of the STEM-Quran approach in Indonesian schools is still very limited. Based on observations made in several schools, the STEM-Quran approach has not been widely applied, especially in science learning. This is the basis of the gap in this study, which aims to explore students' perceptions of the application of STEM-Quran in science learning at a junior high school in Sidoarjo, Indonesia, and provide recommendations for the development of a more integrative curriculum.

METHOD

This study used a quantitative approach and employed a descriptive survey as its technique. The study utilized 530 junior high school students at a junior high school in Sidoarjo, Indonesia. A sample of 80 students was used through random sampling.

This study used a questionnaire of students perceptions of the application of the STEM-Quran approach in science subjects. A survey also known as a questionnaire is a data collection technique in which each person is asked to fill out a series of written questions, this method allows each person to fill in the data based on their own choices and without pressure from other parties (Borrego, 2021). Furthermore, it can be analyzed so as to obtain information. This questionnaire consists of 24 items created and absorbed from Suprapto's journal (Suprapto, 2016), covering four important concepts in the STEM-Qur'an approach, namely Science (S), Technology (T), Engineering (E), Mathematics (M) and Al-Qur'an (Q). The scoring in the questionnaire uses a Likert scale. The Likert scale is used to measure the perceptions, attitudes, or opinions of a person or group about an event or phenomenon. The scoring in the questionnaire with 5 answer options is in Table 1.

Table 1. Questionnaire Scale Categories

Positive Statement	Score
Strongly Disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly Agree	5

Where the higher the score indicates the greater the attitude towards the (STEM-Quran) approach. Through the validation process to check the content validity, the instrument can be declared fit for use for students. In this research activity, data was collected through an online survey. In the online survey, the questionnaire was distributed online with the link of the questionnaire shared through WhatsApp group with the help of science teachers. This ensured that all participants voluntarily took part and responded to the questionnaire. At the beginning

of the survey, students were given an understanding of the purpose of this study and the purpose of the questionnaire. In the questionnaire, the author only addressed the purpose of investigating students' perceptions regarding the application of the STEM-Quran approach. There are five concepts used in this study, namely by describing the level of junior high school students' perceptions of the attitudes of Science (S), Technology (T), Engineering (E), Mathematics (M) and the Quran (Quran) or called STEM-Quran. In this case, students' perception of STEM-Quran is measured by looking at their percentage when answering the statements on the questionnaire. After obtaining the data, the next step is to process it. The Likert scale questionnaire data processing used Microsoft Excel. Furthermore, quantitative data from this study was collected and processed using descriptive statistics using IBM SPSS Statistics. The method used to determine the respondents' level of achievement on Table 2.

Table 2. TCR Classification

Number	Percentage of Achievement (%)	Criteria
1	85 - 100	Very Good
2	66 - 84	Good
3	51 - 65	Fair
4	36 - 50	Less Good
5	0 - 35	Not Good

(Sugiyono, 2012).

RESULTS AND DISCUSSION

The results of the study in the form of questionnaire data about statements and answers regarding student perceptions related to the application of the STEM-Quran approach in science subjects used to analyze student perceptions of the STEM-Quran approach is very good or not good in helping to increase the effectiveness of STEM learning, motivate students to explore STEM fields, and support the development of more effective educational programs and policies in this area. Based on the results of the analysis of the IBM SPSS Statistics program according to descriptive analysis can provide an overview of the distribution and general characteristics of the data obtained from the STEM-Quran questionnaire can be seen in Table 3.

Table 3. Assessment Table of Students Perception of the Quran Items

Category	Item	Perception Value (%)	Description
AlQuran	Exploring students understanding of the Quran, including integrating Quranic verses related to science.	92	Very Good
	Use of Quranic verses to motivate learning		
	Relevance of Quranic teachings to science materials		

This item received excellent student perceptions, with the highest score among all categories. This shows that students have a very positive understanding and assessment of the integration of Quranic verses in STEM learning. This is in line with Novianti Muspiroh's research saying that Islamic values can be integrated into science education and its impact on student understanding (Islam, Muspiroh, & Islam, n.d.). According to Mughal and Kundi (2021) reviewed the perspective of Islamic education on STEM and provided a comparative analysis between traditional STEM education systems and those based on Islamic values. They showed that faith-based STEM education has great potential in improving the quality of STEM education with an approach that is more integrated with religious values. Most likely, this high value is due to the strong relevance of science materials to Quranic verses that make students feel more connected and motivated. This integration may provide deep meaning and inspire students, increasing their interest and understanding of the material. Table 4 shows the Assessment Table of Students Perception of the Technology Items

Table 4. Assessment Table of Students Perception of the Technology Items

Category	Item	Perception Value (%)	Description
Technology	Use of technology in learning	84.4375	Good
	Students ability to use software related to STEM		
	Effectiveness of technology in supporting STEM concept understanding		
	Technology as a tool to solve STEM problems		

Students' perceptions of technology were very good. Students feel technology is used effectively in learning. Technology used in STEM learning may be perceived as a tool that helps and enriches the learning experience. Supported by Rahmaniar & Latip (2021), it is said that the use of technology in secondary education and technology can improve students skills in the STEM field (Rahmaniar & Latip, 2021). The use of innovative and relevant technology in learning may increase student engagement and facilitate understanding of concepts.

Table 5. Assessment Table of Students Perception of the STEM-Quran Items

Category	Item	Perception Value (%)	Description
STEM-Quran	Integration of science, technology, engineering, and mathematics with the Quran	80.625	Good
	Students creativity in using the STEM-Quran approach		
	Impact of the STEM-Quran approach on understanding STEM materials		
	Use of STEM-Quran concepts in completing projects		

This score indicates that students' perceptions of the STEM-Quran approach ere also good. The integration of STEM with the Quran is likely to be well received by students, and they feel the benefits of an approach that combines science with religious values. This is in line with Nur and Nugraha's research saying that the effectiveness of STEM programs in improving student achievement and examining factors that contribute to the success of STEM programs (Nur & Nugraha, 2023). Students may feel that this approach provides a more holistic and relevant view of learning.

Table 6. Assessment Table of Students Perception of the Science Items

Category	Item	Perception Value (%)	Description
Science	Understanding of scientific concepts	80.3125	Good
	Relevance of science to the material being taught		
	Application of scientific principles in daily life		

Students' perceptions of science as part of STEM learning were also good. Students may feel that scientific concepts are taught clearly and applicatively, although not as high as technology or the Quran. According to Sastrika, in using a project-based learning model, it is necessary to consider the suitability of the subject matter with students' thinking abilities, which affects students' understanding of scientific concepts and their attitudes towards science (Ayu et al., 2013). The quality of good science learning and the relevance of science materials in everyday life may be the main factors.

Table 7. Assessment Table of Students Perception of the Mathematics Items

Category	Item	Perception Value (%)	Description

Mathematics	Understanding of mathematical concepts	73.375	Good
	Relevance of mathematics in daily life		
	Integration of mathematics with science and technology		

Perception of mathematics is below science, but still in the good category. Although students may appreciate the importance of mathematics in STEM learning, they may feel that mathematical concepts are not taught in the same inspiring or relevant way as science or technology. Understanding of basic mathematical concepts can be improved and their relevance in the context of STEM education. Using real-world problems as a context for students to learn (Ariandi, 2014). Teaching methods or applications of mathematics in the context of STEM learning may need to be improved to improve student perceptions.

Table 8. Assessment Table of Students Perception of the Engineering Items

Category	Item	Perception Value (%)	Description
Engineering	Basic understanding of engineering principles	72.8125	Good
	Application of engineering in STEM projects		
	Creativity in designing engineering solutions		

Students' perceptions of engineering were the lowest among the other categories, but still in the good category. Students may feel that engineering concepts or applications are less clear or in-depth than other fields. Low engineering skills among students need to be improved because these skills are essential to preparing students for the challenges of the 21st century. By improving engineering skills, students will be better prepared to face the challenges and take advantage of the opportunities that exist in the 21st century, both in their personal and professional lives (Jaya et al., 2023). It is possible that the engineering material taught is not motivating enough or not applicable enough for students, or perhaps the teaching techniques used need to be improved to increase student understanding and engagement.

Overall, the average student perception is categorized as good (80.6%), with the Quran receiving an excellent rating. This aligns with the research by Khan and Abbas (2022), which examines how religious texts, such as the Quran, can influence STEM education within the context of Muslim societies. The study shows that integrating religious texts into STEM education can strengthen students' connection to knowledge and create a deeper understanding of the relationship between science and religion. The differences in perception

indicate that aspects that are more integrated and relevant to students' values, such as the Quran and technology, tend to receive higher ratings compared to other areas that may require improvement in teaching methods or application relevance. The findings support the theory that integrating religious education and science can enhance students' interest and understanding. According to integrative education theory, linking science with religious values can create a more meaningful and relevant learning context for students (Rahmawati et al., 2022). These findings are consistent with a holistic approach to education that emphasizes the development of all aspects of the human being, both intellectual and spiritual.

The majority of students showed an increase in understanding and motivation through the STEM-Quran approach. This result aligns with the integrative education theory, which states that connecting science with religious values can enhance students interest and understanding. Students perceptions of the STEM-Quran approach, assessed from the aspects of science, technology, engineering, mathematics, and Quranic verses, indicate that most students have a positive perception of all these aspects. The highest percentage is found in the integration of Quranic verses, which can enhance their motivation. The majority of students showed positive perceptions toward all the aspects examined.

In the science aspect, students feel that the concepts taught align with Quranic values, which helps their understanding. In mathematics, the integration of Quranic values makes the material more interesting, although some students feel that the difficulty level has increased. The engineering aspect shows that this approach helps students see the practical applications of the theories they learn, even though some students feel that the material has become more complex. In the technology aspect, students feel supported in applying technology ethically, although its impact on their understanding of technology is not very significant. Overall, the integration of Quranic verses enhances students motivation to learn.

Learning through the STEM-Quran approach can be perceived differently by different students. The first step in using the STEM-Quran approach to improve the quality of teaching is to identify students opinions on STEM-Quran education. Students learning perceptions are an important part of knowledge in education (Rahmawati et al., 2022). Students who have negative views toward STEM tend to avoid STEM education (Muhammad & Noor Ibrahim, 2021).

Students perceptions of STEM subjects based on the Quran provide valuable insights into how the integration of science, technology, engineering, and mathematics (STEM) with the teachings of the Quran affects students perspectives and understanding. Based on the results of the student perception questionnaire, students showed great interest in science

lessons. With the STEM-Quran approach and the support of Quranic verses related to science, students felt that science has a strong connection with religious knowledge.

The research conducted by Sumarni et al., (2020) shows that the relationship between STEM and religion increases students interest in science education. In line with this, Barak (2017) shows that integrating science education with religious beliefs can create a more meaningful context for students in understanding knowledge, as well as enhance their interest and understanding. Implementing learning by practicing the integration of science and Islam reflects the essence of non-academic activities. Therefore, incorporating the Quran into science education can have a wide and profound positive impact, both at the individual and societal levels, if done correctly.

CONCLUSION

Based on the results of the research and discussion in this study, we conclude that the perceptions of students towards the STEM-Quran approach (Science, Technology, Engineering, Mathematic, and the Quran) can be concluded that it is generally in the good category. Exploring students' perceptions of the application of the Quran-based STEM approach has great potential to bring positive changes in the world of education, both in terms of learning quality and student character development. Despite the limitations, teachers and students are still eager to apply the STEM-Quran approach in learning. Therefore, this approach is expected to be applied in science learning in schools that have not used the STEM-Quran approach. The data obtained from this study may be further developed to design more effective learning development programs, especially in integrating STEM-Quran.

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