ThufuLA: Jurnal Inovasi Pendidikan Guru Raudhatul Athfal
Volume 12 issue 2, 2024
http://dx.doi.org/10.21043/thufula.v12i2. 28796
https://journal.iainkudus.ac.id/index.php/thufula
p-ISSN 2355-0163 | e-ISSN 2502-3845

INTEGRATING ISLAMIC VALUES INTO STEM EDUCATION: PERSPECTIVES FROM IN-SERVICE AND PRE-SERVICE EARLY CHILDHOOD EDUCATORS

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Abstract: *This study investigates the perceptions of in-service and pre-service early childhood educators regarding the integration of Islamic values into STEM (Science, Technology, Engineering, Mathematics) education and explores the potential development of these values within this framework. Utilizing a qualitative research design and purposive sampling, the study engaged 11 in-service teachers and 13 pre-service teachers from early childhood education (ECE) programs. Data were collected through semi-structured interviews and analysed using Braun and Clarke's six-phase approach to thematic analysis. This approach facilitated the identification of key themes, including the necessity of integrating Islamic values into STEM curricula, particularly the principles of Tawhid (Islamic monotheism), moral teachings, scholarly perspectives, and references from the Quran and Hadith. Participants emphasized the importance of Islamic symbols and identity in shaping STEM education for young children. The findings reveal diverse strategies for embedding these values within STEM subjects, utilizing pedagogical methods such as contextualized teaching, problem-based learning, and the incorporation of Islamic narratives. The analysis also highlighted challenges, such as limited resources and the need for educator training in integrating religious content into STEM. The study is limited by its small sample size and the specific cultural context of the participants, which may not fully represent the broader experiences of early childhood educators.*

Keywords: *Early Childhood Education, Islam, Religion, STEM, Teacher Perception*

A. Introduction

The rapid evolution of society's needs, driven by technological advancements and scientific discoveries, has led to the emergence of new professions that demand specialized skills. In recent years, the link between economic development and a skilled workforce in Science, Technology, Engineering, and Mathematics (STEM) fields has strengthened significantly. Consequently, STEM-related careers have been recognized as critical drivers for a nation's economic growth and global competitiveness (Langdon et al., 2011; Podobnik et al., 2020; Salzman & Douglas, 2022).

Looking ahead to the next 15-20 years, when current preschool-aged children reach the stage of making career decisions, the landscape of employment is projected to transform, with many jobs requiring STEM-related skills and expertise (Baranyai et al., 2016). Despite this, previous research highlights a concerning decline in students' interest in STEM during their secondary education years (Thomas & Watters, 2015). This trend, coupled with the growing demand for STEM knowledge and skills, underscores the necessity for educational systems to adapt their curricula and teaching methods to better engage students with STEM subjects from an early age. However, in countries like Indonesia, where STEM education is still emerging, the integration of Islamic values into STEM education has not been explored in-depth, creating a research gap that this study seeks to address.

Early childhood (EC) STEM education posits that the integration of STEM disciplines should begin in the early stages of education to cultivate foundational skills and foster interest. However, this is not a straightforward task, as effective STEM education for young children also involves fostering inquiry skills and cognitive development. Young children learn through play and integrated activities, where they apply knowledge from their experiences to new situations. From birth, they start exploring their world and are introduced to STEM ideas, knowledge, and skills. Multiple studies have consistently demonstrated the importance of initiating STEM education at the preschool level, emphasizing its pivotal role in fostering key cognitive and problem-solving skills (Mcclure, 2017; Milford & Tippett, 2015). High-quality early childhood education (ECE) that incorporates STEM has been increasingly recognized as a key driver for advancing educational outcomes

for all children (Brenneman et al., 2019). Research further shows that high-quality ECE environments, when combined with STEM learning, contribute significantly to children's later academic achievements (Watts et al., 2014). For example, in a study by Brenneman et al. (2019), early exposure to STEM significantly boosted problem-solving skills and critical thinking among young learners, indicating the long-term benefits of integrating STEM at the preschool level.

Teachers are a fundamental component of education, serving as the primary agents in the delivery and success of learning (Juhji, 2016). In the context of Indonesia, despite the global advancements in STEM education, the adoption of STEM practices within Islamic educational settings has been notably limited. This is evident in the scarce implementation of STEM across various levels of the Indonesian education system (Anjarsari, 2019), as well as the relatively low number of teachers incorporating STEM into their teaching (Nurhikmayati, 2019). Specifically, research by Anjarsari (2019) indicates that while awareness of STEM is growing, there is a lack of teacher training and resources to effectively implement STEM curricula in Islamic schools, particularly at the ECE level. Given the significance of religious and cultural values in Indonesia, integrating Islamic principles into STEM education could present a strategic opportunity to enhance the relevance and appeal of STEM in Islamic schools. The integration of Islamic values is a critical issue within the Indonesian Islamic education system, spanning primary, secondary, and tertiary education, and aligns with the National Religious Research Agenda (ARKAN) 2018-2028, as published by the Ministry of Religious Affairs (Keputusan Direktur Jenderal Pendidikan Islam No. 6994, 2018).

However, before developing a framework for integrating Islamic values into STEM curricula, it is essential to understand the perceptions of in-service and pre-service teachers, as their attitudes and beliefs directly influence how STEM education is delivered in EC settings. Teachers play a pivotal role in shaping educational practices, and their perspectives are vital for ensuring the successful incorporation of religious values into educational initiatives. There have been no empirical studies in Indonesia that explore the intersection between Islamic values and STEM in ECE from the perspective of teachers and pre-service teachers,

making this study a novel contribution to the field.

This study aims to explore the perceptions of in-service and pre-service teachers regarding the integration of Islamic values into STEM education in ECE settings and to identify which Islamic values they believe can be effectively incorporated into STEM teaching in ECE. By focusing on teachers and pre-service teachers, who serve as key agents in the education system, this research will provide valuable insights into how STEM education can be adapted to meet both educational and cultural needs in Indonesian Islamic educational institutions.

B. Method

This study employs a qualitative research approach, focusing on the perceptions of in-service and pre-service ECE teachers regarding the integration of Islamic values into STEM education. The qualitative approach is well-suited for exploring complex phenomena such as educational practices and teacher perceptions, allowing for in-depth insights and an understanding of the subject matter.

Participant

Participants in this study were selected through purposive sampling, a non-probability sampling technique that enables the researcher to choose participants who are most likely to provide relevant and rich data. The selection criteria for in-service teachers included having a minimum of five years of teaching experience in ECE. Additionally, these teachers were required to be employed at schools that implement an Islamic-based curriculum, ensuring their familiarity with both Islamic values and STEM education. Furthermore, they were expected to possess at least a bachelor's degree in education or a related field.

For pre-service teachers, the study involved students currently enrolled in EC teacher education or Islamic ECE programs at the undergraduate level. These students needed to have an active enrolment status during the data collection period, ensuring that their perspectives were relevant and up-to-date. 11 in-service teacher and 13-pre-service teacher involved in this study. The researcher determined this sample size based on the work of (Guest et al., 2006), who found that thematic saturation was reached by the twelfth interview in their study.

Data Collection

The primary method of data collection was semi-structured interviews. This interview format allows for a flexible exchange, enabling the researcher to delve deeper into specific areas of interest while also allowing participants the freedom to express their views in their own words. Online interviews were conducted to gain deeper insights into the perceptions and strategies of in-service and pre-service teachers regarding the integration of Islamic values into EC STEM education.

Data Analysis

The data collected through interviews were analysed using thematic analysis, guided by the six-phase process outlined by Clarke & Braun (2013): (1) Initially, the researcher became thoroughly familiar with the data by reading and re-reading the interview transcripts. This familiarisation process was crucial for developing an in-depth understanding of the content. (2) Following familiarisation, initial codes were generated by identifying significant features of the data relevant to the perception of participants regarding the integration of Islamic values into EC STEM education and their strategies. This phase involved systematically applying labels to segments of data that appeared meaningful. (3) The codes were then grouped into broader themes that captured the essence of the data in relation to the research objectives. These themes represent patterns of meaning that recur across the data set. (4) The themes were subsequently reviewed and refined to ensure they accurately reflected the data. This involved checking the themes against the coded data and the entire data set to ensure coherence. (5) Once the themes were finalized, they were clearly defined and named, ensuring each theme was distinct and provided a clear narrative of the data. (6) The final phase involved writing up the themes in a coherent and systematic manner, ensuring that the analysis was clear, concise, and logically presented.

The data analysis process was supported by NVivo, a qualitative data analysis software that facilitates the management and organization of large data sets. NVivo was used to store, organize, and retrieve data, as well as to aid in the coding process. This software was instrumental in handling the complexity of the data and ensuring that the analysis was rigorous and systematic.

Throughout the analysis, initial codes were modified or grouped into broader themes as the researcher refined their understanding of the data. The final themes were then clearly summarized to provide a comprehensive overview of the findings. Each sub-theme is presented and discussed in detail in the results and discussion sections of this article.

C. Result and Discussion

This study covers two research themes: 1) Perceptions of in-service and pre-rervice teachers regarding the integration of islamic values in STEM content for ECE; and 2) Strategies for integrating Islamic values within STEM content.

Theme 1: Perceptions of In-Service and Pre-Service Teachers Regarding the Integration of Islamic Values in STEM Content for ECE

Rationale for Integrating Islamic Values in STEM Education

The study reveals a strong consensus among both in-service and pre-service teachers on the importance of integrating Islamic values into STEM education for EC settings. In-service teachers expressed a clear recognition of the need for such integration, citing that the current approach to combining Islamic values with STEM is often suboptimal. They pointed out that many educators lack sufficient knowledge of STEM, which hinders effective integration. Furthermore, they noted that incorporating Islamic values into STEM lessons can make the content more engaging, meaningful, and easier for young children to grasp. This approach also provides a holistic learning experience, balancing cognitive and affective domains while fostering critical and higher-order thinking skills. Additionally, teachers emphasized that integrating Islamic values helps in shaping Islamic character, promoting *akhlaq al-karimah* (noble character), and nurturing an understanding of the Creator, which they view as essential components of early education.

> By applying STEM learning and integrating it with Islam, children can benefit from both aspects within a single learning concept. For example, in science education, not only can children explore and understand the world around them, but they can also learn about its Creator.
>
> (IT7, interview, zoom)

Pre-service teachers similarly recognized the importance of integrating Islamic values into STEM education, highlighting several key reasons. They emphasized that children should develop problem-solving skills, imagination, and creativity, which are crucial for their overall growth. Additionally, pre-service teachers believed that integrating Islamic values not only enhances children's Islamic knowledge but also strengthens their *aqidah* (Islamic creed), which they see as foundational for spiritual development. The flexibility of Islamic values allows for seamless integration with STEM content, enabling children to analyse problems from multiple perspectives, including scientific, technological, artistic, and mathematical, while also considering Islamic principles. Moreover, pre-service teachers stressed the importance of cultivating spiritual knowledge in children, helping them develop a rational understanding of Islam, particularly in relation to *ayat-ayat kauniyah* (verses of the universe).

> Because by using more enjoyable learning methods and incorporating Islamic values, children not only gain broader knowledge, but also, when they enjoy the learning process, the Islamic values embedded in STEM education are more easily accepted. Instilling these values is crucial, especially when we start from an early age.
>
> (PT3, interview, zoom)

Both in-service and pre-service teachers demonstrated a strong understanding of the need to integrate Islamic values with STEM in ECE. This aligns with findings from other studies, such as Gloria (2016) and Rofi'ah (2020), which indicate that educators are increasingly capable of describing and implementing such integration in their teaching practices. Specifically, research by Hakim et al., (2021) reveals that nearly 50% of teachers are already familiar with the concept of Islamic integration in subjects like Mathematics, Environment, Technology, Art, Literacy, and Science, and over 50% believe that this integration is suitable for ECE.

Additional studies, such as those by Safitri et al., (2020), demonstrate that teachers have successfully integrated Islamic

values with mathematics and technology, though these studies were conducted outside the EC context. Sahil et al., (2024) further highlight that a majority of teachers see the integration of the Islamic worldview into science classes as a process of creating interconnectedness, where Islamic values and scientific concepts are united into a cohesive whole. Some educators equate this integration with holistic learning, suggesting that it should involve multiple subjects to provide a meaningful learning experience for students. Sahil et al., (2024) also found that teachers perceive the actualization of Islamic values in education as a manifestation of both vertical and horizontal obedience within the context of Islamic schools.

Outside the STEM context, Afendi et al., (2022) reported that teachers are already capable of integrating Islamic values into general ECE. This indicates a broader trend of educators embracing Islamic integration in various educational contexts, further supporting the relevance of integrating Islamic values with STEM.

When focusing on pre-service teachers, the findings resonate with Brooks (2019), who explored pre-service teachers' experiences in teaching religion within a history curriculum. Brooks (2019) found that pre-service teachers often faced fears, worries, and concerns when addressing religious content. They recognized their personal religious identities and experiences as significant factors influencing their teaching practices. Additionally, these candidates identified several aspects of their internships as crucial in supporting their efforts to teach religious content. These insights suggest that while pre-service teachers are aware of the importance of integrating Islamic values into STEM, they may also experience similar challenges, such as anxiety and the need for adequate support during their training.

Integration of Tawhid in STEM Education

The findings indicate a shared belief among both in-service and pre-service teachers on the importance of incorporating *tawhid* (the concept of the oneness of God) into STEM education. In-service teachers emphasized that integrating *tawhid* allows children to become familiar with their religion, recognize the existence of Allah, understand the pillars of Islam, and cultivate good character traits such as gratitude and righteousness. They see

this integration as essential for developing a balanced education that aligns cognitive learning with spiritual and moral growth.

> By applying STEM education, a child not only learns about the world but also understands who created it and the process of creation. In this way, children also learn about Tawhid through the STEM process.
>
> (IT6, interview, zoom)

Pre-service teachers, on the other hand, highlighted that integrating *tawhid* into STEM learning makes education more engaging, active, and enjoyable. They believe that exploring children's curiosity through the lens of *tawhid* not only fosters a deep sense of curiosity but also helps in internalizing the concept of *tawhid*, instilling piety from an early age, and cultivating good morals and gratitude.

> Just as in science, we can integrate Islamic values by highlighting Allah's creations and the wonders of the universe.
>
> (PT8, interview, zoom)

This perspective aligns with Maresca (2024), who argues that schools and teachers can successfully integrate spirituality and science education. With proper guidance and practical examples from various faith traditions, religious education can illustrate the compatibility of faith and science, fostering a holistic approach that enriches both spiritual and intellectual development.

Emphasizing Moral Values in STEM Learning

Both in-service and pre-service teachers recognize the critical need to emphasize moral values within STEM education. In-service teachers argue that teaching moral values through STEM is essential for helping children distinguish between right and wrong, which can be reinforced by referencing *hadith* (prophetic traditions). They believe that this approach helps children develop good character traits, respect for knowledge, and a sense of environmental stewardship. Additionally, they stress the importance of prioritizing ethics over mere acquisition of knowledge, promoting positive social interactions, empathy, creativity, and educational engagement.

> ……so that children can apply good moral values in their daily lives.
>
> (IT1, interview, zoom)

Pre-service teachers also emphasize the importance of building a strong behavioural foundation for children. They advocate for concretizing moral lessons within the context of children's everyday lives, which they believe helps in nurturing good character and ethical behaviour.

> It is essential because STEM education is a form of realistic learning that children will consistently encounter and engage with. By embedding moral values into STEM education, children will learn the appropriate behaviors to adopt. They will be able to distinguish between right and wrong actions, which will influence their daily conduct. This approach encourages children to reflect on their decisions and consider the implications of their actions.
>
> (PT12, interview, zoom)

This view is supported by Sahil et al. (2024), who found that integrating Islamic values in science education offers multiple benefits. Their study shows that educators agree that the goal of integrating science and Islam is to produce students with a balanced intellectual, emotional, spiritual, and physical development rooted in faith in Allah. The moral values derived from Islam and the Quranic approach have a significant influence on students' morality, making the integration of Islamic values in science classes not only effective but also attractive. Science teachers in their study emphasize the importance of grounding scientific facts in relevant arguments, which strengthens students' perspectives and moral reasoning.

The Role of Ulama (Islamic Scholars) in STEM Education

In-service teachers expressed the importance of incorporating the views of Islamic scholars in STEM education. They believe that introducing children to prominent Islamic figures and role models helps them understand the foundations of Islamic law, recognize scholars as sources of knowledge, and develop critical

thinking skills. Teachers also highlighted that Islamic scholars are well-versed in local contexts, which makes their teachings more relatable and easier for students to understand. They argued that scholars can offer religious concepts and values that are adaptable to local cultures, thereby making the lessons more impactful.

> It's important to incorporate the views of scholars in STEM education to help children distinguish cause and effect, solve problems, and develop critical thinking skills.
>
> (IT4, interview, zoom)

Pre-service teachers also see the value in referring to the opinions of Islamic scholars in STEM education. They view scholars as heirs to the prophets, whose guidance can help determine the correctness of various matters and serve as a reinforcement for students, providing a religious perspective on scientific issues.

These insights are consistent with research that highlights the effectiveness of linking local cultural contexts with Islamic values in education, particularly within schools and madrasahs (Mansir, 2023). Such integration fosters a more profound connection between students and the Islamic principles being taught, allowing for a more nuanced understanding of the material (Mansir, 2023).

The Integration of the Quran and Hadith in STEM Education

The findings underscore the teachers' belief in the importance of integrating the Quran and *hadith* into STEM education. In-service teachers emphasized that introducing children to the holy scriptures of Islam is crucial for familiarizing them with their religious teachings, understanding the concept of divine reward, and applying Islamic principles in daily life. They see the Quran and *hadith* as essential sources of knowledge and guidance, which should be central to any educational curriculum.

> Because it will serve as a strong foundation for their thought process on any given matter.
>
> (IT7, interview, zoom)

Pre-service teachers echoed these sentiments, stating that the Quran and *hadith* serve as the primary moral, ethical, and spiritual foundations for children. They believe that integrating these texts

into STEM education helps instil a love for the Quran in children, guiding them to recognize, understand, appreciate, and ultimately embody the teachings of Islam. This integration also fosters *taqwa* (piety) and encourages children to develop noble character traits in their daily lives.

> The Qur'an and Hadith serve as essential guides in the lives of humans, especially for Muslims. Upon deeper reflection, one can find numerous verses from Allah that implicitly explain various aspects of knowledge. However, some verses require further study to fully grasp their meaning related to scientific understanding. Therefore, I believe it is important because within the Qur'an and Hadith, there are divine messages from Allah that hold profound significance for human life.
>
> (PT7, interview, zoom)

Research by (Rofi'ah (2020) in a school in Jember, Indonesia, supports these findings. Her study noted that the school used the Quran and *hadith* as sources of knowledge, linking verses of the Quran with science lessons, including Mathematics and Life Sciences. Although this program was implemented outside regular school hours and involved a collaboration between religious and science teachers, it highlights the potential of integrating Islamic teachings with STEM subjects. Similarly, Jamaludin et al. (2022) demonstrated the integration of life sciences with the Quran and *hadith*, noting that this approach also influenced the affective domain, nurturing attributes such as belief, admiration, humility, gratitude, motivation, and self-awareness.

Reasons for Integrating Islamic Symbols and Identity in STEM Learning

In-service teachers highlighted the significance of integrating Islamic symbols and identity into STEM education. They believe that this integration helps inculcate Islamic values, enhances children's knowledge of their religion, and makes the learning experience more engaging. They also argued that such integration

stimulates various aspects of early childhood development and reinforces the child's identity as a Muslim, fostering a sense of gratitude for the knowledge bestowed by Allah SWT.

Pre-service teachers also emphasized the importance of children recognizing and taking pride in their Islamic identity. They believe that integrating Islamic symbols in STEM education can help children develop a strong sense of belonging and foster a deep love for their Creator.

Research by Bujuri (2024) supports the idea that Islamic symbols and identity can be integrated thematically into teaching materials. The study found that teacher argumentation plays a crucial role in this process. Additionally, Park et al. (2022) explored the use of argumentation in both science and religious education. Their findings revealed that teachers recognized the value of argumentation in their subjects, although there were variations in how they applied instructional strategies to achieve their lesson goals. The study highlights the different understandings and implementations of argumentation as both a disciplinary practice and an instructional objective in science and religious education.

Strategies for Integrating Islamic Philosophical Values in STEM Education

In-service teachers proposed several strategies for integrating Islamic philosophical values into STEM education. These include designing integrated lessons that combine STEM with Islamic values, based on teachings from the Quran and *hadith.* Teachers suggested that students should learn to recognize, understand, appreciate, and embody Islamic teachings through activities such as meaningful play, engaging science experiments, prayer and Quran recitation, and storytelling that illustrates moral lessons. Additionally, teachers emphasized the importance of collaboration with other educators to ensure the successful implementation of these integrated lessons.

Pre-service teachers also proposed various methods, including storytelling, providing examples to children, using concrete and relatable learning experiences, and linking the oneness of Allah with STEM concepts. They suggested hands-on projects that relate directly to real-life experiences, which can help children appreciate the wonders of Allah's creation.

The importance of collaboration in implementing these strategies is confirmed by Chan and Erduran (2023), who found that teacher collaboration significantly impacted their understanding of argumentation and teaching methods. Their study noted that science teachers, in particular, showed greater changes in their appreciation for student participation and the role of argumentation in fostering scientific reasoning when they worked collaboratively with their peers.

In general, the first theme of this research is visualised in the following figure:

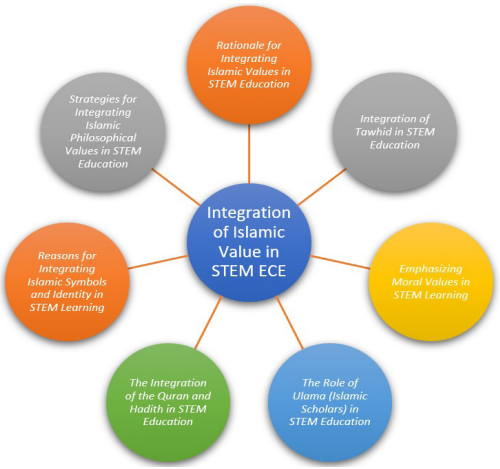

Figure 1. Visualization of Teachers' Perceptions Regarding the Integration of Islamic Values into STEM Content in ECE

Theme 2: Strategies for integrating Islamic values within STEM content.

Integrating Islamic Values in Early Childhood Science

In-service teachers emphasized integrating Islamic values into science content by developing lesson plans and activities that align with Islamic teachings. These activities include introducing natural phenomena as signs of God's creation, exploring the environment, and familiarizing children with significant figures in Islamic history. They also focus on collecting data, identifying relationships and patterns, and generating explanations and ideas

based on evidence. The teachers guide children in observing, identifying changes, and understanding their role in environmental stewardship through an Islamic lens.

> By introducing God's power, for example, through natural phenomena occurring around them.
>
> (IT4, interview, zoom)

Pre-service teachers, on the other hand, highlighted integrating Islamic values through play-based learning and the planning of simple science activities. They also emphasized modelling scientific activities and reinforcing Islamic values within these activities. For instance, they suggested incorporating Quranic verses or *Hadiths* into science lessons to introduce the concept of God's creation, using natural materials, linking Islamic themes with scientific concepts, and fostering compassion towards all of God's creations, such as feeding animals and watering plants.

> Science education often utilizes natural materials, making it easier to introduce Islamic values by highlighting Allah's creations and instilling the principles of Tawhid (the oneness of God).
>
> (PT9, interview, zoom)

The findings align with the study by Billingsley et al. (2013), which revealed minimal collaboration between science and religious education in the curriculum. Although the science curriculum does not explicitly mention religion, science teachers acknowledged the influence of students' religious beliefs on their teaching approaches. Religious education teachers struggled to ensure students were aware of various perspectives on the relationship between science and religion. Furthermore, Erduran (2020) highlighted the need for professional development for teachers to address complex arguments that encompass both scientific and religious education content. Novis-Deutsch & Lifshitz (2016) also found that, despite the challenges, most teachers successfully integrated science and religion, either by adopting a "deficit perspective" and seeing themselves as academic gatekeepers or by fostering cross-cultural dialogue through a "diversity as a resource" perspective.

Integrating Islamic Values in Technology

In-service teachers described integrating Islamic values into technology content by encouraging the development of skills based on children's needs, interests, and ideas, using pre-prepared tools and materials. They also emphasized creating lesson plans and activities that incorporate Islamic teachings. Teachers introduced Islamic figures using technology, allowing children to recognize tools and objects from their surroundings as God's creations (e.g., loose-part media). Additionally, they integrated Islamic values into STEM by teaching concepts of good and bad, *halal* and *haram*, and using various social media platforms to explore Islamic history or by watching Islamic-themed animated films.

Pre-service teachers proposed integrating Islamic values by creating simple technologies to complete tasks or projects, utilizing existing technology infused with Islamic principles, and engaging in play-based learning. They also suggested incorporating Quranic verses or *Hadiths*, along with stories from the Prophet's time and his companions, into technology lessons. Other methods included using video content or games that integrate Islamic values, introducing places of worship or Islamic symbols through PowerPoint presentations, and creating Islamic-themed content to enhance children's understanding of technology within an Islamic framework. Research by Jawaz & Hanif (2024) supports the integration of technology in religious education, highlighting its potential to enhance learning quality by building more complex knowledge structures, developing students' competencies, and fostering collaboration among students.

Integrating Islamic Values in Early Childhood Engineering Concept

In-service teachers discussed integrating Islamic values into engineering content by stimulating children to learn with wisdom and objectivity. They introduced basic engineering concepts, explained the use of technology in play-based learning, and provided information on how technology is created by humans. For example, children could build a mosque replica using Lego, house blocks, or recycled cardboard, learning about the mosque's functions and parts, as well as related prayers (e.g., entering and

exiting the mosque). Other activities included building models of cars or other objects using blocks, Legos, or cardboard, and conducting learning sessions via video or Zoom.

Pre-service teachers suggested using educational tools embedded with Islamic values, planning simple engineering activities, and connecting Quranic verses or *Hadiths* with engineering projects. They also emphasized instilling values of order and precision in following prescribed steps.

> Planning simple technology-based activities for young children involves several steps. First, prepare the necessary materials and tools to be used in the activity. Then, demonstrate the technology-related task to the children, guiding them through the process. Once the children have completed the activity, the teacher reinforces the use of technology and integrates Islamic values into the discussion, emphasizing how these values are reflected in the activity.
>
> (PT6, interview, zoom)

Integrating Islamic Values in Early Mathematics

In-service teachers integrated Islamic values into mathematics content to help children think symbolically. They introduced mathematical concepts such as quantity (how much or how many), structure (shape), space (angles and distance), patterns, and numbers, linking these to the recognition of God's existence. Children were encouraged to apply reasoning in decision-making processes. For example, they learned about charity (sadaqah) by comparing who is most deserving, understanding the concepts of more or less in the context of giving, and learning the Five Pillars of Islam and the Articles of Faith. Other activities included learning Arabic numerals through play, counting body parts or senses created by God, and understanding the Hijri calendar and its calculations based on Islamic teachings. Tasks such as creating Arabic numbers using loose parts were also incorporated.

> Introducing the concept of charity by helping children compare and determine who is more in need of receiving it.
>
> (IT8, interview, zoom)

Pre-service teachers emphasized that planning simple mathematics activities for young children should involve Quranic verses or *Hadiths,* teaching honesty and integrity in numerical tasks, such as not altering quantities dishonestly. They also highlighted the importance of instilling Islamic values during the introduction of mathematical concepts. Ahmad et al. (2019) underscored that successful integration of Islamic knowledge with mathematics education necessitates a sound understanding of scientific concepts, ensuring that the integration is both meaningful and accurate.

In general, the second theme of this research is illustrated in the following figure:

Figure 2. Visualization of Strategies for Integrating Islamic Values into STEM Content

D. Conclusion

This study reveals diverse perceptions among in-service and pre-service teachers regarding the integration of Islamic values into STEM education in EC settings. Both groups of educators acknowledge the necessity of embedding elements of *Tawhid* (the Islamic concept of monotheism), moral values, the opinions of Islamic scholars, and references to the Quran and Hadith. They also emphasize the importance of incorporating Islamic symbols and identity into the STEM curriculum.

The findings illustrate various approaches to integrating

Islamic philosophical values into STEM content across science, technology, engineering, and mathematics. These approaches include a range of instructional methods that align with Islamic principles. The novelty of this study lies in its exploration of how Islamic values, which are deeply rooted in religious and cultural contexts, can be systematically integrated into STEM education at the EC level. While previous research has primarily focused on STEM education in secular contexts or at higher educational levels, this study provides new insights by bridging religious education and STEM for young learners. This represents a significant contribution, especially for Islamic educational settings, where such integration has not been extensively explored.

Moreover, this research is one of the few that investigates both in-service and pre-service teachers' perceptions of Islamic values within STEM education, offering a dual perspective that enhances understanding of potential pedagogical approaches. By addressing the integration of Islamic values specifically in EC STEM education, the study opens up new pathways for developing curricula that balance modern scientific and technological education with foundational religious teachings.

However, the study's limitations, including the small sample size, suggest a need for further research with a larger participant base to enhance the generalizability of the findings. Future studies should consider a more comprehensive selection of participants, including variations in the quality of ECE institutions and the qualifications of teachers involved.

Based on these findings, it is recommended that future research focus on the development of models and strategies for integrating Islamic values into STEM education at the EC level. Additionally, there is a need for increased support for EC educators and pre-service teachers in developing their skills and understanding of both STEM education and the integration of Islamic values. This support is crucial for fostering effective and meaningful integration of these values within the STEM curriculum.

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