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Islamic Ethics as the Foundation for Science and Technology Education in Elementary Schools: A Case Study at SDN Paduran Sebangau 2

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ABSTRACT

This study aims to analyze how Islamic ethics are operationalized as the foundation of science and technology education at SDN Paduran Sebangau 2. This study employs a qualitative approach using an intrinsic case study design through in-depth interviews, participatory observation, and analysis of learning documents. Informants included the school principal, classroom teachers, Islamic education teachers, and upper-grade students. Data analysis was conducted thematically using source and method triangulation to ensure the credibility of the findings. The results indicate that Islamic ethics are systematically integrated from the lesson planning stage, actualized in STEM pedagogical practices, internalized into students' digital ethical awareness, transmitted through teachers' exemplary behavior, and reinforced by the school culture. Values such as trustworthiness, honesty, responsibility, and the common good are translated into concrete pedagogical indicators in the use of technology in the classroom. These findings affirm a shift from a value-neutral STEM learning paradigm toward value-driven learning, where science and technology are understood as tools for character development. This study contributes theoretically to the integration of Islamic ethics, character education, and digital citizenship, and practically demonstrates an implementable model of value-based STEM education in elementary schools.

1. INTRODUCTION

Advances in science and technology (S&T) have significantly transformed various aspects of human life, including education. The integration of digital technology into learning has expanded students' access to information, communication, and knowledge development from an early age. However, technological advancement is not always accompanied by the strengthening of ethical and moral dimensions in educational practice (UNESCO, 2021; OECD, 2019). This imbalance has contributed to various problems such as the misuse of digital technology, weak digital ethics, cyberbullying, plagiarism, and declining student character, including at the elementary school level. Elementary school students today are increasingly exposed to digital devices and internet-based learning environments before they possess sufficient ethical maturity in using technology responsibly (Livingstone, 2018). Previous studies indicate that digital literacy without moral guidance may encourage unethical behaviour in technology use (Ribble, 2021; Vallor, 2016). Therefore, elementary education is not only required to develop students' technological competence but also to cultivate ethical awareness and responsible digital behaviour from an early age. Within the perspective of Islamic education, science and technology are not viewed as value-free, but should be guided by moral responsibility and social benefit (Al-Attas, 1995; Nasr, 1996). Islamic education places character formation as a central goal of the learning process, where values such as honesty, responsibility, trustworthiness (*amanah*), discipline, and self-control are integrated into educational practices (Halstead, 2004). These values are highly

relevant in guiding students' interactions with technology in the digital era. Several previous studies have emphasized the importance of integrating Islamic values into science and technology education. Abdullah (2017) explains that Islamic education has the potential to integrate faith, knowledge, and ethical responsibility within modern learning contexts. Hashim and Langgulung (2008) also argue that scientific development in schools should not be separated from moral and spiritual values. More recent studies further strengthen this argument. Pranoto & Haryanto (2024) found that Islamic education contributes to shaping ethical digital citizenship through values such as honesty, responsibility, and verification in digital activities. Similarly, Hatija et al. (2025) reported that integrative learning based on Islamic values supports more ethical student behaviour in the use of technology. Reza et al. (2025) also emphasized that digital ethics education should begin at the elementary school level through habituation and supervised digital practices.

Studies focusing on elementary education additionally highlight the importance of value-based learning in shaping students' digital behaviour. Berkowitz and Bier (2005) explain that character education is most effective when integrated into classroom activities and school culture from an early age. Livingstone (2018) further stresses that children's ethical awareness in digital spaces develops through guided educational experiences and teacher supervision. In line with this, Djazilan et al. (2024) argue that the integration of digital literacy, artificial intelligence, and character education in elementary schools must be accompanied by ethical guidance so that students are able to use technology responsibly. Rosilah et al. (2025) also found that responsible AI literacy in elementary education contributes to students' moral awareness and digital self-control. Despite the growing discussion regarding Islamic ethics and digital education, most previous studies remain conceptual and theoretical. Empirical studies examining how Islamic ethical values are operationalized in STEM learning practices are still limited. In particular, research focusing on public elementary schools remains minimal, especially studies investigating how teachers integrate Islamic ethics into classroom instruction, how these values are practiced in everyday digital learning activities, and how they influence students' attitudes toward technology use. This research gap highlights the need for empirical studies exploring the practical implementation of Islamic ethics in elementary STEM education. Therefore, this study investigates how Islamic ethical values are integrated into science and technology learning at SDN Paduran Sebangau 2, how teachers apply these values in classroom practices, and how they contribute to students' digital ethical awareness. This study is expected to contribute theoretically to the development of value-based STEM education and practically to the design of ethical and character-oriented technology learning in elementary schools.

2. METHODS

This study employed a qualitative approach with an intrinsic case study design to gain an in-depth understanding of how Islamic ethics serve as a foundation for science and technology education in elementary schools. A case study design was selected because it enables researchers to investigate phenomena contextually within real-life settings (Creswell & Poth, 2018; Yin, 2018). The research was conducted at SDN Paduran Sebangau 2, which was purposively selected because the school integrates character education, religious values, and technology use in classroom learning (Patton, 2015). Research participants consisted of the school principal, classroom teachers, Islamic Religious Education teachers, and upper-grade students (Grades IV-VI) who were directly involved in STEM learning activities and character education practices. Informants were selected purposively based on their roles and experiences related to the implementation of Islamic ethics in science and technology learning. The total number of informants in this study was 12 participants. Data collection was conducted until the information obtained became repetitive and no new themes emerged, indicating data saturation (Guest et al., 2006).

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Table 1. Research Informants

No	Informant Category	Number of Informants	Description
1	School Principal	1	Principal responsible for school policies
2	Classroom Teachers	4	Teachers involved in STEM learning
3	Islamic Education Teachers	2	Teachers responsible for Islamic values integration
4	Students (Grades IV-VI)	5	Students actively involved in digital learning
	Total	**12**	

Data were collected through semi-structured interviews, participant observation, and document analysis of teaching modules, lesson plans, school regulations, and school policies. These techniques were used to establish methodological triangulation in order to enhance data credibility and depth of understanding (Miles, Huberman, & Saldaña, 2014). The researcher served as the primary research instrument using interview guidelines, observation sheets, and document analysis formats developed based on Islamic ethical indicators such as trustworthiness, honesty, responsibility, self-control, and the common good. Data analysis was conducted interactively through data condensation, data display, and conclusion drawing/verification (Miles et al., 2014). Data validity was ensured through source triangulation, method triangulation, member checking, and audit trails. Ethical considerations were also maintained by ensuring confidentiality, voluntary participation, and informed consent from all participants. The stages of the research process are illustrated in the following sequence:

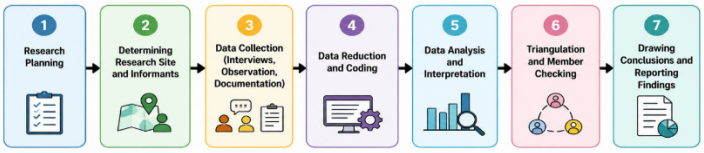

Figure 1.

3. RESULTS AND DISCUSSION

Results

3.1 Integration of Islamic Ethical Values into Science and Technology Curriculum Planning

Findings at SDN Paduran Sebangau 2 show that Islamic ethical values are systematically integrated into science and ICT learning starting from the planning stage. Lesson plans and teaching modules indicate that learning objectives are not only focused on cognitive achievement but also include attitudes such as honesty, responsibility, and responsible use of digital devices. This is reflected in the statement of a 5th-grade teacher*: "In our lesson plans, the learning objectives are not only to understand science material but also how children use the internet honestly and responsibly when searching for information."* (Teacher SF). In addition, the Islamic Education teacher stated: *"We remind students that seeking knowledge through technology is part of amanah, so it must not be misused."* (Teacher MA). The documentation analysis also shows that indicators such as "citing sources honestly" and "responsible use of devices" are explicitly included in lesson plans. This indicates that ethical values are not incidental but are embedded in instructional design.

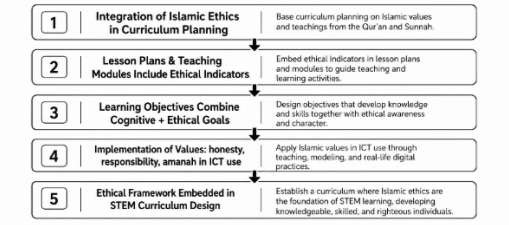

Figure 1. Framework for Integrating Islamic Ethics into STEM Curriculum Design

3.2 Developing Students' Digital Ethical Awareness

Interviews with students in grades IV-VI reveal that students have begun to develop awareness regarding ethical boundaries in using digital technology. Students understand that digital devices should be used responsibly and according to learning purposes. One fifth-grade student stated: *"If I use the school laptop, I must ask permission first and cannot open other applications."* (Student FZ). Another student explained: *"We are not allowed to play games during lessons because the laptop is for studying."* (Student BA). Teachers also observed behavioral changes among students. A teacher stated: *"Students are now more careful when using the internet and understand the limits during digital learning."* (Teacher SF). Observation findings indicate that students increasingly demonstrate self-control, discipline, and responsibility during digital learning activities.

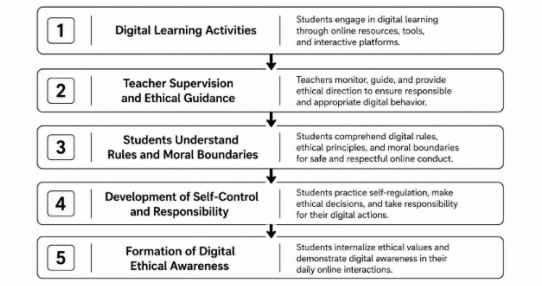

Figure 2. Conceptual Framework of Digital Ethical Awareness Formation

3.3 Teachers' Role Models as a Medium for Transmitting Ethics

Findings at SDN Paduran Sebangau 2 indicate that teachers play an important role as ethical role models in technology use. Students observe not only teachers' instructions but also their behaviour when using digital devices and online resources. One student stated: *"When the teacher takes material from the internet, the teacher always shows the website and says where the source comes from."* (Student AP). A classroom teacher also explained: *"Teachers must set an example first. We cannot ask students to be honest if we ourselves do not practice it."* (Teacher TA). Observation findings show that teachers consistently cite information sources, avoid using devices for personal purposes during class, and carefully select appropriate digital content for students.

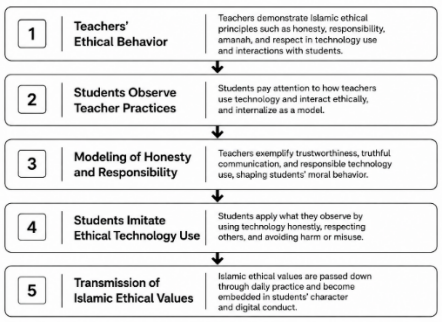

Figure 3. Conceptual Framework of Islamic Ethical Values Transmission through Teacher Modeling

3.4 Islamic Ethics as School Culture in Technology Use

School documents and interviews indicate that Islamic ethical values have become part of the institutional culture at SDN Paduran Sebangau 2. School regulations related to technology use consistently employ moral language such as honesty, responsibility, discipline, and wise technology use. The school principal stated: "*Technology rules in this school are connected with religious values so students understand that these are not just school regulations but part of moral responsibility."* (Principal KS). School policies also emphasize responsible internet use, discipline in digital learning, and ethical behaviour when using school devices. Observation findings show

that these values are consistently reinforced through classroom practices, school rules, and teacher supervision.

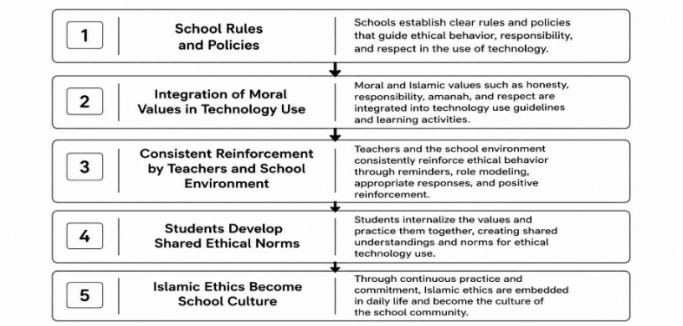

Figure 4. Conceptual Framework of Islamic Ethical Culture Formation in Schools

Discussion

The findings of this study demonstrate that the integration of Islamic ethics into science and technology education at SDN Paduran Sebangau 2 is implemented comprehensively through curriculum planning, pedagogical practices, teacher role modelling, students' digital ethical awareness, and school culture. Islamic ethical values are not positioned merely as complementary moral messages but are operationalized within learning objectives, classroom interactions, and institutional regulations related to technology use. The integration of ethical indicators such as honesty, responsibility, trustworthiness (*amanah*), discipline, and self-control into lesson plans and STEM learning activities indicates that science and technology education in this school is not viewed as value-free. This finding supports Al-Attas's (1995) argument that knowledge is always connected to a particular worldview and cannot be separated from moral and spiritual dimensions. In this context, the use of technology in education is framed as part of students' moral responsibility as human beings. Similarly, Nasr (1996) emphasizes that modern educational problems emerge when science becomes detached from ethical and sacred values. The practices found in this study demonstrate an effort to reconnect technological learning with ethical responsibility grounded in Islamic values. These findings also strengthen Halstead's (2004) perspective that morality is the core of Islamic education and should be integrated into all educational activities rather than taught separately as an isolated subject. At SDN Paduran Sebangau 2, ethical values are embedded not only in religious instruction but also in science and ICT learning activities. This integration is reflected in teachers' guidance regarding responsible internet use, honesty in citing information sources, and discipline during digital learning. From the perspective of character education, the findings confirm Berkowitz and Bier's (2005) argument that effective character formation must be integrated into instructional design, daily classroom practices, and school culture. Ethical values in this school are strengthened through repeated habituation during digital learning activities and reinforced through teacher supervision and institutional rules. Therefore, character education occurs systematically through students' direct experiences rather than solely through theoretical moral instruction.

The findings further indicate that pedagogical practices play a significant role in fostering students' digital ethical awareness. Students begin to understand ethical boundaries in technology use, including discipline, self-control, honesty, and responsibility in accessing digital information. This supports Ribble's (2021) concept of digital citizenship, which emphasizes that ethical technology use must be developed through guided educational practices and responsible digital behaviour. Likewise, Livingstone (2018) explains that children's ethical awareness in digital environments develops through supervision, habituation, and meaningful educational experiences. The results of this study show that ethical awareness among elementary school students can be developed when digital literacy is consistently accompanied by moral guidance. Another important

finding is the role of teachers as ethical role models in digital learning. Teachers not only instruct students regarding ethical technology use but also demonstrate ethical behaviour directly through their actions, such as citing sources honestly, using devices responsibly, and selecting appropriate digital content. This finding supports Halstead's (2004) view that moral values in Islamic education are effectively transmitted through exemplary behaviour. In line with this, Berkowitz and Bier (2005) emphasize that modelling is one of the most influential approaches in shaping students' moral conduct. The findings of this study are also strengthened by several recent studies concerning digital ethics and Islamic education. Pranoto and Haryanto (2024) found that Islamic education contributes significantly to shaping ethical digital citizenship when values such as honesty, responsibility, and trustworthiness are explicitly integrated into learning activities. Similarly, Hatija et al. (2025) explain that integrative learning grounded in Islamic values supports more ethical student behaviour in technology use. Reza et al. (2025) also argue that digital ethics education should begin at the elementary school level through supervised and consistent digital practices. Furthermore, Manik (2025) emphasizes that teachers' professional ethics in the digital age should be based on the principles of *amanah*, *sidq*, *tabayyun*, and exemplary conduct (*uswah*). This perspective aligns with the findings of this study, where teachers function not only as facilitators of knowledge but also as moral exemplars in technology use. Jailani (2025) additionally argues that digital transformation in education will only be meaningful if it is grounded in ethical values such as integrity, justice, responsibility, and protection from technology misuse. Overall, the findings indicate a shift from a value-neutral approach to science and technology education toward a value-oriented educational model rooted in Islamic ethics. The integration of ethical values at SDN Paduran Sebangau 2 demonstrates that STEM education at the elementary school level can simultaneously develop technological competence and students' moral character. Islamic ethics therefore functions not merely as normative discourse but as an operational pedagogical framework shaping responsible digital behaviour and ethical technology use among students.

4. CONCLUSION

Research at SDN Paduran Sebangau 2 indicates that Islamic ethics can effectively function as an operational foundation for science and technology education in elementary schools. Ethics does not merely appear as a normative discourse separate from science and technology learning, but is systematically integrated from curriculum planning, actualized in pedagogical practices, internalized into students' digital ethical awareness, transmitted through teachers' exemplary behavior, and reinforced through school culture. The findings reveal a shift from a value-neutral STEM learning paradigm toward value-driven learning, where technology use is understood as part of moral responsibility (*amanah*). Instructional planning that includes ethical indicators, contextual pedagogical practices, the cultivation of responsible digital behavior, and teacher role modeling collectively contribute to shaping students' ethical awareness in interacting with technology. Theoretically, these findings affirm Al-Attas's (1995) perspective that knowledge is never value-free, as well as Halstead's (2004) argument that morality constitutes the core of Islamic education. In the contemporary context, the findings also support Ribble's (2021) concept of digital citizenship and Livingstone's (2018) discussion regarding children's ethical awareness in digital environments. Practically, this study demonstrates that the integration of Islamic ethics into STEM education is not only conceptually relevant but can also be operationalized concretely through instructional design, classroom interaction, and school culture. Consequently, STEM education at the elementary school level can produce students who are not only technologically literate but also ethically responsible in their use of digital technology. However, this study has several limitations. First, the research was conducted only in one public elementary school, which limits the

generalizability of the findings to broader educational contexts. Second, this study primarily focused on qualitative exploration of educational practices and did not measure students' ethical development quantitatively. Third, the findings are limited to the perspectives of teachers, school leaders, and students within a specific socio-cultural setting, which may differ from other schools with different educational environments and technological infrastructures. Therefore, future studies are recommended to involve a larger number of schools and participants from different educational and regional backgrounds to obtain more comprehensive findings. Future research may also employ mixed-method or quantitative approaches to measure the effectiveness of Islamic ethics integration in improving students' digital ethical behavior and technological responsibility. In addition, further studies could explore the implementation of Islamic ethics in AI-based learning, digital citizenship education, and technology-integrated STEM programs at different educational levels.

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