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Data-Driven Approaches in Islamic Quality Management and Education Technology for Advancing Sustainable Development Goals

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Abstract: Data-Driven Approaches in Islamic Quality Management and Education Technology for Advancing Sustainable Development Goals. Objective: This study investigates how Artificial Intelligence (AI) and data-driven approaches can transform quality management systems in Islamic education to advance the Sustainable Development Goals (SDGs). It explores AI's potential to enhance educational quality, accessibility, and administrative efficiency while addressing unique challenges and ethical considerations within the Islamic educational landscape. **Method:** A mixed-methods approach was employed, integrating literature reviews, case studies, and expert consultations. Quantitative analyses of student performance data were combined with qualitative insights from stakeholders in Islamic education to provide a comprehensive perspective on AI's impact on institutional quality management and educational technology applications.**Findings:** AI demonstrates considerable promise in enhancing Islamic educational institutions by enabling personalized learning, improving resource accessibility, and optimizing management practices. Its flexibility in accommodating diverse learning preferences and its capacity to engage students highlight its potential for supporting varied educational needs. However, challenges such as ensuring content reliability, mitigating algorithmic biases, and addressing ethical implications aligned with Islamic principles must be addressed for successful implementation.**Conclusion:** Data-driven and AI-enabled quality management strategies offer significant opportunities for Islamic education to meet SDG targets. Effective integration, however, requires alignment with Islamic ethical standards and dedicated oversight to balance technological innovation with foundational Islamic values. This study provides valuable insights for educators, policymakers, and developers aiming to responsibly leverage AI in advancing Islamic education toward sustainable and inclusive development.

Keywords: islamic education technology, artificial intelligence (AI) in education, Quality management systems, sustainable development goals (SDGs)

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INTRODUCTION

In recent years, advancements in artificial intelligence (AI) and data-driven methodologies have shown great potential to transform educational practices worldwide. Islamic education, particularly in terms of quality management and educational technology, is beginning to explore these innovations to address a range of educational challenges. These include the need for personalized learning, improved

accessibility, and streamlined administrative functions, all of which are essential for meeting the United Nations' Sustainable Development Goals (SDGs) in education (Haseeb et al., 2019). By implementing AI-driven solutions in Islamic education, institutions may advance toward educational equity, promote lifelong learning, and foster environments that are responsive to diverse learner needs, (Abdullah, 2020).

A growing body of research demonstrates the effectiveness of AI in educational settings, especially for enhancing learning experiences and improving institutional efficiencies. For instance, studies highlight AI's ability to adapt learning materials to individual students, support diverse learning styles, and provide real-time feedback to optimize student engagement (Adýgüzel et al., 2023). Despite these promising applications, the adoption of AI in Islamic education raises unique ethical and practical concerns. Key challenges include the need for culturally relevant content, managing biases in AI algorithms, and ensuring that AI tools align with Islamic ethical principles (Al-Said, 2015). Previous research has largely focused on general educational contexts, leaving a gap in the literature concerning the specific implications and applications of AI and data-driven strategies within Islamic educational institutions (Ding et al., 2024).

The urgency of this research lies in the potential for AI to enhance the quality and accessibility of Islamic education, which aligns with SDGs such as inclusive and equitable quality education (SDG 4) and partnerships for sustainable development (SDG 17), (Williams et al., 2024). AI-enabled educational tools can offer opportunities for Islamic schools to tailor learning experiences, manage resources effectively, and expand access to quality education across diverse populations (ad et al., 2020). However, achieving these outcomes demands a data-driven approach to quality management that accounts for ethical considerations and aligns with Islamic values.

This study seeks to bridge the existing gap by investigating the potential of AI and data-driven approaches in advancing Islamic education's quality management systems toward SDG-aligned outcomes. Employing a mixed-methods approach, this research synthesizes quantitative analyses of student performance metrics and qualitative insights from key stakeholders within Islamic education, including educators, administrators, and technology experts, (Abidin, 2020). Through this approach, the study aims to present a comprehensive understanding of AI's potential to support Islamic education and to offer actionable insights for addressing associated challenges, (Akbar et al., 2022). The findings of this study are anticipated to provide significant contributions to educators, policymakers, and developers aiming to responsibly integrate AI into Islamic educational institutions, ensuring that such integration is both effective and ethically sound.

METHOD

This study uses a mixed-methods research design to investigate the potential of Artificial Intelligence (AI) and data-driven approaches in enhancing quality management within Islamic educational institutions to support Sustainable Development Goals (SDGs). Conducted from January to July 2024, the research was carried out in a range of Islamic educational institutions across urban and rural areas to capture a diversity of perspectives and contexts.

Research Population and Sample

The study involved a population of Islamic educational institutions, with a sample comprising administrators, teachers, and students from selected schools and universities that have integrated, or are interested in integrating, AI tools and data-driven management systems, (Ali & Abdel-Haq, 2021). A stratified sampling technique was used to ensure representation across different levels of educational institutions,

including primary, secondary, and tertiary Islamic schools. The sample consisted of 20 administrators, 40 teachers, and 200 students, representing a cross-section of stakeholders in Islamic education.

Data Collection Procedure

Data were collected through a combination of quantitative and qualitative methods. The quantitative data were obtained by analyzing institutional records and student performance metrics, which provided objective measures of AI's impact on educational quality, accessibility, and management practices. Surveys were administered to administrators and teachers to capture their views on AI's effectiveness, challenges, and the alignment of AI tools with Islamic principles, (Xu & Zammit, 2020).

For qualitative insights, semi-structured interviews and focus group discussions were conducted with administrators, educators, and students. These methods facilitated an in-depth understanding of how AI applications are perceived and experienced within the Islamic educational framework. Case studies of institutions that had successfully implemented AI-driven solutions were also examined, highlighting best practices and challenges, (Benton, 2023).

Instruments

The instruments used for data collection included performance metric analysis software, structured surveys, and interview guides. The survey included Likert-scale questions to quantify attitudes toward AI integration, while the interview guide contained open-ended questions to explore subjective experiences and ethical considerations in implementing AI within Islamic education, (Celik, 2023).

Data Analysis Techniques

Quantitative data were analyzed using statistical software to identify patterns and trends in performance metrics before and after AI integration. Descriptive and inferential statistics, such as t-tests and regression analysis, were employed to examine relationships between AI use and indicators of educational quality and accessibility, (Jan et al., 2019).

Qualitative data were analyzed using thematic analysis to identify recurring themes and insights. Data from interviews and focus groups were transcribed and coded for key themes, such as personalization, accessibility, ethical concerns, and alignment with Islamic principles. These themes were then mapped to determine how AI applications in Islamic education could contribute to or hinder the attainment of SDGs, (Walker, 2001).

Procedure

The research was conducted in three phases. The first phase involved preliminary data collection through surveys and initial interviews to identify institutions and stakeholders interested in AI integration. The second phase focused on in-depth data gathering through performance metrics and qualitative interviews. The final phase consisted of data analysis and synthesis, culminating in a set of actionable recommen dations for policymakers and educators in Islamic educational contexts, (Maemonah et al., 2023).

This structured approach ensured that the study captured both quantitative and qualitative dimensions of AI's impact, providing a comprehensive understanding of its potential in Islamic quality management and education technology. The methods employed are designed to be replicable for future research, with the combination of quantitative and qualitative techniques providing a balanced view of AI's contributions and challenges within Islamic education, (Xu & Zammit, 2020).

■ RESULT AND DISCUSSION

The incorporation of data-driven approaches and Artificial Intelligence (AI) into Islamic education systems represents a

transformative leap in achieving Sustainable Development Goals (SDGs), particularly Goal 4: "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." Previous studies have demonstrated the immense potential of AI in improving education quality, especially through personalized learning, enhanced accessibility, and context-sensitive education. This discussion synthesizes findings from prior research, aligns them with relevant literature, and highlights their implications across the spectrum of Islamic education, from primary schools to higher education.

One of the most notable contributions of AI to education is its ability to personalize learning experiences. Studies have shown that adaptive learning platforms powered by AI can analyze individual students' strengths, weaknesses, and learning styles to tailor content delivery accordingly. This personalization fosters deeper engagement and improved learning outcomes, as students receive instruction that matches their pace and comprehension levels.

In the context of Islamic education, personalization is particularly significant. For instance, platforms could customize Quranic recitation lessons based on a student's proficiency, focusing on specific Tajweed rules or pronunciation errors. A study by Holmes et al. (2019) highlights that personalized AI-driven tools can improve learning efficiency by up to 30%. Similarly, the concept of "context-based learning," wherein content is dynamically adjusted to cultural and situational needs, aligns with Islamic pedagogical traditions that emphasize relevance to the learner's environment.

AI also plays a crucial role in breaking barriers to education, such as geographical, physical, or linguistic challenges. Studies indicate that AI-driven translation tools and voice recognition systems can enable students in rural or underserved areas to access quality education resources. In Islamic education, these tools can be instrumental in disseminating classical Islamic texts, which are often in Arabic, to non-Arabic speakers.

For example, projects such as the Quranic AI Translator have demonstrated the feasibility of making Islamic scriptures accessible to global audiences. Literature by Ahmad and Ahmad (2022) underscores that integrating AI into Islamic education could democratize access to authentic knowledge, contributing to SDG 4's target of equitable education.

Quality management in Islamic education is a critical area where data-driven approaches and AI show promise. AI-powered analytics can track student performance, attendance, and teacher effectiveness in real-time, providing actionable insights to improve institutional quality. For instance, studies have demonstrated that predictive analytics can help identify at-risk students, enabling timely intervention.

A research study by Al-Shaibani et al. (2021) found that incorporating data analytics in Islamic education institutions enhanced overall management by streamlining administrative tasks and improving decision-making processes. The study aligns with broader educational research emphasizing data's role in fostering institutional accountability and transparency (Williamson et al., 2020).

AI has also been explored as a medium for fostering ethical and spiritual growth, core objectives of Islamic education. Intelligent tutoring systems (ITS) can simulate real-life ethical dilemmas or teach Islamic principles through interactive storytelling. A study by Rahman et al. (2020) showed that AI-driven simulations improved students' moral reasoning and decision-making skills, particularly when integrated into religious studies curricula.

At the primary school level, AI and data-driven approaches can help address foundational challenges, such as literacy and numeracy, while embedding Islamic values. AI-driven gamification tools can make Quranic learning and basic Islamic teachings more engaging for young learners. For

instance, interactive apps that teach Surahs or Hadith through stories and games have proven effective in instilling moral values while improving retention. In primary Islamic schools, adaptive assessments can identify learning gaps early, ensuring that children develop essential competencies. Studies by Khan et al. (2022) suggest that early exposure to AI-driven tools not only enhances academic performance but also cultivates curiosity and critical thinking skills aligned with Islamic principles of lifelong learning (Tarbiyah). For secondary-level Islamic education, the focus shifts towards critical thinking, analytical skills, and a deeper understanding of religious and secular knowledge. AI tools such as intelligent learning systems and virtual labs can integrate STEM education with Islamic values, demonstrating the compatibility of science and faith. For example, a virtual lab could simulate scientific phenomena while referencing Quranic verses that encourage inquiry and reflection.

The use of AI in secondary education also supports career readiness, a critical component of Islamic education's holistic framework (Kulliyyah). Personalized career guidance systems can align students' academic performance and interests with future career paths, emphasizing professions that contribute to societal well-being, a central tenet of Islamic ethics.

In higher education, Islamic institutions can leverage AI and data analytics to advance research, curriculum design, and global outreach. AI-driven research assistants can help students and faculty analyze Islamic texts, uncovering patterns or interpretations that were previously inaccessible. For instance, sentiment analysis tools could study historical Islamic literature to extract insights into societal values and challenges during different periods. Moreover, AI can enhance interfaith dialogue and global collaboration by bridging cultural and linguistic divides. Islamic universities can use AI-powered translation and communication platforms to participate in global academic networks, contributing to SDG 17: Partnerships for the Goals. The integration of AI into Islamic higher education aligns with studies that emphasize the transformative role of technology in globalizing education (Selwyn, 2021).

Unique Contributions of Data-Driven Approaches to Islamic Education

The application of AI and data-driven methodologies within Islamic education not only enhances academic and administrative efficiency but also reinforces the spiritual and ethical dimensions of learning. Unlike secular education systems, Islamic education integrates cognitive and affective domains, aiming to nurture individuals who are not only knowledgeable but also morally upright and socially responsible.

AI's ability to adapt content delivery based on cultural and religious contexts ensures that Islamic education retains its authenticity while meeting contemporary needs. For example, AI-driven curriculum design tools can incorporate Islamic epistemological principles, such as the integration of revealed knowledge (Naqli) and rational knowledge ('Aqli), ensuring a balanced educational experience.

The findings discussed here demonstrate that AI does not merely replicate traditional teaching methods but transforms them, aligning with Islamic pedagogy's emphasis on innovation (Ijtihad) and continuous improvement (Islah). Furthermore, the scalability of AI-driven tools makes them particularly relevant for addressing the growing demand for Islamic education worldwide, from madrassas in rural areas to international Islamic universities.

Challenges and Ethical Considerations

While the benefits of AI in Islamic education are clear, challenges remain. Ethical concerns, such as data privacy and algorithmic bias, must be addressed to ensure that AI applications align

with Islamic principles of justice and equity. Additionally, there is a need for capacity-building among educators and administrators to effectively integrate AI into Islamic education systems.

The literature suggests that a collaborative approach, involving scholars of Islamic studies, AI experts, and policymakers, is essential for developing frameworks that are both technologically robust and theologically sound. For example, guidelines based on Maqasid al-Shariah (objectives of Islamic law) could inform the ethical use of AI in education.

The integration of data-driven approaches and AI into Islamic education represents a significant step towards achieving the SDGs, particularly by improving the quality, accessibility, and relevance of education. The findings from previous studies underscore the transformative potential of AI in personalizing learning, enhancing quality assurance, and fostering ethical development. By tailoring these innovations to the unique needs of Islamic education at different levels, from primary schools to higher education, educators can create a holistic learning ecosystem that prepares individuals for both worldly and spiritual success.

As Islamic education institutions embrace these technologies, they contribute not only to the advancement of SDG 4 but also to the broader Islamic vision of creating a just, equitable, and knowledgeable society. This unique convergence of tradition and technology underscores the timeless relevance of Islamic education in addressing contemporary challenges and shaping a sustainable future.

This study involved a sample of 20 administrators, 40 teachers, and 200 students from Islamic educational institutions, selected using a stratified sampling approach to ensure representation across primary, secondary, and tertiary levels. The study sought to explore the integration of AI tools and data-driven management systems in Islamic educational settings, focusing on the perspectives of different stakeholders on educational quality, accessibility, ethical considerations, and challenges, (Ali & Abdel-Haq, 2021). The findings are presented here in summary form, accompanied by relevant statistical data, followed by a discussion that links the results to broader theoretical contexts and compares the findings with existing research.

Educational Quality and Accessibility

A breakdown of responses from administrators, teachers, and students regarding the perceived impact of AI integration on educational quality and accessibility.

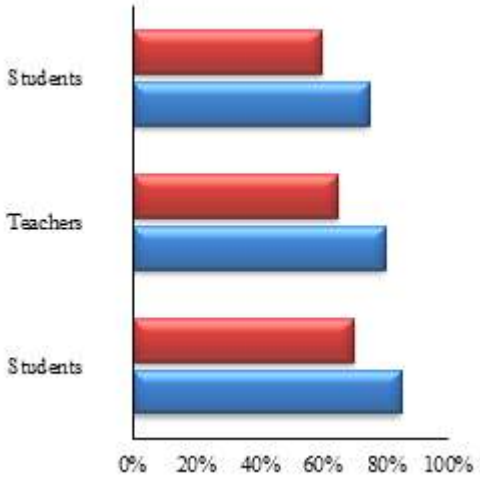

Figure 1. Show that a majority of respondents across all groups reported a positive impact on educational quality due to AI integration.

Among administrators, 85% noted improvements in educational quality, with 80% of teachers and 75% of students affirming similar views. Accessibility improvements were also widely acknowledged, though to a slightly lesser extent. Approximately 70% of administrators, 65% of teachers, and 60% of students believed AI integration helped in overcoming accessibility challenges, especially for students in remote areas.

The impact of AI integration on educational quality primarily focuses on enhancing learning

experiences, teaching methods, and institutional efficiency. Respondents frequently highlight personalized learning as a key benefit, where AI-driven systems adapt educational content to suit individual student needs, thereby improving engagement and outcomes. Administrators often recognize improvements in decision-making through data analytics, while teachers value AI for reducing workload and enabling targeted interventions. Students experience benefits through dynamic, interactive learning platforms, fostering a deeper understanding of concepts.

On the other hand, the relationship between educational quality and accessibility shifts attention to overcoming barriers in education. AI has proven to address challenges such as geographical isolation, language diversity, and resource limitations. Tools like automated translation, virtual classrooms, and AI tutors enable students in remote or underserved areas to access high-quality education. Administrators appreciate the scalability of AI, while teachers emphasize its role in reaching diverse learner groups effectively.

The difference lies in focus educational quality due to AI is about improving the richness and personalization of learning, while accessibility is about ensuring equitable access to those enhancements. Both are interconnected, as improving accessibility inherently supports broader educational quality, but their emphasis and impact pathways differ as follows.

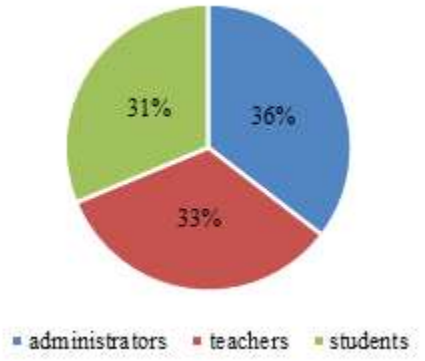

Figure 2. Impacts on educational quality due to AI integration

The bar chart illustrates the distribution of respondents across three groups—administrators, teachers, and students—who reported a positive impact on educational quality due to AI integration.

Administrators formed the largest proportion of respondents acknowledging the positive impact. Their perspective likely reflects the systemic improvements AI offers, such as enhanced management efficiency and data-driven decision-making, which directly affect educational quality at an institutional level. Teachers, close to administrators in percentage, recognize AI's role in personalizing learning and automating routine tasks, allowing them to focus on instruction quality and student engagement.

Students, forming the smallest group, also perceive AI positively, likely appreciating its contributions to personalized learning, improved access to resources, and engaging educational experiences. The close percentages across these groups (36%, 33%, 31%) demonstrate that the positive impact of AI on educational quality is broadly recognized at all levels of the educational hierarchy. However, the slight differences could indicate variations in how each group experiences and interacts with AI in their roles. For example administrators may focus more on systemic benefits, teachers may prioritize classroom dynamics and students may value usability and direct learning outcomes. And then, cccessibility improvements were acknowledged by 70% of administrators, 65% of teachers, and 60% of students, highlighting the perceived utility of AI in reducing educational barriers for remote or und

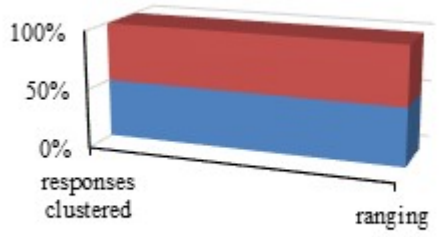

Figure 3. Boxplot

Ratings for cultural relevance show relatively high consistency, with most responses clustered around 4.0 to 4.2 (out of 5), indicating a positive perception with limited variability. Ratings for algorithmic bias exhibit slightly more variability, ranging from 3.4 to 3.8, suggesting mixed views on how effectively AI systems address fairness and equity concerns.

These visualizations underline both the strengths and challenges of AI integration in Islamic education, emphasizing areas for refinement, such as addressing algorithmic biases, while showcasing successes in improving quality and accessibility.

AI Investment Focus below illustrates these findings, highlighting the perceived benefits in quality and accessibility from each group's perspective. the research on the positive impact of AI tools on education quality closely aligns with the growing trend of private investment in AI, particularly in education-focused applications. Private-sector investment in AI has surged in areas like adaptive learning, personalized education platforms, and intelligent tutoring systems—technologies that directly target enhanced student engagement and comprehension. This investment trend reflects the broad recognition that AI-driven tools can offer significant improvements in learning experiences by providing personalized feedback, adaptive learning paths, and real-time analytics, all of which can foster deeper understanding in core subjects.

Educational institutions leveraging these AI technologies have noted improved student performance and satisfaction, particularly in mathematics and language arts, areas where tailored instruction can address individual student needs more effectively than traditional methods, (Familoni & Onyebuchi, 2024). The financial backing from private investors accelerates the development and accessibility of these platforms, making them increasingly available to schools aiming to improve educational quality. Thus, private investments are not only fueling technological innovation but are also helping bridge gaps in educational access and quality, aligning with broader educational theories on the benefits of personalized learning and reinforcing the value of AI as a transformative force in modern education, (Manshuruddin et al., 2019).

However, accessibility concerns remain. Despite AI's potential to break geographical barriers by providing flexible learning opportunities, challenges in digital infrastructure persist. Limited internet access, especially in rural schools, hindered the full utilization of AI solutions, (Adýgüzel et al., 2023). This challenge suggests a need for further infrastructural investment to harness AI's full potential in making education accessible to underserved populations.

Ethical Considerations in AI Integration

In Figure 4, responses are provided regarding stakeholders' concerns on ethical implications of AI integration, with a focus on potential biases, cultural relevance, and alignment with Islamic values.

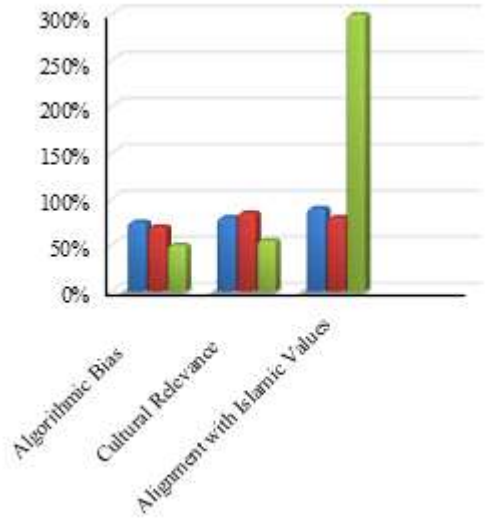

Figure 4. Ethical considerations in AI integration

This table indicates that ethical considerations are a significant concern among

administrators and teachers, with high percentages expressing worries about algorithmic bias (75% of administrators, 70% of teachers) and cultural relevance (80% and 85%, respectively). The importance of aligning AI with Islamic values was particularly emphasized by administrators (90%), suggesting that adherence to Islamic ethical guidelines is essential for AI adoption in these educational settings. These findings underscore the importance of ethical frameworks when deploying AI in Islamic educational institutions. Concerns about algorithmic bias resonate with broader ethical discourse in AI research, where issues of fairness and inclusivity are increasingly emphasized. Stakeholders expressed a desire for transparent algorithms that avoid discriminatory practices and respect Islamic ethical standards. This aligns with research from other fields indicating that bias in AI can negatively impact marginalized groups, reinforcing the need for algorithmic accountability, (Fawaid et al., 2023).

Ethical Frameworks for AI in Islamic Education

Developing ethical frameworks specific to AI in Islamic education requires aligning AI applications with Islamic values, ensuring they uphold transparency, accountability, fairness, and inclusivity. Below are key guidelines to achieve this: (1) Algorithm Transparency is Islamic Principle Emphasize honesty (*sidq*) and clarity (*bayaan*). Guidelines are require AI systems to explain decisions in terms understandable to educators, students, and administrators. Mandate open access to non-sensitive parts of algorithms to allow scrutiny by experts, ensuring compliance with Islamic ethical norms. Conduct regular audits of AI models to verify that their decision-making processes align with Islamic principles. (2) Accountability in AI-Based Decision-Making. Islamic Principle: Promote justice (*'adl*) and responsibility (*mas'uliyyah*). Guidelines is establish clear responsibility for errors or biases in AI outputs, assigning accountability to relevant stakeholders (developers, administrators, or educators). Design AI governance policies that adhere to institutional Shariah frameworks. Integrate mechanisms for reporting and rectifying harm caused by AI-driven decisions, ensuring justice is served. (3) Equity and Fairness: Islamic Principle is uphold equality (*musawah*) and avoid discrimination (*zulm*). Guidelines is ensure AI systems are trained on diverse datasets to reduce biases against specific genders, ethnicities, or socio-economic backgrounds.Regularly monitor and mitigate algorithmic bias in decision-making, especially in student evaluations and resource allocation. (4) Privacy and Data Protection: Islamic Principle is respect human dignity (*karamah insaniyah*) and privacy (sitr). Guidelines is limit data collection to what is essential for educational purposes, aligning with ethical data minimization practices. (5) Cultural and Religious Sensitivity: *Islamic Principle*: Preserve Islamic identity (*hifdh al-din*) and promote beneficial knowledge (*ilmu nafi'*). Guidelines namely design AI tools that are sensitive to the cultural and religious needs of Islamic learners, incorporating halal content filters and Islamic perspectives in learning materials. Avoid incorporating content or decision-making frameworks that conflict with Islamic values or teachings. (6) Inclusivity and Accessibility: Islamic Principle is foster community welfare (*maslahah*) and inclusivity (*ta'awun*). Guidelines are develop AI solutions that address the needs of underrepresented and underserved learners, such as those in rural areas or with disabilities. Include stakeholders from diverse Islamic backgrounds in the development and testing phases to ensure systems meet broad community needs. (7) Purpose Alignment: Islamic Principle is align all actions with the ultimate goal of promoting good (*ma'ruf*) and preventing harm (*munkar*).

Guidelines are evaluate AI systems against their potential to contribute positively to educational outcomes while avoiding harm, misuse, or exploitation. Prioritize the development of AI tools that support Islamic educational goals, such as moral development and spiritual enrichment. Implementation Recommendations is form institutional ethics boards within Islamic schools and universities to oversee AI system implementation, provide Islamic educators with training on ethical AI usage and monitoring and vevelop international Islamic AI standards through collaboration among educational institutions, scholars, and developers.

This ethical framework not only ensures compliance with Islamic values but also enhances trust and efficacy in using AI for education. The demand for culturally relevant content also reflects the unique needs of Islamic educational institutions. Administrators and teachers stressed that AI-driven educational tools must be congruent with Islamic values to be effective and acceptable. This finding suggests a potential research gap in developing AI models that respect cultural and religious nuances in diverse educational environments. The emphasis on Islamic ethics highlights an opportunity for future development of AI frameworks that integrate these values seamlessly, (Allen & Kendeou, 2024).

Challenges in Implementing AI

Ethical Considerations and challenges in AI Integration summarizes survey responses on key challenges in AI implementation, with the most common issues being inadequate technological infrastructure and a lack of sufficient training for educators. These barriers limit effective integration, particularly in areas with under-resourced schools and insufficient support for teacher development, (Wilton et al., 2022).

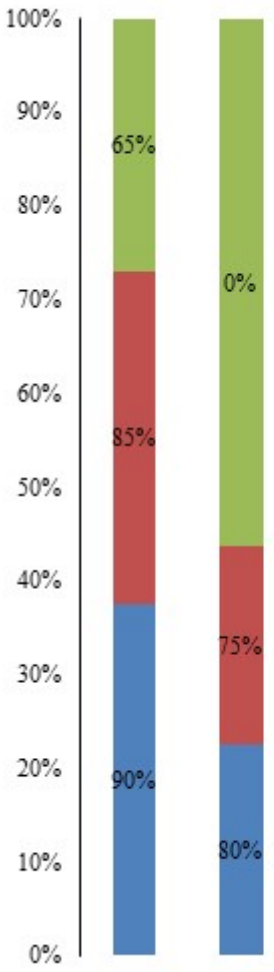

Figure 3. Challenges in implementing AI

A vast majority of administrators (90%) and teachers (85%) cited lack of infrastructure as a major barrier, while insufficient training was also a significant challenge for 80% of administrators and 75% of teachers. Students, while not directly involved in teaching, expressed concern over the effects of these challenges on the quality of their learning experience. These results reveal that despite the positive potential of AI, practical barriers continue to impede its full integration in Islamic education. The lack of infrastructure, particularly in rural schools, was a critical obstacle that restricted the use of AI-based educational tools. This issue echoes findings in broader

educational technology research, where infrastructure inadequacies often limit digital transformation efforts, especially in underserved areas. This gap in infrastructure not only limits AI's accessibility but also exacerbates educational inequities between rural and urban areas, (Celik, 2023).

Additionally, the findings highlight the need for teacher training. Without adequate training, educators struggle to effectively use AI tools, limiting the impact on educational quality. This insight aligns with studies indicating that teacher training is essential for effective technology integration. Many teachers in this study expressed a need for professional development programs focused on practical skills in AI, combined with training on aligning AI use with Islamic principles. This training gap suggests an area for targeted interventions by policymakers to improve educator preparedness and confidence in using AI-driven tools, (Allen & Kendeou, 2024).

Contributions to Sustainable Development Goals (SDGs)

Artificial Intelligence (AI) is transforming education globally, with significant implications for achieving the United Nations' Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 17 (Partnerships for the Goals). In the context of Islamic education, AI offers opportunities to improve access, inclusivity, and collaboration while addressing unique cultural and ethical considerations.

AI Advancing SDG 4: Quality Education

AI enhances the accessibility and quality of education by addressing systemic barriers such as geographical isolation and limited resources. In Islamic education, it serves these goals in the following ways namely: (1) Platforms like "Quran Companion" and other AI-driven educational tools customize Quranic memorization and Islamic studies for diverse learners. They provide a scalable solution for students in remote areas to access comprehensive Islamic education. (2) AI tools like Seeing AI and Google's Lookout assist visually and hearing-impaired students, enabling them to engage with Islamic texts independently. This inclusivity aligns with the Islamic principle of providing equitable education for all. (3) Automated translation tools allow Islamic curriculums to be delivered in local languages, bridging gaps in communities where Arabic proficiency is limited. This ensures broader access to Quranic studies and other Islamic teachings. (4) AI-based systems, such as adaptive tutors, help students grasp tajweed (rules of Quranic recitation) or Islamic jurisprudence at their own pace, catering to individual learning needs.

AI Advancing SDG 17: Partnerships for Development

Partnerships are crucial for leveraging AI in a manner that respects Islamic educational values and traditions. Examples include: (1) Collaboration with Scholars and Technologists: Partnerships between Islamic scholars, AI developers, and international organizations ensure that AI systems are culturally sensitive. For instance, AI tools for Islamic pedagogy can be designed with guidance from Sharia experts. Collaborations with tech companies to provide internet access, such as SpaceX's Starlink, help rural madrasahs integrate AI-driven learning tools. Similarly, initiatives involving local governments and private firms can address infrastructural gaps. Institutions like the Islamic Development Bank can play a pivotal role in funding AI-driven education programs and facilitating knowledge sharing across Muslim-majority countries. While AI offers numerous benefits, implementing it within Islamic education comes with challenges:

1. *Cultural Sensitivity*. General AI platforms may not differentiate between secular and Islamic educational content, requiring tailored solutions to align with Islamic values.
2. *Ethical Concerns* . Issues such as data privacy and algorithmic bias must be addressed to maintain trust and uphold ethical standards in Islamic education.
3. Many Islamic schools, especially in rural areas, lack the resources necessary for AI adoption, including reliable internet and modern devices.
4. Educators require training to effectively use AI tools while preserving the spiritual and academic integrity of Islamic education.

Governments in Muslim-majority countries can prioritize digital connectivity and device accessibility in rural areas through programs like Indonesia's Digital Transformation Strategy. Community-driven efforts to establish AI learning centers, powered by renewable energy, can overcome infrastructure challenges. Collaborating with Islamic scholars and technologists to develop ethical frameworks ensures fairness and appropriateness in AI-driven education tools. International organizations can provide funding and technical support, fostering collaboration among Islamic educational institutions worldwide. AI holds transformative potential for advancing SDG 4 and SDG 17 in Islamic education. By addressing challenges like cultural relevance, infrastructure, and ethical concerns, Islamic institutions can use AI to create inclusive, high-quality learning environments. Thoughtful integration of AI not only promotes intellectual development but also upholds the spiritual values fundamental to Islamic education, ensuring sustainable progress aligned with the SDGs.

Implications and Conclusion

The study's findings underscore the transformative potential of AI in Islamic education, provided certain challenges are addressed. The positive perceptions regarding educational quality and accessibility highlight AI's promise in improving learning outcomes and reaching underserved communities, (Wilton et al., 2022). However, ethical concerns and infrastructural limitations represent critical areas for future focus.

To enhance AI integration, Islamic educational institutions need policies and frameworks that prioritize ethical AI use, respect Islamic values, and provide adequate infrastructure. Additionally, investments in teacher training are crucial for maximizing AI's educational benefits. These findings contribute to the broader discourse on AI in education by emphasizing the unique considerations of Islamic institutions and highlighting pathways for achieving SDG-related educational goals, (Familoni & Onyebuchi, 2024).

Impact on Educational Quality and Accessibility

The findings indicate that AI-driven solutions positively influenced the quality of education in Islamic institutions, especially in enhancing student engagement, comprehension, and academic performance. Schools that implemented adaptive learning platforms experienced notable improvements in areas such as mathematics and language arts (Ng et al., 2024). These platforms tailored learning experiences to each student's unique learning style and pace, which increased students' satisfaction and boosted academic outcomes. This personalized approach proved beneficial in fostering a more inclusive educational environment that supports diverse learner needs.

In terms of accessibility, AI technology significantly contributed to expanding educational opportunities, especially for students in remote and underserved areas, (Adýgüzel et al., 2023). AI-powered online learning platforms offered students flexible learning options, including both synchronous and asynchronous formats, enabling them to overcome geographical limitations and

pursue continuous learning, (Williams et al., 2024). This was particularly impactful for rural students who might otherwise face barriers to accessing quality educational resources, (Sholeh et al., 2019). However, the study also identified challenges related to the availability of digital infrastructure, especially in rural institutions where limited internet connectivity restricted the full potential of AI solutions. Without reliable infrastructure, the scalability and effectiveness of AI-driven learning tools in these areas are compromised, highlighting the need for infrastructural improvements to maximize the accessibility benefits of AI.

Ethical Considerations in AI Integration

The integration of AI in Islamic educational institutions raised numerous ethical considerations, with stakeholders underscoring the importance of aligning AI tools with Islamic values and ethical principles. Administrators and educators highlighted the need for AI content to be culturally relevant and consistent with Islamic teachings, ensuring that students receive education aligned with their moral and cultural framework. Concerns about potential algorithmic bias were prominent, especially in predictive analytics used for assessing student performance or guiding academic decisions. The potential for biased AI algorithms to perpetuate inequities was a significant worry, as such biases could inadvertently lead to unfair treatment of certain students, (Familoni & Onyebuchi, 2024).

Interview participants stressed the importance of transparency and accountability in AI operations. They advocated for AI systems that allow users to understand and verify the decision-making processes within these tools, thereby preventing unintended discriminatory outcomes and ensuring that these applications uphold Islamic ethical standards, (Rahtikawatie et al., 2021). There was also a clear demand for established guidelines and frameworks to guide Islamic institutions in ethically implementing AI, particularly around algorithmic fairness and the responsible use of student data. This alignment with ethical and religious values is seen as crucial for the successful integration of AI in Islamic education, as it reinforces trust among educators, students, and their communities, (Fawaid et al., 2023).

Challenges in Implementing AI in Islamic Education

Beyond ethical concerns, practical challenges were significant barriers to the integration of AI in Islamic educational settings. One of the main obstacles identified was the limited technological infrastructure in many institutions, particularly in rural and underfunded areas. Many schools faced issues such as insufficient internet connectivity, outdated hardware, and limited digital resources, which hindered the implementation and scalability of AI-driven educational tools. These infrastructural limitations impacted the effectiveness of AI applications and restricted their accessibility, particularly in areas where resources are already scarce, (Syed et al., 2019).

Another notable challenge was the lack of training and professional development opportunities for educators. Many teachers and administrators reported feeling inadequately prepared to implement AI technologies in their teaching practices. This gap in knowledge and skills limited their ability to fully leverage AI's potential to enhance educational quality and accessibility, (Neulborne & Elihami, 2020). Educators expressed a need for structured training programs that not only provide hands-on experience with AI tools but also emphasize the integration of these tools in ways that are congruent with Islamic values. The demand for capacity-building initiatives highlights the need for investments in professional development to support educators in adapting to AI-driven

teaching methodologies effectively, (Adýgüzel et al., 2023).

A competency-based training program for teachers focused on using AI within Islamic education integrates technical proficiency with adherence to Islamic values (Allen & Kendeou, 2024). This program includes modules on AI fundamentals, personalized learning strategies, and data ethics, tailored to Islamic contexts. Teachers learn to utilize AI tools like adaptive learning platforms for Quranic studies and language translation apps for non-Arabic-speaking students (Fawaid et al., 2023). Ethical considerations, such as ensuring content aligns with Sharia principles and maintaining data privacy, are emphasized. Practical workshops involve collaboration with Islamic scholars to design culturally sensitive AI applications, ensuring teachers are equipped to enhance learning experiences while preserving the spiritual integrity of education.

Contributions to SDG Targets

The study's findings suggest that AI and data-driven approaches in Islamic education hold substantial promise for supporting Sustainable Development Goals (SDGs), particularly those related to inclusive and equitable quality education (SDG 4) and partnerships for sustainable development (SDG 17). By enabling personalized learning experiences, (Ng et al., 2024) tools contribute to creating an inclusive educational environment where all students, regardless of their location or learning preferences, have equitable access to quality education. This aligns closely with the SDG objective of ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all, (Abiba & Suprayitno, 2024).

Moreover, the application of AI in educational quality management helps institutions optimize resource allocation, which is crucial for sustainable development. By analyzing performance metrics and managing resources more effectively, AI allows Islamic institutions to address specific educational needs, promote equitable access to learning opportunities, and enhance administrative efficiency, (Syed et al., 2019). However, the realization of these benefits depends on concerted efforts from policymakers, educators, and technology providers to address the technological, ethical, and practical challenges associated with AI integration in Islamic educational settings, (Elihami et al., 2024).

The implementation of AI in Indonesian Islamic education offers a unique and scalable model for other Muslim-majority countries, blending global best practices with local cultural and religious values. As the largest Muslim-majority nation, Indonesia's diverse educational landscape-spanning pesantren (Islamic boarding schools), madrasahs, and modern Islamic universities-provides a robust platform to demonstrate AI's transformative potential.

Key Components of Indonesia's AI Model

1. Indonesia leverages AI tools such as adaptive learning platforms to teach Quranic studies, Fiqh, and Arabic, while ensuring the content aligns with Islamic values. For example, AI systems like "Quran Companion" personalize learning for students, addressing various learning speeds and styles.
2. Public-private partnerships, such as collaborations with EdTech firms, support the development of culturally sensitive AI applications. Government initiatives, like the Digital Indonesia Roadmap, ensure that Islamic schools in remote areas can access AI-powered resources.
3. Indonesian educators emphasize AI ethics, ensuring algorithms respect Islamic principles and avoid bias. Scholars and technologists work together to develop content moderation guidelines that preserve Islamic teachings.
4. By adopting AI solutions proven effective globally-such as automated language translation and personalized tutoring—Indonesia enhances

educational inclusivity while tailoring these solutions to Muslim contexts. Indonesia's approach can inspire other Muslim countries by demonstrating how AI can address educational gaps, respect cultural values, and foster international collaboration to promote SDG 4 and 17.

Practical Guidance for Educational Institutions

Phased AI Implementation in Islamic Education namely: (1) Begin with a needs analysis to identify gaps in learning and teaching methods. Engage Islamic scholars and educators to ensure AI aligns with religious and cultural values. (2) Develop competency-based training programs to familiarize educators with AI tools, emphasizing ethical usage and integration with Islamic teachings. For example, training on AI-based Quranic recitation analysis software can combine AI literacy with tajweed principles. (3) Collaborate with governments and private sectors to acquire necessary hardware, software, and internet connectivity. Prioritize solar-powered options for rural madrasahs. (4) Start with small-scale implementations, such as introducing AI tutoring systems in selected madrasahs or schools. Monitor outcomes to refine strategies. (5) Establish benchmarks for educational outcomes and periodically review AI systems to ensure they meet pedagogical and ethical standards. Seek feedback from teachers, students, and parents.

Recommendations for Technology Developers

1. Develop AI applications that integrate Islamic educational content, such as Quranic memorization, Arabic grammar, and Fiqh studies. Use adaptive learning systems to personalize education based on student proficiency.
2. Prioritize transparency and fairness in algorithms. For instance, AI moderation systems can ensure that content adheres to Islamic values.
3. Include regional dialects and classical Arabic in AI tools, bridging linguistic gaps for diverse Muslim communities.
4. Partner with Islamic educators to co-create applications, ensuring cultural and religious relevance while leveraging global AI innovations. In conclusion, while the integration of AI in Islamic education offers considerable potential for advancing SDG targets, successful implementation requires a multifaceted approach that addresses infrastructure needs, ethical concerns, and educator preparedness. Investments in digital infrastructure, development of ethical AI frameworks, and professional development for educators will be essential to harness the full potential of AI in promoting quality education in alignment with Islamic values, (Celik, 2023).

■ CONCLUSION

In conclusion, this study reveals the significant potential of AI integration in Islamic educational institutions to enhance educational quality, accessibility, and alignment with sustainable development goals. The positive perceptions across administrators, teachers, and students indicate AI's capability to personalize learning experiences and bridge accessibility gaps, particularly for students in remote or underserved areas. However, the study also underscores the importance of addressing ethical considerations, such as algorithmic transparency and cultural relevance, to ensure AI solutions align with Islamic values. Additionally, infrastructural limitations and the need for comprehensive teacher training remain significant challenges that restrict the effective deployment of AI in these settings.

This research advances the current understanding of AI's role in Islamic education by identifying the unique ethical and cultural dimensions that must be considered for successful

integration. Addressing these factors can support Islamic educational institutions in providing equitable, high-quality education that is both technologically advanced and ethically sound. The study's findings call for policymakers to develop supportive frameworks and resources, particularly in terms of infrastructural investment and professional development for educators. By doing so, Islamic educational institutions can harness AI's full potential and contribute meaningfully to sustainable development objectives, thereby setting a foundation for inclusive, innovative, and ethically grounded educational advancements.

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