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DEVELOPMENT OF ISLAMIC STUDY PRACTICES IN THE DIGITAL ERA: A CASE STUDY ON QUR'AN LEARNING WITH ARTIFICIAL INTELLIGENCE (AI)

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ABSTRACT

This community service research aims to examine the effectiveness of implementing the Ngaji artificial intelligence (AI) application at Taman Pendidikan al-Qur'an (TPQ) Birul Walidain in Pekalongan. A pre-experimental design with pre- and post-tests was applied to 20 students aged 10–13 years, using a structured knowledge assessment instrument analyzed descriptively and quantitatively. The results showed significant improvements across all indicators: basic AI understanding increased from 55% to 100% (+45 percentage points), awareness of learning enhancement aspects increased from 20% to 100% (+80 percentage points), and understanding of AI benefits increased from 55% to 75%, with an average cross-indicator increase of ±37.5 percentage points. These findings contribute empirically to the discourse on edupreneurship by demonstrating that an AI-integrated learning model can be effectively implemented in TPQs, while also offering a replicable framework for the modernization of non-formal Islamic education based on digital literacy.

Keywords: *Qur'anic Learning, Edupreunership, Artificial Intelligence, TPQ*

A. Introduction

Advances in artificial intelligence (AI) technology have driven a global transformation in education, including in Indonesia. AI has proven capable of enriching the learning experiences of young children through adaptive, interactive, and personalized content, while also supporting the overall effectiveness of teaching and learning activities (Noviyanti, 2023).

In the context of Islamic religious education, In a learning orientation that optimizes cognitive aspects, (Anamisari et al., 2026) the integration of technology provides opportunities for teachers to deliver material in ways that are easier, more engaging, and more varied, ensuring that students do not easily become bored and that digital literacy within the religious education environment continues to grow (Sodikin, 2025). The emergence of artificial intelligence (AI) within the Muslim community has indeed presented various challenges and opportunities for Islamic communication in the digital sphere, where its use must remain consistent with religious principles and values, meaning (Utami & Luhuringbudi, 2026). This development underscores that technology is no longer merely an accessory but a strategic component in the renewal of Indonesia's non-formal Islamic education system.

The Taman Pendidikan al-Qur'an (TPQ), as a non-formal Islamic educational institution, plays a strategic role in shaping a generation of Muslims who are competent in reading, understanding, and practicing the Al-Qur'an. However, reality shows that most TPQs in Indonesia still face structural problems that hinder the quality of learning, including the dominance of traditional methods, a shortage of teaching staff, and a lack of adequate supporting facilities (Majid, 2018). This situation is exacerbated by low student motivation due to a lack of pedagogical innovation, as children tend to be more interested in digital entertainment than in participating in TPQ learning activities, which are perceived as irrelevant to the needs of the times (Tafsir, 2017).

The TPQ is a non-formal educational institution that plays an important role in shaping a Muslim generation that has a basic knowledge of religion, especially in terms of reading, understanding, and applying the Al-Qur'an. However, in reality, many TPQs in Indonesia still face various problems, such as traditional teaching methods, a limited number of teachers, and a lack of learning support facilities. This has an impact on the quality of the learning process and the achievement of educational goals at TPQs, which are still unsatisfactory (Majid, 2018).

This paradox calls for innovative solutions capable of synergistically bridging Islamic values with technological advancements. Although the discourse on the integration of AI in general education has grown rapidly, empirical studies specifically examining the application of AI within the TPQ ecosystem particularly through an edupreneurship approach as a framework for developing educational

institutions based on innovation and self-reliance remain very limited, including studies on the ethical boundaries of artificial intelligence in the context of Islamic education,(Adinugraha & Folaranmi, 2026) This research gap constitutes an urgent academic issue that needs to be addressed, given that TPQ are non-formal Islamic educational institutions reaching millions of students across Indonesia yet have not received adequate attention in the educational technology literature. The novelty of this study lies in the integration of three key intersections that have never been examined simultaneously: AI, edupreneurship, and TPQs as non-formal Islamic educational institutions.

Based on this gap, this community service research aims to examine the effectiveness of implementing the Ngaji AI application at TPQ Birul Walidain, Pekalongan, in enhancing students' AI literacy and their understanding of the role of technology in Quranic learning. More broadly, this study aims to demonstrate that an AI-based learning model oriented toward edupreneurship can serve as an innovative, effective, and replicable solution for the modernization of TPQs in Indonesia.The significance of this study lies in its potential as a development model that can be adopted by other TPQs in integrating technology without compromising the values and identity of Islamic education.

This study employed a pre-experimental community service design, using pre-test and post-test measurements as the primary evaluation instruments. The study subjects consisted of 20 students aged 10–13 years at TPQ Birul Walidain, Pekalongan. The intervention was conducted through the introduction and direct use of the Ngaji AI application in a single structured learning session. Data were collected using a structured knowledge assessment instrument and analyzed descriptively and quantitatively. The results showed a significant increase in all understanding indicators, with an average increase of ±37.5 percentage points, including the highest surge in the indicator of awareness of learning improvement aspects, which increased from 20% to 100% (+80 points), as well as basic understanding of AI, which reached 100% from the previous 55% (+45 points).

B. Pre-test and Post-test Questionnaire Results (ages 10-13)

Research data were collected using a structured knowledge assessment instrument administered to 20 students aged 10–13 years at TPQ Birul Walidain, Pekalongan, before and after the Ngaji AI app-based learning intervention. The instrument consisted of 8 items covering the dimensions of AI literacy, the use of technology in learning, and AI-based personalized learning.

The validity of the instrument was verified through content validity by assessing the alignment of the questions with the intervention's objectives and their relevance to the presented material. Data analysis was conducted using descriptive-quantitative methods by comparing the frequency of correct answers on the pre-

test and post-test to identify the extent of improvement in understanding for each indicator.

Number	Comprehension Indicators	Pre-test Yes (%)	Post-test Yes (%)	Increase (points)
1	What does AI stand for	11 (55%)	20 (100%)	**+45**
2	One of the benefits of AI learning	11 (55%)	15 (75%)	**+20**
3	AI can help teachers, except	13 (65%)	15 (75%)	**+10**
4	Examples of AI applications in the development of instructional materials	9 (45%)	13 (65%)	**+20**
5	The primary role of AI in analyzing learning needs	11 (55%)	17 (85%)	**+30**
6	AI-powered learning materials	14 (70%)	16 (80%)	**+10**
7	The development of AI-based instructional materials can enhance various aspects of learning	4 (20%)	20 (100%)	**+80**
8	Definition of AI-Based Personalized Learning	10 (50%)	11 (55%)	**+5**
	Rata-rata peningkatan	**52,5%**	**79,4%**	**±27,5 points**

Table 1. Recapitulation of Pre-test and Post-test Results

1. Basic AI Literacy (Indicator 1)

Students' understanding of the full form of "Artificial Intelligence" increased significantly from 55% to 100%, marking an increase of 45 percentage points. Perfect achievement on this indicator confirms that the Ngaji AI-based intervention successfully built a comprehensive foundation of basic digital literacy within a single learning session. This finding aligns with Noviyanti's (2023) study, which confirms that direct and contextual exposure to AI technology is proven effective in building basic conceptual understanding among early childhood learners.

2. Benefits of AI in Learning (Indicator 2)

Understanding of the benefits of AI in learning increased from 55% to 75% (+20 points). This increase reflects students' ability to begin associating AI technology with concrete learning activities in daily life. Although the achievement has not yet reached a perfect level, an increase of 20 points in a single intervention session demonstrates the effectiveness of the experiential learning approach implemented through the Ngaji AI application.

3. The Role of AI in the Learning Context (Indicators 3 & 4)

Understanding of AI's role as a teacher's tool increased from 65% to 75% (+10 points), while understanding of examples of AI utilization in instructional material development increased from 45% to 65% (+20 points). These two indicators measure the applied dimension of AI literacy, and their improvement indicates that students are beginning to understand AI not only as an abstract concept but as a concrete and functional pedagogical instrument, as theorized within the framework of Technology-Enhanced Learning (Sodikin, 2025).

4. The Analytical Functions of AI in Learning (Indicator 5)

The fifth indicator shows a substantial increase of 30 percentage points, from 55% to 85%. This increase indicates that students are beginning to understand AI's capacity to analyze individual learning needs, which is one of the key advantages of AI technology over conventional methods. This finding aligns with the principles of edupreneurship, which emphasize data-driven innovation and the personalization of educational services.

5. AI-Based Learning Media (Indicator 6)

Understanding of AI-based learning media increased from 70% to 80% (+10 points). The relatively high pre-test score (70%) on this indicator suggests that students possess a fairly solid foundational knowledge of digital media, although this has not yet been specifically linked to the context of AI in Quranic education.

6. Learning Improvement Aspect (Indicator 7)

The seventh indicator recorded the most dramatic surge in the overall data, rising from 4 respondents (20%) to 20 respondents (100%), representing an increase of 80 percentage points. This perfect achievement is the most significant finding in this study, indicating that the direct experience of using the Ngaji AI app effectively transformed all students' perceptions regarding AI's capacity to enhance various aspects of learning. These results support the argument that an AI-based edupreneurship approach is capable of creating comprehensive and measurable changes in perception in a short period of time, as highlighted in recent studies on technology-based non-formal educational innovation.

7. Personalized Learning (Indicator 8)

The personalized learning indicator showed the most moderate increase, rising from 50% to 55% (+5 points), with 9 respondents still not fully understanding this concept. This situation can be explained by the higher level of abstraction of the personalization concept compared to other indicators, as well as the limited duration of the intervention, which covered only one learning session. This finding also identifies a program development area that needs to be prioritized in follow-up interventions, particularly in explaining the mechanisms of AI-based content adaptation to students aged 10–13 years.

Summary of Findings and Contributions to the Edupreneurship Discourse. Overall, the results of the descriptive-quantitative analysis show an average increase in understanding across indicators of ±27.5 percentage points, with the average post-test score reaching 79.4% compared to 52.5% on the pre-test. Perfect scores (100%) were achieved on two key indicators: basic understanding of AI (Indicator 1) and awareness of the aspects of AI-based learning enhancement (Indicator 7). These findings empirically demonstrate that the AI-integrated learning model via the Ngaji AI application not only enhances students' technical capacity in digital literacy but also broadens their understanding of the strategic role of technology in non-formal Islamic religious education.

From an edupreneurship perspective, these research results affirm that AI-based innovation in the TPQ environment is not merely technological enrichment but a model of institutional transformation oriented toward sustainability, effectiveness, and replicability. TPQ Birul Walidain can thus serve as a proof of concept for the development of similar models in other TPQ institutions in Indonesia, within the framework of modernizing non-formal Islamic education that remains grounded in Islamic values and identity.

C. Pedagogical and Social Learning Outcomes of Student Facilitators

The implementation of community service activities at TPQ Birul Walidain in Pekalongan not only had an impact on the students but also provided significant

pedagogical and social learning opportunities for the student facilitators. This reflective analysis is structured based on the experiential learning framework (Kolb, 1984), service learning, and Islamic Pedagogy as conceptual foundations for interpreting the facilitation experiences gained during the intervention.(Uno & Furco, 1996)

The implementation of the learning intervention at the TPQ presented a complex pedagogical context, given that the students possessed diverse levels of ability, character, and motivation. This heterogeneity required student facilitators to dynamically adapt their teaching approaches, incorporating a combination of lecture methods, question-and-answer sessions, collaborative problem-solving, and the use of the Ngaji AI application as an interactive medium. The application of these varied methods proved to enhance students' active engagement and minimize boredom during learning sessions (Ubabuddin, 2019). From the perspective of experiential learning, this facilitation experience places students within a concrete learning cycle (concrete experience) that encourages reflection, conceptualization, and active experimentation (Kolb, 1984), so that student facilitators not only transfer knowledge but simultaneously build a deep understanding of the principles of differentiated instruction, managing heterogeneous classrooms, and adapting technology within the context of non-formal Islamic education. This aligns with the principles of Islamic Pedagogy, which emphasize that the educational process is a moral responsibility (amanah) that demands sensitivity to the individual needs of learners (Majid, 2018).

This community service activity was carried out by a team consisting of four student facilitators with a structured division of roles based on each member's competencies, including Quran reading guidance, development of interactive learning media, classroom management, and student motivation facilitation. This systematic division of roles resulted in effective coordination and well-organized program implementation. The dynamics of this team collaboration reflect the principle of collaborative learning as articulated by Setiawan (2022), that the learning process is more effective through interaction and collaboration with others. In the context of service learning, this teamwork experience develops students' interpersonal competencies, including the ability to engage in constructive discussions, provide formative feedback, and professionally manage differences in approach within the team (Heru Setiawan, 2022).

Intensive interaction between student facilitators and learners during the activity resulted in meaningful social learning for both parties. Learners demonstrated collaborative behavior that developed during the intervention, marked by increased solidarity among peers, a willingness to help one another with reading and memorization, and the courage to ask questions and express opinions during class discussions (Ciptandi Dwi Pangestuti, 2022). Within the service learning framework, student engagement in the TPQ environment extends beyond

the technical role of instructor, transforming them into social agents who contribute to strengthening the learning community within the non-formal Islamic education setting. The use of interactive methods based on the Ngaji AI app, question-and-answer sessions, and Islamic narratives significantly enhances classroom dynamics and encourages active student participation in the learning process (Ciptandi Dwi Pangestuti, 2022). Qur'anic learning support activities, including the memorization of prayers, the study of tajwid, and recitation, provide a pedagogical-spiritual dimension that strengthens the student facilitators' understanding of the principles of Islamic pedagogy. From this perspective, the educational process is not merely an academic activity but also a form of service (khidmah) that holistically integrates intellectual, moral, and spiritual dimensions (Tafsir, 2017).

This experience reinforces the conception of Islamic Pedagogy that positions the educator as a murabbi—a figure who not only transfers knowledge but also shapes character and fosters the spirituality of learners (Majid, 2018). The integration of Islamic values into the AI-based learning facilitation process underscores that technology and religious values are not conflicting entities but can be productively synergized within the framework of Islamic educational edupreneurship (Noviyanti, 2023).

During the implementation of the program, a number of facilitation challenges were identified and systematically addressed. The main challenges included fluctuations in student concentration, disruptive behavior, and limitations in the learning resources available at the TPQ. The intervention strategies implemented included the application of a positive reinforcement system in the form of verbal appreciation and small incentives, as well as the integration of the Ngaji AI application as an alternative learning medium proven to measurably increase students' enthusiasm and engagement (Ubabuddin, 2019). From an experiential learning perspective, these challenges serve as reflective stimuli that encourage student facilitators to develop pedagogical flexibility, creativity in problem-solving, and professional resilience as essential competencies for prospective educators in the era of technology-based education (Kolb, 1984).

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D. DESCRIPTION OF THE NGAJI AI APP: FEATURES, HOW IT WORKS, AND PEDAGOGICAL VALUE

The Ngaji AI app is an artificial intelligence (AI)-based Quran learning platform designed to integrate technology with Islamic religious education in an interactive and adaptive manner. In the context of digital religious pedagogy, this app represents a paradigm shift from conventional learning approaches toward personalized learning models, where the system automatically adjusts content and difficulty levels based on the user's abilities and interaction history (Rachmawati, 2021). The presence of this AI-based application in Quran education aligns with

developments in educational technology that position artificial intelligence as a strategic tool in supporting the effectiveness of non-formal Islamic religious education (Isma Aina Salsabila, 2024).

Functionally, the Ngaji AI application is equipped with six main features that integrally support the Quran learning process. The Speech Recognition feature utilizes Automatic Speech Recognition (ASR) technology to detect the accuracy of Qur'an recitation in real-time, providing immediate corrections that users can imitate. The Exercise feature offers pronunciation practice in the form of verse excerpts and Arabic letters to improve users' articulation of the letters.(Alsayadi & Hadwan, 2022)

The Exercise feature provides pronunciation practice in the form of verse excerpts and Arabic letters to help users improve their articulation. The Scoring System feature allows users to track their learning progress through a three-tiered proficiency system: beginner, intermediate, and advanced. The Leaderboard feature serves as an extrinsic motivational tool that encourages users to practice consistently. The Prayer Schedule feature integrates a spiritual dimension by providing location-based prayer schedule information. The Exam feature facilitates the identification of areas for improvement in Quran recitation while providing contextual reading recommendations (Isma Aina Salsabila, 2024).

From a motivation theory perspective, the feature architecture of the Ngaji AI app reflects the application of gamification principles in learning, where competitive elements such as leaderboards and scoring systems function as extrinsic motivators that drive sustained user engagement in the learning process (A. Nugroho, 2022). The mechanism of instant feedback through the Speech Recognition and Scoring System features simultaneously supports the principle of formative assessment—that is, formative and continuous assessment to guide students' learning development—as outlined in technology-based learning theory.

From the perspective of digital religious education, the Ngaji AI app serves not merely as a technology-based entertainment platform, but as a learning tool that integrates Islamic values with a scientific and data-driven approach. Its minimalist interface, responsive to various device sizes, and equipped with accessibility features such as font size adjustment and dark mode, make this app inclusive and accessible to a wide range of users, including Islamic boarding school students, schoolchildren, and the general public (Rachmawati, 2021).

The dashboard design, which displays activity summaries, daily surah recommendations, and reminders for recitation schedules, further reinforces the concept of personalized learning, where the system actively supports the formation of consistent and structured learning habits (A. Nugroho, 2022).

Overall, the Ngaji AI app represents a digital religious pedagogy model that synergistically integrates three dimensions of learning: the cognitive dimension through the understanding of tajwid concepts and memorization; the psychomotor

dimension through pronunciation exercises based on speech recognition; and the affective dimension through the reinforcement of motivation and the consistent development of religious character. In the context of edupreneurship, this app offers an innovative framework that can be replicated as a solution for modernizing Quranic education in TPQs across Indonesia, without compromising the substance and core values of Islamic education (Isma Aina Salsabila, 2024).

E. CHALLENGES IN IMPLEMENTING LEARNING TECHNOLOGY IN THE BIRUL WALIDAIN TPQ ENVIRONMENT

The adoption of digital technology in the learning process is an unavoidable necessity in 21st-century education, including in non-formal Islamic educational settings such as the Al-Qur'an Education Center (TPQ). The digital divide in the context of non-formal Islamic education is not merely a technical issue but also touches on pedagogical, socio-economic, and cultural dimensions that interact in complex ways (Majid, 2018). Based on observations conducted during community service activities at TPQ Birul Walidain, Pekalongan, the identified challenges were classified into the following three main categories.

1. Structural Challenges

Limited internet infrastructure is the most fundamental obstacle faced by TPQ Birul Walidain in integrating technology into the learning process. Unstable internet connections directly limit facilitators' ability to make optimal use of digital platforms, including the Ngaji AI app, which requires a stable connection to operate its Speech Recognition feature based on Automatic Speech Recognition (ASR)(Shah, 2025). As institutions that operate largely independently and are community-based, TPQs often do not receive infrastructure support equivalent to that of formal educational institutions (Tafsir, 2017). The limited availability of adequate technological devices, such as smartphones and tablets, further restricts the scope for technology implementation within the TPQ environment.

2. Pedagogical Challenges

Challenges in the pedagogical dimension are closely related to facilitators' technological competence and learners' readiness. Not all instructors at TPQs possess sufficient digital literacy to effectively integrate technology into their Quran teaching practices. The resistance to technology adoption that arises is not due to a rejection of innovation, but rather a lack of adequate technical capacity. From the perspective of experiential learning (Kolb, 1984), facilitators' technological competencies can only develop through structured hands-on experience and continuous mentoring.

On the learners' side, the heterogeneity in basic Qur'an reading skills among students aged 10–13 creates significant challenges for differentiated instruction. Some students who have not yet fully mastered the Arabic alphabet face additional difficulties when accessing materials through digital interfaces, so the potential of technology to personalize learning has not yet been fully optimized (Ubabuddin, 2019)

3. Socio-Economic Challenges

The economic conditions of students' families in the Birul Walidain TPQ community directly influence access to technology in the learning context. Parents' limited financial ability to provide regular internet data plans, as well as the need to share devices with other family members, pose significant barriers to the continuity of technology-based learning outside the TPQ environment (Sirin, 2005).

The low awareness among some parents regarding the relevance of technology in religious education further creates a support gap that impacts students' learning motivation. This situation reflects issues in the literature on the digital divide in Islamic education, where socio-economic factors often serve as the primary determinants of successful technology adoption in community-based educational settings (Noviyanti, 2023). Concentration disruptions caused by students' tendency to use digital devices for entertainment rather than learning further underscore the urgency of a digital literacy approach integrated with Islamic pedagogical values.(Consumer & Connected, 2017).

4. Efforts to Overcome Challenges

Overcoming the challenges of implementing technology at the Birul Walidain TPQ requires a comprehensive and contextual approach at the following three levels. Structural Level: Strengthening internet network infrastructure to reach non-formal Islamic educational institutions is a prerequisite that cannot be overlooked, accompanied by the provision of adequate technological devices for the TPQ environment.(Resta & Laferrière, 2007)

Pedagogical Level: Digital literacy training programs specifically designed for TPQ teaching staff, accompanied by ongoing mentoring, are necessary to build adequate facilitation capacity (Eshet-alkalai, 2004). The implementation of a blended learning model that combines conventional face-to-face approaches with the use of the Ngaji AI application has proven effective in bridging the gap between traditional methods and technology-based innovations in the context of the Birul Walidain TPQ (Ubabuddin, 2019).

Socio-Economic Level: Strengthening collaboration between TPQ administrators, parents, and community stakeholders is necessary to create a sustainable support ecosystem for the implementation of technology in non-formal Islamic education (Heru Setiawan, 2022). The integration of digital literacy

education based on Islamic values into the TPQ curriculum serves as an essential long-term foundation for shaping a generation of Muslims who are both technologically literate and possess Islamic character.

F. Conclusion

This community service research demonstrates that the implementation of the Ngaji AI app at TPQ Birul Walidain in Pekalongan resulted in a significant improvement across all comprehension indicators for students aged 10–13, with an average increase of approximately 27.5 percentage points across eight indicators, including perfect scores in basic AI comprehension (55% → 100%) and awareness of learning enhancement aspects (20% → 100%). These findings empirically demonstrate that an AI-based learning model oriented toward edupreneurship can be effectively implemented in non-formal Islamic educational settings, while offering a replicable framework for the modernization of TPQs in Indonesia. Implicitly, the results of this study encourage TPQ administrators, Islamic education policymakers, and technology developers to collaborate in building an innovative, adaptive, and digital literacy-based Quran learning ecosystem.(Chen et al., 2020)

This research contributes empirically to the discourse on edupreneurship by demonstrating that an AI-integrated learning model can be effectively implemented in TPQs, while also offering a replicable framework for the modernization of non-formal Islamic education based on digital literacy. This study has a number of limitations that must be acknowledged academically. The pre-experimental design used without a control group limits the ability to infer causality from the findings obtained. The limited number of research subjects 20 students in a single intervention session at one TPQ institution restricts the generalizability of the research findings to a broader population. Furthermore, the short duration of the intervention has not yet allowed for the measurement of long-term impacts on Quranic reading skills and the sustainable development of technology based learning habits. Given these limitations, further research is recommended to adopt a quasi experimental design with a control group, expand the scope of participants across multiple TPQs in various regions of Indonesia, and integrate longitudinal measurements to assess the long-term sustainability of AI-based learning impacts.

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