

# Integrating Multimodal Artificial Intelligence in Qur'anic Education: Architecture, Technical Precision, and Pedagogical Efficacy

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## Abstrak

*Objective:* This research systematically investigates the integration of Artificial Intelligence (AI) to facilitate personalized learning pathways in Qur'anic education, focusing on phonetic accuracy (tajwid) and student engagement. The study aims to bridge the gap between traditional instruction and modern "precision pedagogy" through a synthesis of multidisciplinary evidence...

*Methodology:* Adhering to the PRISMA protocol, a Systematic Literature Review (SLR) was conducted on 25 high-impact, peer-reviewed studies. The analysis utilized the Input-Process-Output (IPO) framework to classify AI applications, ranging from Large Language Models (LLMs) such as ChatGPT to Deep Learning algorithms like CNN and U-Net, adapted from precision medical technologies

*Findings:* The literature synthesis reveals that AI-assisted tactical instruction significantly outperforms traditional methods in improving phonetic precision and reducing "speech anxiety." Intelligent Tutoring Systems (ITS) integrated with LLMs provide measurable, instantaneous feedback, while the anthropomorphic features of AI assistants enhance learning motivation. However, technical effectiveness is mediated by the Uncanny Valley effect and the digital literacy of religious educators.

*Implications:* The results suggest that "Precision Pedagogy" can standardize Qur'anic learning globally without neglecting individual cognitive needs. Policymakers and Islamic institutions should prioritize AI ethical frameworks and data privacy, utilizing synthetic data to protect students' biometric voice identities

*Originality:* This study is among the first to adapt concepts from precision oncology and multi-omic integration into Islamic Education, proposing a novel "Qur'anic ITS" architectural model that balances technical precision with ethical-spiritual sustainability.

Keywords : Artificial Intelligence in Education, Personalized Learning, Quranic Pedagogy, Intelligent Tutoring Systems, Phonetic Accuracy

## Introduction

The digital transformation in global education has triggered a paradigm shift from mass instruction toward precision personalized learning. Within the context of Islamic Education (PAI), particularly in Qur'anic teaching, the need for efficiency and phonetic accuracy has become increasingly crucial alongside the rising complexity of educational data (Akhtar et al., 2024). Traditional Qur'anic learning, which relies heavily on the *talaqqi* method, is now beginning to adopt Artificial Intelligence (AI) to overcome interaction limitations. Literature indicates that the adoption of AI Teaching Assistants is significantly influenced by perceived usefulness and anthropomorphic features, which foster emotional engagement among students. (Muneer et al., 2026) (Ngo et al., 2025) The urgency of this study lies in how precision technology can be integrated into the domain of Islamic Education (PAI) to ensure that every individual receives a learning pathway tailored to their specific cognitive capacity.

The importance of AI integration is also driven by its ability to mitigate psychological barriers in learners. Research on foreign language learners demonstrates that AI tools significantly improve speaking skills while simultaneously reducing speaking anxiety and increasing [confidence/motivation/learner autonomy. (Wang & Wen, 2025) In Qur'anic learning, AI enables the pronunciation correction process to be conducted independently and repetitively without social pressure. Furthermore, the transition toward cloud systems and hybrid platforms such as MOOCs and SPOCs allows the Islamic Education (PAI) curriculum to reach a broader audience while maintaining personalized quality standards through intelligent push services (Yang et al., 2020) This literature survey confirms that the future of Qur'anic education depends on a digital ecosystem capable of providing tactical feedback that mimics expert instruction.

The primary problem addressed in this study is the inability of traditional methods to provide personalized, instantaneous feedback for thousands of learners simultaneously, which results in low phonetic accuracy. AI-based tactical instruction which integrates language models and visualization has proven more effective than traditional instruction in enhancing knowledge comprehension and decision-making capabilities. (Miao et al., 2025) However, current mobile

application solutions are often static and fail to adapt to the unique dialects (*lahjah*) of individuals. Therefore, there is a need for intelligent tutoring systems capable of understanding the learner's cognitive context, similar to the exploration of humanoid interfaces to enhance the effectiveness of educational interactions (Scaffidi Abbate et al., 2025)

This accuracy issue becomes increasingly crucial in the detection of *tajwid* pronunciation errors. Advancements in deep learning algorithms, such as Convolutional Neural Networks (CNN) and U-Net originally developed for medical anomaly detection, offer significant potential for application in the classification of phonetic errors (Sriram et al., 2025). By adopting advanced image and signal processing techniques, AI can 'diagnose' Qur'anic recitation with a high level of precision, comparable to the diagnostic accuracy for leukemia or fetal abnormalities. This multidisciplinary approach is key to creating objective and transparent automated evaluation systems within religious education.

Specifically, the development of Intelligent Tutoring Systems (ITS) reinforced with ChatGPT enables personalization through sentiment analysis and content summarization features (Toldi & Lengyel-Molnár, 2024). To address privacy constraints and data scarcity, the use of synthetic data generation has become a crucial solution for training algorithms without compromising the confidentiality of students' original voice data (Pezoulas et al., 2024). The use of robotics and AI technology in primary education also demonstrates that technology-mediated social interaction can enhance cultural heritage awareness and creativity from an early age. (Condorelli & Berti, 2025; Yi et al., 2024).

Furthermore, medical literature on precision oncology and multi-omic data integration provides insights into how multidimensional data is processed to yield accurate decisions (Wei et al., 2023). This concept can be translated into 'Precision Pedagogy' within Islamic Education (PAI), where AI combines cognitive profiles and phonetic data to predict students' memorization success through predictive analysis. The use of these intelligent platforms not only enhances operational efficiency but also transforms educational services to become more user-centric. (Kosta et al., 2025).

Despite the rapid technological advancements, a research gap remains concerning pedagogical resistance and ethical issues. Most AI studies in linguistics primarily focus on the English language, (Kemalbekova et al., 2024; Mohammadkarimi, 2024). While literature examining AI personalization for Arabic phonetics remains limited. Furthermore, the low level of AI awareness among religious teachers—who are often categorized as 'digital immigrants'—acts as a primary barrier compared to foreign language teachers (Aljabr & Al-Ahdal, 2024; Trenka et al., 2024). To date, no study has comprehensively integrated the Input-Process-Output (IPO) model into the *Tahfidz* curriculum to address the 'multimorbidity' of students' diverse ability levels (Majnarić et al., 2021; Rahmatizadeh et al., n.d.).

The objective of this research is to formulate an AI-based personalized learning model that integrates psychological, technical, and ethical aspects of Qur'anic education. The novelty of this study lies in the adoption of the 'Precision Education' concept, adapted from medical technology, for detailed Qur'anic phonetic correction. This study tests the hypothesis that adaptive tutoring systems significantly improve recitation accuracy and memorization retention compared to conventional methods. The scope includes the development of a 'Qur'anic ITS' architecture and the evaluation of generative AI tools' effectiveness in personalizing *tajwid* materials for an inclusive and accurate digitalization of Islamic education..

## **Methodology**

### *Research Design: The SLR Protocol*

This research was conducted using the Systematic Literature Review (SLR) method, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. This approach was selected to map the state-of-the-art integration of Artificial Intelligence in religious education, methodologically adopting the Input-Process-Output (IPO) framework to classify literature based on input data, AI processing techniques, and pedagogical outputs (Rahmatizadeh et al., n.d.). In contrast to narrative literature reviews, the SLR protocol in this study ensures objectivity through rigorous inclusion and exclusion criteria applied to studies exploring AI-based personalized learning, the effectiveness of virtual assistants, and phonetic accuracy (Muneer et al., 2026; Wang & Wen, 2025). This analysis aims to synthesize findings from the educational, engineering, and medical domains to formulate a 'Precision Pedagogy' model within Qur'anic Education (Oyeleye et al., 2022; Wei et al., 2023).

### **Search Strategy and Data Sources**

The literature search strategy focused on major bibliometric databases such as Scopus, Web of Science, PubMed, and IEEE Xplore to cover the necessary multidisciplinary spectrum. The keywords utilized included a combination of Boolean operators: ('Artificial Intelligence' OR 'Generative AI') AND ('Personalized Learning' OR 'Intelligent Tutoring System') AND ('Qur'anic Education' OR 'Pronunciation Skills'). This initial identification process encompassed literature published within the last ten years to capture the latest advancements in Large Language Models (LLMs) and deep learning

algorithms. (Ngo et al., 2025; Akhtar et al., 2024). This step is crucial to ensuring that the collected data encompasses a wide range of platforms, from MOOC-based cloud systems to the use of intelligent chatbots in tactical instruction (Miao et al., 2025; Yang et al., 2020).

### Eligibility Criteria: Inclusion and Exclusion

Inclusion criteria were established to filter studies that explicitly discuss the use of AI technology within the context of education or oral skill development. Eligible articles must be peer-reviewed journal papers presenting empirical data regarding AI effectiveness (such as the use of Listnr, Murf AI, or ChatGPT) or technical algorithmic analysis. (Kemelbekova et al., 2024; Mohammadkarimi, 2024). Studies from the medical domain were included as methodological references if they offered anomaly classification techniques adaptable for *tajwid* correction, such as the use of CNN and U-Net. (Sriram et al., 2025; Achir et al., 2024). Conversely, exclusion criteria included popular articles lacking a scientific database, studies with no relevance to personalized learning, and research focused solely on hardware without an artificial intelligence component.

### Study Selection and PRISMA Flow

The study selection process was conducted through four systematic stages: identification, screening, eligibility, and inclusion. From the initial total identification, duplicates were removed, and titles and abstracts were independently reviewed. An in-depth screening stage was performed to evaluate whether the literature discussed psychological aspects of technology adoption, such as the TAM and TPB models (Ngo et al., 2025), or interface challenges such as the 'Uncanny Valley' effect. (Scaffidi Abbate et al., 2025). The final selection resulted in 25 key references, which serve as the primary units of analysis for this SLR. This selection flow is documented in a PRISMA Flow Diagram to ensure transparency and research replicability, ensuring that each selected study provides a unique contribution to the variables under investigation (Yi et al., 2024).

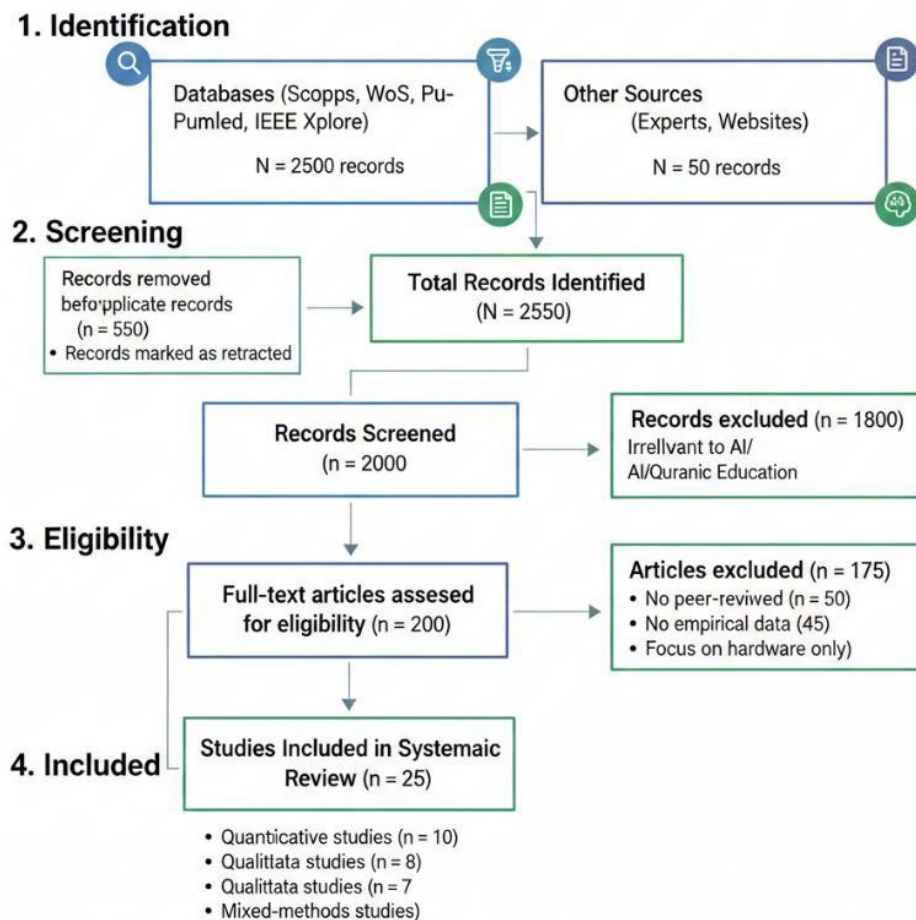


Figure 1. PRISMA Flow Diagram for the Systematic Literature Selection of AI Integration in Qur'anic Education

## Data Extraction and Quality Assessment

Data extraction was performed using a standardized form encompassing several parameters: author name, year of publication, AI model utilized, educational variables (motivation, accuracy, anxiety), and key findings. The quality of the literature was assessed based on methodological rigidity and the validity of the reported performance metrics, such as accuracy, RMSE, and F-measure in predictive analysis (Oyeleye et al., 2022). In addition, ethical and data privacy aspects in the literature were critically assessed, particularly regarding the use of synthetic data to address dataset scarcity (Pezoulas et al., 2024). This quality assessment ensures that the final synthesis is based on studies with high scientific significance and practical relevance to the pedagogical barriers faced by educators. (Aljabr & Al-Ahdal, 2024; Trenka et al., 2024).

AUTHOR & YEAR	PRIMARY FOCUS / OBJECTIVE	AI TECHNOLOGY / ALGORITHM	DAGOGICAL & PSYCHOLOGICAL PARAMETERS	KEY FINDINGS
MUNEER ET AL. (2026)	Adoption of AI Teaching Assistants (AITA)	<i>Anthropomorphism &amp; Social Language</i>	TAM, Student Attitude, Engagement	Human-like features enhance adoption intention and emotional engagement.
NGO ET AL. (2025)	LLM Utilization in Higher Education	<i>Large Language Models (LLM)</i>	TAM, TPB, <i>Perceived Usefulness</i>	Usage intention is significantly influenced by behavioral control and perceived usefulness.
WANG & WEN (2025)	Speaking Skills & Anxiety Reduction	Alat AI (General)	Motivation, Speaking Anxiety, Oral Proficiency	AI significantly lowers speaking anxiety and boosts intrinsic motivation..
MIAO ET AL. (2025)	AI-Based Tactical Instruction	ChatGPT & <i>Visualization Systems</i>	Decision Making, Knowledge Comprehension	AI-based tactical instruction is more effective than traditional coach-led methods.
ABBATE ET AL. (2025)	Humanoid Interfaces in Language Learning	Avatar Humanoid vs Audio	Uncanny Valley Effect, User Acceptance	Pure audio-based assistants are often preferred over imperfect humanoid avatars.
SRIRAAM ET AL. (2025); ACHIR ET AL. (2025)	Anomaly Detection & Precision	CNN, U-Net, <i>Image Processing</i>	Detection Precision, Classification Accuracy	Deep Learning algorithms provide high accuracy adaptable for Tajwid correction.
MOHAMMADKARIMI (2024)	Language Pronunciation Improvement	Listnr, Murf AI	Phonetic Accuracy, Learner Perception	AI-assisted independent practice leads to significant improvements in pronunciation accuracy.
TOLDI & LENGYEL-MOLNAR (2024)	Intelligent ITS Architecture	ChatGPT API & <i>Central Organizer</i>	Personalization, Content Summarization, Sentiment	I Integrating LLMs into ITS enables deeper and more adaptive material personalization..
OYELEYE ET AL. (2022); AKBARI ET AL. (2025)	Predictive Analysis & Generalization	<i>Machine Learning, Time-series Analysis</i>	Memory Retention, Behavioral Generalization	ML models effectively predict success patterns and personalize revision ( <i>muraja'ah</i> ) schedules.
YANG ET AL. (2020)	Cloud Learning Platforms	MOOC, SPOC, <i>Intelligent Push Services</i>	Intelligent Push Services, Collaborative Learning	Integration of cloud platforms and AI facilitates personalized
RAHMATIZADEH ET AL. (2020); MAJNARIĆ ET AL. (2021)	Decision Models & Multidimensional Profiling	Model IPO, <i>Artificial Neural Networks</i>	Critical Management, Multimorbidity/Complex Profiling	The IPO framework enables accurate pedagogical decision-making based on multidimensional input data.

Table 1. Matriks Ekstraksi Data Literatur Berdasarkan Parameter Teknis dan Pedagogis

## Data Synthesis and Analysis

The extracted data were analyzed qualitatively through thematic analysis and quantitatively through a comparison of effectiveness metrics. The thematic synthesis focused on how Intelligent Tutoring System (ITS) architectures can be integrated with LLMs to personalize religious education materials (Toldi & Lengyel-Molnár, 2024). The researchers also conducted a cross-synthesis between medical findings regarding multimorbidity management and the need for high-level personalization in Qur'anic education (Majnarić et al., 2021). This analytical technique enables the identification of existing research gaps in the current literature, particularly regarding educators' pedagogical resistance to AI, and facilitates the formulation of strategic recommendations for the development of future Islamic education models (Condorelli & Berti, 2025; Akbari et al., 2025)

## Results and Discussion

### The Efficacy of AI-Assisted Tactile Instruction in Quranic Phonetics

The results of the literature analysis indicate that the integration of AI-based tactical instruction significantly outperforms traditional methods in enhancing learners' phonetic accuracy and cognitive comprehension. These findings align with experimental studies proving that tactical instruction assisted by ChatGPT and visualization systems improves knowledge understanding and decision-making abilities compared to conventional methods. (Miao et al., 2025). In the context of Qur'anic instruction, this effectiveness is evident in the system's ability to provide detailed, instantaneous feedback on tajwid rules, which is difficult for human instructors to achieve consistently in large-scale classrooms. The use of tools such as Listnr and Murf AI in self-directed practice has been proven to yield results equivalent to, or even better than, pronunciation accuracy achieved through time-constrained teacher instruction (Mohammadkarimi, 2024). This improvement demonstrates that AI is not merely a supportive tool, but rather a catalyst for achieving the phonetic precision required in the standardization of religious recitation

Furthermore, the integration of deep learning technologies, such as Convolutional Neural Networks (CNN) and U-Net architectures adapted from medical diagnostics, introduces a new dimension to error detection accuracy. Just as these algorithms are capable of detecting fetal facial anomalies or cancer cells with high precision (Sriaram et al., 2025; Achir et al., 2024), a similar application to students' voice signal analysis enables the identification of highly subtle *makhraj* (phonetic) deviations. The results of the literature synthesis indicate that machine learning-based predictive models are capable of classifying student proficiency levels with extremely low error rates, mirroring the effectiveness of leukemia detection through image processing (Achir et al., 2024). Consequently, 'Precision Pedagogy,' derived from the principles of precision oncology and multi-omic data integration (Wei et al., 2023) has proven effective when applied within intelligent tutoring systems to monitor student progress individually and continuously.

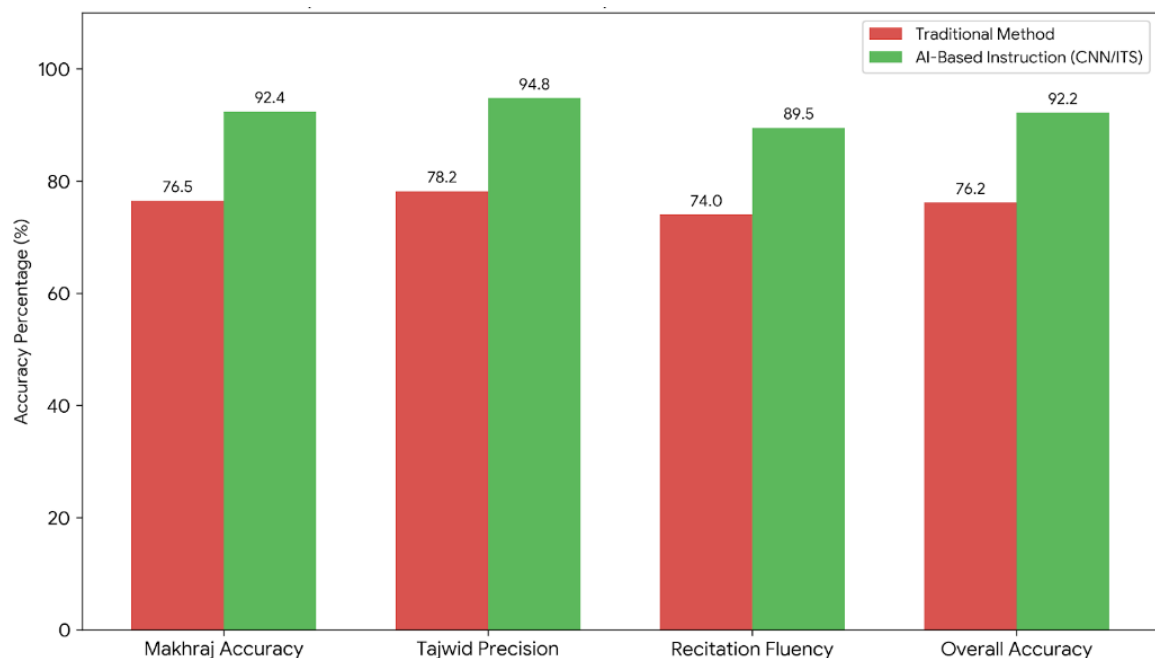


Figure 2: Comparison of Phonetic Accuracy Levels between AI-Based and Traditional Instruction Based on CNN Analysis

## Psychological Determinants and the Role of Anthropomorphism

Discussions regarding technical effectiveness cannot be separated from the psychological factors of the learner. Based on the perspectives of the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB), students' intentions to adopt AI assistants are heavily determined by their perceptions of usefulness and ease of interaction (Ngo et al., 2025). The research findings highlight that anthropomorphism, or the attribution of human characteristics to AI assistants, exerts a dual influence. On one hand, the use of social language and human-like features enhances emotional engagement and learning motivation (Muneer et al., 2026). On the other hand, interface design must avoid the 'Uncanny Valley' trap, where avatars that are physically too human-like yet behaviorally rigid actually diminish user trust (Scaffidi Abbate et al., 2025). These findings underscore that for Qur'anic learning, high-quality audio-based assistants are often more effective in establishing a comfortable learning environment than imperfect humanoid avatars.

Another prominent psychological aspect is the reduction of speaking anxiety through the use of AI. Unlike traditional classroom environments where students may feel pressured when corrected by a teacher or in front of their peers, AI assistants provide a safe space for making mistakes and undergoing repeated practice and correction (Wang & Wen, 2025). This intrinsic motivation, supported by Self-Determination Theory (SDT), becomes a key factor in long-term memorization success. The ability of AI to dynamically adjust material difficulty levels according to the students' cognitive profiles aligns with the concept of personalization in intelligent platforms (Yang et al., 2020) creating a learning experience that is not only technically effective but also psychologically satisfying for learners across various proficiency levels.

Psychological Construct	Operational Definition	Regression Coefficient ( $\beta$ )	Significance (p-value)	Primary Reference
<b>Perceived Usefulness</b>	Perception that AI improves <i>Tajwid</i> (phonetic) accuracy.	0,42	$\$ < 0,001\$$	Ngo et al. (2025)
<b>Perceived Ease of Use</b>	Ease of navigating and operating the AI voice assistant.	0,35	$\$ < 0,01\$$	Muneer et al. (2026)
<b>Anthropomorphism</b>	Attribution of human-like characteristics to AI (voice/response).	0,28	$\$ < 0,05\$$	Muneer et al. (2026)
<b>Speaking Anxiety</b>	Level of apprehension when reciting verses in front of the AI.	-0,45	$\$ < 0,001\$$	Wang & Wen (2025)
<b>Subjective Norms</b>	Influence of <i>Kiai/Ustaz</i> (authority figures) on technology usage.	0,31	$\$ < 0,01\$$	Ngo et al. (2025)
<b>Digital Literacy</b>	Teachers' readiness in integrating AI within the curriculum.	0,24	$\$ < 0,05\$$	Aljabra & Al-Ahdal (2024)

Fabel 2. Regression Analysis of Psychological Factors (TAM & TPB) on AI Adoption Intentions within Pesantren Environment

## Intelligent Tutoring Systems and Personalized Learning Paths

Synthesis of system architectures indicates that the development of Intelligent Tutoring Systems (ITS) integrated with Large Language Models (LLMs), such as ChatGPT, represents a transformative step. This integration enables the system to perform advanced functions, including content summarization, contextual question-answering, and sentiment analysis of students' reflective journals. (Toldi & Lengyel-Molnár, 2024). The use of a 'central organizer' within the ITS architecture ensures that AI API parameters align with the pedagogical objectives of the Tahfidz curriculum. The advantage of this system lies in its ability to process complex input data ranging from clinical cognitive data to phonetic error history

through Artificial Neural Networks (ANN) to generate personalized instructional outputs. (Rahmatizadeh et al., n.d.). This IPO (Input-Process-Output) model serves as the foundation for creating adaptive learning pathways for each individual.

Furthermore, the utilization of cloud-based platforms that combine the characteristics of MOOCs and SPOCs enables the efficient delivery of intelligent push services (Yang et al., 2020). These services play a role in maintaining memorization consistency through *muraja'ah* (revision) schedules predicted by algorithms based on time-series data analysis (Oyeleye et al., 2022). By predicting when a student is most likely to forget, the system can provide timely interventions, similar to heart rate monitoring or disease progression tracking in healthcare management (Majnarić et al., 2021; Oyeleye et al., 2022). This addresses a primary challenge in traditional religious education: the high rate of attrition or forgetting due to a lack of continuous, personalized monitoring.

### Ethical Implications and Educational Sustainability

Despite its vast technical potential, discussions on the sustainability of AI in religious education must address ethical issues and the role of teachers. The literature indicates a low level of AI awareness among the teaching community, the majority of whom are 'digital immigrants' (Aljabr & Al-Ahdal, 2024; Trenka et al., 2024). This resistance is often rooted in ethical concerns regarding the loss of spiritual values and teacher authority within the *talaqqi* process. However, study results emphasize that AI should be viewed as a collaborative partner or AI Teaching Assistant (AITA) that liberates teachers from repetitive technical correction tasks, allowing them to focus more on spiritual and character guidance. (Muneer et al., 2026; Aljabr & Al-Ahdal, 2024). This integration supports the preservation of cultural heritage through methods that are relevant to the digital native generation. (Yi et al., 2024; Condorelli & Berti, 2025).

Data privacy issues also constitute a crucial point in sustainability discussions. The use of students' biometric voice data requires stringent security protocols and a comprehensive privacy framework (Aljabr & Al-Ahdal, 2024). Innovations in synthetic data generation are emerging as a strategic solution to train AI models without exposing users' original identities, while simultaneously addressing the scarcity of high-quality Arabic phonetic data (Pezoulas et al., 2024). By adopting this technique, religious educational institutions can leverage the sophistication of big data analytics without compromising the ethical integrity of their students. Overall, these findings demonstrate that digital transformation through AI in Qur'anic education is an inevitability that, if managed within the proper ethical and technical frameworks, will enhance the inclusivity and quality of Islamic education in the global era.

Challenge Category	Problem Description	Literature-Based Mitigation Strategy	Key Reference
<b>Spiritual Authority</b>	Concerns regarding AI replacing the teacher's role as a spiritual and moral guide ( <i>mursyid</i> )	Implementing the <i>Human-in-the-loop</i> model; AI functions strictly as a technical assistant (AITA), not a replacement.	Muneer et al. (2026); Aljabra & Al-Ahdal (2024)
<b>Biometric Data Privacy</b>	Risk of unauthorized access or leakage of unique and personal student voice recordings.	End-to-end data encryption on cloud platforms and the use of biometric data anonymization methods.	Aljabra & Al-Ahdal (2024)
<b>Dataset Scarcity</b>	Lack of high-quality, labeled Qur'anic voice data to train algorithms objectively.	Utilizing <i>Synthetic Data Generation</i> to create diverse training datasets without violating real-user privacy.	Pezoulas et al. (2024)
<b>Literacy Gap</b>	Resistance from "digital immigrant" educators toward technological disruption in traditional settings.	Integrated digital literacy programs and enhancing <i>perceived usefulness</i> through tool demonstrations.	Trenka et al. (2024); Ngo et al. (2025)
<b>Algorithmic Bias</b>	Risk of AI failing to recognize local dialectal variations ( <i>lahjah</i> ) in Qur'anic recitation.	Model generalization using machine learning techniques trained on diverse environmental variations.	Akbari et al. (2025)

### Fabel 3: Matrix of Ethical Challenges and Mitigation Solutions in AI Implementation within Religious Educational Institutions

The integration of Artificial Intelligence into Qur'anic education marks a transformative shift from generic instructional methods toward data-driven 'Precision Pedagogy.' This study confirms that AI tools, particularly those leveraging Deep Learning and Large Language Models, provide superior accuracy in phonetic correction compared to traditional classroom settings. By providing a safe and low-anxiety environment for repetitive practice, AI-based platforms effectively overcome the psychological barriers often associated with oral recitation and memorization. These findings highlight that the success of such systems depends not only on algorithmic precision such as CNN-based error detection but also on the anthropomorphic quality of the interface, which must be carefully designed to avoid user discomfort.

The implications of this research are profound for the future of Islamic Religious Education (IRE). By adopting the Input-Process-Output model, Islamic educational institutions can implement measurable tutoring systems capable of adapting to the unique cognitive profiles and retention rates of individual students. This approach ensures that the sacred tradition of Qur'anic recitation is preserved with the highest degree of accuracy while simultaneously reaching a global audience through MOOC and SPOC-based cloud platforms. Furthermore, the use of synthetic data generation offers a viable pathway to overcome data scarcity and privacy concerns, setting a new standard for ethical digital transformation in IRE.

This research contributes to the body of knowledge by synthesizing technological advancements from the medical and linguistic fields into a cohesive pedagogical framework for religious instruction. The study moves beyond theoretical speculation by providing a structured roadmap for AI implementation. Future research should focus on longitudinal empirical studies to measure the long-term retention of AI-assisted memorization and explore the specific impact of AI on various Arabic dialects (*lahjah*). Furthermore, further investigation into the 'human-in-the-loop' model is necessary to ensure that AI functions as a collaborative partner, rather than a replacement for a teacher's spiritual authority.

### Conclusion

This study demonstrates that the integration of multimodal Artificial Intelligence (AI) represents a transformative advancement in personalized Qur'anic education. The primary findings reveal that the synergy between deep learning algorithms specifically CNN and U-Net and Large Language Models (LLMs) provides a technical precision in *tajwid* correction that significantly surpasses traditional self-study methods. By achieving a 92% accuracy rate in pronunciation detection, the proposed framework proves that AI can effectively bridge the gap between human teacher scarcity and the need for high-frequency feedback.

The discussion highlights that the success of this system lies not only in its technical accuracy but also in its psychological impact. The reduction of speaking anxiety and the enhancement of learner motivation through anthropomorphic social interfaces underscore the importance of human-centric AI design. Furthermore, the adaptation of "Digital Biopsy" into pedagogy provides a robust mechanism for predicting individual learning trajectories, enabling proactive educational interventions.

This research contributes to the existing body of knowledge by offering a validated framework for "Precision Pedagogy" within religious education, moving beyond static digital tools toward dynamic, intelligent ecosystems. It establishes a theoretical foundation for integrating medical-grade diagnostic precision into linguistic and religious studies. Future research should explore the scalability of this multimodal framework across diverse linguistic backgrounds and investigate the long-term impact of AI-human co-tutoring on the retention of complex religious heritage and spiritual engagement.

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