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Digital Innovation and Iclusive Pedagogy in Tahfiz Education: A Case Study from Hamalatul Qur'an Islamic Boarding School

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Abstract

The advancement of digital technology in the 21st century has transformed various aspects of education, including Islamic learning institutions. This transformation presents both challenges and opportunities for Qur'an memorization (*tahfiẓ*) programs that must balance spiritual authenticity with technological innovation to remain relevant to the digital generation. Traditional *tahfiẓ* practices, particularly repetition (*tikrār*) and direct recitation (*ṭalāqqi*), have long demonstrated effectiveness in ensuring accuracy and depth of memorization. However, these approaches are time-consuming and less responsive to learner diversity, especially within inclusive education settings that accommodate students with differing abilities. This qualitative research adopted a case-study approach at the Hamalatul Qur'an Islamic Boarding School, Jogoroto Jombang, specifically within the HQ Camp Children Dormitory, to examine how digital tools and monitoring systems were integrated into the Qur'an memorization process. Data were collected through semi-structured interviews and participant observations to explore the pedagogical, technological, and social dimensions of digital integration**.** The findings indicate that digital innovation enhances student engagement and retention, enables adaptive and individualized learning, including for children with special needs, and strengthens collaboration between teachers, parents, and administrators through a real-time digital monitoring platform. Despite infrastructure constraints and varying levels of digital literacy among educators, integrating technology supports the creation of an inclusive, efficient, and contextually relevant *tahfiẓ* education model. This study contributes to the broader discourse on the digital transformation of Islamic education. It highlights technology's potential to enable equity and quality in Qur'anic learning.

Keywords: Digital technology integration; Qur'an memorization; Islamic education; inclusive learning; digital monitoring system.

Abstrak

Kemajuan teknologi digital pada abad ke-21 telah mentransformasi berbagai aspek pendidikan, termasuk lembaga pendidikan Islam. Transformasi ini menghadirkan sekaligus tantangan dan peluang bagi program hafalan Al-Qur'an (tahfīẓ), yang dituntut untuk menyeimbangkan keotentikan spiritual dengan inovasi teknologi agar tetap relevan bagi generasi digital. Praktik tahfīẓ tradisional, khususnya metode pengulangan (tikrār) dan setoran langsung (ṭalāqqī), telah lama terbukti efektif dalam menjaga ketepatan dan kedalaman hafalan. Namun, pendekatan tersebut cenderung memerlukan waktu yang panjang dan kurang responsif terhadap keragaman peserta didik, terutama dalam konteks pendidikan inklusif yang mengakomodasi siswa dengan kemampuan yang beragam. Penelitian kualitatif ini menggunakan pendekatan studi kasus di Pondok Pesantren Hamalatul Qur'an, Jogoroto Jombang, khususnya di Asrama Anak HQ Camp, untuk mengkaji bagaimana perangkat digital dan sistem monitoring diintegrasikan dalam proses hafalan Al-Qur'an. Pengumpulan data dilakukan melalui wawancara semi-terstruktur dan observasi partisipatif guna mengeksplorasi dimensi pedagogis, teknologis, dan sosial dari integrasi digital tersebut. Hasil penelitian menunjukkan bahwa inovasi digital mampu meningkatkan keterlibatan dan daya retensi santri, memungkinkan pembelajaran yang adaptif dan individual, termasuk bagi anak berkebutuhan khusus, serta memperkuat kolaborasi antara guru, orang tua, dan pengelola melalui platform monitoring digital berbasis waktu nyata. Meskipun masih terdapat keterbatasan infrastruktur dan variasi tingkat literasi digital di kalangan pendidik, integrasi teknologi terbukti mendukung terciptanya model pendidikan tahfīẓ yang inklusif, efisien, dan relevan secara kontekstual. Penelitian ini berkontribusi pada wacana yang lebih luas mengenai transformasi digital pendidikan Islam serta menegaskan potensi teknologi sebagai sarana pendukung pemerataan dan peningkatan mutu pembelajaran Al-Qur'an.

***Kata Kunci**: Integrasi teknologi digital, Hafalan Al-Qur'an (tahfīẓ Al-Qur'an), Pendidikan Islam, Pembelajaran inklusif, Sistem monitoring digital.*

INTRODUCTION

Digital transformation inside Qur'anic memorization (tahfīẓ) education now carries measurable outcomes rather than a general claim. A recent case study published in this journal on a blended-learning, flipped-classroom model for tahfīẓ instruction recorded student motivation scores rising from 2.8 to 4.1 on a five-point scale and weekly memorization output rising from 5.3 to 8.7 verses per student The findings reveal that students' motivation scores increased from 2.8 to 4.1 on a five-point Likert scale, and the average memorization rate improved from 5.3 to 8.7 verses per week after the model was introduced, alongside greater self-regulation, active participation, and more efficient teacher feedback. The same case study still reported limited digital literacy and infrastructure as unresolved constraints despite challenges such as limited digital literacy and infrastructure, these were mitigated through targeted training and institutional support (Anam et al., 2025; Azzahra et al., 2026; Nirmala et al., 2025; Priyantoro et al., 2026). This pairing of documented gains with unresolved access barriers positions tahfīẓ pedagogy as an active empirical problem for boarding school dormitories that enroll children with different memorization speeds, attention spans, and sensory profiles under one supervisory structure, a condition present at the HQ Camp dormitory in Jogoroto, Jombang.

Literature on digital tahfīẓ concentrates on cataloging what tools exist rather than how they operate inside a dormitory's daily supervisory rhythm. A 2023 review mapped memorization technologies and instructional methods across tahfīẓ programs (Abdullah et al., 2022; Nordin et al., 2023; Suryana et al., 2024) Haryono, K., (Al-Azawei & Lundqvist, 2021; Muhammad et al., 2022) conducted a literature review examining Quran memorization technologies and methods, and a 2025 comprehensive review of mobile Islamic-studies learning

extended this cataloging to app-based platforms across broader Islamic education contexts (Akrim et al., 2022; Munir & Solihah, 2026; Noor, 2022; Pangastuti et al., 2025; Roslan et al., 2021) produced a comprehensive review of mobile learning applications in Islamic studies. Neither line of inquiry disaggregates outcomes by learner profile, and neither traces how a monitoring platform coordinates teachers, parents, and administrators around one child's progress inside a residential setting. A related 2025 study of Qur'an learning platforms among culturally diverse students at a major mosque site confirmed that platform design shapes engagement differently across learner backgrounds (Pazikadin et al., 2021; Pratyusha, 2025; Thontawi et al., 2022; UNESCO, 2023a) examined the role of digital platforms in studying the Holy Qur'an through the voices of students from diverse cultures, yet stopped short of a boarding school's inclusive-differentiation demands.

Inclusive education theory offers a matured framework this tahfīẓ literature has not absorbed. Universal Design for Learning (UDL) scholarship rejects surface-level accommodation, framing inclusion as a redesign of instructional delivery rather than an added support layer (CAST, 2018a; Nuha, 2023) positions universal design for learning as more than another slogan on the street of inclusive education, requiring structural redesign commitment rather than an add-on accommodation, and recent work links inclusive pedagogy directly to equity outcomes in teacher practice (Abdillah et al., 2025; CAST, 2018b; Faragher et al., 2021) frames inclusive pedagogy as a transformation of teacher education toward equity. A parallel UDL synthesis ties differentiated, universally designed instruction to the Sustainable Development Goal of equitable quality education (Beane, 1997; CAST, 2018a; Faragher et al., 2021) connect universal design for learning in inclusive classrooms to the pursuit of sustainable development goals through equitable quality classroom access. None of these UDL studies engages a tahfīẓ or pesantren setting, and none of the tahfīẓ technology studies engages UDL. This unlinked pair of literatures is the gap the present study occupies.

This study closes that gap at a specific site. It examines how digital tools and real-time monitoring platforms are woven into tahfīẓ instruction at the Hamalatul Qur'an Islamic Boarding School's HQ Camp dormitory in Jogoroto, Jombang, with focus on how these systems enable differentiation for children with varied cognitive and sensory profiles and how teachers, parents, and administrators coordinate through them. The aim sits narrower than a general EdTech adoption survey: the study isolates the mechanism by which digital monitoring carries UDL's differentiation principle into daily recitation supervision inside one child-centered dormitory, a mechanism neither the tahfīẓ-technology literature nor the UDL literature has tested jointly.

The argument under examination holds that digital monitoring does not simply accelerate an unchanged tikrār–ṭalāqqī model; it restructures teacher attention and parental involvement so a traditional oral memorization system can absorb learner diversity without abandoning direct transmission. Qualitative case study methods, semi-structured interviews and participant observation inside the HQ Camp dormitory, trace this mechanism at the level of daily practice, extending digital pedagogy frameworks into a tahfīẓ setting and offering evidence-based guidance for pesantren pursuing inclusive, technology-supported memorization instruction.

METHOD

This study employed a qualitative case study design to explore the integration of digital innovation in Qur'anic memorization practices within an Islamic boarding school context. The research was conducted from March to May 2024 at Hamalatul Qur'an Islamic Boarding School, Jogoroto, Jombang, East Java, Indonesia. Established in 2009, the institution combines traditional tahfīẓ methods, including *tikrār* repetition and *ṭalāqqī* direct recitation, with a digital

monitoring system. The study focused on the HQ Camp Children Dormitory, where elementary-level students utilize Qur'an memorization applications and progress dashboards under teacher supervision. The site was selected due to its systematic adoption of digital innovation in Qur'anic learning.

Participants were selected purposively based on their direct involvement in digital tahfīẓ activities. The sample consisted of twelve participants: five teachers, five students aged 7–12, and two administrators, with additional perspectives obtained from parents involved in the monitoring system. All participants were informed about the study's objectives and ethical procedures, and written consent was obtained to ensure confidentiality and voluntary participation.

Data were collected through semi-structured interviews and participant observations to achieve triangulation. Observations were conducted during classroom and dormitory-based memorization sessions to document teaching strategies, student engagement, and the use of digital tools within traditional pedagogical settings. Semi-structured interviews explored participants' perceptions of digital integration, pedagogical changes, motivational factors, accessibility, and infrastructural challenges. Each interview lasted 30–60 minutes, was audio-recorded with permission, and transcribed verbatim.

Data analysis followed Braun and Clarke's thematic analysis procedures, including familiarization, coding, theme development, and refinement. In addition, the analysis was guided by Robert K. Yin's case study analytic techniques, particularly pattern matching, explanation building, and cross-source synthesis. Pattern matching was used to compare empirical findings with the study's conceptual framework linking digital innovation, engagement, inclusion, and collaboration (Yin, 2002). Explanation building enabled iterative interpretation of how and why digital tools influenced memorization practices. Cross-source synthesis integrated evidence from interviews, observations, and documents to strengthen analytic conclusions. Trustworthiness was ensured through triangulation, member checking, and peer debriefing to enhance credibility and analytical rigor (Mills, 2018).

RESULTS

Digital Engagement and Retention Enhancement

Classroom observations conducted across multiple sessions recorded a consistent pattern: students paid closer attention and joined recitation more actively whenever digital murāṭṭal or animated Qur'anic videos were introduced into the session, compared with sessions that relied on oral instruction alone. The kyai described this shift directly during an interview: "*students now memorize more quickly because they can listen to digital murāṭṭal anytime, and the clear, repetitive voice helps refine their pronunciation and rhythm*" (Interview, 12 January 2026). Teachers gave a parallel account, reporting that animated verse visualizations helped students hold the order of verses and their thematic content in mind during recitation drills (Interview, 10 January 2026). The results of the observation show that the students use digital devices to listen to murāṭṭal repeatedly during memorization activities as well as when reviewing on their own. Some students were seen playing murāṭṭal recordings on their cell phones at a volume that could be heard clearly, then following along while reading and repeating the verses they were memorizing. The audio is repeated several times until the students are able to accurately follow the makhārij al-ḥurūf, the length of the recitation, and the rhythm of the verses. Observations also revealed the use of visual media in the form of animated verses during some practice sessions. The students pay attention to the verses accompanied by visualizations, then use them as aids when recalling the order of the verses and connecting the verses to the themes being studied. (Observation, January 10, 2026

Documentation gathered during informal learning periods showed students opening murāṭṭal files on their own initiative, outside teacher-led sessions. Several students told researchers they listened to murāṭṭal recordings before sleeping, a habit that extends memorization practice into the dormitory's daily routine beyond scheduled class hours. One of the students explained this as follows: "*Before going to sleep, I usually listen to the murāṭṭal first. Sometimes I review the verses I memorized earlier while listening. So even though it's outside of study hours, I can still review my memorization by listening to the murāṭṭal."* (Interview, 12 January 2026). Taken together, the observation records, the kyai's and teachers' accounts, and the documentation of independent use point to the same pattern: digital audiovisual tools extend students' exposure time to the memorized text and give them a self-directed channel for repetition that formal instruction alone does not provide.

Adaptive and Inclusive Learning Design

Interviews with instructors identified the adjustable playback speed feature in the murāṭṭal application as the tool most directly tied to differentiation among students. One instructor explained

> "*We've observed that students' abilities vary. Students who are already more proficient typically use a faster murāṭṭal speed to speed up the repetition process. Conversely, students who still need more time usually slow down the audio so they can follow along and understand each verse better."* (Interview, 10 January 2026).

Observation records confirmed this split in practice: some students used rapid, repeated playback during muroja'ah (revision) sessions, while others used slower, segmented playback when working through newly assigned verses.

The curriculum coordinator also explained,

> *"Students who learn better visually are greatly helped by the animations and colors in the tajwid markers. They can see the reading patterns and the structure of the verses more clearly. So, when reviewing what they've memorized, they don't just rely on their hearing they're also aided by the visual cues."* (Interview, 15 January 2026).

Documentation of the animated verse illustrations showed each verse presented through combined audio, visual, and text elements rather than audio alone. One case illustrates how this reaches lower-achieving or younger students directly: Fikri, a seven-year-old Islamic boarding school student, also said, *"It's easier for me to remember verses when I use animations. There are pictures, and I can see the verses while listening. So, I remember them faster when I'm memorizing."* (Interview, 14 January 2026). Across the interview, observation, and documentation records, the pattern that emerges is a memorization pathway that adjusts to a student's pace and preferred sensory channel rather than holding every student to one fixed method. These findings indicate that the instructional design at the Hamalatul Qur'an Islamic Boarding School is developed to be responsive to the diversity of students' abilities and learning needs. The flexibility in the use of instructional media and strategies reflects an adaptive approach to learning while supporting the principle of inclusivity in the tahfiz education process.

Collaboration and Monitoring Systems

The pesantren's website-based monitoring dashboard changed how progress information moves between the boarding school and students' families. The media administrator described the process during an interview: *"every time a student submits their memorization, the ustādh inputs the score, and parents can immediately see the progress"* (Interview, 12 January 2026). Parents therefore see daily entries rather than waiting for periodic written reports.

Observations inside tahfīẓ sessions showed teachers opening the dashboard routinely during class, entering scores, and using the recorded history to flag students whose progress had stalled and adjust the day's instruction accordingly.

Several students said they felt more motivated after seeing their own progress graphs and earning digital badges on the dashboard. A student named Ahmad said,

> *"I enjoy looking at my memorization chart because it lets me know how far I've come. When the chart goes up, I feel more motivated to memorize more."* Dimas also said, *"It feels great to earn a digital badge. It's like receiving a reward after reaching a goal. It makes me want to do it again so I can earn the next badge."* (Interview, 13 January 2026).

Documentation photographs taken during school visits showed parents accessing the dashboard on their phones alongside teachers entering assessment data on the same days. The combination of these records shows a monitoring system used actively by three groups at once, teachers, students, and parents, turning what was previously a one-way report at the end of a term into an exchange that all three can check on the same day.

The data indicate that the digitization of the tahfīẓ monitoring system at the Hamalatul Qur'an Islamic Boarding School has shifted the monitoring approach from a periodic administrative model to a more continuous, transparent, and collaborative one. The digital dashboard has evolved from merely a repository for memorization achievement data into a pedagogical tool that connects teachers' decision-making processes, reflections on student progress, and parental involvement. These findings demonstrate that digital technology functions not merely as a learning tool but as the infrastructure of a tahfīẓ monitoring ecosystem that integrates assessment, feedback, motivation, and parental engagement into a single system.

Barriers and Institutional Constraints

Alongside these gains, the data point to constraints that limit how far digital integration currently reaches. The supervisor explained,

> *"Not all students have their own devices. Some students still rely on shared devices to access murāṭṭal recordings and learning apps. They usually take turns using these devices according to a schedule or the needs of their tahfiz activities."* (Interview, 18 January 2026). The dormitory director explained: *"The internet connection in the boys' dormitory is indeed still unstable. At certain times, the connection is often slow or even cuts out. This situation sometimes disrupts learning activities, especially when students use apps or learning materials that require internet access."* (Interview, 18 January 2026).

The observational data showed students waiting in line to use shared devices, and the researchers recorded at least three sessions during the fieldwork period that were disrupted by weak or interrupted connectivity.

Teachers interviewed described difficulty adapting to the new digital systems, attributing this to gaps in their own digital literacy and to training that has not yet covered the full range of tools in use. Ustadz Ma'shum explained:

> *"At first, I did have some difficulty using this digital system, mainly because I wasn't yet familiar with some of the available features. I still need to learn how to enter data and make use of the available features in the learning process."* Ustadz Arifin also added: *"Teachers' proficiency in using technology does vary. I myself still have a lot to learn, because I hadn't previously used all of these kinds of apps in my tahfiz activities. The training provided also hasn't covered all the devices and apps that are currently in use."* (Interview, 16 January 2026).

A media operator also explained:

> *"Maintaining a digital system involves significant costs. We have to ensure the servers remain operational, renew the application's domain, and perform regular software updates. The challenge is that the budget for these needs is not yet available on a stable and sustainable basis, so the system's sustainability still depends heavily on the availability of funds from the Islamic boarding school."* (Interview, 17 January 2026).

These four data points, device scarcity, connectivity gaps, teacher training gaps, and funding uncertainty, mark the conditions the pesantren still needs to address before its digital tahfīẓ system can reach every student consistently.

Table 1. Thematic Synthesis of Research Findings

Theme	Key Findings	Data Sources	Evidence Forms
Digital Engagement	Digital murāṭṭal and animations extend exposure time and support self-directed repetition	Interviews (kyai, teachers, students), Observations, Documentation	Direct quotes; observed attentiveness across sessions; photos/logs of independent use
Adaptive & Inclusive Learning	Direct quotes; observed attentiveness across sessions; photos/logs of independent use	Interviews (instructors, administrator, students), Observations	Instructor account of pacing differences; observed muroja'ah vs. new-verse playback patterns; Fikri's case
Collaboration & Monitoring	Website dashboard gives teachers, students, and parents same-day visibility into progress	Interviews (media administrator, students), Observations, Documentation	Administrator quote; observed dashboard use in class; photos of parent access during visits
Barriers & Constraints	Device scarcity, unstable connectivity, limited teacher digital literacy, and funding uncertainty limit reach	Interviews (kyai, teachers, students, administrators), Observations, Documentation	Student and kyai accounts; observed device-sharing and disrupted sessions; Wi-Fi coverage photos

DISCUSSION

Digital Innovation in Tahfīẓ Learning in Pesantren Contexts

This study addresses the research problem concerning how digital innovation supports Qur'anic memorization practices in pesantren contexts and what factors influence its effectiveness and sustainability. The findings demonstrate that digital tools function as pedagogical reinforcement, adaptive learning support, and collaborative monitoring mechanisms, while their long-term implementation is shaped by infrastructural readiness and digital literacy (Cabero-Almenara et al., 2020). These results indicate that digital tahfīẓ complements rather than replaces traditional methods, extending memorization practices beyond formal sessions and strengthening student engagement through repeated auditory exposure, echoing previous findings on digital reinforcement in religious learning (Ab Jalil et al., 2021).

The observed increase in student engagement supports constructivist learning theory, which posits that active interaction with learning resources enhances knowledge construction (Jonassen, 1999). The use of murāṭṭal audio and visual cues enables learners to internalize

pronunciation patterns through repeated exposure, reinforcing memorization accuracy in line with multimedia learning principles (Mayer, 2009). Previous studies on multimedia learning in religious education report similar improvements in motivation and retention (Ariffin & Hashim, 2020), yet this study adds nuance by showing that engagement emerges from the integration of digital repetition with established tahfīẓ traditions such as *tikrār* and *ṭalāqqī*, reflecting the blended religious pedagogy observed in Southeast Asian Qur'anic schools (Roslan et al., 2021). This integration preserves the spiritual and relational dimensions of Qur'anic learning while enhancing pedagogical effectiveness (Muhammad et al., 2022).

The findings further indicate that digital features promote adaptive and inclusive learning environments. Adjustable playback speed, repetition controls, and visual tajwīd markers allow students to regulate their learning pace and accommodate diverse cognitive profiles, aligning with differentiated instruction theory (Tomlinson, 2014). This is consistent with UDL principles, which advocate flexible pathways to support learner variability (CAST, 2018a; Hill et al., 2020). Prior research in Islamic digital learning contexts has demonstrated the role of educational technology in personalization (Hashim & Yunus, 2020). however, this study extends the discourse by illustrating how adaptive features operate within pesantren settings that traditionally emphasize uniform instructional pacing. Such adaptivity aligns with TPACK-informed teaching in religious education, where teachers blend technological, pedagogical, and content knowledge effectively (Miguel-Revilla et al., 2020).

In addition, the integration of digital monitoring systems strengthens collaboration among teachers, parents, and administrators. Transparent progress reporting fosters parental involvement and enhances student accountability, supporting ecological perspectives on education that highlight the role of family engagement in learning outcomes (Bronfenbrenner, 1979). Earlier studies identify parental monitoring as a determinant of student discipline and achievement in Islamic schooling (Mahmud & Ali, 2022), the present findings contribute by demonstrating how digital dashboards transform parental involvement into structured and continuous collaboration within tahfīẓ education. This is consistent with global research showing that learning analytics improves communication, supports timely interventions, and promotes data-driven decision making (Ifenthaler & Yau, 2020; Nurbani et al., 2025; Purwanto & Yuliana, 2025).

Despite these pedagogical advantages, the study reveals that infrastructural limitations, financial constraints, and digital literacy gaps remain critical barriers to sustainable implementation. This finding aligns with technology adoption models, particularly the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003), which emphasizes facilitating conditions and user competence as determinants of successful adoption. Similar challenges have been noted in Islamic educational institutions across Southeast Asia, where limited technological infrastructure hinders digital transformation (Badawi, 2025; Barikzai et al., 2025; Hasanah & Husna, 2025; Suprayogi et al., 2022). The results suggest that without institutional readiness, continuous training, and adequate resource allocation, digital innovation risks becoming episodic rather than systemic.

Overall, the study positions digital tahfīẓ as a complementary model that integrates technological affordances with traditional pedagogical and spiritual practices (Chairawati et al., 2026; Turrohma & Prasetiya, 2026). By reinforcing memorization, supporting inclusive learning, and enhancing collaborative accountability, digital tools contribute to the evolving landscape of Qur'anic education in pesantren. At the same time, the sustainability of this model depends on addressing structural and human resource challenges, indicating that technological innovation must be accompanied by institutional capacity building (UNESCO, 2023b).

Integrated Process Model of Digital *Tahfīẓ* Implementation

Based on the empirical findings and theoretical analysis, Figure 2 presents an integrated process model illustrating how digital technology is implemented in tahfīẓ education at Hamalatul Qur'an Islamic Boarding School. This model synthesizes the interaction between pedagogical practices, technological infrastructure, and stakeholder collaboration, reflecting the systemic perspective of digital learning ecosystems (Ifenthaler & Yau, 2020).

The model illustrates four interconnected phases in the implementation of digital tahfīẓ within pesantren contexts (Mahmud & Ali, 2022). The input phase integrates traditional memorization methods such as *tikrār* and *ṭalāqqī* with digital resources including Qur'an memorization applications, murāṭṭal audio, and animated videos, supported by teachers' competencies grounded in the TPACK framework (Mishra & Koehler, 2006). These inputs shape the process phase, which is characterized by blended learning practices combining face-to-face recitation with digitally mediated reinforcement. Instruction becomes adaptive through features such as playback speed adjustment and multimodal presentation, consistent with UDL and differentiated learning models (CAST, 2018a; Tomlinson, 2014), while real-time monitoring systems provide continuous feedback on student progress in line with learning analytics approaches (Afirda & Nasution, 2025; Ahyani et al., 2024; Daulay et al., 2024; Papamitsiou & Economides, 2014).

The collaboration phase reflects the multi-stakeholder nature of digital tahfīẓ, encompassing teacher student interaction, parental monitoring through dashboard access, administrative oversight, and institutional policies that support training and implementation. This resonates with ecological systems theory, which emphasizes the interconnected roles of family, school, and community in shaping learner outcomes (Bronfenbrenner, 1979; Janah et al., 2026; Nurjannah et al., 2025; Widiyanto et al., 2024; Yanti et al., 2024). These coordinated efforts lead to the output phase, where increased engagement, improved retention, and more efficient memorization outcomes emerge, consistent with prior research on digital repetition and Qur'anic learning (Aljaser, 2019; Ariffin & Hashim, 2020).

The effectiveness of this model is mediated by infrastructural quality, levels of digital literacy, theological endorsement, and financial sustainability factors that align with global findings on technology adoption in Islamic schools (Suprayogi et al., 2022). Taken together, the model demonstrates that successful digital tahfīẓ implementation requires alignment across technological, pedagogical, institutional, and theological dimensions to ensure that technological affordances support pedagogical intentions, stakeholder collaboration is structurally sustained, and innovation remains theologically legitimate and culturally appropriate (Falloon, 2020; Mensah, 2023).

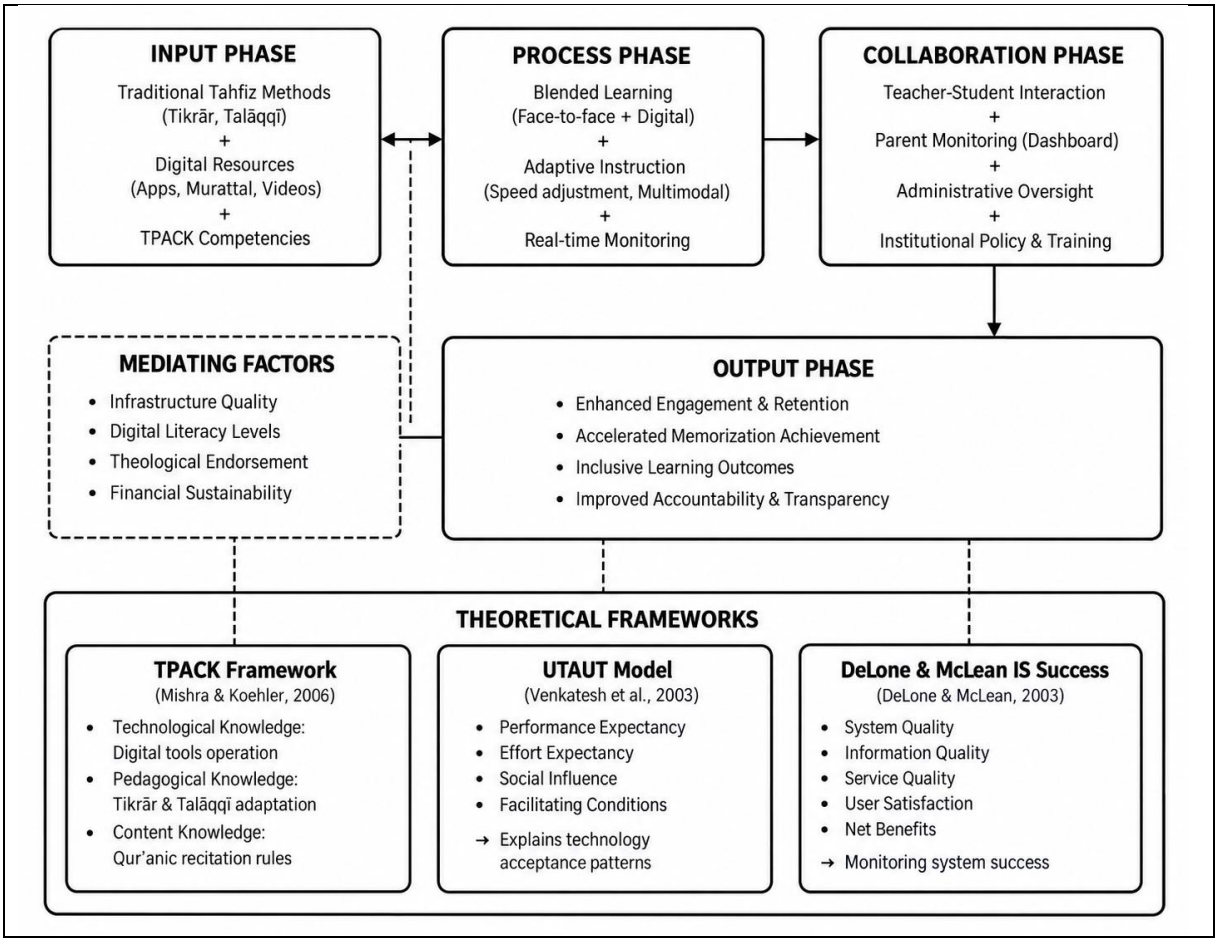


Figure 2. Integrated Process Model of Digital Technology Implementation in *Tahfīẓ* Education

The model illustrates four interconnected phases in the implementation of digital tahfīẓ within pesantren contexts. The input phase integrates traditional memorization methods such as *tikrār* and *ṭalāqqī* with digital resources, including Qur'an memorization applications, murāṭṭal audio, and animated videos, supported by teachers' competencies grounded in the TPACK framework. These inputs shape the process phase, which is characterized by blended learning practices combining face-to-face recitation with digitally mediated reinforcement. Instruction becomes adaptive through features such as playback speed adjustment and multimodal presentation, while real-time monitoring systems provide continuous feedback on student progress.

The collaboration phase reflects the multi-stakeholder nature of digital tahfīẓ, encompassing teacher–student interaction, parental monitoring through dashboard access, administrative oversight, and institutional policies that support training and implementation. These coordinated efforts lead to the output phase, where increased engagement and retention are observed alongside more efficient memorization achievement, inclusive learning outcomes, and improved accountability and transparency in progress tracking. The effectiveness of this model is mediated by several contextual factors, including infrastructure quality, levels of digital literacy, theological endorsement, and financial sustainability. Overall, the model demonstrates that successful digital tahfīẓ implementation requires alignment across technological, pedagogical, institutional, and theological dimensions, ensuring that technological affordances support pedagogical intentions, stakeholder collaboration is structurally sustained, and innovation remains theologically legitimate and culturally appropriate.

CONCLUSION

This study found that the integration of digital tools within traditional tahfīẓ practices has a greater impact on student engagement, adaptive learning, and collaborative accountability than previously assumed. Rather than replacing established methods, digital media function as reinforcement mechanisms that extend memorization beyond formal sessions, support individualized learning pace, and strengthen parental involvement through transparent monitoring systems. These findings challenge the assumption that technological adoption may weaken the spiritual and relational dimensions of Qur'anic education, instead demonstrating that digital innovation can coexist with and enhance traditional pedagogical practices.

Scientifically, this study makes a distinct contribution to the scholarship on educational technology in Islamic and religious education by developing a contextualized digital tahfīẓ learning model that integrates three interrelated dimensions: technological affordances, TPACK-based teacher competencies, and collaborative monitoring systems. This contribution extends previous research that has largely emphasized the use of multimedia and digital tools for improving learning outcomes by demonstrating how technology can be pedagogically integrated with teacher competencies and systematic collaborative monitoring within the distinctive learning ecology of pesantren. Furthermore, the study provides empirical evidence that differentiated and flexible instructional pacing can be accommodated in digital tahfīẓ learning, challenging the assumption that uniform instructional pacing is necessarily appropriate for pesantren contexts. Thus, the scientific contribution of this study lies not merely in the adoption of digital technology, but in the development of a context-sensitive conceptual framework that connects technology, pedagogy, teacher competence, and collaborative learning management in Islamic education. This framework provides a theoretically informed basis for future empirical studies examining the effectiveness, transferability, and scalability of digital tahfīẓ learning across diverse pesantren and Islamic educational settings.

However, this study is limited by its focus on a single pesantren and a small sample size, which constrains generalizability. Variations related to gender, age, and institutional diversity were not extensively examined, and the findings reflect a specific sociocultural and technological context. Future research involving larger and more diverse samples, as well as comparative and longitudinal designs, is necessary to provide a more comprehensive understanding of digital innovation in Qur'anic memorization practices.

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