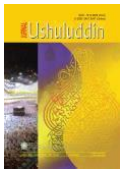

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Strengthening the Competency of Makharijul Letters through Digitalization: An Academic Study of Tahsin al-Qur'an

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Abstract

The ability to read the Qur'an with correct tajweed is an obligation for every Muslim. However, reality shows a decline in this competence, particularly in the aspect of makharij al-huruf (the articulation points of letters), among students. This phenomenon is further exacerbated by technological advancements and the challenges posed by distance learning. This research aims to conduct an academic review of strengthening the competence of makharij al-huruf through various digitalization approaches. Utilizing research and development (R&D) methods alongside literature studies, this paper analyzes three primary digital methods: Augmented Reality (AR), interactive applications with gamification, and online learning platforms/LMS. The analysis reveals that digitalization offers significant potential to enhance motivation, accessibility, and accuracy in tahsin learning. AR applications, such as "Tahsin Digital AR, provide a unique three-dimensional visualization experience. Meanwhile, interactive apps and LMSs offer flexibility and diverse feedback mechanisms. This paper concludes that the integration of digital technology is not intended to replace the role of the muallim/muallimah but to serve as an effective support tool. The implication is that the development of tahsin digital media must continue while maintaining scientific validity and sanad authenticity, as well as addressing challenges such as the digital divide and the risk of over-reliance on technology..

Introduction

The Qur'an is a holy book revealed by Allah SWT to the Prophet Muhammad PBUH as a guide (*hudan*) and a guideline for life for mankind.[1] As the main source of revelation, interaction with the Qur'an, especially through recitation (*qira'ah*), is a worship that has high value. Therefore, the ability to read the Qur'an in accordance with the established rules is a must for every Muslim. The science that regulates how to read the Qur'an correctly and beautifully is known as the science of Tajweed and Tahsin.[2]

Among the most important pillars in tajweed is *makharij al-huruf*, which is the science that studies the places where hijaiyah letters come out of human speech. The accuracy of *makharij* will fundamentally affect the clarity, truth, and beauty of the reading. A letter that comes out of its *makharij* will change the meaning and may invalidate the reading.[3]

However, it is very unfortunate that the competence of reading the Qur'an among the younger generation, especially students in Islamic universities, has decreased. Based on the Decree of the Director General of Islamic Education No. 102 of 2019, Qira'ah al-Qur'an is a compulsory course throughout UIN, but its implementation in the field encounters many challenges. Test results in several classes show that many students are still wrong in reading Ta'awuz and Basmalah, distinguishing the short length of mad readings (2, 4, and 6 harakat), to distinguishing between buzzing (*ghunnah*) and the thickness of the letters. More worrying data comes from the Qur'an literacy index of students from 14 campuses in Indonesia which shows that some institutions are at the lowest level, with a reading index of only 1.86 and a written index of 1.90, well below the national average.[4]

This problem is increasingly complex in the era of the Covid-19 pandemic which forces learning to be carried out online. *Face-to-face and face-to-face* Qira'ah learning of the Qur'an becomes very difficult to implement optimally.[5] This is where the role of technology is important. Gadgets, which were initially thought of as distractions, can be transformed into effective learning mediums if developed appropriately.[6]

Original research conducted by Nelvawita, et al. has developed an Augmented Reality (AR)-based application called "Tahsin Digital AR" as a solution for learning *makharij al-huruf*. This application has proven to be very valid based on the assessment of tahsin experts and technologists. However, AR is only one of many digital approaches. Therefore, this paper will conduct a broader academic review, not only discussing AR, but also exploring other digitization methods in strengthening the competence of *makharij al-huruf*. The purpose of this study is to (1) map various digital methods that can be used for *learning makharij al-huruf*, (2) analyze the advantages and disadvantages of each method from the perspective of Islamic education and technology, and (3) provide recommendations for the development of tahsin digital media in the future.

To build a strong frame of thought, this research relies on two main theoretical pillars: the study *of makharij al-huruf* within the framework *of Ulum al-Qur'an* and the theory of learning based on digital media.

1. Makharij al-Huruf in the Study of Ulum al-Qur'an

Makharij al-huruf (مَخَارِجُ الْحُرُوفِ) etymologically means places of exit. In the context of tajweed, it refers to specific places within the oral cavity and throat where an Arabic letter is pronounced

[1] Ahmad Syafi'i et al., "'Ulumul Qur'an," *Al-Riwayah : Jurnal Kependidikan* 15, no. 2 (2023), https://doi.org/10.47945/al-riwayah.v15i2.929.
[2] MA Amir, "Ilmu Tajwid Praktis," *Books.Google.Com* 11, no. 1 (2019).
[3] MA Amir, "Ilmu Tajwid Praktis."
[4] Abdul Aziz, "Indeks Kemampuan Baca Al-Quran Mahasiswa UIN Malang Tertinggi," *Https://Www.Detik.Com/*, 2019.
[5] Abdul Majid and Hamdani Hamid, "Pengembangan Sistem Pendidikan Di Indonesia," *Journal of Chemical Information and Modeling* 53, no. 9 (2015).
[6] Nanik Tri Wiyanti, Fitri Laila Suwardi, and Syamsuriani Syamsuriani, "Analisis Dampak Penggunaan Gadget Pada Anak Usia Dini Dalam Pembelajaran Jarak Jauh," *JIIP - Jurnal Ilmiah Ilmu Pendidikan* 5, no. 6 (2022), https://doi.org/10.54371/jiip.v5i6.627.

correctly.[7] This study is not just a vocal technique, but has a fundamental place in *the Ulum al-Qur'an*. The accuracy of *makharij* is a guarantee to maintain the purity of the recitation of the Qur'an which has been inherited *mutawatir* (chain and massif) from generation to generation.[8]

Classical scholars divide *makharij* into five main parts: Al-Jauf (oral cavity), Al-Halq (throat), Al-Lisan (tongue), Ash-Intercession (two lips), and Al-Khaishum (nasal cavity).[9] Each of these sections is then further broken down into specific exit points for each letter. For example, the letters 'ain (ع) and 'ha (ح) come out of the middle of the throat (*wasath al-halq*), while the letters 'ba' (ب) come out between the two wet lips (*bayna asy-syafatayn al-mutabaghayn*).[10]

Inaccuracies in *makharij* can cause a change in meaning. For example, saying the phrase "قَالَ رَبُّكُمْ" (Your Lord has said) by misplacing *the makharij* of the letter ق (qaf) so that it sounds like ك (kaf) will change the meaning to meaningless "قَالَ كَبُّكُمْ" which is meaningless.[11] Therefore, mastery of *makharij al-huruf* is not only a matter of the aesthetics of the reading, but also an effort to maintain the integrity of revelation. In the context of Islamic education, this makes *makharij* learning a part of *the fardhu 'ain* that cannot be ignored.

2. Learning Theory and Digital Media

The development of learning media cannot be separated from the underlying learning theory. Digital media for *learning makharij al-huruf* can be analyzed through several theoretical lenses:

Theory of Behaviorism: This theory emphasizes the formation of behavior through stimulus and response. In the context of tahsin applications, this applies to the drill and practice model. The app provides a stimulus (e.g., displaying the letters and *their makharij*), the user responds (recording their voice), and the app provides reinforcement (points, true/false feedback) that will form the correct speech habit.[12]

Theory of Cognitivism: This theory focuses on the process of processing information in the mind.[13] Digital media such as AR and interactive video are very much in line with this theory. 3D visualization of the oral cavity helps students build strong mental models of abstract concepts such as *makharij*. Animations that show tongue and lip movements help organize sensory information into a cognitive schema that is easier to remember and understand.[14]

Constructivism Theory: This theory states that learners actively build their own understanding based on experience.[15] Online learning platforms that allow for exploration, student-to-student discussion, and self-recording projects support this approach. Students are no longer passive recipients, but actively seek information, experiment with their speech, and build common understanding in learning communities.[16]

Understanding these theories is the key to designing digital media that is not only technologically advanced, but also pedagogically effective to achieve the goal of strengthening the competence of *makharij al-huruf*.

[7] MA Amir, "Ilmu Tajwid Praktis."
[8] Syafi'i et al., "'Ulumul Qur'an."
[9] MA Amir, "Ilmu Tajwid Praktis."
[10] MA Amir, "Ilmu Tajwid Praktis."
[11] MA Amir, "Ilmu Tajwid Praktis."
[12] Ahmad Fujiyanto, Asep Kurnia Jayadinata, and Dadang Kurnia, "Penggunaan Media Audio Visual Untuk Meningkatkan Hasil Belajar Siswa Pada Materi Hubungan Antar Makhluk Hidup," *Jurnal Pena Ilmiah* 1, no. 1 (2016).
[13] Jean Piaget, "The Science of Education and the Psychology of the Child," *Advances in Child and Adolescent Psychology*, 1969.
[14] Merve Yavuz et al., "Augmented Reality Technology Adoption: Case of a Mobile Application in Turkey," *Technology in Society* 66 (2021), https://doi.org/10.1016/j.techsoc.2021.101598.
[15] Richard Swe Dberg, "Mind in Society: The Development of Higher Psychological Processes," *Science & Society: A Journal of Marxist Thought and Analysis* 44, no. 1 (1980), https://doi.org/10.1177/003682378004400121.
[16] Retmaniar Karima and Ijah Rochimah Boru Sagala, "Pengembangan Model Pembelajaran TPS-RI Untuk Meningkatkan Keterampilan Menulis Teks Deskripsi," *Lingkar Mutu Pendidikan* 22, no. 1 (2025).

Digitalization opens various doors for innovation in *learning makharij al-huruf*. Based on the literature review and the latest technological developments, there are three main approaches that can be implemented. Each has its own characteristics, advantages, and challenges.

Augmented Reality (AR): 3D Interactive Visualization

As developed by Nelvawita, et al., Augmented Reality (AR) offers an immersive and unique learning experience. AR is a technology that overlays digital information (images, videos, 3D models) into the real world in real-time.[17] In the context of *makharij learning*, AR enables the three-dimensional visualization of the articulating organs (tongue, lips, throat) that appear on a book or physical marker through a smartphone screen.

- **Advantages of the AR Method:**

Concrete Representation: Transforming abstract concepts such as *makharij* into 3D models that can be viewed from various points of view. Students can visually understand where exactly the tongue should touch the palate to pronounce the letter 'dhad' (ض).

High Engagement: The "miracle" element of AR technology increases students' motivation and interest in learning, changing the perception that learning tajweed is monotonous.[23]

Independent Learning: Students can access visual models anytime and anywhere without having to be accompanied by a teacher, supporting the concept of repetitive learning.

Implementation of "Tahsin Digital AR": The application developed by Nelvawita, et al. is a good example of implementation. The app not only features 3D visualizations, but also comes with animations of articulated organ movements and audio samples of verified qori. The validation results show that the app is rated "Very Valid" by technologists (84.55%) and material experts (93.89%), with a total average ideality of 89.22%. This proves that AR is a viable and effective approach.

AR Challenge:

Reliance on Markers: Some AR systems still require physical markers that can be lost or damaged.

Device Needs: Requires a smartphone with certain specifications and a good camera, which not all students may have.

Complex Development: Creating accurate 3D models and smooth animations requires specialized expertise and considerable cost.

Interactive Apps and Gamification: Motivation through Games

The second approach is through mobile applications that are designed interactively and incorporate game elements (*gamification*). The app focuses on repetitive exercises, instant feedback, and a reward system to motivate users.

- **Key Features of Interactive App:**

Interactive Diagram: Displays a clickable 2D oral cavity. When the user clicks on a specific area (for example, the tip of the tongue), the app will display what letters are *makharij* there, complete with sample audio.

Speech Recognition: An advanced feature that allows the app to "hear" the user's speech and provide immediate feedback, whether the pronunciation of the letters is correct or not. This technology uses *machine learning* algorithms

[17] Bruno Arnaldi, Pascal Guitton, and Guillaume Moreau, *Virtual Reality and Augmented Reality: Myths and Realities*, in *Virtual Reality and Augmented Reality: Myths and Realities* (2017), https://doi.org/10.1002/9781119341031.

that have been trained with thousands of voice samples from competent qori.[18]

Gamification System: Users earn points, *badges*, and level up after successfully completing a series of exercises. There is also a leaderboard to foster a healthy sense of competition.

- **Advantages of this method:**

Personalized Feedback: Speech recognition *technology* provides personalized and instant feedback, something that is difficult to do in a classroom with many students.

Intrinsic and Extrinsic Motivation: Gamification effectively increases extrinsic motivation (points, rankings) which in turn can build intrinsic motivation (satisfaction of being able to read correctly).[19]

Accessibility and Flexibility: The app can be downloaded and used offline after the initial installation, making it very flexible.

Digitalization Methodology in Makharij al-Huruf Learning

- **Interactive App Challenges:**

Speech Recognition Accuracy: Arabic with its various dialects and subtle *makharij* nuances is a major challenge for *speech recognition* algorithms. The accuracy may not be 100%, especially for beginners.

Focus on Technology: There is a risk that students are more focused on "winning the game" than on understanding the spiritual and scientific essence of tahsin learning.

Lack of Human Touch: This fully automated app may miss the aspects of guidance, subtle corrections, and spiritual encouragement provided by the teacher.

Online Learning Platforms and LMS: Structured and Collaborative Learning

The third approach utilizes online learning platforms or Learning Management Systems (LMS) such as Moodle, Canvas, or special platforms developed for Islamic education. This method puts the teacher back at the center of the learning process, with technology serving as a facilitator.

- **Learning Components in LMS:**

Structured Video Module: The expert teacher or qori records a series of video tutorials that explain each *makharij* systematically, from the most general to the most specific. These videos can be accompanied by supporting text, graphics, and animations.

Asynchronous Discussion Forums: Students can ask questions, share difficulties, and give feedback to each other in discussion forums moderated by teachers. It encourages social and collaborative learning in accordance with the theory of constructivism.[20]

Audio Collection Assignment: Students are asked to record the recitation of specific verses that highlight the *makharij* variations and upload them to the LMS. The teacher can then provide in-depth evaluation and feedback personally, maintaining the chain of guidance (*sanad*).

- **Advantages of this method:**

Clear Curriculum Structure: The LMS allows for a structured learning structure from week to

[18] Hasan Ali Gamal Al-Kaf et al., "QVR: Quranic Verses Recitation Recognition System Using PocketSphinx," *Journal of Quranic Sciences and Research* 02, no. 02 (2021), https://doi.org/10.30880/jqsr.2021.02.02.004.

[19] Juho Hamari, Jonna Koivisto, and Harri Sarsa, "Does Gamification Work? - A Literature Review of Empirical Studies on Gamification," *Proceedings of the Annual Hawaii International Conference on System Sciences*, 2014, https://doi.org/10.1109/HICSS.2014.377.

[20] Swe Dberg, "Mind in Society: The Development of Higher Psychological Processes."

week, ensuring all competencies are met to standard.

Role of the Teacher That Remains Central: In contrast to fully automated applications, this method retains the role of the teacher as facilitator and evaluator, maintaining aspects *of scientific sanad* and spiritual guidance.[21]

Asynchronous Learning: Materials can be accessed at any time, and discussions can run without the need for all members online at the same time, ideal for distance learning.[22]

- **LMS Challenges:**

Dependence on Teachers: The quality of learning is highly dependent on the commitment and competence of teachers in managing digital classrooms.

Requires Student Discipline: Asynchronous learning demands a high level of discipline and self-motivation from students.

Infrastructure: Requires a stable internet connection for teachers and students, as well as a reliable server to host the LMS.

These three methods are not mutually exclusive. A comprehensive tahsin learning program ideally combines all three: using AR for engaging concept introduction, interactive apps for intensive self-paced exercise, and an LMS for in-depth evaluation and structured collaborative learning. This hybrid or *blended learning* approach offers the most holistic solution.

Academic Review: Comparative Analysis and Implications

After mapping out the various methods of digitization, it is important to conduct a deeper academic examination of its implications, challenges, and development potential. Comparative analysis is a crucial step to understand the position of each method in the tahsin learning ecosystem.

Comparative Analysis of Digital Methods

To give a clearer picture, here is a comparative analysis of the three methods that have been discussed:

Criteria	Augmented Reality (AR)	Interactive Applications & Gamification	Platform LMS
Engagement	Very High ("Wow" effect & 3D interaction)	High (Motivation from Points, Rewards, & Competition)	Medium (Depends on instructional design and teacher interaction)
Accessibility	Medium (Requires specific smartphone and marker)	Very High (Only requires smartphone, can be offline)	High (Requires internet connection, multi-device accessible)
Feedback Mechanism	Visual & Audio (Cenderung pasif, one-way)	Instant & Personal (Active, via *speech recognition*, but limited)	Scheduled & In-Depth (Active, from the teacher, highly personal and holistic)

[21] MA Amir, "Ilmu Tajwid Praktis."
[22] Anjar Purba Asmara, "PENGEMBANGAN MEDIA PEMBELAJARAN BERBASIS AUDIO VISUAL TENTANG PEMBUATAN KOLOID," *Jurnal Ilmiah Didaktika* 15, no. 2 (2015), https://doi.org/10.22373/jid.v15i2.578.

Criteria	Augmented Reality (AR)	Interactive Applications & Gamification	Platform LMS
Curriculum	Specific (Focus on concept visualization)	Structured (Based on level and progress)	Highly Flexible (Designed entirely by instructors)
The Role of the Teacher	As a material developer/validator	As a material developer/validator	Central (As a facilitator, evaluator, and mentor)
Scientific Validity (Sanad)	High (If developed by an expert)	High (If content by an expert)	Very High (If the teacher has sanad)
Key Challenges	Complex development, advanced device requirements	Accuracy *of speech recognition*, risk of lack of human touch	Dependence on teachers, requires student discipline & infrastructure

From the table above, it can be seen that no single method is perfect. The selection of the most appropriate method depends on the learning objectives, the characteristics of the students, and the resources available. AR excels at building initial conceptual understanding, interactive applications are effective for exercises and drills, while LMS is best suited for long-term structured learning that maintains the role of the teacher and scientific validity.

Fundamental Challenges in Tahsin Digitalization

Despite offering a lot of potential, the digitization of tahsin learning, particularly *makharij al-huruf*, faces several fundamental challenges that must be seriously addressed:

Challenge to Scientific Validity (*Sanad*): The science of tajweed and tahsin has traditionally been passed down through a chain of sanad that is connected to the Prophet Muhammad (PBUH)[23] Digital applications, however accurate, risk breaking this chain of transmission if they are not developed and supervised directly by tajweed scholars who have a clear sanad. App developers must ensure that all material, audio, and video presented have been verified by credible experts. This is not only a matter of technical truth, but also of scientific validity in the Islamic tradition.

Digital Divide Challenge: Not all students have access to a smartphone or a stable internet connection. This creates a "digital divide" that can widen the gap in Qur'anic competence between capable and incapable students.[33] The solution is to develop an app that can run *offline* and does not require too high device specifications, and educational institutions need to provide facilities for students in need.

Over-Reliance Challenges: There is a risk that students and teachers become overly dependent on technology, ignoring the importance of direct interaction. The nuances, spiritual guidance, and subtle corrections that a teacher can provide face-to-face are difficult to fully replicate by machines. Technology must be positioned as *a tool, not as* a *substitute for the teacher.[24] The relationship between teacher and student (*ustadz-student*) has a tarbiyah (education) dimension that cannot be automated.*

[23] MA Amir, "Ilmu Tajwid Praktis."

[24] Majid and Hamid, "Pengembangan Sistem Pendidikan Di Indonesia."

The digitization of *makharij al-huruf learning* has broad and profound implications for the Islamic education ecosystem. These implications touch a wide range of stakeholders, from the micro level (students and teachers) to the macro level (institutions and technology developers).

Implications for Teachers and Educational Institutions

For teachers, digitalization demands a shift in role from mere "information conveyors" to "learning designers" and "technology facilitators." Teachers no longer only teach in front of the class, but must also be able to:

Selecting and Evaluating Media: Able to assess which application or platform best suits students' needs and learning objectives.

Integrating Technology: Designing *blended learning* that combines face-to-face learning with digital-based activities.

Improving Digital Competence: Continue to learn about educational technology developments so that they don't go out of style.[25]

For educational institutions (madrasas, Islamic boarding schools, Islamic universities), the implications are:

Policies and Budgets: It is necessary to develop policies that support the integration of technology in the tahsin curriculum and allocate a budget for the development or purchase of legitimate digital media, as well as its supporting infrastructure (WiFi, devices).

Training and Staff Development: It is mandatory to provide regular training for Qira'ah al-Qur'an teachers to improve their digital competence.

Collaboration: Build cooperation with technology developers or research institutions to create quality Islamic education products that are tailored to needs.

Implications for Technology Developers

For app and platform developers, the field of Qur'anic education, especially tahsin, is a large market and has high social value. Implications:

Collaboration with Experts: To create a credible product, developers must work with religious experts (*subject matter experts*) such as tajweed and qori scholars who have sanad. This ensures the resulting products are not only technologically superior, but also religiously valid and beneficial.

Focus on User Experience (UX): App design should be intuitive, engaging, and easy to use for a wide range of audiences, from children to adults.

Sustainable Development: Technology is rapidly evolving. A commitment to continuous *updates* and development is required to improve features, add content, and keep the product relevant.

Implications for Students and the Wider Community

For students, digitalization offers a more engaging, personalized, and flexible way of learning. They can learn at their own pace, iterate on difficult material, and get instant feedback. This can increase their motivation and ultimately their competence in reading the Qur'an. Strengthening these competencies will, in turn, be:

1. **Increases Confidence:** Students become more confident when leading prayers or reading the Qur'an in public.
2. **Strengthening Religious Identity:** The ability to read the Qur'an properly and correctly is an integral part of a Muslim's identity.

[25] I Putu Widyanto and Endah Tri Wahyuni, "Implementasi Perencanaan Pembelajaran," *Satya Sastraharing* 04, no. 02 (2020).

3. **Creating a Generation of the Qur'an:** Ultimately, the biggest goal is to create a generation that can not only read, but also understand, live, and practice the content of the Qur'an.

For the wider community, the availability of quality and affordable tahsin digital media can be an effective means of da'wah and education, assist parents in teaching their children, and improve the general quality of reading the Qur'an in the community.

Advanced Case Study and the Future of Tahsin Digitalization

To enrich this academic review, it is important to look further into the future and consider more complex case studies that integrate a variety of methods.

Hypothetical Case Study: "Integrated Tahsin" Model

Imagine a comprehensive model of tahsin learning in an Islamic university, called the "Integrated Tahsin Model". This model combines the three digital methods that have been discussed:

- **Stage 1: Conceptual Foundations (Weeks 1-2)**
    - **Activity:** Students download the "Tahsin Digital AR" application that has been developed. They used markers in their handbook to visualize the 3D *makharij* of the 10 main letters.
    - **Goal:** Build a strong visual and conceptual understanding from the start. The teacher acts as a guide in the classroom, answering questions and reinforcing explanations.
    - **Technology:** Augmented Reality.
- **Stage 2: Intensive Training (Weeks 3-6)**
    - **Activities:** Students are required to install the "Makharij Master" application (fictitious interactive application). They must complete daily practice levels, achieve minimum scores, and compete on the class leaderboards.
    - **Objective:** To train articulation muscles and build correct speech habits through measurable drill and practice.
    - **Technology:** Interactive Applications & Gamification.
- **Stage 3: Holistic Evaluation and Guidance (Weeks 7-10)**
    - **Activity:** Learning switches to the campus LMS. Every week, teachers upload in-depth tutorial videos on letter *patterns* and relationships between letters. Students must record a specific letter reading and upload it to the LMS. The teacher provides detailed written audio feedback, not only on *makharij* but also on other aspects. Class discussions are conducted in forums.
    - **Objective:** To provide an in-depth, personal evaluation, and maintain the role of mentor and the validity of sanad.
    - **Technology:** LMS.

This model shows that technology does not stand alone, but becomes a mutually supportive ecosystem, where each method plays its optimal role at different stages of learning.

The Future: Artificial Intelligence and Ultra Personalization

The future of tahsin digitization will be influenced by the advancement of Artificial Intelligence (AI). Some possible developments include:

- **Personal Tutor AI:** Future applications will not only recognize whether letters are correct or incorrect, but can analyze a student's error patterns. The "AI Tutor" will be able to identify that students are consistently having trouble pronouncing the letter 'ghain' (غ) because their tongue is too advanced, and then automatically give them specific exercises to loosen and position the tongue correctly.
- **Biometric Analysis:** Using a mobile phone camera, AI can analyze students' lip movements and mouth shapes while speaking, providing real-time visual correction. "Your lips are too round when you say 'chest', try to widen them out."
- **Adaptive Content:** The learning system will automatically adjust the difficulty level of the material based on student performance. If students are proficient in *the vocabulary* of the letters of the throat, the system will automatically focus on *the more complex vocabulary of the language.*

Ethical and Philosophical Considerations

As technology advances, important ethical and philosophical questions arise:

- **Loss of "Beautiful Mistakes":** In the traditional learning process, there are "beautiful mistakes" that become magical moments for a teacher to provide loving guidance. Will overly perfect AI take away this touch of humanity?
- **Personal Data:** Apps that analyze facial voice and video collect highly personal biometric data. Who has this data? How is student privacy protected?
- **Standardization vs. Diversity:** The science of qira'ah has a variety of legitimate histories. Will technology tend to standardize on just one qira'at (e.g., qira'at 'Ashim), and ignore the rich diversity of Islamic heritage?

Answering these questions will be a challenge for future scholars, educators, and technology developers, to ensure that digitalization is in line with the core values of Islam, not undermining it.

Conclusion

Strengthening the competence of *makharij al-huruf* through digitalization is no longer an option, but an urgent need in the modern era. This comprehensive academic review shows that digital technology, if designed and implemented correctly, has tremendous potential to address the tahsin learning challenges faced today, especially post-pandemic and amid the dominance of gadgets.

This research has mapped the three main pillars of tahsin digitization: (1) Augmented Reality (AR) which excels in visualizing concepts and building a strong basic understanding; (2) Effective Interactive and Gamification Applications for self-practice, motivation, and habit-building through instant feedback; and (3) Online Learning Platform/LMS that maintains the curriculum structure, the central role of teachers as mentors, and scientific validity (*sanad*).

The application "Tahsin Digital AR" developed by Nelvawita, et al. is tangible proof that digital innovation in this field is not only technically possible, but also very valid academically and religiously. However, this paper also asserts that technology is just a *tool* (wasilah). The success of strengthening *makharij al-huruf competencies* ultimately remains dependent on a harmonious synergy between three key elements: the quality of the digital media developed (accurate, engaging, and authentic),

the competence of teachers in facilitating hybrid learning, and the motivation and active participation of the students themselves.

Challenges such as maintaining the legitimacy *of sanad*, addressing the digital divide, and preventing over-reliance on technology are real and must be faced wisely. Digitalization should not be an attempt to eliminate the role of humans (teachers), but rather to strengthen and expand its reach. The ultimate goal is not to create a "technically perfect" reader of the Qur'an but "empty spirit", but rather to produce a generation of Muslims who are competent, confident, and above all, closer to Allah SWT through true and solemn interaction with His Word

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