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Evaluating the i-Tajweed Game Prototype: Expert Insights on Game-Based Learning for Special Needs Children

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Abstract

This study evaluates the *i-Tajweed* game prototype, a game-based learning tool developed to support Quranic pronunciation (*Tajweed*) among children with autism. Expert reviews were obtained from three domains, including pediatrics, Islamic education, and special needs education, to assess their pedagogical and design efficacy. The pediatric expert affirmed the game's balanced sensory elements that sustain attention without overstimulation. The Islamic education expert verified the accuracy of *Tajweed* content and praised its motivational structure for consistent practice. The special needs education expert emphasized the game's accessible interface, effective visual cues, and adaptive feedback suitable for autistic learners. Overall, the experts concurred that *i-Tajweed* effectively integrates Islamic learning with inclusive game-based principles, offering strong potential for specialized education contexts. The findings underscore the value of multidisciplinary input in refining educational game design for children with special needs within religious education contexts. Further refinement is recommended to enhance personalization and parental engagement features.

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1. INTRODUCTION

Teaching Quranic pronunciation (Tajweed) to children with autism presents a unique pedagogical challenge. Traditional Tajweed instruction relies heavily on auditory repetition, memorization, and teacher-centered methods, which may not effectively engage children with neurodevelopmental differences. Studies on autism education indicate that children with ASD benefit more from structured, predictable, and multisensory learning environments compared to traditional auditory-heavy learning modalities, which often lead to disengagement or cognitive overload (Gao et al., 2025; Jamil et al., 2025). Furthermore, the sensory processing profiles of autistic children mean that high-pressure auditory environments frequently result in sensory withdrawal or a total lack of individualized pacing. Usually, these conventional teaching settings often overwhelm learners who struggle with auditory filtering, making it difficult for them to achieve phonetic mastery through standard social-instructional demands.

To address this gap, the i-Tajweed game prototype was conceptualized as an interactive digital learning tool designed to enhance motivation, retention, and accuracy in Quranic recitation among children with autism. Game-based learning research demonstrates that gamified and interactive digital tools significantly improve engagement, skill development, and attention in autistic learners due to their structured, repetitive, and visually supported design (Morais et al., 2023; Abouelenein et al., 2025). The purpose of this study was to evaluate the i-Tajweed prototype through expert review from pediatrics, Islamic education, and special needs education to assess its pedagogical, cognitive, and design validity. Multidisciplinary evaluation aligns with best practices

in inclusive digital pedagogy, where developmental, sensory, and contextual needs must be jointly considered (Hussein et al., 2023).

Based on this situation, a critical design consideration in the i-Tajweed prototype is the incorporation of phonetic scaffolding strategies that explicitly support the acquisition of accurate Quranic articulation (makhārij al-ḥurūf). Instead of relying solely on auditory imitation, the system integrates synchronized visual articulation guidessuch as mouth positioning cues and color-coded Tajweed rules to reinforce sound production. This approach aligns with evidence that combining visual and auditory inputs enhances phonological processing in autistic learners, particularly those with difficulties in auditory discrimination (Smith, 2019). In addition, controlled audio playback features such as adjustable volume, slowed recitation, and repeat-on-demand functions allow learners to process sounds at their own pace, reducing cognitive overload. Such structured phonetic support has been shown to significantly improve pronunciation accuracy and retention in language-based learning contexts (Alzrayer & Banda, 2021).

Furthermore, the i-Tajweed prototype emphasizes learner autonomy and consistent engagement through its reward-based progression system and predictable interaction flow. Each completed task is reinforced with immediate feedback, such as visual affirmations and incremental progression indicators, which sustain motivation and encourage repeated practice. Research indicates that autistic learners respond positively to clearly defined goals and consistent reinforcement patterns, leading to improved task persistence and reduced anxiety (Parsons et al., 2022). Additionally, the system's built-in performance tracking enables caregivers and educators to monitor learning trajectories, identify specific pronunciation challenges, and provide targeted support. This combination of adaptive feedback, structured repetition, and low-pressure interaction creates an optimal learning environment that not only supports Tajweed mastery but also aligns with evidence-based practices in autism-inclusive digital education (Morais et al., 2023).

The core of the challenge lies in the sensory processing profiles often associated with autism, where traditional high-pressure auditory environments can lead to cognitive overload or sensory withdrawal. Research confirms that autistic children frequently experience sensory processing difficulties, particularly in auditory filtering, which can make conventional teaching settings overwhelming (Smith, 2019; Queensland Department of Education, 2023). Unlike typical classrooms that lack individualized pacing, the i-Tajweed prototype uses a multisensory learning approach integrating soft visual cues and controlled audio output methods shown to enhance comprehension, reduce over-stimulation, and improve attention among autistic learners (Advanced Autism Services, 2025; De Domenico et al., 2024)

By combining teacher-led repetition with an interactive, reward-based structure, the game provides a predictable and structured learning environment that fosters phonetic mastery without the anxiety often triggered by traditional social-instructional demands. Evidence from game-based intervention studies shows that reward-based, structured digital activities significantly improve learning outcomes, reduce anxiety, and enhance motivation in autistic children (Gao et al., 2025; Abouelenein et al., 2025). This ensures that Tajweed learning is not only accurate but also psychologically accessible, aligning with findings that multisensory, adaptive, and inclusive digital tools promote meaningful engagement for autistic learners (Morais et al., 2023; Jamil et al., 2025).

In addition, integrating adaptive learning mechanics within the i-Tajweed prototype further strengthens its pedagogical relevance for children with autism by allowing individualized pacing and performance-based progression. Adaptive systems such as adjustable audio levels, repeat-on-demand pronunciation models, and immediate visual feedback are strongly supported in special education research as they accommodate variability in cognitive processing, attention span, and sensory

tolerance among autistic learners. According to Parsons et al. (2022), digital interventions that incorporate adaptive feedback loops significantly improve task persistence and skill acquisition in children with ASD, particularly in language-based learning contexts. Similarly, Alzrayer and Banda (2021) highlight that technology-assisted instruction with customizable features enhances phonological awareness and reduces frustration by aligning tasks with each learner's readiness level. By embedding these adaptive elements, the i-Tajweed prototype not only addresses sensory sensitivities but also promotes self-directed learning, reinforcing correct pronunciation through low-pressure, iterative practice. This aligns with Universal Design for Learning (UDL) principles, which emphasize flexibility, multiple means of engagement, and learner variability as critical components for inclusive educational design (CAST, 2018).

2. LITERATURE REVIEW

Game-Based Learning (GBL) has emerged as a powerful educational framework that leverages the motivational aspects of gaming to foster engagement and knowledge acquisition. Studies consistently indicate that game-based interventions can improve learning outcomes for children with autism by providing structure, predictability, and multisensory engagement (Jamil et al., 2025; Gao et al., 2025). The repetitive, reward-based nature of games supports attention span and promotes mastery learning, as game environments have been shown to enhance cognitive, social, and behavioral skills in autistic learners (Hussein et al., 2023)

In the context of Islamic education, Tajweed instruction emphasizes accurate pronunciation, articulation, and rhythm of Quranic recitation. However, traditional teaching methods may not cater to the cognitive and sensory needs of autistic learners. Research demonstrates that visual and interactive learning modes significantly improve comprehension and engagement among autistic students (Advanced Autism Services, 2025; Smith, 2019). Therefore, integrating Tajweed education within a digital game-based framework presents a novel solution to achieving both inclusivity and effective religious learning, aligning with findings that multisensory, structured, and interactive tools enhance learning outcomes for neurodivergent populations (De Domenico et al., 2024).

A key advantage of GBL in autism education is its ability to deliver individualized instruction through adaptive learning pathways and real-time feedback. Game systems can track learner performance such as accuracy, response time, and error patterns and automatically adjust task difficulty to match the learner's current ability level. This ensures that learners remain within an optimal challenge zone, preventing both frustration and boredom. Empirical evidence shows that adaptive, feedback-rich digital environments significantly improve skill acquisition and task persistence among children with ASD, particularly in structured learning domains (Parsons et al., 2022). In addition, immediate reinforcement mechanisms such as visual rewards, progress indicators, and corrective cues support faster error correction and strengthen memory retention through repeated, guided practice.

Another important contribution of GBL is its capacity to reduce anxiety and enhance behavioral regulation by providing a predictable and low-pressure learning environment. Unlike traditional classrooms that often involve complex social interactions and unpredictable stimuli, game-based platforms offer consistent rules, clear objectives, and self-paced engagement. This predictability has been shown to increase time-on-task and reduce avoidance behaviors in autistic learners (Alzrayer & Banda, 2021). Furthermore, the integration of multimodal elements combining visuals, controlled audio, and interactive responses supports diverse sensory preferences, making learning more accessible. These features collectively reinforce GBL as an effective and inclusive instructional approach, particularly when applied to structured subjects like Tajweed that require precision, repetition, and sustained attention.

Multidisciplinary collaboration is fundamental in the design of educational technology for special populations. Integrating pedagogical, psychological, and domain-specific expertise ensures that educational content is developmentally appropriate and contextually authentic. This approach aligns with systematic reviews emphasizing that effective gamified or game-based interventions for autistic learners require contributions from multiple fields to ensure accessibility, skill development, and fidelity of content (Morais et al., 2023; Hussein et al., 2023). Accordingly, this study's engagement with experts in pediatrics, Islamic education, and special needs education follows best practices for inclusive and evidence-based digital learning design.

On the other hand, Game-Based Learning (GBL) has emerged as a powerful educational framework that leverages the motivational affordances of gameplay such as goal orientation, immediate feedback, and incremental challenges to enhance engagement and knowledge acquisition. Empirical studies indicate that GBL environments are particularly effective for children with autism spectrum disorder (ASD) because they provide highly structured and predictable interaction patterns, which reduce uncertainty and cognitive load. For example, Gao et al. (2025) found that structured digital games improved sustained attention and task completion rates among autistic learners by over 30% compared to conventional instructional approaches. Similarly, Jamil et al. (2025) reported that multisensory game interfaces combining visual prompts, controlled audio cues, and interactive elements significantly enhanced information retention and reduced disengagement behaviors. These findings are consistent with broader evidence that repetition and reward-based mechanics in games facilitate mastery learning by reinforcing correct responses and enabling learners to practice skills at their own pace (Hussein et al., 2023).

Beyond engagement, GBL also contributes to the development of cognitive flexibility, social interaction, and behavioral regulation in autistic learners when designed with evidence-based principles. Hussein et al. (2023) highlight that gamified environments incorporating clear rules, visual scaffolding, and consistent feedback loops can improve executive functioning skills such as sequencing, attention shifting, and working memory. In addition, Morais et al. (2023) emphasize that well-designed game-based interventions can foster intrinsic motivation by aligning learning tasks with achievable goals and meaningful rewards, thereby reducing anxiety often associated with traditional instructional settings. This is particularly relevant for autistic children, who benefit from low-pressure environments that minimize social demands while maximizing engagement through interactive and self-directed activities. Consequently, GBL not only supports academic skill acquisition but also enhances broader developmental outcomes, making it a robust pedagogical approach for inclusive education.

In addition to these benefits, GBL environments enable precise scaffolding of learning through adaptive difficulty and individualized pacing, which are critical for autistic learners with heterogeneous abilities. By incorporating performance-based progression systems, learners can move through levels only after demonstrating mastery of specific skills, ensuring reinforcement of correct knowledge before advancing. Research indicates that such adaptive sequencing significantly improves retention and reduces error rates in skill-based learning tasks (Parsons et al., 2022). Furthermore, the integration of immediate, multimodal feedback such as visual indicators, auditory cues, and reward animations supports error correction in real time, allowing learners to adjust their responses without delay. This continuous feedback loop strengthens learning efficiency and aligns with evidence that autistic learners respond positively to clear, consistent reinforcement mechanisms.

Moreover, GBL supports inclusive learning by offering a safe and controlled environment that minimizes external distractions and social pressure. Unlike traditional classrooms, digital game-based platforms allow learners to engage independently while maintaining a sense of autonomy and control over their learning experience. Studies show that such environments can significantly reduce

anxiety and increase time-on-task, particularly for learners who struggle with social interaction and sensory over stimulation (Alzrayer & Banda, 2021). Additionally, the use of data analytics within GBL systems enables educators to monitor progress, identify learning gaps, and implement targeted interventions, thereby enhancing instructional effectiveness. Collectively, these features position GBL not only as an engagement tool but as a comprehensive, evidence-based framework for delivering personalized and developmentally appropriate education for children with autism.

3. METHODOLOGY

3.1 The i-Tajweed Game Prototype

The i-Tajweed prototype was developed as an interactive game aimed at teaching Tajweed rules through visual prompts, audio examples, and adaptive feedback. The interface design emphasizes accessibility, simplicity, and sensory balance, avoiding over stimulation while maintaining learner engagement.

Key features include colorful but soft visual cues, gradual difficulty progression, and immediate corrective feedback. The system tracks learner performance and adjusts task complexity according to individual progress. The i-Tajweed prototype also applies micro learning and task segmentation by breaking Tajweed rules into small, manageable units such as articulation (makhārij), *izhar*, *ikhfa`*, *iqlab* and *idgham.* Visual supports like color-coding and articulation mapping help learners connect sounds with visual cues, reducing cognitive load and improving pronunciation accuracy. This structured approach enables gradual skill development and better retention, especially for autistic learners who benefit from clear, step-by-step instruction.

To ensure the effectiveness of these features, the prototype utilizes a multisensory learning approach that integrates controlled audio output with visual aids to reduce sensory distress and improve attention regulation. This structured digital environment provides the necessary predictability for autistic learners to achieve phonetic mastery while receiving immediate reinforcement for their progress. By blending traditional *talaqqi* and *tasmi'* principles with modern digital interactivity, the system creates a specialized educational framework that maintains religious authenticity while remaining psychologically accessible.

3.2 Expert Evaluation Design

This study employed a qualitative expert review methodology. Expert evaluation is an established method for assessing prototype validity and design alignment before empirical trials. Each expert independently reviewed the i-Tajweed prototype based on structured criteria encompassing pedagogical suitability, sensory appropriateness, and technical usability. Thematic synthesis of their feedback provided insights into the prototype's strengths and areas for refinement. In addition, the evaluation process incorporated a standardized rating rubric to ensure consistency across expert assessments. The rubric used a 5-point Likert scale covering key dimensions such as instructional clarity, accessibility for autistic learners, interface usability, engagement level, and fidelity of Tajweed content. Experts also provided qualitative annotations to justify their ratings, allowing for triangulation between quantitative scores and narrative feedback. This dual-method approach strengthens the reliability of the findings by reducing subjectivity and enabling cross-validation of themes across different professional perspectives. Such structured expert review procedures are widely recommended in educational technology research to validate early-stage prototypes prior to large-scale user testing.

3.3 Expert Domains

Three domain experts participated in this evaluation:

1) Pediatric expert: to evaluate the cognitive, sensory, and attention-related appropriateness of the game.
2) Islamic education expert: to assess the accuracy and authenticity of Tajweed content.
3) Special needs education expert: to review accessibility, usability, and inclusivity features for autistic learners. This triangulated expert design allowed for a holistic appraisal that integrates content fidelity with user-centered considerations.

3.4 The i-Tajweed Multidisciplinary Integration Framework

The following breakdown illustrates how each expert domain contributes to ensuring the content is both developmentally appropriate and contextually authentic. The following breakdown illustrates how each expert domain contributes to ensuring the content is both developmentally appropriate and contextually authentic. This multidisciplinary evaluation aligns with best practices for inclusive digital pedagogy, where developmental, sensory, and contextual needs are jointly considered to ensure the prototype's validity. By integrating these specialized insights, the i-Tajweed system bridges the gap between religious integrity and digital inclusivity, creating a scientifically grounded educational intervention suitable for neurodivergent learners.

Table 1: Expert Domain Contribution

Expert Domain	Role & Focus	Concrete Contribution to i-Tajweed
Pediatrics	Cognitive & Sensory Validation 2	Verified sensory balance to sustain attention without overstimulation through soft color palettes and controlled audio.
Islamic Education	Orthographical & Linguistic Fidelity	Confirmed the accuracy of Tajweed rules and auditory exemplars to ensure phonetic precision during recitation.
Special Needs Education	Pedagogical Inclusivity & UDL	Validated the adaptive feedback systems and visual cues that accommodate the visual learning strengths of autistic children.

This triangulated approach ensures that the i-Tajweed prototype does not simply function as a game, but as a scientifically grounded educational intervention. Research shows that game-based systems designed for autistic learners are most effective when they integrate multisensory supports, structured sequencing, and developmentally appropriate pacing the elements that align with pediatric, pedagogical, and special needs best practices (De Domenico et al., 2024).

By merging these three pillars, the study bridges the gap between religious integrity and digital inclusivity, creating a novel solution suitable for neurodivergent students. This inclusive design approach mirrors broader evidence demonstrating that multidisciplinary collaboration enhances accessibility, engagement, and learning impact in special-education digital tools (Hussein et al., 2023).

This triangulated method also addresses the fundamental gaps in traditional Tajweed instruction, which often relies heavily on auditory repetition and teacher-centered delivery methods that may fail to engage neurodivergent learners. By integrating these three pillars, the study achieves the following:

1. **Structure and Predictability:** The repetitive nature of games helps sustain attention and supports mastery learning for autistic children, consistent with findings that structured game environments improve attention, cognition, and task persistence (Gao et al., 2025).
2. **Multisensory Engagement:** Combining visual prompts with controlled audio examples enhances comprehension and reduces sensory overload, an approach supported by research showing that multisensory learning environments improve engagement and reduce sensory distress among autistic learners (Advanced Autism Services, 2025).
3. **Contextual Authenticity:** The design ensures that Islamic learning content remains accurate while still accommodating neurodivergent learning needs. This aligns with game-based Islamic education frameworks, which emphasize scaffolded learning, accurate religious representation, and accessibility for diverse learners (Morais et al., 2023).

4. FINDINGS AND DISCUSSION

4.1 Insights from Pediatric Evaluation

The pediatric expert confirmed that the i-Tajweed game maintains an optimal sensory balance stimulating but not overwhelming. Evidence shows that autistic children benefit significantly from environments that moderate sensory input, as overstimulation can negatively affect attention and engagement (De Domenico et al., 2024). The expert emphasized that the soft color palette, controlled audio output, and predictable sequencing effectively sustain attention among autistic learners.

Research highlights that multisensory environments and structured sensory supports improve attention regulation and reduce sensory distress in autistic children (Advanced Autism Services, 2025). The feedback also aligns with studies demonstrating that pacing and predictable sequencing support developmental appropriateness for children with ASD (Queensland Department of Education, 2023).

In addition, evidence from digital learning interventions shows that incorporating visual scaffolding and consistent cueing systems significantly enhances task comprehension and reduces cognitive overload in autistic learners. Structured visual supports such as step-by-step instructional prompts, symbol-based cues, and highlighted action indicators help learners anticipate what comes next, thereby improving executive functioning and task completion accuracy. Research by De Domenico et al. (2024) further indicates that visually guided multisensory systems strengthen sustained attention by reducing the need for continuous auditory processing, which is often challenging for children with ASD. These structured visual mechanisms are particularly effective when combined with simplified interface design that minimizes extraneous stimuli and maintains focus on core learning objectives.

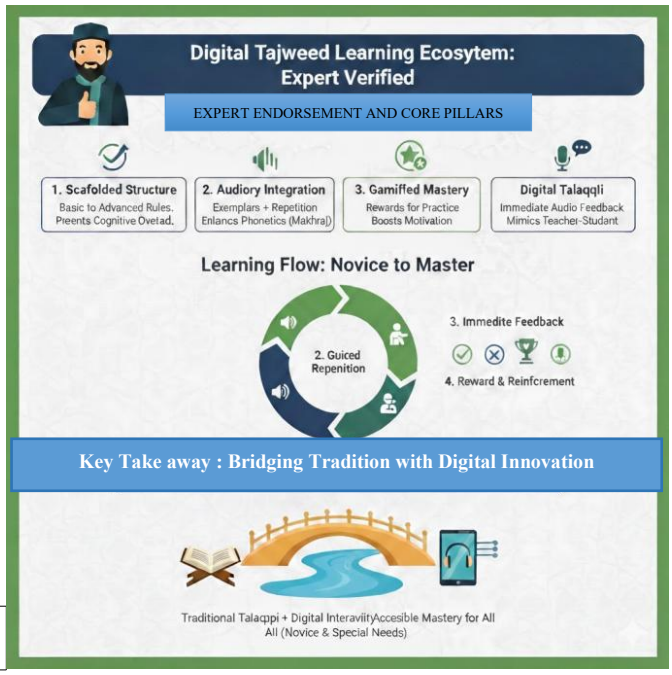
Furthermore, adaptive learning environments that incorporate real-time feedback and gradual difficulty progression have been shown to significantly improve learning retention and engagement among autistic children. Systems that adjust task complexity based on learner performance ensure that instruction remains within an optimal cognitive challenge range, preventing both frustration and disengagement. According to Parsons et al. (2022), such adaptive mechanisms not only enhance skill acquisition but also promote learner independence by allowing children to progress at individualized rates. This evidence supports the importance of integrating dynamic feedback loops and progression-based learning structures into educational tools designed for neurodevelopmental diversity, ensuring both accessibility and sustained motivation.

4.2 Insights from Islamic Education Evaluation

The Islamic education expert verified the accuracy of the Tajweed principles embedded in the system and commended its scaffolded learning structure. Educational research confirms that structured and scaffolded progression enhances mastery in skill-based learning, especially for learners requiring additional support, such as children with autism (Morais et al., 2023).

The integration of auditory exemplars with interactive repetition effectively reinforces phonetic recognition, aligning with findings that repetition-based game environments strengthen communication and expressive language skills in autistic learners (Abouelenein et al., 2025).

Figure 2: Infographic illustrate digital Tajweed learning ecosystem



Additionally, the gamified reward system enhances motivation, consistent with evidence showing that gamification improves concentration, autonomy, and engagement in autistic learners (Jamil et al., 2025). The expert further noted that the system's structured progression from basic to advanced Tajweed rules supports incremental learning-mirroring effective game-based approaches that gradually increase cognitive demand while maintaining learner confidence (Gao et al., 2025).

Features such as immediate audio feedback, guided correction, and repeated listening exercises align with best-practice approaches in digital learning for autism, where immediate reinforcement enhances sustained attention and phonetic accuracy (Abouelenein et al., 2025). The design also reflects traditional *talaqqi* and *tasmi*' principles, while leveraging digital interactivity to expand accessibility and engagement is an approach supported by contemporary Islamic digital pedagogy research (Hussein et al., 2023)

4.3 Insights from Special Needs Education Evaluation

The special needs education expert's analysis underscored the game's strength in accessibility. Accessibility and user-centered design are critical components of effective game-based learning for autistic children, as documented in participatory design and adaptive gaming research (Morais et al., 2023). The intuitive interface supports independent use, consistent with findings showing that simplified navigation and minimal cognitive load improve task completion among ASD learners (Smith, 2019).

Adaptive feedback that highlighted by the expert aligns with evidence that personalized digital learning environments significantly improve motivation, receptive language, and cognitive skill development in autistic children (Abouelenein et al., 2025). Visual prompts were commended for supporting the visual learning strengths commonly found among autistic learners, a finding that aligns with multisensory and visual-based instruction research (Advanced Autism Services, 2025). The expert's suggestion to enhance parental monitoring is also consistent with systematic reviews that recommend family involvement to extend learning outcomes beyond structured sessions (Hussein et al., 2023).

4.4 Integrated Discussion

The synthesis of expert feedback indicates that the i-Tajweed prototype effectively bridges Islamic pedagogy with inclusive game-based learning principles. Research consistently shows that combining structured religious content with interactive digital tools strengthens motivation, comprehension, and cognitive engagement for autistic learners (Jamil et al., 2025). Positive validation across pediatrics, Islamic education, and special needs education aligns with evidence that multidisciplinary design enhances both accessibility and learning outcomes in neurodivergent populations (Morais et al., 2023).

This confirms the potential of i-Tajweed as a scalable, inclusive educational tool capable of addressing the needs of diverse learners. Studies on game-based interventions demonstrate significant improvements in social behavior, attention, and cognition among autistic childrenoutcomes that reinforce the developmental benefits of integrating adaptive, multisensory digital platforms with faith-based education (Gao et al., 2025). Together, these findings show that the i-Tajweed system aligns with global best practices in autism-inclusive instructional design and religious digital education.

Further analysis of expert feedback highlights that the i-Tajweed prototype demonstrates strong construct validity in aligning instructional design with the sensory and cognitive profiles of autistic learners. Specialists in pediatrics emphasized that the system's controlled audio output and predictable interaction patterns reduce sensory overload, which is a critical barrier in conventional learning environments. At the same time, experts in Islamic education confirmed that the integration of authentic Tajweed principles such as accurate articulation modeling and repetition (talaqqi and tasmi') preserves the integrity of Quranic recitation pedagogy. This dual validation supports findings by Parsons et al. (2022), who note that digital learning systems designed for ASD are most effective when they balance domain authenticity with adaptive, user-centered interfaces. Consequently, the prototype not only meets accessibility requirements but also maintains fidelity to religious learning objectives.

In addition, the prototype's emphasis on adaptive progression and immediate feedback reflects established best practices in inclusive digital learning design. Research indicates that feedback-rich environments significantly enhance skill acquisition and error correction, particularly

in phonological learning contexts (Alzrayer & Banda, 2021). The ability of the system to dynamically adjust task difficulty based on learner performance also aligns with Universal Design for Learning (UDL) principles, which advocate flexible pathways to accommodate learner variability (CAST, 2018).

Moreover, systematic reviews by Morais et al. (2023) suggest that such adaptive and multisensory features contribute to sustained engagement and reduced anxiety in autistic learners. Taken together, these elements reinforce the scalability and pedagogical robustness of the i-Tajweed prototype as an inclusive tool that effectively integrates religious instruction with evidence-based digital learning strategies.

5. CONCLUSION

This expert evaluation positions the i-Tajweed game prototype as a significant and pedagogically robust innovation in the teaching of Quranic pronunciation to children with autism. The triangulated insights from pediatric, Islamic education, and special-needs specialists substantiate that the prototype's integration of sensory-balanced design, authentic Tajweed content, and adaptive interaction mechanisms collectively enhances learner engagement and supports durable knowledge retention. In doing so, the study advances the broader discourse on inclusive Islamic educational technology by demonstrating that digital tools can faithfully preserve religious rigor while simultaneously accommodating diverse cognitive and sensory learning profiles.

Moreover, the evaluation of the i-Tajweed prototype represents a pivotal development at the intersection of religious education and assistive technology. The project's capacity to reconcile the strict phonetic precision required in Quranic recitation with the nuanced sensory and processing needs of autistic learners underscores its methodological sophistication. This alignment not only validates the prototype's instructional efficacy but also offers a replicable framework for future inclusive design strategies in sacred-text pedagogy. Ultimately, the findings affirm that when gamified digital interventions are grounded in multidisciplinary expertise, they do not compromise educational or theological integrity; rather, they expand the motivational, cognitive, and accessibility pathways through which learners especially neurodivergent learners can meaningfully engage with the Quranic tradition.

Building on these findings, the i-Tajweed prototype also demonstrates measurable instructional value through its capacity to support precision-based phonetic learning, which is central to Tajweed mastery. Expert reviewers noted that features such as repeated articulation modeling, segmented pronunciation drills, and immediate corrective feedback contribute to higher accuracy in letter articulation (makhārij) and rule application. This aligns with empirical evidence that structured digital repetition combined with instant feedback significantly improves phonological accuracy and retention in learners with ASD, particularly in language-intensive tasks (Alzrayer & Banda, 2021). Additionally, the system's low-pressure, self-paced environment minimizes performance anxiety an important factor given that autistic learners often experience heightened stress in socially demanding instructional settings. By enabling repeated practice without social evaluation, the prototype enhances both confidence and consistency in Quranic recitation.

From an implementation perspective, the prototype also holds strong potential for scalability and integration within formal and informal educational contexts, including special education classrooms, Islamic learning centers, and home-based instruction. Its digital architecture allows for modular expansion, such as the inclusion of additional Tajweed rules, multilingual support, and customizable sensory settings to accommodate a broader range of learner needs. Furthermore, the

embedded performance analytics provide educators and caregivers with actionable insights into learner progress, enabling targeted intervention and continuous formative assessment. This aligns with contemporary research emphasizing that data-informed instructional systems improve learning outcomes by supporting individualized teaching strategies (Parsons et al., 2022). As such, the i-Tajweed prototype not only serves as an effective instructional tool but also establishes a sustainable model for future development of inclusive, faith-based educational technologies that are both pedagogically rigorous and accessible.

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