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Multidimensional Assessment of Prayer Rituals: An AHP-Based Approach for Determining Learning Priorities in Educational Games

Muhammad Ferelian El Hilaly Daksana [1*], Hani Nurhayati [1]
[1] Universitas Islam Negeri Maulana Malik Ibrahim Malang, Indonesia
* Author Correspondence

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Abstract
Conventional evaluation methods in Islamic prayer (*salat*) instruction rely predominantly on unidimensional, binary scoring (correct/incorrect), failing to capture cognitive hesitation and learners' prior knowledge, factors essential for diagnosing latent learning gaps. To address this limitation, this study introduces a novel multidimensional diagnostic model integrated into a 3D educational game, *"Shalat Academy,"* utilizing the Analytic Hierarchy Process (AHP) to automate personalized remedial material prioritization. Using a Research and Development (R&D) methodology with 58 junior high school students, the system evaluates real-time gameplay across three weighted criteria: Score (weight = 0.539, *cost*), Prior Experience (weight = 0.297, *benefit*), and Response Time (weight = 0.164, *benefit*, serving as a proxy for cognitive hesitation). Unlike static assessment tools, this approach transforms temporal and experiential gameplay telemetry into ranked remedial trajectories. Empirical validation yielded a "Highly Feasible" rating (82.67%) from media experts and an "Acceptable" System Usability Scale (SUS) score of 64.35, while achieving a 60.34% diagnostic alignment rate with Fiqh subject-matter experts, where the remaining 39.66% discrepancy underscores the model's heightened sensitivity in flagging hesitant yet correct responses missed by manual grading. Ultimately, this study advances religious educational technology by shifting digital serious games from passive visualization media to intelligent, diagnostic decision-support systems.

Contact : Corresponding author e-mail: ferelian75@gmail.com
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Introduction

Mastering the correct performance of Salat is a fundamental obligation for every Muslim. However, ensuring effective instruction and assessment poses significant pedagogical challenges, whether in formal schooling or non-formal religious settings (Kasiono et al., 2023). The primary issue lies in conventional evaluation methods, which typically rely on a linear accumulation of correct and incorrect answers to determine a final score (Abdurrohman & Sungkono, 2022). This quantitative approach is insufficient; it fails to capture critical nuances such as response time or hesitation, which are key indicators of a learner's confidence and comprehension depth. Furthermore, standard assessments often overlook the learner's prior knowledge. Consequently, educators lack the diagnostic depth required to distinguish between genuine mastery and lucky guesses, resulting in an incomplete picture of student competency (Sim, 2017).

Previous studies have created various multimedia learning tools, but most lack decision support for adaptive assessment (Mardliyaturrahma & Kusuma, 2024). Our study introduces a new method by embedding the Analytic Hierarchy Process in a 3D educational game. We picked AHP because it handles complex multi-criteria decisions effectively (Aminuddin et al., 2022; Surya et al., 2022). The key goal here is building an assessment system that weighs Score, Time, and Experience to set priorities for remedial work making learning more targeted and efficient for each student. This research bridges the divide between static assessment and adaptive learning via a multidimensional evaluation system built into the "Shalat Academy" game. Breaking from earlier studies, it applies AHP to combine three key factors Score, Response Time, and Experience. At its heart, the work offers a decision model that gauges student understanding while auto-generating a ranked lineup of remedial content, personalizing practice to target weak spots in prayer rituals (Hayati, 2023).

To address these engagement challenges, Game-Based Learning (GBL) offers a compelling solution, particularly for digital-native students who thrive in interactive environments (Liu et al., 2022). While numerous educational games for Islamic studies have been developed to visualize prayer movements, most serve merely as multimedia textbooks rather than diagnostic tools. Existing applications typically present static simulations or basic quizzes that lack intelligent feedback mechanisms, failing to adapt to the user's specific learning pace or weaknesses (Wongvilaisakul et al., 2023). This technological gap creates an urgent need for a "serious game" that transcends mere visualization by integrating a robust decision-making engine that provides personalized learning trajectories rather than generic content delivery (Ben-Assuli et al., 2020).

Method

This study employed a Research and Development methodology adapted for software engineering to develop a functional prototype of an educational game, following requirements analysis, system design, implementation, and testing (Ortega et al., 2022). Central to this research is decision logic based on the Analytic Hierarchy Process as the game's evaluation engine, implemented in Unity Engine for the 3D environment and a Finite State Machine for Non-Player Character interactions. The core logic is organized to focus on 'Remedial Material

Prioritization'. It uses three criteria identified by experts: Score or Grade (higher scores lower the priority), Experience (based on students' self-reported prior knowledge), and Response Time (longer times raise the priority). The importance of each criterion was set using pairwise comparisons with subject matter experts. Testing was conducted with 58 junior high school students aged 12–15 from the Malang Raya region. Data collection employed three instruments: an in-game pre-test for real-time AHP inputs, expert validation forms from Fiqh specialists and game media experts to assess content validity and technical feasibility, and a post-test System Usability Scale questionnaire to measure user satisfaction and usability (Li et al., 2024).

Results and Discussion

Results

AHP Weighting Analysis The fundamental component of the assessment system is the determination of criteria weights (Asuquo et al., 2024). Using Saaty's pairwise comparison scale (1-9), the analysis prioritized cognitive mastery (Score) as the most critical factor, followed by the user's background (Experience) and hesitation (Time). Table 1 presents the pairwise comparison matrix used in this study. Response time was modeled as a benefit criterion representing hesitation intensity, where longer durations indicate higher remedial priority. The calculation yielded a Consistency Ratio (CR) value below 0.1, confirming that the expert's judgment in weighing these criteria was consistent and the resulting weights are mathematically valid to be implemented in the game logic.

Table 1. Pairwise Comparison Matrix of Assessment Criteria

Criteria	Score	Experience	Time
Score	1	2	3
Experience	0.5	1	2
Time	0.33	0.5	1

Based on the matrix above, the final global weights obtained were 0.539 for Score, 0.297 for Experience, and 0.164 for Response Time. This indicates that while the correctness of the answer is paramount, the system significantly values the student's background and speed of response in determining the learning priority. Game Implementation and Diagnostics The game "Shalat Academy" implements these weights into a 3D adventure format. Figure 1 illustrates the gameplay interface where the assessment takes place. Players interact with NPCs to answer questions regarding prayer pillars. The system captures the data in real-time without interrupting the flow of the game.



Figure 1. Quiz Interaction

Following the successful implementation of the assessment logic, the study proceeded to data collection to evaluate the system's diagnostic accuracy. Field testing was conducted at MTsN 7 City of Malang and MTsN City of Batu, with 8th-grade students serving as the primary participants. As illustrated in Figure 2, the testing environment was designed to replicate independent learning sessions (Iskak et al., 2023). Participants utilized the provided devices to engage with the "Shalat Academy" game and complete the diagnostic quests within a specified timeframe. Direct observation ensured that the data collected, including response times and answer accuracy, reflected authentic student performance without external assistance. The active engagement of students during these sessions provided empirical data to assess whether the AHP logic aligns with established educational standards (Fu et al., 2025).



Figure 2 Documentation in MTsN 7 Malang

A media expert validation was conducted to assess the technical feasibility and instructional quality of the developed game. Five experts evaluated the application using a structured questionnaire comprising 15 items rated on a 5-point Likert scale (Hazrullah & Lubis, 2023). The evaluation addressed interface design, functionality, interactivity, and instructional clarity. The total score from all validators was 310 out of a maximum of 375. Applying the feasibility index formula, the resulting score was 82.67%, which is classified as "Highly Feasible" according to established educational media evaluation criteria, as summarized in Table 2. These findings demonstrate that the game is technically robust and appropriate for use as a learning and assessment tool (Astra et al., 2015).

Table 2. Media Expert Validation Summary

Indicator	Value
Number of Experts	5
Number of Items	15
Scale	Likert (1–5)
Total Score	310
Maximum Score	375
Feasibility Index	82.67%
Category	Highly Feasible

To thoroughly test the proposed model's performance, we compared the remedial priorities set by the AHP system with those determined by Fiqh subject matter experts. We used data from 58 respondents to represent student performance. As shown in Table 3, the system's recommendations aligned with teachers' judgments in 60.34% of cases. In diagnostic assessment contexts, partial disagreement with human judgment is expected, particularly when temporal cognitive indicators are incorporated. While this figure indicates a moderate level of agreement, the approximately 40% discrepancy provides a critical insight into the system's added value. This divergence is primarily attributed to the AHP's ability to quantify "response latency" the time it takes a student to answer a question. In traditional manual grading, evaluation is often binary and unidimensional, focusing solely on whether the final answer is correct or incorrect. Conversely, the AHP system operates in a multidimensional manner (Nie et al., 2021). AHP interprets a correct but delayed response as a sign of "hesitation" or lack of cognitive certainty (Sense & Van Rijn, 2022). Consequently, the system may flag a material for remedial action even if the student answered correctly, provided they took an excessive amount of time to do so. This suggests that the AHP system offers a more granular and stricter diagnosis, capable of uncovering latent learning gaps that typically escape conventional human assessment (Afif, 2023).

Table 3. Comparison of System Output and Manual Assessment

Description	Quantity	Percentage (%)
Total Respondents	58	100%
Aligned	35	60.34%
Not Aligned	23	39.66%

Beyond verifying the system's diagnostic logic, it is equally important to ensure that the application is accessible and user-friendly for the target audience. A technologically advanced assessment tool is of limited value if users find it difficult to navigate. Therefore, to evaluate the User Experience (UX), the study employed the System Usability Scale (SUS) as the measurement instrument (Nik Ahmad & Megat Sazali, 2021). The questionnaire consisted of 10 standardized items, ranging from system complexity to ease of use, and was distributed to all 58 participants after the gameplay session. The specific items used in this survey are detailed in Table 4.

Table 4. Mapping of Questionnaire Items to Usability Components

No.	Statement	Component	Positive/Negative
Q1	I think that I would play the "Shalat Academy" game again.	Satisfaction	Positive
Q2	I found the "Shalat Academy" game complex to play.	Efficiency	Negative
Q3	I found the "Shalat Academy" game easy to play.	Learnability	Positive
Q4	I needed technical support or assistance from others to play the "Shalat Academy" game.	Error	Negative
Q5	I found that the features in the "Shalat Academy" game functioned as intended.	Efficiency	Positive
Q6	I felt there was too much inconsistency within the "Shalat Academy" game.	Error	Negative
Q7	I imagine that most people would learn to use the "Shalat Academy" game quickly.	Learnability	Positive
Q8	I found the "Shalat Academy" game confusing.	Error	Negative
Q9	I encountered no difficulties while playing the "Shalat Academy" game.	Efficiency	Positive
Q10	I needed to familiarize myself with the system before playing the game.	Memorability	Negative

To assess whether the application works well in practice, we conducted a usability test using the System Usability Scale (SUS). Figure 3 shows how participants responded. The average score was 64.35, which falls within the 'Acceptable' range according to SUS standards (Fenny Purwani & Fatikah Aulia Farhah, 2024). This suggests that the system's main features, especially the multidimensional assessment logic, work well. However, there are still some small issues with how users interact with the system. The score shows that the user interface needs further improvements to better support students with varying levels of digital skills, making the system not only functional but also easy for everyone to use (Saputra, 2019).

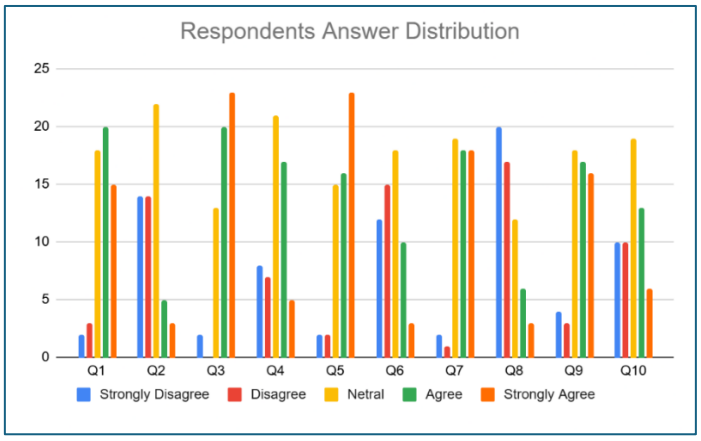


Figure 3. SUS Answer Chart

As illustrated in Figure 3, the distribution of SUS scores varies among participants. While the cumulative average (64.35) places the application in the "Acceptable" category, the individual data points reveal a divide based on digital literacy. Students accustomed to mobile gaming tended to rate the usability significantly higher, whereas those with limited exposure to 3D interfaces struggled with navigation controls. This suggests that while the pedagogical logic is sound, the user interface (UI) requires distinct improvements, such as the addition of a comprehensive tutorial mode, to accommodate non-gamer students (Lee et al., 2018).

Discussion

The primary objective of this study was to transcend the limitations of conventional prayer education tools, which typically function as static instructional media rather than diagnostic instruments. The development of "Shalat Academy" integrating the Analytic Hierarchy Process (AHP) has demonstrated that educational games can serve as intelligent decision support systems (Pratama & Wahdiniwaty, 2024). The Shift from Unidimensional to Multidimensional Assessment Most existing Islamic educational applications focus on memorization and visual correctness, evaluating students solely based on whether their answer is "True" or "False" (Nurohmah & Ma'rifah, 2025). This study argues that such unidimensional assessment is insufficient for measuring genuine mastery. The results of this research confirm that integrating Response Time and Experience alongside Scores creates a more rigorous evaluation model. The AHP weighting analysis revealed that while cognitive accuracy (Score) remains the dominant factor (0.539), the system places substantial weight on the non-cognitive aspects (0.461 combined). This aligns with the theory of mastery learning, where true competence is defined not just by accuracy, but by fluency and confidence in execution (Saputri, 2021).

Interpreting the Discrepancy: Algorithm vs. Human Judgment A critical finding of this research is the 60.34% conformity rate between the AHP system's recommendations and the manual assessment by Fiqh teachers. While a higher match rate might initially seem desirable, the 40% discrepancy highlights the unique value proposition of the computational approach. In manual grading, teachers often overlook the "hesitation factor." A student who answers correctly after 30 seconds of thinking is typically graded the same as one who answers instantly. However, the AHP system identifies the former as lacking "cognitive certainty" and flags the material for remedial action (Theocharous et al., 2019). Therefore, the system does not merely replicate human judgment but augments it by detecting latent learning gaps that human observers might miss due to cognitive bias or lack of attention to temporal details . This proves that the system offers a stricter, more granular diagnosis suitable for personalized learning (Binns, 2022).

Usability and Implementation Challenges Despite the robust backend logic, the usability testing (SUS score of 64.35) indicates that the complexity of the 3D environment poses a barrier for some users. This finding is consistent with Bangor's assertion that system capability does not always equate to perceived usability (Bangor et al., 2008). The "Acceptable" rating suggests that while the game is functional for classroom use, the cognitive load required to control the character may interfere with the learning process for novice users. Future iterations must balance the immersive appeal of the 3D world with streamlined controls to ensure that

the technical interface does not overshadow the theological content (Pardo-Mosquera et al., 2023).

Educational Implications The implementation of this adaptive system promotes a shift towards personalized religious education. By automatically generating a prioritized list of remedial materials (e.g., Rukun Sujud needs more attention than Niat), the system allows students to engage in self-regulated learning. This is particularly relevant in the context of Islamic boarding schools or Madrasahs where student-to-teacher ratios are often high, making individual supervision difficult. The game acts as a personalized tutor that directs students to their specific areas of weakness, thereby optimizing learning efficiency (Syahrizal et al., 2024).

Conclusion

The development and implementation of "Shalat Academy" demonstrate that integrating the Analytic Hierarchy Process (AHP) into a 3D game environment effectively transforms a standard educational tool into an intelligent diagnostic instrument. This study confirms that assessing prayer understanding requires a multidimensional approach; relying solely on correct answers is insufficient to measure true mastery. By mathematically weighing Score (0.539), Experience (0.297), and Response Time (0.164), the system successfully quantifies "hesitation" as a critical indicator of learning gaps; a nuance often overlooked in conventional grading. The empirical results, highlighted by a 60.34% diagnostic agreement with subject matter experts and a "Highly Feasible" media validation rating, validate the system's logic as pedagogically sound. However, the study also reveals a crucial trade-off between technological sophistication and user accessibility. While the system functions robustly in generating personalized remedial priorities, the System Usability Scale (SUS) score of 64.35 (Acceptable) suggests that the complexity of 3D navigation remains a barrier for students with lower digital literacy. Consequently, this research concludes that while the adaptive assessment model is ready for deployment, the user interface requires simplification to ensure the technology facilitates rather than hinders the learning process. Future research should focus on optimizing the control mechanics for non-gamers and expanding compatibility with mobile platforms to reach a wider student demographic in Islamic educational institutions.

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Authors' Note

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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