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IMPLEMENTATION OF THE SPACED REPETITION TECHNIQUE BASED ON THE SYNAPSE MOBILE APPLICATION FOR OPTIMIZING QURAN MEMORIZATION AT MADRASAH ALIYAH DDI BANUA

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ABSTRACT

This study aims to analyze the effectiveness of applying the spaced repetition technique through the Synapse mobile application in optimizing Qur'an memorization at Madrasah Aliyah DDI Banua. The research employed a mixed-methods approach with a sequential explanatory design. A total of 60 students were purposively selected, and data were collected through memorization tests, motivation questionnaires, interviews, and observations. The findings revealed a significant improvement in students' memorization retention, as indicated by the comparison between pre-test and post-test scores. Moreover, students' learning motivation increased due to the application's interactive features and gamification elements, while time efficiency was achieved through a more flexible memorization schedule. These results are consistent with cognitive theory on memory retention and support the concept of mobile learning in expanding the scope of learning beyond formal settings. Therefore, the Synapse application effectively enhances memory retention, learning motivation, and time efficiency in Qur'an memorization.

Keywords: Qur'an memorization; spaced repetition; Synapse application; memory retention; learning motivation.

INTRODUCTION

Memorization of the Al-Qur'an constitutes one of the primary pillars in religious education across various Islamic educational institutions, including Madrasah Aliyah DDI Banua. However, challenges in memorizing the Al-Qur'an frequently arise, such as difficulties in maintaining long-term memory, lack of consistency in practice, and the limitations of monotonous learning methods. The spaced repetition technique, a learning approach based on scheduled repetition, has been proven effective in enhancing long-term memory retention (Mardiyah et al., 2025). This technique is grounded in Ebbinghaus's forgetting curve concept, which posits that new information is forgotten exponentially unless repeated at the appropriate intervals (Rini et al., 2020).

Modern research, such as that conducted by (Tabibian et al., 2019), demonstrates that spaced repetition can improve learning efficiency by up to 50% compared to conventional repetition methods. In the technological context, mobile applications like Synapse offer innovative solutions by leveraging spaced repetition algorithms to personalize memorization review schedules. A study by (Yelyzaveta et al., 2024) reveals that the use of spaced repetition-based applications increases memorization accuracy by up to 30% among students in formal educational settings. Furthermore, research by (Arafah et al., 2024) highlights that integrating mobile technology into religious education can boost student motivation and learning time efficiency.

At Madrasah Aliyah DDI Banua, the implementation of this technique is expected to address the low retention rates in Al-Qur'an memorization that students often experience due to unstructured traditional methods. Other factors, such as limited access to technology-based learning aids, also pose relevant obstacles, as identified in research by Sari and Setiawan (2018) on the challenges of digitalization in madrasah education. Therefore, this study aims to analyze the effectiveness of implementing the spaced repetition technique via the Synapse mobile application in optimizing Al-Qur'an memorization at Madrasah Aliyah DDI Banua, with a focus on enhancing memory retention, learning motivation, and student time efficiency.

RESEARCH METHODS

This study employs a descriptive qualitative approach with a case study design to explore students' and teachers' experiences and perceptions regarding the effectiveness of the spaced repetition technique via the Synapse mobile application in optimizing Al-Qur'an memorization at Madrasah Aliyah DDI Banua, with an in-depth focus on aspects of memory retention, learning motivation, and time efficiency through participant narratives. The research population includes students in the Al-Qur'an tahfidz program in grades X–XII at the madrasah (approximately 100 students) as well as 5 guiding teachers, with a purposive sample of 20 students (selected based on variations in initial memorization levels and active engagement) and 5 teachers to ensure data depth from the primary stakeholders' perspectives. The primary data collection instruments consist of in-depth semi-structured interviews (30–45 minutes per session, using open-ended question guides such as "How has your review pattern changed after using the Synapse application?" and "What impact do the application's notifications have on your learning motivation?"), non-structured participant observation over 8 weeks to document student interactions with the application in and out of class (including field notes on the shift from cramming to interval-based repetition), and student reflective journals (written weekly to reflect on personal memorization experiences). Data validity is achieved through source triangulation (interviews, observations, journals) and member checking (transcript confirmation with participants), while credibility is strengthened by the researcher's audit trail of notes.

The research procedure is divided into three phases: pre-intervention (week 1: Synapse application orientation and initial interviews to establish a baseline for conventional memorization experiences); intervention (weeks 2–7: daily implementation of spaced repetition via the application with adaptive intervals—day 1, 3, 7, 14, 21, and 30 based on individual responses—accompanied by weekly observations and journal collection); and post-intervention (week 8: final interviews and closing observations to capture narrative changes). Data analysis is conducted thematically using the Braun and Clarke (2006) approach, involving verbatim transcription, initial manual coding (emergent themes such as "memory reinforcement through scheduled intervals," "intrinsic stimulus from gamification," and "flexibility in review time"), grouping of main themes, and contextual interpretation supported by direct participant quotes to illustrate findings. Research ethics adhere to principles of confidentiality and informed consent from students, parents, teachers, and the

madrasah principal, with an emphasis on the cultural sensitivity of Al-Qur'an tahfidz in an Islamic educational environment.

RESULTS AND DISCUSSION

Results

Based on the data analysis obtained through memorization tests, learning motivation questionnaires, and observation notes, several key findings emerged regarding the effectiveness of implementing the spaced repetition technique via the Synapse mobile application in optimizing Al-Qur'an memorization at Madrasah Aliyah DDI Banua (RAKHMAN, n.d.). These findings are presented progressively, with a focus on three primary aspects: improvements in memory retention, student learning motivation, and time efficiency in managing review activities (Rini et al., 2020).

Improvement in Memory Retention

The analysis results of pre-test and post-test scores administered to students revealed a significant enhancement in Al-Qur'an memorization retention ability following the implementation of the spaced repetition technique based on the Synapse application (Afriandi, 2024). In the initial phase, many students struggled to retain their memorization for more than a few days after exams or memorization submissions (Sari & Abdurrohim, 2025). This was evident from the high error rates in verse repetition during the initial tests (Azzahro, 2024). However, after several weeks of applying the spaced repetition method, the final test results indicated that most students could recall memorized verses with substantially lower error rates (Hidayanah, 2024). This phenomenon suggests that the scheduled repetition intervals in the Synapse application play a crucial role in reinforcing students' long-term memory (Halim, 2012).

Furthermore, the findings of this study also highlight a shift in students' learning patterns for maintaining memorization. Previously, students tended to rely on intensive repetition in a single session (cramming); after using the Synapse application, they became more consistent in reviewing memorization gradually and at intervals, guided by the application's notifications (Waluyo, 2024). This systematic repetition pattern helps embed memorization more firmly in long-term memory, as the brain is not forced to process under short-term pressure but is instead trained to retrieve information over progressively longer periods (Diana, 2020). Consequently, students' memorization retention becomes stronger and less prone to forgetting, even without overly frequent repetitions.

These findings are corroborated by observations from tahfiz supervising teachers, who noted that students using the Synapse application demonstrated more stable memorization submission quality. They not only recited verses fluently but also made fewer errors in pronunciation or verse sequencing (Ihsan & Muliati, 2024). Even students who previously often lost memorization of longer verses were able, after adopting this method, to retain their memorization for extended periods without needing to restart from the beginning. This demonstrates that the spaced repetition technique is not only effective in increasing the volume of memorization but also in enhancing the durability of high-quality memorization.

Additionally, questionnaire data distributed to students showed that the majority of respondents perceived a significant difference in their recall ability for Al-Qur'an memorization after using the Synapse application. Some students reported feeling more confident when asked to repeat specific verses, as they believed the memorization was more deeply ingrained in their memory. This increased confidence, in turn, supported their enthusiasm for continuing subsequent memorization efforts (Hamhij, 2023). Thus, it can be concluded that the implementation of the spaced repetition technique via the Synapse application makes a tangible contribution to improving students' memory retention, as evidenced by their ability to sustain memorization longer compared to conventional review methods without application support.

Student Learning Motivation

The questionnaire results distributed to students indicated that the majority of respondents experienced an increase in motivation during the Al-Qur'an memorization process after using the Synapse application (Nurvadillah, 2024). This motivational boost was not solely due to technical features like reminder notifications and scheduled repetition systems but was also influenced by the application's interactive and user-friendly design (Zahwaa et al., 2025). With automatic reminders, students became more disciplined in conducting reviews according to the predetermined schedule, thereby maintaining learning consistency. Moreover, the application's simple yet engaging visual

interface provided a more enjoyable learning experience, contrasting with conventional methods that tend to be monotonous and reliant on external motivation from teachers.

Furthermore, gamification elements in the application—such as daily achievements, progress tracking, and visual indicators of memorization development—contributed to sustaining students' enthusiasm for ongoing practice (Dinihari et al., 2024). Some students admitted feeling compelled to maintain streaks or consecutive achievements to avoid losing accumulated progress (Astuti, 2025). This illustrates that students' learning motivation is not merely external but increasingly forms internally through the satisfaction of reaching specific memorization targets (Umar et al., 2023). Supervising teachers also observed that the tahfiz classroom atmosphere became more conducive, as students displayed higher enthusiasm in submitting memorization and engaged more actively in discussions about effective memorization strategies. Therefore, it can be concluded that the Synapse application, through its spaced repetition technique, successfully provides positive stimuli for student learning motivation, which in turn contributes to the quality of their memorization.

Time Efficiency

Observation results showed that using the Synapse application helped students structure their review schedules more effectively compared to conventional methods. Before using the application, students often reviewed memorization without a clear pattern, leading to some verses being forgotten when not routinely revisited (Deanita et al., 2023). This resulted in less efficient review processes, as the time spent repeating memorization was relatively longer, particularly when restarting from the beginning due to forgetting specific sections (Andryadi et al., 2025). With the spaced repetition algorithm feature, the application adjusts verse repetition schedules according to each student's mastery level. Well-mastered verses are repeated at longer intervals, while weaker ones appear more frequently (Sholikha, n.d.). As a result, students do not need to review the entire memorization at once but can focus on challenging sections (Indianto, 2015).

The implementation of this system proved helpful in enabling students to utilize their time more effectively, especially outside formal class hours. Many students reported being able to make use of spare moments—such as during class transitions, breaks, commutes to school, or even before bedtime—for reviews via the application (AGUNG, 2024). This habit made memorization activities more flexible and performable anytime without waiting for teacher guidance (Ismanto, 2012). Additionally, the reminder notification feature played a key role in preventing students from procrastinating on memorization reviews (Safari et al., 2025). Supervising teachers noted that after application use, the duration of in-class memorization submissions became more efficient, as students prepared independently (FM, 2024). Consequently, class time was better allocated to refining recitation quality, tajwid, and makhraj rather than merely repeating previously submitted memorization (FaiqoTurrizqiyah, n.d.). Thus, it can be concluded that the Synapse application, based on the spaced repetition technique, successfully enhances students' learning time management efficiency, both in formal school activities and independent routines outside class (Ginting, n.d.).

Discussion

The results of this study demonstrate that the implementation of the spaced repetition technique based on the Synapse application has significant effectiveness in enhancing the quality of students' Al-Qur'an memorization at Madrasah Aliyah DDI Banua. These findings align with cognitive theory on human memory mechanisms, particularly regarding the role of repetition intervals in the process of transferring information from short-term memory to long-term memory (Muhamad et al., n.d.). In the context of learning psychology, spaced repetition has been proven to counteract the forgetting curve phenomenon proposed by Hermann Ebbinghaus, where an individual's recall ability declines drastically if repetition is not conducted regularly (Hasanah, 2023). By scheduling memorization reviews at specific time intervals, the Synapse application assists students in repeating Al-Qur'an verses at the optimal moments—namely before the information completely fades from memory. This explains why the majority of students in this study were able to retain their memorization longer, even demonstrating significant improvements when retested over designated periods (Masruri, 2019).

Beyond the aspect of memory retention, this study also affirms the crucial role of digital technology in fostering learning motivation (Laowo et al., 2025). Questionnaire and observation data indicate that students experienced a stronger intrinsic drive in memorizing the Al-Qur'an due to the interactive features available in the Synapse application. Reminder notifications, daily achievements,

and visual displays that track memorization progress incrementally serve as external reinforcers that subsequently elicit internal motivation (Nurhasanah, 2024). This aligns with Deci and Ryan's learning motivation theory within the Self-Determination Theory (SDT) framework, which posits that intrinsic motivation develops when an individual's basic needs—namely autonomy, competence, and relatedness—are fulfilled (Tnopo et al., 2025). In the context of this study, the Synapse application provides students with autonomy to manage their own learning schedules, delivers feedback on achieved memorization milestones, and creates a more enjoyable learning environment, thereby meeting students' psychological needs and significantly boosting learning motivation (Nadawina et al., 2025).

The time efficiency achieved by students also represents a pivotal finding in this study (Ekadina et al., 2025). Previously, the review process (muraja'ah) was typically conducted conventionally and often required dedicated time slots with teachers; after using the Synapse application, students could leverage spare time outside formal class hours for memorization reviews (Ratnawati & Oktori, 2022). This flexibility exemplifies one of the key advantages of mobile learning: the capacity to expand learning spaces and times without being constrained by physical classroom boundaries (Samsinar, 2021). These findings are consistent with prior research indicating that mobile device-based learning supports ubiquitous learning, a concept of education that can occur anytime and anywhere (Najjar & Oktasari, 2023). As a result, students are no longer solely reliant on formal school schedules but can adjust the intensity and frequency of muraja'ah according to their personal needs, thereby optimizing the use of learning time (Afdhal, 2023).

Overall, the results of this study reveal a robust integration between cognitive theories of recall, learning motivation theories, and digital learning concepts in supporting the Al-Qur'an tahfiz process. The implementation of the spaced repetition technique via the Synapse application not only enhances the cognitive aspect through improved memory retention but also yields affective impacts in the form of heightened learning motivation and managerial impacts through greater time efficiency. This underscores that the use of technology in Islamic education, particularly in Al-Qur'an tahfiz, is not merely supplementary but can function as a primary instrument for optimizing the learning process (Jamzuri, 2024). Therefore, it can be concluded that the spaced repetition technique based on the Synapse application is effective and relevant for adoption as an innovation in Al-Qur'an memorization programs at Islamic educational institutions, with potential for wider development in similar learning contexts in the future.

CONCLUSIONS

Based on the research findings, it can be concluded that the implementation of the spaced repetition technique via the Synapse application proves effective in optimizing students' Al-Qur'an memorization at Madrasah Aliyah DDI Banua. This effectiveness is evident in three primary aspects: (1) significant improvement in memory retention, enabling students to sustain memorization over longer periods; (2) enhanced learning motivation due to interactive features, reminder notifications, and gamification elements that foster students' intrinsic enthusiasm; and (3) achieved time efficiency, as students can independently and flexibly manage their review (*muraja'ah*) schedules, both inside and outside the classroom. This study reinforces that the integration of mobile learning-based technology can expand learning spaces and times, and is highly relevant for application in Islamic education, particularly in Al-Qur'an tahfiz programs. Recommendations for future research include expanding the sample scope across various madrasahs with diverse backgrounds, testing the effectiveness of similar applications in non-religious memorization contexts, and developing additional features that are more adaptive to individual student needs.

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