The Development of Reading Comprehension Ability Using the SQ6R Learning Management Approach Combined with Artificial Intelligence (AI) for Grade 8 Students

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Abstract

This study aimed (a) to examine the effectiveness of the SQ6R–AI learning management plan according to the 80/80 criterion, (b) to determine its effectiveness index, and (c) to compare students' reading comprehension ability before and after the intervention. The participants were 40 Grade 8 students from Satri Si Suksa School, Roi Et Province, Thailand, selected through cluster random sampling. The research instruments included six SQ6R–AI lesson plans and a 30-item multiple-choice reading comprehension test. Data were analyzed using descriptive statistics, the E1/E2 criterion, the effectiveness index (E.I.), and a paired-samples t-test. Results showed that the learning management plan achieved 94.55/81.50 effectiveness, an effectiveness index of 0.6459, and a statistically significant improvement in posttest scores compared to pretest scores ($p < .05$). This study contributes a practical and technology-enhanced instructional model that combines structured reading strategies with AI support to improve students' reading comprehension outcomes.

Keywords: reading comprehension, SQ6R, artificial intelligent in education

1. Introduction

Artificial intelligence (AI) has emerged as a transformative force in education, reshaping traditional pedagogical approaches and enabling personalized, data-driven learning experiences (Holmes & Tuomi, 2022; Selwyn, 2022; Zhai et al., 2021). Leveraging intelligent systems provides a more comfortable tool for teachers to analyze students' learning patterns, provide instant feedback, and design adaptive learning environments that cater to individual needs (Zhai et al., 2021). In language education, where learners' abilities and motivations vary widely, AI offers opportunities to enhance both instruction and learning outcomes through interactive platforms, automated assessments, and tailored learning resources (Huang et al., 2023; Ji et al., 2023). Its integration into classrooms signals a paradigm shift from one-size-fits-all teaching toward a more learner-centered, technology-enhanced model.

Parallel to these technological advances, instructional strategies grounded in cognitive learning principles remain essential for developing core academic skills. One such strategy is the SQ6R learning approach, an expanded version of the original SQ4R (Survey, Question, Read, Recite, Review) method widely used in language classrooms to improve reading comprehension and retention (Astiza et al., 2023; Aziz, 2020; Saputra & Haddar, 2024). The SQ6R model adds two critical steps—Record and Reflect – the components that help in processing information and indicating key ideas and critically evaluating their understanding (Williams, 2005). From a theoretical perspective, reading comprehension involves complex cognitive processes, including decoding, inferencing, synthesizing, and evaluating information, all of which require structured and purposeful engagement with texts (Thakhulee et al., 2025; Wiyana et al., 2019). The SQ6R model provides a step-by-step framework that aligns well with these theoretical underpinnings, promoting deeper interaction with reading materials and enhancing learners' comprehension skills.

From an applied-linguistics perspective, reading comprehension is an interactive process that coordinates lower-level and higher-level language operations (Butterfuss et al., 2020; Perfetti, 1985). Efficient word recognition and fluency free cognitive resources for syntactic parsing and clause integration; vocabulary breadth and depth support lexical

access and nuance; knowledge of discourse structure and cohesion aids global coherence building; background (schema) knowledge enables bridging and elaborative inferences; and metacognitive regulation—goal setting, monitoring, and repair—guides strategic actions such as predicting, questioning, clarifying, summarizing, and evaluating (Grabe, 2009; Grabe & Stoller, 2002; Jiang et al., 2000; Schmitt et al., 2011). In short, skilled comprehension emerges from the interplay of decoding, linguistic comprehension, discourse processing, and strategic self-regulation within working memory constraints.

Studies consistently highlight the benefits of the SQ6R strategy in developing reading comprehension across various educational settings. Research shows that SQ6R, by guiding learners through structured phases such as surveying, questioning, reading, reciting, reviewing, recording, and reflecting, helps improve comprehension and retention in both first and second language contexts (Wiyana et al., 2023; Rusmiati et al., 2022; Thakhulee et al., 2022; Astiza et al., 2023). These findings collectively affirm that SQ6R promotes active engagement with texts, enhances metacognitive awareness, and supports deeper understanding of reading materials.

Recent empirical findings underscore AI's potential to elevate reading comprehension through personalization, adaptability, and immediate feedback. Hidayat (2024) demonstrated that AI-based personalized reading platforms significantly improved comprehension scores among senior high school students compared to a control group, supporting the value of tailored reading support. In a similar vein, Huszti, Fodor, and Hnatik (2025) showed that AI-powered reading assistance—leveraging techniques like natural language processing and machine learning—can deliver real-time, individualized guidance that enhances learners' English reading comprehension. Shafiee Rad (2025) reported that AI-centered interventions foster both engagement and self-regulated reading behavior, contributing to improved L2 comprehension in secondary learners. Additionally, the use of ReadTheory, an AI-driven self-access learning tool, was found to significantly boost EFL learners' enjoyment and comprehension, particularly among Thai university students, according to Wangdi and Shimray (2025). Collectively, these studies suggest that AI-based tools support individualized, engaging, and strategically oriented reading experiences that promote meaningful comprehension gains.

Seen through this lens, the integration of SQ6R with Artificial Intelligence (AI) forms an SQ6R–AI teaching model, in which the structured, metacognitive stages of SQ6R are dynamically supported by AI-driven tools and analytics. In this model, AI is not an additional component but an embedded mechanism that enhances each phase of SQ6R: during Survey and Question, AI generates adaptive pre-reading prompts and comprehension questions tailored to learners' profiles; in the Read and Record stages, it provides in-text glosses, syntactic hints, and summarization aids to support meaning construction; in Recite and Review, AI delivers immediate feedback and retrieval activities that reinforce memory and understanding; and in Reflect, it visualizes progress through interactive dashboards that guide learners' metacognitive self-evaluation. Thus, the SQ6R–AI model combines human-guided strategy instruction with data-driven personalization, ensuring that the structure of SQ6R organizes learning behaviors while AI optimizes difficulty, timing, and feedback. Together, these elements cultivate decoding efficiency, lexical–syntactic integration, discourse-level coherence, and self-regulated reading development.

Given the need for effective, scalable literacy instruction at lower-secondary level, this study investigates the integration of SQ6R with AI to develop reading comprehension in Grade 8 students. The work expects both theoretical value—demonstrating how an interactive model of reading can be operationalized through strategy instruction plus adaptive technology—and practical value, offering a replicable routine teachers can implement with existing classroom constraints. The purposes of the study include:

to determine the effectiveness of the SQ6R learning management plan combined with Artificial Intelligence (AI) on reading comprehension for Grade 8 students, based on the 80/80 efficiency criterion,

to determine the effectiveness index of reading comprehension ability using the SQ6R learning management approach combined with Artificial Intelligence (AI) for Grade 8 students, and

to develop reading comprehension ability before and after implementing the SQ6R learning management approach combined with Artificial Intelligence (AI) for Grade 8 students.

2. Methodology

2.1 Research Design

This study employed an experimental research design using a one-group pretest–posttest approach. The design involved administering a reading comprehension pretest, implementing a series of instructional interventions based

on the SQ6R learning model integrated with Artificial Intelligence (AI), and subsequently conducting a posttest to evaluate changes in students' reading comprehension ability.

2.2 Participants

The population consisted of 360 Grade 8 students from Satri Si Suksa School, Roi Et Province, Thailand, enrolled in the second semester of the 2024 academic year. The sample comprised one intact class of 40 students selected through cluster random sampling. The selected class represented mixed-ability levels (high, moderate, and low achievers) to ensure diversity and balance in learning performance. Prior to participation, ethical approval was obtained from the relevant institutional review board, and formal permission was sought from the school administration.

2.3 Instruments

2.3.1 Integrated SQ6R–AI Learning Management Plan

The main instructional instrument in this study was a set of six lesson plans developed using the SQ6R learning model integrated with Artificial Intelligence (AI), hereafter referred to as the SQ6R–AI learning management plan. The design of the plan was grounded in two key principles: (1) *Cognitive and metacognitive learning theory*, emphasizing structured processes for activating prior knowledge, guiding comprehension, promoting self-monitoring, and encouraging reflection; and (2) *Technology-enhanced learning*, which utilized AI tools to provide adaptive questioning, interactive feedback, and real-time progress tracking.

The AI support was implemented through Google's AI-based learning tools and ChatGPT (OpenAI platform), which were prepared and facilitated by the researchers but directly operated by students during classroom activities. Each lesson followed the SQ6R sequence—Survey, Question, Read, Record, Recite, Review, and Reflect—with AI embedded in specific phases. In *Survey* and *Question*, AI generated adaptive pre-reading prompts and comprehension questions based on the input text. During *Read* and *Record*, it provided vocabulary explanations, sentence simplification, and summarization support to aid understanding. In *Recite* and *Review*, AI supplied immediate feedback through automated comprehension quizzes, while in *Reflect*, it helped students evaluate their performance by summarizing their progress and highlighting key learning points.

The instructional content covered six reading topics relevant to Grade 8 students, each lasting two hours for a total of 12 instructional hours. For instance, in the lesson on *Reading for Main Ideas*, students used AI-generated guiding questions before reading, received instant clarification support during reading, and completed AI-assisted quizzes and reflection prompts afterward. To ensure quality and appropriateness, all lesson plans were reviewed by five experts in curriculum design, Thai language education, and educational measurement. The experts evaluated content validity, curriculum alignment, instructional feasibility, and AI integration using a five-point Likert scale. Revisions were made according to feedback, and the final version achieved a mean rating above 3.51, indicating a "good" to "very good" level of suitability for classroom implementation.

2.3.2 Reading Comprehension Test

A 30-item multiple-choice reading comprehension test was developed based on Grade 8 Thai language curriculum standards to assess students' comprehension before and after instruction. The test items, covering six reading units, were reviewed by five experts for content validity using the Index of Item-Objective Congruence (IOC), with only items scoring between 0.50 and 1.00 retained. A pilot test was conducted to examine item difficulty, discrimination, and reliability. The final version included items with appropriate difficulty (P = 0.33–0.83), acceptable discrimination (B = 0.20–0.73), and a reliability coefficient of 0.91, indicating strong internal consistency for classroom use.

2.4 Data Collection and Data Analysis

Data collection occurred in three phases: (a) a pretest was administered to assess students' initial reading comprehension, (b) six two-hour lessons using the Integrated SQ6R–AI Learning Management Plan were implemented over four weeks, and (c) a posttest using the same instrument was administered to measure learning gains. Scores from the pretest and posttest, along with formative assessments during lessons, were recorded for analysis. Descriptive statistics (mean, standard deviation, and percentage) were used to summarize the data, and the distribution was examined using measures of normality (skewness and kurtosis) to determine appropriate statistical tests. The E1/E2 criterion was employed to assess instructional effectiveness, where E1 represented the average percentage of students' scores on formative assessments during the learning process, and E2 represented the average percentage of posttest scores. The effectiveness index (E.I.) was also calculated to determine the proportion of improvement relative to the maximum possible gain. Finally, differences between pretest and posttest scores were

analyzed using a dependent t-test.

3. Results

The normality of the data was assessed using the Shapiro–Wilk test. Results showed that both pretest ($p = .110$) and posttest ($p = .420$) scores were normally distributed ($p > .05$). Therefore, a dependent t-test as a parametric statistic was employed.

Table 1. Effectiveness of the SQ6R–AI Learning Management Plan (E1/E2)

Effectiveness	N	Full Score	Mean	S.D.	Percentage
Process (E1)	40	120	113.45	4.48	94.55
Product (E2)	40	30	24.45	1.85	81.50
E1 / E2					**94.55 / 81.50**

Note. E1 = Process effectiveness; E2 = Product effectiveness.

The results in Table 1 indicate that the Integrated SQ6R–AI Learning Management Plan achieved an effectiveness score of 94.55/81.50, which exceeds the predetermined 80/80 criterion. This suggests that the learning activities were well-designed and effectively enhanced students' reading comprehension performance both during and after instruction.

Table 2. Effectiveness Index (E.I.) of the SQ6R–AI Learning Management Plan

Full Score × N	Posttest Score	Pretest Score	E.I.
30 × 40	978	573	0.6459

The effectiveness index (E.I.) in Table 2 was 0.6459, indicating that students' reading comprehension scores improved by 64.59% relative to the maximum possible gain. This reflects a substantial improvement in reading comprehension after participating in the SQ6R–AI learning activities.

Table 3. Comparison of Pretest and Posttest Scores

Test	N	Mean	S.D.	t	p
Pretest	40	14.33	2.25		
Posttest	40	24.45	1.85	2.16	.04*

Note. $p < .05$ indicates statistical significance.

As shown in Table 3, the mean posttest score ($M = 24.45$, $SD = 1.85$) was significantly higher than the mean pretest score ($M = 14.33$, $SD = 2.25$), $t(39) = 2.16$, $p = .04$. This result indicates that students demonstrated substantial gains in reading comprehension ability following the implementation of the SQ6R–AI learning management plan. The increase in mean scores suggests that the structured phases of SQ6R, combined with AI-based support for questioning, feedback, and reflection, helped students develop stronger comprehension strategies and apply them effectively during reading tasks. Furthermore, the statistically significant difference between pretest and posttest scores confirms that the intervention not only improved immediate learning outcomes but also met the study's objective of enhancing reading comprehension performance beyond conventional instruction.

4. Discussion

The current study demonstrated a significant improvement in Grade 8 students' reading comprehension following the implementation of an SQ6R-based instructional program integrated with AI support. This finding aligns with prior research that has consistently evidenced the effectiveness of SQ6R in facilitating comprehension and learner engagement. For instance, Wiyana, Basori, and Efendi (2023) reported mastery-level gains in programming contexts when students engaged with SQ6R-structured reading tasks. Likewise, Rusmiati et al. (2022) found enhanced EFL

reading comprehension among secondary students using SQ6R compared to a control group. These results, along with findings from Thakhulee et al. (2022), who observed improvements meeting an 80/80 effectiveness threshold, consolidate SQ6R's value in promoting active reading behaviors—such as surveying, questioning, summarizing, and reflecting—that scaffold comprehension and retention. Therefore, instruction in a structured, metacognitive cycle helps students internalize strategic reading routines, making the improvement observed in the present study both credible and theoretically grounded.

Beyond SQ6R's strategic framework, the integration of AI into the instructional sequence likely amplified the intervention's impact. AI tools facilitated individualized questioning, immediate feedback, and adaptive prompts, which dynamically guided students through each SQ6R phase. Previous studies support this synergy: Hidayat (2024) and Huszti, Fodor, and Hnatik (2025) demonstrated that AI-based platforms can offer personalized reading assistance—such as targeted scaffolding and responsive feedback—that elevates comprehension in both EFL and general education contexts. Shafiee Rad (2025) similarly found that AI-enhanced interventions foster learner engagement and self-regulatory behaviors, which are key mediators of reading success. Weaving AI capabilities into each stage of SQ6R, especially during questioning, recitation, and reflection, the present study provided a responsive learning environment where students could more effectively monitor and adjust their understanding as they read.

The current findings underscore how the combination of SQ6R's structured cognitive strategies with AI's adaptivity creates a powerful instructional blend. SQ6R offers a clear scaffold, guiding learners through key comprehension processes, while AI enriches each stage with real-time support tailored to individual needs. This hybrid model resonates with theories in applied linguistics that emphasize strategic reading, schema activation, and metacognition as core drivers of comprehension. It also mirrors recent calls in educational technology to shift from static, one-size-fits-all designs to dynamic, data-informed pedagogy. In practice, such an integrated approach may help overcome typical constraints in large classrooms—where individualized teacher attention is limited—by offering each student a personalized pathway to comprehension through the AI interface.

Nonetheless, future research should explore the long-term effects of SQ6R–AI instruction, investigate which AI features yield the greatest benefits (e.g., adaptive questioning vs. feedback timing), and examine how such designs perform across proficiency levels and text types. Mixed-method approaches incorporating student interviews and think-aloud protocols could also illuminate how learners engage with SQ6R–AI routines from a metacognitive perspective. Furthermore, comparative studies that isolate SQ6R-only, AI-only, and combined conditions would clarify the added value of the integration. Such investigations will refine our understanding of how to design optimal reading interventions in digitally supported language classrooms.

5. Conclusion

This study developed and implemented an SQ6R–AI learning management plan to enhance Grade 8 students' reading comprehension abilities. The intervention combined structured reading strategies with AI-based support across six lesson plans over four weeks. Results showed a significant improvement in students' reading comprehension performance, with effectiveness scores exceeding the 80/80 criterion and posttest scores significantly higher than pretest scores. These findings contribute to literacy pedagogy by demonstrating how metacognitive strategy instruction, when integrated with AI technology, can promote active engagement, personalized feedback, and improved comprehension outcomes in secondary classrooms. Moreover, the study offers a practical instructional model for teachers seeking to combine evidence-based reading strategies with emerging educational technologies.

The findings imply that integrating AI into strategy-based reading instruction can address classroom challenges such as limited teacher feedback and diverse learner needs. However, the study was limited by its single-group design, short intervention duration, and focus on immediate learning outcomes. Future research should adopt experimental or longitudinal designs, explore AI features that most enhance learning, and include qualitative data to capture learners' perceptions and cognitive processes.

References

Astiza, D. A., Hidayatulloh, M. K. Y., & Ashoumi, H. (2023). The Influence of the SQ4R Learning Model on Learning Outcomes Student. *APPLICATION: Applied Science in Learning Research*, *3*(2), Article 2. https://doi.org/10.32764/application.v3i2.4750

Aziz, I. N. (2020). Implementation of SQ3R Method in Improving the Students' Basic Reading Skill. *EDUCATIO:*

Journal of Education, *5*(1), Article 1. https://doi.org/10.29138/educatio.v4i1.179

Butterfuss, R., Kim, J., & Kendeou, P. (2020). Reading Comprehension. In *Oxford Research Encyclopedia of Education*. https://doi.org/10.1093/acrefore/9780190264093.013.865

Grabe, W. (2009). *Reading in a second language: Moving from theory to practice*. Cambridge University Press.

Grabe, W., & Stoller, F. L. (2002). *Teaching and researching reading*. Pearson Education.

Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *European Journal of Education*, *57*(4), 542-570. https://doi.org/10.1111/ejed.12533

Huang, X., Zou, D., Cheng, G., Chen, X., & Xie, H. (2023). Trends, Research Issues and Applications of Artificial Intelligence in Language Education. *Educational Technology & Society*, *26*(1), 112-131.

Huszti, I., Fodor, K., & Hnatik, K. (2025). Enhancing students' English reading comprehension with AI assistance. *Наука і Техніка Сьогодні*, *6*(47), 372-379.

Ji, H., Han, I., & Ko, Y. (2023). A systematic review of conversational AI in language education: Focusing on the collaboration with human teachers. *Journal of Research on Technology in Education*, *55*(1), 48-63. https://doi.org/10.1080/15391523.2022.2142873

Jiang, X., Grabe, W., & Carrell, P. L. (2000). Reading. In R. Schmitt & M. P. H. Rodgers (Eds.), *An Introduction to Applied Linguistics*. Routledge.

Perfetti, C. A. (1985). *Reading ability*. Oxford University Press.

Saputra, D. G., & Haddar, G. A. (2024). Enhancing Reading Comprehension in Education: A Study on the Effec-tiveness of the SQ3R Method. *Jurnal Ilmu Pendidikan Dan Humaniora*, *13*(3), Article 3.

Schmitt, N., Jiang, X., & Grabe, W. (2011). The Percentage of Words Known in a Text and Reading Comprehension. *The Modern Language Journal*, *95*(1), 26-43.

Selwyn, N. (2022). The future of AI and education: Some cautionary notes. *European Journal of Education*, *57*(4), 620-631. https://doi.org/10.1111/ejed.12532

Shafiee Rad, H. (2025). Reinforcing L2 reading comprehension through artificial intelligence intervention: Refining engagement to foster self-regulated learning. *Smart Learning Environments*, *12*(1), 23. https://doi.org/10.1186/s40561-025-00377-2

Srinivasan, V., & Murthy, H. (2021). Improving reading and comprehension in K-12: Evidence from a large-scale AI technology intervention in India. *Computers and Education: Artificial Intelligence*, *2*, 100019. https://doi.org/10.1016/j.caeai.2021.100019

Thakhulee, A., Sarnkong, R., & Athan, A. (2025). Using the SQ6R Technique to Enhance Reading Comprehension Abilities for Thai 8th-Graders. *Journal of Education and Learning*, *14*(6), 157. https://doi.org/10.5539/jel.v14n6p157

Williams, S. (2005). Guiding Students through the Jungle of Research-Based Literature. *College Teaching*, *53*(4), 137.

Wiyana, R. P., Basori, B., & Efendi, A. (2019). Implementation of SQ6R Learning Model to Improve Reading Comprehension of Algorithm on Basic Programming Subjects. *Journal of Informatics and Vocational Education*, *2*(1). https://doi.org/10.20961/joive.v2i1.35701

Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., Liu, J.-B., Yuan, J., & Li, Y. (2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity*, *2021*(1), 8812542. https://doi.org/10.1155/2021/8812542

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