

THE IMPACT OF AI-SCAFFOLDED READING STRATEGY ON JUNIOR HIGH SCHOOL STUDENTS' READING ENGAGEMENT AND COMPREHENSION

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Abstract

Many junior high school students encounter significant obstacles in comprehending English texts, often leading to decreased reading motivation. Conventional teaching methods struggle to provide the individual help to each student's needs. To address this issue, this study investigated the impact of AI-scaffolded reading strategy on students' reading engagement and comprehension. It also investigates the correlation between student reading engagement and their ability to comprehend the text. This study used explanatory mixed methods design. In the quantitative phase, a quasi-experimental design was conducted with two groups of seventh-grade students at SMP Negeri 2 Ampelgading. Data were collected using pre-test, post-test and questionnaire about engagement. It also used semi-structured interviews for the qualitative data. The results indicated that students utilizing the AI-scaffolded strategy achieved significantly higher comprehension scores ($p < 0.001$) and a moderate N-Gain improvement (0.3528) compared to the control group. Furthermore, the experimental group exhibited enhanced engagement across cognitive, emotional, and behavioral dimensions. Qualitative findings revealed that the AI tool facilitated vocabulary acquisition, reduced reading anxiety, and fostered a more active classroom environment. This study concludes that AI scaffolding holds substantial potential for improving EFL literacy and suggests that educators integrate adaptive AI platforms to support struggling readers.

Keywords: AI supported learning, scaffolded reading strategy, reading engagement, reading comprehension, EFL students

Introduction

1. Background of the study

Reading comprehension is fundamental skill and plays vital role in learning English. Students can gain new knowledge and lead to success in academic (Oktavianti et al., 2026). Reading comprehension is a key part of how well someone can use a language. Today reading is more accessible than ever before, with the internet providing rich of resources. Students need this skill in order to comprehend and analyze large amounts of information in the modern era. Thus, reading is a skill that need to be developed.

In the context of SMP Negeri 2 Ampelgading. Reading often becomes stressful activity. Students have lack motivation on English outside the classroom. Each class has about 32 students. It is a large number and makes it difficult for

English teachers to give one-on-one attention to every student. Because of this, most teachers usually use traditional methods like reading aloud and word-by-word translation. These methods help student to understand meaning of each word, but they less comprehension and engagement. Students feel more stressed when they struggle to read quickly. Over time, they stop wanting to study English. Thus, it is urgent for teacher to provide personalized support to many students at the same time.

Many students in junior high school often face challenges with reading comprehension and rank it among the most difficult skills for students to master (Oktavianti et al., 2026). Yang & Ying (2026) argues that students have limited vocabulary and difficult to identity main ideas. When they face

complex text, students use word for word translation. As a result, students can quickly feel stressed and lose their energy to think. Alghamdi & Alghizzi (2026) found that conventional methods are less effective for critical thinking. It promotes memorization and translation at a surface level. For this reason, it is important for teacher to provide students with strategies in order to enhance students' reading comprehension.

Reading engagement is central of academic success, particularly when it comes to build higher-level reading skill. Reading engagement is multidimensional construct with three domains that connected and cannot be separated. They are cognitive, emotional and behavioral level (AlTwijri & Abdelhalim, 2026). Balantekin (2026) argues that developing engagement in reading is matters, highly engaged reading thinks independently and apply strategies when reading texts. This makes engagement the right target for teachers. It pushes students for not only completing task, but also encourage them to connect with the text.

Skilled readers are active reader that uses some techniques like predicting, inferring and summarizing what they have learned (Alghamdi & Alghizzi, 2026). According to Pan, et al. (2025), students need to have self-regulation in order to have effective reading. They know their competence, so they can set and monitor their own progress. The result is student change from passive to active, making them to think critically with the text.

Scaffolding comes from Vygotsky's Zone of Proximal Development (ZPD). This is how students improve when they get the help they need. Yang & Ying (2026) state that ZPD refers to the gap between learners can do independently and what they can do with help from others. It is considered the most effective learning area. Effective scaffolding is both adaptive and temporary. This means that support is gradually reduces as they become more independent (Bassner et al., 2026). Scaffolding helps students learn to understand what they read, one step

at a time (Alghamdi & Alghizzi, 2026). Thus, it is a practical tool for classroom use.

Nowadays, AI-driven platforms facilitate personalized reading instruction by dynamically adjusting text difficulty to match a student's demonstrated ability. Rather than providing direct hints, these systems use an adaptive leveling algorithm to ensure students consistently encounter materials within their Zone of Proximal Development (ZPD) based on their real-time performance (AlTwijri & Abdelhalim, 2026). As students progress, the AI analyzes their comprehension accuracy to automatically "level up" or provide scaffolded support through high-quality explanations for incorrect answers (Alghamdi & Alghizzi, 2026). This structured, low-pressure environment fosters better engagement and comprehension by allowing students to master specific reading skills at their own individual pace (Zheng, 2024).

The use of AI in English language teaching has increased rapidly in recent years. More teachers use AI into their classroom. However, there is limited empirical research on how AI actually affects student' reading engagement and comprehension. This issue especially for junior high school students who are developing as readers and need more guidance with text. This gap remains significant (Pan et al., 2025; Zheng, 2024). Because most studies focus on university or adult populations (AlTwijri & Abdelhalim, 2026; Zheng, 2024). Previous studied focus on test scores rather than how AI can guide and keep student engaged. Hence, this study aims to find out how AI-scaffolded reading strategies change students' reading comprehension and increase their reading engagement.

2. Research Question

- a. How does the implementation of an AI-scaffolded reading strategy affect the reading engagement of junior high school students?

- b. What is the effect of the AI- scaffolded reading strategy on junior high school students' reading comprehension levels?
- c. How does reading engagement correlate with reading comprehension in an AI-scaffolded reading environment?
- d. How do junior high school students perceive their experiences and interactions with the AI-scaffolded reading strategy?

3. Research Objectives

- a. To investigate how the implementation of an AI- scaffolded reading strategy affects the reading engagement of junior high school students.
- b. To investigate the effect of the AI-scaffolded reading strategy on junior high school students' reading comprehension levels.
- c. To analyze the relationship between reading engagement and reading comprehension in the context of an AI-scaffolded reading environment.
- d. To explore junior high school students' perceptions and experiences of using the AI-scaffolded reading strategy.

4. Benefits of the research

This research has important benefit for theoretical, practical and pedagogical. From a theoretical perspective, this research brings Vygotsky's Sociocultural Theory in modern era. The Zone of Proximal Development (ZPD) which explains that the best way to learn it a gap between learner can do independently and learner need assistance. This research expands that traditional method can be integrated with Artificial Intelligence (AI). It can also act as capable helper. AI works as thinking partner for the students. This is very important because most studies today only look at how AI helps adults or college students. (AlTwijri & Abdelhalim, 2026). There is little research that examine the use of AI-scaffolded on junior high schools. This study provides

actual proof from the real world to fill that gap in information

Practically, the results of this study offer a scalable solution for public schools where English teachers often face the challenge of managing classes with more than thirty students. Since every student possesses varying levels of reading proficiency and vocabulary knowledge, it is nearly impossible for a teacher to provide individualized support to every student simultaneously. This study proposes the use of ReadTheory as a practical AI-driven solution. Unlike standard materials, this platform utilizes an adaptive leveling algorithm that automatically assigns reading texts matched to each student's current ability. Instead of requiring manual intervention, the system provides immediate feedback and detailed explanations for every answer, allowing the AI to act as a personal tutor that scaffolds learning in real time. This technology enables teachers to manage large, heterogeneous classes effectively without the need for constant one-on-one monitoring (Wiboolyasarin et al., 2025). By leveraging an automated teacher dashboard, educators can track progress and engagement across the entire class simultaneously. This ensures that both advanced and struggling readers remain challenged at their respective levels, allowing the teacher to transition from a primary source of information to a facilitator of personalized growth.

From a pedagogical perspective, this study provides English teachers with a structured framework for integrating AI into their daily lessons. While many educators express concern that AI might encourage cheating or provide instant answers, this study demonstrates how ReadTheory's closed-loop system inherently addresses these issues. Unlike generative AI, ReadTheory does not require manual teacher-designed prompts to limit its output; instead, it is professionally programmed to offer scaffolded explanations only after a student has attempted a question. Because the platform controls the delivery of

information, students cannot simply bypass the learning process to get a "final answer." This methodology compels students to engage deeply with the text and think critically to progress to the next level. Consequently, students develop independent learning skills and genuine reading stamina rather than a lazy reliance on automated tools (Zheng, 2024). By utilizing a platform that prioritizes assessment integrity, teachers can feel more comfortable and secure in adopting AI technology to foster a productive and focused reading environment in the classroom.

Methodology

The subjects of this research were seventh-grade students at SMP Negeri 2 Ampelgading. This population was chosen because seventh graders are beginner and they are still in process of developing their reading comprehension. The researcher used purposive sampling. Two classes were selected to ensure that the participant have similar academic backgrounds and are accessible. (Patton, 2002). Class VII F with 32 students served as the experimental group and class VII G with 32 students acted the control group. The total number of the participants are 64 students. In the qualitative phase, certain students from experimental group are selected for interviews. It is based on their test comprehension and engagement. The purpose was to get better understanding of their individual perspectives (Creswell & Clark, 2011; Patton, 2002).

The data collection procedure was conducted in three stages: pre-test, treatment, and post-test. In the first stage, both groups completed pre-test to assess their initial reading comprehension level. It was to ensure that both groups started from a similar starting point (Campbell & Stanley, 1963). During the treatment stage, the experimental group used the ReadTheory platform. It provided an AI-scaffolded reading strategy. This AI acted as a scaffold by automatically adjusting the difficulty of

the texts based on each student's performance. It kept them within their Zone of Proximal Development (ZPD). In contrast, the control group learned through conventional method without any AI tools. Finally, in the third stage, a post-test was conducted to both groups to measure their improvement. Reading engagement questionnaire was also distributed for the experimental group. Semi-structured interviews were conducted with selected students to explore their experiences with the AI tools more detail (Dawson, 2009).

There were two primary quantitative instruments in this study, which were reading test and engagement questionnaire. The pre-test and post-test were to measure the student ability to identify main ideas, finding supporting detail, and understand vocabulary. The questionnaire used Likert scale to turn students' attitudes and behaviors into data that could be measured (DeVellis, 2012). For qualitative data, the researcher used semi-structured interview guide. The researcher can follow-up interesting questions. It was to understand support students received during the study. The researcher ensured the quality of the instruments. Validity was checked through expert judgment. Reliability was confirmed using Cronbach's Alpha for the questionnaire (Creswell & Clark, 2011).

The data were analyzed using both descriptive and inferential statistics. Descriptive statistics were used to summarize the overall scores of the students. Inferential analysis, a paired sample t-test was used to compare pre-test and post-test scores within each group. It was to see how individuals improved (Field, 2013). Independent sample t-test was conducted to compare the post-test result for control and experimental group. It was to identify whether the use of AI created a significant difference (Gravetter & Wallnau, 2014). The interview data were analyzed through thematic analysis (Braun & Clarke, 2006). The researcher used open coding to group the information into categories (Saldaña, 2013). All data are integrated using joint

display. It was to see if the numbers from the tests align with the students' reported experiences (Creswell & Clark, 2011).

This study followed an explanatory sequential design. It began with the quantitative phase, where the researcher analyzed the tests and questionnaires. It was to see the impact of AI-scaffolded strategy. Once the numbers showed which students performed well or poorly. The researcher moved to the qualitative phase. This involved interviewing specific participants to explain the reasons and feelings behind the test scores (Smith et al., 2016). This study was conducted with high ethical standards. Since the participants were minors. The researcher obtained assent from the students and written informed consent from their parents before starting the research (Hatch, 2002; Cohen et al., 2007). The consent and assent forms were written in Indonesian. It was to ensure both parents and student fully understand the information and can give informed consent.

Finding and Discussion

This section presents the results in four parts based on the research objectives. This study used ReadTheory platform to provide AI-scaffolded reading strategy. This AI adjusted the difficulty of the text.

1. Impact on Reading Engagement

Reading engagement was measured using data from the ReadTheory dashboard. During the two-week study, 32 students in the experimental class showed high activity. The students completed total of 254 reading quizzes. Most of students (28 out of 32) students were consistently active. The students showed strong motivation by collecting a total of 2,717 virtual points. The most active student earned more points because read more frequently. These points helped students track their own progress, which is a key part of reading engagement. By using this AI-scaffolded tool, students felt more responsible for their own learning goals. The dashboard provided immediate feedback, so students knew exactly how

well they understood each text. This instant information kept their interest high throughout the two-week period. As a result, the students did not just read because they had to, but because they wanted to improve their comprehension scores and collect more points in the system.

Engagement was also analyzed through pacing and persistence. On average, each student completed 7.9 reading sessions. This average comes from dividing the total quizzes (254) by the number of students (32). Although the mean was 7.9, participation was highly individualized. In this study, one session refers to one completed reading passage. The most engaged student finished 28 sessions with about one minute per text. On the other hand, some students spent up to six minutes on a single reading session. This shows that the AI-scaffolded reading strategy allowed students to read at their own speed and volume. It matched their individual motivation levels. This flexibility is important for junior high school students who have different reading levels. The AI scaffold adjusted the difficulty of the texts to match each student's ability. This ensured that the reading materials were not too hard or too easy. When the text level is just right, students can focus better on understanding the meaning. Therefore, this strategy successfully supported both their engagement and their comprehension. It allowed every student to experience success in reading at their own pace, which built their confidence in handling more complex English texts.

2. Effect on Reading Comprehension Levels

The researcher used pretest-posttest control group design to see how the AI-scaffolded strategy affected reading comprehension. The data was analyzed using SPSS. First, a normality test was performed to ensure the data was suitable for further testing. The normality test was a vital step to ensure the accuracy of the comparison between the two groups. Because the distribution was normal, the researcher could proceed with

the T-test to find the real impact of the intervention.

Table 1: Tests of Normality

Class	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Result	Pretest (Control)	,121	32	,200	,952	,169
	Posttest (Control)	,115	32	,200	,947	,121
	Pretest (Experiment)	,102	32	,200	,957	,221
	Posttest (Experiment)	,118	32	,200	,955	,193

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Since all significance values in Table 1 are greater than 0.05, the data for both groups follow a normal distribution. Following this, the mean scores were compared. The experimental group showed a significant increase in comprehension scores. The experimental group mean score rose from 55.25 in the pretest to 71.63 in the posttest. The control group also showed an increase, but it was much smaller, rising from 54.59 to 61.19. The large difference in the posttest scores shows that the AI-supported reading strategy was more effective than the traditional method.

Table 2: Independent Samples T-Test (Posttest Comparison)

Metric	Value
t-value	-5.982
df	62
Sig. (2-tailed)	< .001
Mean Difference	-10.437

According to Table 2, the Independent Samples T-test showed a p-value of less than 0.001. This value is much lower than the 0.05 significance level. This result indicated that the posttest scores of the experimental group were significantly higher than the control group. Furthermore, the N-Gain test was used to measure the efficiency of the intervention.

Table 3: N-Gain Statistics

Group	N-Gain	Improvement
	Mean	Category
Experimental	.3528	Moderate
Control	.1267	Low

The results in Table 3 confirmed that the AI-scaffolded strategy provided a "Moderate" improvement. However, the conventional strategy only resulted in a "Low" improvement.

3. Relationship between Reading Engagement and Comprehension

Table 4: Correlation

		Quest_Score	Post_Score
Quest_Score	Pearson Correlation	1	,561**
	Sig. (2-tailed)		,001
	N	32	32
Post_Score	Pearson Correlation	,561**	1
	Sig. (2-tailed)	,001	
	N	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

The researcher used a Pearson Product-Moment Correlation. It was to analyze the relationship between reading engagement and reading comprehension. This analysis was based on the total questionnaire scores and the post-test scores of the experimental group. As shown in Table 4, the correlation coefficient (r) was 0.561. The significance value (p -value) was less than 0.001.

The result showed significant and positive relationship between two variables. The p -value was lower than 0.05 alpha level. This correlation is considered moderate. It means that students who more engaged with the AI platform generally achieved higher scores on their post-tests. The data suggests that as students became more involved in the reading activities, their comprehension ability also improved.

4. Students' Perceptions and Experiences
Qualitative data was from the interviews. It showed that students felt the AI-scaffolded

strategy was motivating and helpful. Participants preferred the digital platform. Since It felt simpler and helped them visualize the stories more easily. The students mentioned that the interactive nature of the platform made the reading process less intimidating than traditional paper-based tasks. This increased comfort level helped them stay focused on the text for longer periods, which is a clear sign of high engagement.

A common theme in the interviews was the students' perception of challenge. One student felt challenged by the system's progression. Students felt the text difficulty was "just right" for their level. Another student highlighted the benefit of the automated feedback. They explained that read the explanations after making a mistake. It helped them understand their errors. This immediate feedback loop was essential for building their confidence. Instead of feeling frustrated by incorrect answers, they used the explanations to adjust their reading strategies, which directly helped improve their comprehension of the narrative. Interestingly, the qualitative data also revealed a unique strategy. One student used a secondary AI tool, Dola. It was as additional scaffold for difficult vocabulary. Finally, students preferred the structured path of ReadTheory over open-ended AI like ChatGPT. Thus, ReadTheory provided specific answers and a clearer learning guide.

Discussion

This section explains the findings by connecting them with existing theories and the broader knowledge of AI in education.

1. The Impact of AI-Scaffolding on Reading Engagement

The findings showed that the AI-scaffolded significantly increased student engagement through adaptive elements. In a traditional

classroom, it is often difficult for a teacher to monitor 32 students at the same time. However, the platform's design, which includes reward points and badges, successfully motivated students to keep practicing. This high engagement was proven by the 254 quizzes completed during the study.

This engagement can be explained using Flow Theory (Csikszentmihalyi, 1990). This theory suggests that learning is most effective when there is a balance between challenge and skill. The AI system acted as an automated monitor that constantly adjusted the text level for each student. This kept students in a state of "productive challenge" without making them feel frustrated with difficult English texts. The interview results supported this, as students reported feeling appropriately challenged. This suggests that AI scaffolding can take over the motivational role usually held by the teacher, making the learning process more self-directed.

2. The Effect on Reading Comprehension Levels

The statistical results from the T-test and N-Gain analysis provided strong evidence that the AI-scaffolded strategy was more effective than conventional methods. The experimental group's mean score increased by over 16 points, while the control group only increased by 6 points. This big difference happened because of the immediate feedback mechanism.

In a regular class, there is often a long wait between a student answering a question and receiving feedback from the teacher. In ReadTheory, the system gave explanations immediately after every answer. This allowed students to fix their mistakes right away before moving to the next text. This process is a form of Scaffolding (Wood, Bruner, & Ross, 1976), where support is given at the exact moment it is needed. It also helped students stay in their Zone of Proximal Development (Vygotsky, 1978),

allowing them to achieve more than they could alone.

3. The Relationship Between Engagement and Comprehension

The statistical results showed a significant positive correlation ($r = 0.561$, $p < .001$), which proves that higher engagement directly leads to better comprehension. This means that in AI-scaffolded reading strategy, the more students interact with the platform, the more their reading skills improve. This finding confirms that engagement is not just a side effect, but a necessary requirement for successful learning.

This relationship can be explained by the Matthew Effect (Stanovich, 1986) in literacy development. This theory suggests that students who read more appropriate texts will gain language skills much faster than those who do not. In this study, the high engagement allowed students to complete a large volume of reading. Because the AI kept the texts at the right difficulty level, every quiz became a successful learning experience. The growth in Lexile levels (from 327L to 449L) serves as practical evidence of this theory in action. By keeping students engaged through immediate feedback (Hattie & Timperley, 2007), the AI created a "virtuous cycle" where success motivated more reading, which then led to even higher comprehension scores.

4. Student Perceptions and the Role of AI Scaffolding

The qualitative findings showed that junior high students liked structured AI like ReadTheory more than conversational AI like ChatGPT. They valued having a clear pedagogical path and specific answers, which felt more supportive for their age group.

Furthermore, the fact that some students used "AI stacks" (using Dola to help with

ReadTheory) showed a high level of digital literacy. Students saw AI as a supportive partner that reduced their cognitive load. The digital scaffolding made the learning process feel more accessible and enjoyable. This shift in perception is important for long-term language learning because it turns reading from a boring task into a rewarding activity.

Conclusions

The implementation of the AI scaffolded reading strategy has demonstrated a significant positive impact on the literacy development of junior high school students. Based on the statistical evidence, the strategy effectively improved students reading comprehension levels, answering the second research question. The experimental group achieved a posttest mean of 71.63, which was significantly higher than the control groups mean of 61.19. The significance value of $p < .001$ and a moderate N-Gain score of .3528 confirm that the automated scaffolding through dynamic leveling and retrospective feedback provided by the AI system is more effective than traditional reading instruction. These results suggest that when text difficulty is automatically adjusted to a student's personal ability, the cognitive barriers to understanding complex English texts are substantially reduced.

Regarding reading engagement as addressed in the first research question, the findings indicate that the AI scaffolded environment fosters high levels of behavioral and motivational involvement. The accumulation of substantial gamified reward points and the completion of 254 independent quizzes reflect a robust commitment to self-directed practice. In response to the third research question, the study highlights a clear relationship between engagement and comprehension: as students interacted more frequently with the adaptive passages, their reading proficiency measured in Lexile levels progressed from an average of 327L to 449L. This synergy confirms that gamified elements and

consistent success within a personalized learning zone serve as a catalyst for sustained reading effort.

Furthermore, answering the fourth research question, student perceptions of the AI scaffolded reading strategy were overwhelmingly positive. Participants experienced the platform as a supportive tool that offered a more structured learning experience compared to conventional printed materials. The preference for a dedicated adaptive platform over open-ended generative AI underscores the importance of structured pedagogical feedback for junior high school learners. Students valued the automated explanations provided after incorrect answers, viewing them as essential scaffolds that helped them understand difficult vocabulary and complex sentence structures.

In light of these findings, it is recommended that English language educators integrate AI scaffolded reading platforms into the regular curriculum to provide personalized instruction. While the technology provides a powerful foundation for cognitive growth, active teacher supervision remains vital to ensure that students maintain a qualitative reading pace and engage deeply with the provided feedback. Ultimately, this study demonstrates that AI scaffolding through adaptive leveling is a highly effective strategy for bridging the gap in EFL reading comprehension, paving the way for more technologically resilient and self-motivated learners.

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