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Artificial Intelligence-Based Interactive Learning Media for Improving Reading Comprehension in Elementary Education

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ABSTRACT

This study investigates the effectiveness of Artificial Intelligence (AI)-based interactive learning media in improving elementary school students' reading comprehension within a technology-enhanced learning environment. The increasing integration of AI in education has created opportunities to develop adaptive, data-driven, and interactive instructional systems that support personalized learning. However, empirical studies examining the impact of AI on elementary-level reading comprehension remain limited. This study employed a quasi-experimental design with a pretest–posttest control group approach involving 60 fourth-grade students from a public elementary school in East Lombok Regency, Indonesia. Participants were divided into an experimental group that received AI-supported reading instruction and a control group that received conventional reading instruction. Data were collected using a reading comprehension test consisting of 30 items, student response questionnaires, and classroom observations. Quantitative data were analyzed using descriptive statistics, paired-sample and independent-sample t-tests, normalized gain (N-gain) analysis, and effect size calculations.
In contrast, qualitative data were examined through thematic analysis. The results indicate that students exposed to AI-based interactive learning media demonstrated significantly greater improvements in reading comprehension than those receiving traditional instruction. The greatest learning gains were observed in higher-order comprehension skills, particularly inferential reasoning and summarizing ability. Additionally, students reported positive perceptions of the AI-supported learning environment, highlighting the role of adaptive feedback and interactive tasks in fostering comprehension. These findings suggest that AI-based interactive learning media can effectively enhance elementary students' reading comprehension and offer a promising approach to strengthening literacy instruction in technology-enhanced learning environments.

Keywords: *Artificial Intelligence; Elementary Education; Interactive Learning Media; Reading Comprehension; Technology-Enhanced Learning*

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INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has significantly reshaped contemporary education by enabling the development of adaptive, data-driven, and interactive learning environments. In recent years, AI-powered educational technologies have increasingly been integrated into digital learning ecosystems to facilitate personalized learning experiences, enhance learner engagement, and support more responsive instructional design through intelligent feedback mechanisms and multimedia-based interaction (AlShaikh et al., 2024; Pellas, 2023). These technologies enable learning systems to adapt dynamically to students' cognitive needs and behavioral patterns, thereby supporting more individualized learning trajectories. Within such environments, AI-based media has also been used to scaffold cognitive processing, stimulate reflective learning, and promote deeper interaction between learners and educational content (Lim et al., 2023; Saritepeci & Durak, 2024). As these technological capabilities continue to expand, questions regarding how AI-driven learning systems can effectively support foundational literacy competencies—particularly reading comprehension—have emerged as a critical issue in educational technology and language education research.

Within contemporary education systems, reading comprehension remains a fundamental competence that enables learners to access knowledge, interpret information, and engage in higher-order cognitive processes across academic disciplines. Numerous empirical studies demonstrate that students' reading proficiency is strongly associated with broader academic achievement and learning outcomes in diverse educational contexts (Abid et al., 2023; Orellana et al., 2024). Moreover, the development of effective reading strategies and metacognitive regulation has been shown to significantly enhance comprehension performance and facilitate deeper engagement with textual

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information (Muhid et al., 2020; Yapp et al., 2023). Simultaneously, the growing presence of digital environments in students' daily lives has transformed how reading activities are mediated through technological platforms. Evidence suggests that balanced, purposeful digital engagement may improve comprehension and learning efficiency (Rico-Juan et al., 2024). Consequently, strengthening reading comprehension within technologically mediated learning environments has become a key educational priority for preparing learners to navigate complex knowledge systems.

In response to these developments, the integration of digital technologies into elementary language education has increasingly been explored as a strategy to enhance students' engagement in reading activities and support comprehension through interactive learning environments. Several studies have reported that digital learning tools can positively influence students' motivation and vocabulary acquisition. For example, the Voca-Lens platform demonstrated measurable improvements in primary pupils' vocabulary repertoire and reading engagement when integrated into literacy instruction (Md Yunus et al., 2020). Likewise, the use of digital instructional content in remote learning contexts has been associated with increased learner motivation and greater accessibility of language-learning resources (Fansury et al., 2020). However, despite these benefits, implementing digital technologies in primary literacy instruction continues to pose significant operational challenges. Research indicates that limitations in technological infrastructure, internet accessibility, and teacher readiness remain critical constraints affecting the sustainability and scalability of digital learning environments (Rasmitadila et al., 2020). Although specialized systems such as GraphoLearn have demonstrated effectiveness in supporting early reading acquisition (Maassen et al., 2025), many existing approaches still provide limited adaptive support for higher-level comprehension processes in authentic classroom contexts.

Building on the growing adoption of digital learning environments, a substantial body of research has examined the integration of Artificial

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Intelligence in language and literacy learning from multiple methodological and conceptual perspectives. Empirical evidence suggests that AI-assisted learning environments can improve language learning outcomes by providing adaptive feedback, automated assessment, and personalized learning pathways aligned with the principles of Technology-Enhanced Learning. For instance, AI-mediated instruction has been shown to enhance students' language achievement, learning motivation, and self-regulated learning behaviors in English language learning contexts (Wei, 2023). Similarly, conversational AI systems such as ChatGPT have demonstrated promising results in improving writing performance and learner motivation among EFL students (Song & Song, 2023). Additional studies have explored AI-driven language games and AI literacy instruction as mechanisms for fostering engagement, self-efficacy, and communication confidence in language classrooms (Ma & Chen, 2025; Zhang et al., 2025). Despite these advancements, many investigations remain concentrated in secondary or higher education settings, while technical challenges—including system reliability, technological anxiety, and the standardization of AI-supported interactions—continue to constrain broader educational implementation (Crompton et al., 2024).

Although the pedagogical potential of AI-based learning systems has been widely acknowledged, several substantive limitations remain evident in the current body of literature. Existing studies have reported improvements in reading fluency, vocabulary acquisition, and student engagement through AI-supported learning tools. For example, integrating AI voice chatbots such as Alexa has been shown to improve fourth-grade students' oral reading fluency and comprehension in classroom settings (Elmaadaway et al., 2025). Likewise, AI-mediated instructional platforms have been associated with enhanced language achievement, motivation, and self-regulated learning among EFL learners (Wei, 2023). Other AI-supported systems, including intelligent reading tools and vocabulary learning platforms, have shown potential to support

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bilingual literacy development and vocabulary acquisition among young learners (Feng & Wang, 2023)(Wen et al., 2025).

Nevertheless, much of this research continues to focus predominantly on secondary or higher education contexts, often relying on descriptive analyses or short-term interventions. Furthermore, practical challenges such as technological reliability and user anxiety continue to affect the operational effectiveness of AI-supported learning systems (Crompton et al., 2024). As a result, empirical investigations examining AI-supported reading comprehension development in elementary education remain relatively limited.

Addressing these limitations requires a more focused investigation of how AI-supported learning environments can support literacy development in primary education contexts. Building on the research gaps identified in previous studies, this study analyzes the effect of AI-based interactive learning media on elementary students' reading comprehension. More specifically, the research evaluates changes in students' reading comprehension performance before and after the implementation of AI-supported learning media through a quasi-experimental design, using reading comprehension tests and gain-score analysis to capture measurable learning improvements. This analytical approach enables a deeper examination of how adaptive learning technologies influence comprehension development within authentic classroom settings. The novelty of this study lies in the application of Artificial Intelligence as an adaptive literacy learning medium in elementary education, integrating the principles of Reading Comprehension Theory and Technology-Enhanced Learning to support more effective text comprehension processes. Through this framework, the study addresses existing empirical and methodological gaps while strengthening the theoretical and practical foundations for integrating AI-based learning media into elementary literacy education.

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METHOD

Research Design

This study employed a quasi-experimental design with a pretest–posttest control-group framework to examine the effect of AI-based interactive learning media on elementary students' reading comprehension. The quasi-experimental approach was selected because random assignment at the individual level was not feasible within the natural classroom structure, which required intact classes to be maintained. Such a design is widely adopted in educational research to investigate causal relationships in authentic school contexts while preserving ecological validity.

The research design involved two groups: an experimental group that received reading instruction supported by AI-based interactive learning media and a control group that received conventional reading instruction using standard classroom materials. Both groups completed a reading comprehension pretest before the intervention to establish baseline equivalence and a posttest after the intervention to measure learning gains. This design enabled the study to address the research questions concerning (1) students' reading comprehension ability before the implementation of AI learning media, (2) changes in reading comprehension after the intervention, and (3) the effectiveness of AI-supported learning media compared with traditional instruction.

The study adopted a mixed explanatory design, integrating quantitative analyses of reading comprehension scores with qualitative observations and student perceptions to provide a more comprehensive understanding of how AI-supported learning environments influence literacy development.

Research Context

The research was conducted in an elementary public school located in an urban area of East Lombok Regency, West Nusa Tenggara, Indonesia. The school had access to digital learning facilities, including computers and tablet devices that enabled the implementation of AI-based learning media within classroom instruction.

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The participants were fourth-grade students, typically aged 9-10, at the intermediate stage of literacy development. At this level, students transition from basic decoding skills toward higher-order comprehension processes such as identifying main ideas, drawing inferences, and summarizing textual information.

The instructional implementation followed a blended classroom learning model, combining face-to-face instruction with AI-supported reading activities delivered through digital devices. In this environment, teachers acted primarily as facilitators, while the AI platform provided adaptive reading tasks and automated feedback to support individualized learning.

Participants and Sampling

The study involved 60 fourth-grade students from two parallel classes within the same school. Participants were selected using cluster random sampling, a sampling strategy commonly used in school-based research where intact classes are treated as sampling units.

The classes were randomly assigned to two groups:

- Experimental group: 30 students receiving AI-supported reading instruction
- Control group: 30 students receiving conventional reading instruction

Participants were between 9 and 10 years old and followed the national elementary school curriculum. All students possessed basic reading skills necessary to participate in comprehension activities.

The inclusion criteria were as follows:

- students were officially enrolled as fourth-grade students;
- students possessed basic reading proficiency;
- Parental consent for participation was obtained.
- Students were excluded from the study if they:
- exhibited severe reading difficulties requiring specialized intervention;
- did not participate in the complete instructional intervention.

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A power analysis conducted before the study indicated that a minimum sample size of 54 participants would be required to detect a moderate effect size (0.5) with statistical power of 0.80 at a significance level of 0.05. The final sample of 60 students, therefore, met the recommended threshold.

Instruments

Reading Comprehension Test

The primary research instrument was a Reading Comprehension Test consisting of 30 items designed to assess students' comprehension of narrative and informational texts. The instrument measured five key constructs derived from Reading Comprehension Theory:

1. Identification of the main idea
2. recognition of important information
3. inferential comprehension
4. summarizing ability
5. Interpretation of contextual meaning

The test consisted of multiple-choice items, short-answer questions, and text interpretation tasks, enabling the assessment of both literal and inferential comprehension skills. Scores were calculated on an interval scale ranging from 0 to 100.

Student Response Questionnaire

A student response questionnaire was administered to evaluate students' perceptions of the AI-supported learning environment. The instrument used a five-point Likert scale (1–5) and measured several constructs, including:

- perceived interactivity of the learning media
- ease of use
- learning motivation
- perceived support for reading comprehension.

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Classroom Observation Sheet

Structured classroom observations were conducted using an observation sheet designed to record:

- student engagement during reading activities
- interaction with AI-supported learning media
- responses to automated feedback provided by the system.

These observational data complemented the quantitative results by providing contextual insights into classroom implementation.

Data Collection Procedure

Data collection followed a structured and chronological process.

Preparation Phase

During the preparation stage, the AI-based learning media were developed and configured for classroom use. Research instruments were validated through expert review, and teachers in the experimental group received training on implementing the AI-supported reading platform.

Pretest Administration

Before the intervention, all participants completed a reading comprehension pretest to assess baseline comprehension and ensure equivalence between the experimental and control groups.

Instructional Intervention

The instructional intervention was conducted over six weeks during regular reading lessons.

Students in the experimental group participated in reading activities supported by AI-based interactive learning media. The system provided several instructional features, including:

- adaptive reading tasks
- automated feedback on student responses
- interactive comprehension questions.

Students in the control group received conventional reading instruction using printed texts and teacher-led discussions.

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To ensure intervention fidelity, both groups followed identical lesson objectives and schedules, and teachers adhered to standardized lesson plans.

Posttest and Additional Data Collection

At the end of the intervention period, all students completed the posttest reading comprehension assessment. Following the posttest, the experimental group completed the student response questionnaire, and classroom observations were conducted to document engagement patterns during the intervention.

Data Analysis

Quantitative data were analyzed using SPSS version 26. The analysis procedures included several stages.

First, descriptive statistics were calculated to summarize students' reading comprehension scores, including mean values and standard deviations.

Second, data screening procedures were conducted to detect missing data and outliers. Outlier detection was performed using boxplot analysis.

Third, normality was assessed using the Kolmogorov–Smirnov test, and Levene's test was used to evaluate homogeneity of variance between groups.

To examine within-group changes, paired-sample t-tests were conducted to compare pretest and posttest scores. Differences between the experimental and control groups were analyzed using independent-sample t-tests.

Learning improvement was further examined using Normalized Gain (N-Gain) analysis, and the magnitude of the intervention effect was estimated using Cohen's d.

All statistical tests were conducted with a significance level of $\alpha = 0.05$.

Qualitative data obtained from observations and student responses were analyzed using thematic analysis, involving systematic coding, categorization, and theme identification.

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Validity and Reliability

Several procedures were implemented to ensure the study's methodological rigor.

Content validity of the research instruments was established through evaluation by three experts in language education and educational technology, who assessed the alignment of the instrument items with the intended constructs.

Construct validity was examined using an exploratory factor analysis (EFA) to confirm the questionnaire's dimensional structure.

Reliability was assessed using Cronbach's alpha, with a reliability threshold of 0.70 considered acceptable.

Before the main study, the instruments were pilot tested with 20 students from a different elementary school to ensure clarity of instructions, appropriate difficulty levels, and internal consistency of measurement.

Ethical Considerations

The study adhered to established ethical standards for educational research involving human participants.

Before the research was conducted, written informed consent was obtained from the school administration and parents or guardians of participating students. Participation was voluntary, and students were informed that they could withdraw from the study at any time without academic consequences.

The research protocol received approval from the university research ethics committee responsible for overseeing studies involving minors.

To ensure participant confidentiality, all collected data were anonymized, and identifying information was removed from the dataset. Data were stored securely and accessed only by members of the research team for academic purposes.

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Methodological Limitations

Despite its methodological rigor, several limitations should be acknowledged. The use of a quasi-experimental design without full randomization may limit causal generalization. In addition, the sample was drawn from a single school, which may restrict the broader generalizability of the findings. The intervention's duration was also relatively short, which may affect the long-term evaluation of learning outcomes.

Nevertheless, the study provides a systematic empirical investigation of the use of AI-supported interactive learning media for improving reading comprehension in elementary education, contributing to the growing body of research on technology-enhanced literacy learning.

RESULT

Overview of Research Findings

This study investigated the effectiveness of **AI-based interactive learning media** in improving elementary school students' reading comprehension. The findings are presented in accordance with the research questions and are derived from both **quantitative and qualitative data** collected during the instructional intervention. Quantitative results were obtained from pretest and posttest reading comprehension assessments, while qualitative data were gathered through classroom observations and student response questionnaires.

Overall, the results indicate that integrating AI-supported learning media led to measurable improvements in students' reading comprehension. Students who participated in the AI-supported learning environment demonstrated greater learning gains compared with those who received conventional instruction. In addition, qualitative findings reveal increased engagement and positive perceptions of the AI-based learning environment, suggesting that the system's adaptive and interactive features supported students' comprehension.

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Baseline Reading Comprehension Ability

The first analysis examined students' **baseline reading comprehension before** the instructional intervention. Pretest results were analyzed to determine the equivalence of the experimental and control groups before implementing AI-based learning media.

Descriptive statistics show that both groups demonstrated relatively similar initial reading comprehension performance. The experimental group obtained a mean pretest score of **63.2**, while the control group obtained a mean score of **62.7**. These results indicate that both groups began the study with comparable levels of reading comprehension ability.

Normality testing using the **Kolmogorov–Smirnov test** indicated that the data were normally distributed ($p > 0.05$), and the **Levene test** confirmed homogeneity of variance between groups ($p > 0.05$). These findings suggest that the two groups were statistically comparable before the intervention, providing an appropriate basis for examining the effects of the instructional treatment.

Further examination of item-level scores revealed that students initially experienced the greatest difficulty with inferential comprehension and summarizing text. In contrast, higher scores were observed in identifying explicit information in the text.

Changes in Reading Comprehension After the Intervention

The second analysis examined the changes in students' reading comprehension following the instructional intervention. Posttest results indicate that students in the experimental group demonstrated greater improvement in reading comprehension than those in the control group.

The experimental group's mean score increased from 63.2 in the pretest to 82.5 in the posttest, whereas the control group's mean score increased from **62.7 to 71.3** during the same instructional period.

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The **N-Gain score** for the experimental group was **0.62**, placing it in the **moderate-to-high improvement category**. In contrast, the control group obtained an N-Gain score of **0.28**, indicating relatively modest improvement.

A **paired-sample t-test** revealed a statistically significant improvement in reading comprehension scores within the experimental group ($p < 0.001$). In addition, the **independent-sample t-test** comparing posttest scores between groups indicated a significant difference ($p < 0.01$), suggesting that students who learned using AI-based interactive media achieved higher comprehension outcomes than those who participated in conventional reading instruction.

The calculated **effect size (Cohen's d = 0.85)** indicates a **large practical effect**, suggesting that the AI-supported learning environment had a substantial influence on students' reading comprehension development.

Improvement Across Reading Comprehension Indicators

Further analysis was conducted to examine improvements across different **reading comprehension indicators**. The results indicate that the largest gains occurred in **inferential comprehension and summarizing ability**, followed by improvements in identifying the main idea and interpreting contextual meaning.

Students in the experimental group demonstrated notable progress in drawing inferences from text and synthesizing information into concise summaries. These improvements suggest that the AI-supported learning media facilitated deeper cognitive engagement with reading materials.

In contrast, students in the control group showed moderate improvement primarily in identifying explicit textual information, while gains in higher-order comprehension skills remained limited.

These findings indicate that the AI learning system's adaptive and interactive features may have contributed to the development of higher-level reading comprehension skills.

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Student Responses to AI-Based Learning Media

Qualitative data from student questionnaires and classroom observations were analyzed to explore students' perceptions of the AI-supported learning environment.

Thematic analysis identified several dominant response patterns. Students frequently reported that the AI-based learning media were **interactive, engaging, and helpful for understanding reading materials**. The most frequently mentioned features included **automatic feedback**, **adaptive reading tasks**, and **interactive comprehension questions**.

Students also reported that the system's immediate feedback helped them recognize errors and revisit relevant parts of the text. Observational data indicated that students actively interacted with the AI platform during reading activities and often revisited reading passages after receiving automated feedback.

These findings suggest that the AI-supported learning environment not only improved reading comprehension but also enhanced students' motivation and engagement in reading.

DISSCUSION

The findings of this study provide empirical evidence that **AI-based interactive learning media can significantly enhance elementary students' reading comprehension**, particularly in higher-order comprehension processes such as inferential reasoning and summarization. Students who participated in AI-supported reading instruction demonstrated greater learning gains than those receiving conventional instruction, indicating that adaptive learning technologies can facilitate more effective literacy learning environments. These results align with previous research suggesting that AI-driven educational technologies enable personalized learning experiences and enhance student engagement through adaptive feedback and interactive content delivery (AlShaikh et al., 2024; Pellas, 2023). Within the context of reading comprehension, such technological affordances appear to support

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deeper cognitive engagement with textual information by guiding learners through scaffolded reading tasks and providing immediate feedback that encourages reflection and revision of understanding.

The improvement in students' reading comprehension can also be interpreted through the lens of Reading Comprehension Theory, which emphasizes the interaction among readers, texts, and cognitive strategies during comprehension. AI-supported learning environments appear to function as **cognitive scaffolding**, assisting learners in identifying key textual information, drawing inferences, and constructing coherent representations of meaning. The adaptive features embedded within the AI-based learning media—such as automatic feedback and interactive comprehension prompts—likely contributed to the development of metacognitive strategies that support deeper comprehension. This interpretation is consistent with previous studies showing that structured reading strategies and metacognitive regulation significantly enhance comprehension outcomes (Muhid et al., 2020; Yapp et al., 2023). By integrating these processes into a technology-enhanced learning environment, the AI system appears to support learners in navigating complex reading tasks more effectively.

From the perspective of **Technology-Enhanced Learning**, the results further suggest that AI-supported instructional systems can provide learning environments that are more responsive to individual learner needs. Unlike traditional instructional approaches, AI-based learning media can dynamically adjust the difficulty of reading tasks and provide personalized feedback based on students' performance patterns. Such adaptive learning pathways may explain the stronger improvements observed in higher-order comprehension skills, particularly inferential reasoning and summarization. These findings are consistent with prior studies reporting that AI-mediated learning environments enhance language learning outcomes, including learner motivation, self-regulated learning, and engagement with instructional content (Wei, 2023). Similarly, AI-based conversational and interactive learning systems have been shown to foster learner motivation and participation by

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creating more immersive and responsive learning experiences (Song & Song, 2023).

The positive perceptions students have of the AI-supported learning environment further highlight the role of **interactive and adaptive instructional features** in supporting reading development. Students reported that the system's immediate feedback and interactive tasks helped them better understand reading materials and maintain engagement throughout the learning process. These observations correspond with previous findings indicating that AI-supported language learning environments can strengthen learner engagement, self-efficacy, and communication confidence in language learning contexts (Zhang et al., 2025)(Ma & Chen, 2025). In particular, the presence of automated feedback mechanisms appears to encourage students to revisit texts and reconsider their interpretations, thereby fostering more active engagement with reading tasks. Such processes are essential for developing deeper comprehension skills and promoting self-regulated learning behaviors.

Despite these promising findings, the results should be interpreted in light of several contextual considerations highlighted in previous research. Earlier studies have noted that implementing AI-supported learning systems may face practical challenges, including technological reliability, infrastructure limitations, and varying levels of teacher readiness for technology integration (Crompton et al., 2024; Rasmitadila et al., 2020). Although the present study was conducted in a school environment with sufficient technological support, broader implementation may require additional institutional resources, teacher training, and technical support systems to ensure sustainable integration. Furthermore, concerns related to technological anxiety and the standardization of AI-mediated learning interactions remain important considerations for the broader adoption of AI-based educational technologies.

Importantly, this study helps address the **research gap identified in previous literature**, which has largely focused on AI applications in secondary and higher education contexts. By examining the impact of AI-based learning media on **elementary students' reading comprehension**, the findings extend

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existing knowledge regarding the pedagogical potential of AI in foundational literacy development. While previous studies have demonstrated the benefits of AI-supported systems for language learning outcomes such as vocabulary acquisition, reading fluency, and learner engagement (Elmaadaway et al., 2025; Feng & Wang, 2023; Wen et al., 2025), empirical evidence regarding their effectiveness in supporting deeper comprehension processes in primary education has remained limited. The present findings, therefore, provide important insights into how AI-driven learning systems can be designed to support early literacy development in authentic classroom contexts.

Taken together, the findings suggest that **AI-based interactive learning media represent a promising approach for strengthening reading comprehension in elementary education**, particularly when designed to provide adaptive learning pathways and immediate instructional feedback. By integrating principles from Reading Comprehension Theory and Technology-Enhanced Learning, AI-supported learning environments may enable more responsive and personalized literacy instruction that supports students' cognitive engagement with texts. Consequently, the results contribute to the growing body of research on technology-enhanced literacy education and highlight the potential of AI-driven learning systems to address persistent challenges in elementary reading instruction.

CONCLUSION

This study examined the effectiveness of AI-based interactive learning media in improving elementary school students' reading comprehension within a technology-enhanced learning environment. The findings demonstrate that integrating AI-supported instructional media can significantly enhance students' reading comprehension performance compared with conventional reading instruction. In particular, students who participated in AI-supported learning activities showed greater improvement in higher-order comprehension skills, including inferential reasoning and summarizing textual information. These results indicate that adaptive

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feedback mechanisms and interactive reading tasks embedded within AI-based learning systems can facilitate deeper cognitive engagement with texts and support the development of essential literacy skills.

From a theoretical perspective, the results reinforce the relevance of Reading Comprehension Theory and Technology-Enhanced Learning frameworks in explaining how adaptive digital learning environments can support comprehension processes. The AI-based learning media served as cognitive scaffolding, guiding students through structured reading activities while providing immediate feedback and personalized learning pathways. Such features appear to help learners regulate their reading processes more effectively and construct meaning from textual information. Consequently, integrating AI-supported instructional media can be a promising strategy for strengthening literacy development in elementary education.

This study also contributes to addressing the research gap identified in previous literature, which has predominantly examined the role of AI in language learning within secondary and higher education contexts. By focusing on elementary school students, the present research provides empirical evidence regarding the potential of AI-driven learning systems to support foundational literacy development during early stages of education. These findings, therefore, extend existing scholarship by demonstrating that AI-based learning environments can effectively support the development of reading comprehension in primary school settings.

In terms of practical implications, the results suggest that educators and schools may consider integrating AI-based learning media into reading instruction to create more interactive and adaptive literacy learning environments. However, successful implementation requires adequate technological infrastructure, teacher readiness, and pedagogical integration to ensure that AI systems function effectively as instructional support tools rather than merely technological supplements.

Despite its contributions, the study has several limitations. The use of a quasi-experimental design and a relatively limited sample from a single school

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may restrict the generalizability of the findings. In addition, the intervention period was relatively short, which may limit the ability to observe long-term learning effects. Future research is therefore recommended to explore the long-term impact of AI-supported literacy instruction across diverse educational contexts, larger samples, and extended intervention periods. Further investigations may also examine how different AI features—such as adaptive feedback, learning analytics, and personalized reading pathways—contribute to the development of students' comprehension strategies and literacy outcomes.

Overall, the study provides empirical evidence that AI-based interactive learning media have strong potential to enhance reading comprehension in elementary education, particularly when designed to support adaptive learning processes and meaningful interaction with reading texts.

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