

## THE EFFECTIVENESS OF ARTIFICIAL INTELLIGENCE IN IMPROVING STUDENTS' CRITICAL READING SKILLS AT EFL STUDENTS OF SULTAN AGENG TIRTAYASA UNIVERSITY

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### ABSTRACT

*This study investigates the effectiveness of Artificial Intelligence (AI) in improving students' critical reading skills in higher education. As digital technologies increasingly shape learning environments, AI offers potential to enhance higher-order thinking. This research employed a quantitative approach using a quasi-experimental one-group pretest–posttest design. The participants were 30 sixth-semester students enrolled in the Qualitative Research on ELT course at Universitas Sultan Ageng Tirtayasa, selected through purposive sampling. The instrument was a standardized critical reading test measuring students' ability to identify main ideas, analyze arguments, evaluate evidence, detect bias, and draw conclusions. It included multiple-choice and short-response items to assess analytical comprehension. The treatment integrated AI-based tools for text analysis, summarization, argument mapping, and reflective questioning. Students also compared their interpretations with AI-generated feedback to enhance metacognitive awareness. The intervention was conducted over four meetings under guided supervision. Data were analyzed using descriptive statistics and a paired-sample t-test. The findings revealed a statistically significant improvement in students' posttest scores compared to pretest results at the 0.05 level. These results indicate that AI can effectively support critical reading development and foster deeper engagement with academic texts in EFL contexts.*

**Keywords:** Artificial Intelligence, Critical Reading, AI-Assisted Learning, Higher-Order Thinking, Higher Education

### ABSTRAK

*Penelitian ini mengkaji efektivitas Kecerdasan Buatan (AI) dalam meningkatkan keterampilan membaca kritis mahasiswa di perguruan tinggi. Seiring dengan semakin besarnya peran teknologi digital dalam membentuk lingkungan pembelajaran, AI menawarkan potensi untuk meningkatkan kemampuan berpikir tingkat tinggi. Penelitian ini menggunakan pendekatan kuantitatif dengan desain kuasi-eksperimental satu kelompok pretest–posttest. Peserta penelitian ini adalah 30 mahasiswa semester keenam yang terdaftar dalam mata kuliah Penelitian Kualitatif tentang Pengajaran Bahasa Inggris (ELT) di Universitas Sultan Ageng Tirtayasa, yang dipilih melalui sampling purposif. Instrumen yang digunakan adalah tes membaca kritis terstandar yang mengukur kemampuan siswa dalam mengidentifikasi gagasan utama, menganalisis argumen, mengevaluasi bukti, mendeteksi bias, dan menarik kesimpulan. Tes tersebut mencakup soal pilihan ganda dan soal jawaban singkat untuk menilai pemahaman analitis. Perlakuan intervensi ini mengintegrasikan alat berbasis AI untuk analisis teks, ringkasan, pemetaan argumen, dan pertanyaan reflektif. Siswa juga membandingkan interpretasi mereka dengan umpan balik yang dihasilkan AI untuk meningkatkan kesadaran metakognitif. Intervensi ini dilaksanakan selama empat pertemuan di bawah bimbingan dan pengawasan. Data dianalisis menggunakan statistik deskriptif dan uji-t sampel berpasangan. Temuan menunjukkan peningkatan yang signifikan secara statistik pada skor pasca-tes siswa dibandingkan dengan hasil pra-tes pada tingkat signifikansi 0,05. Hasil ini menunjukkan bahwa AI dapat secara efektif mendukung pengembangan membaca kritis dan mendorong keterlibatan yang lebih mendalam dengan teks akademis dalam konteks EFL.*

**Kata kunci:** Artificial Intelligence, Critical Reading, AI-Assisted Learning, Higher-Order Thinking, Higher Education

### INTRODUCTION

Critical reading is an essential academic skill that enables students to engage deeply with texts, evaluate arguments, and construct informed interpretations. In the field of English as a Foreign Language (EFL), developing critical reading skills is particularly challenging due to linguistic constraints and limited exposure to authentic academic discourse. As noted by William Grabe and Fredricka L. Stoller, EFL learners often struggle not only with comprehension but also with higher-level processes such as analysis and evaluation (Grabe & Stoller, 2011). Consequently, many students remain at a surface level of understanding and fail to engage critically with texts.

The concept of critical thinking underpins critical reading. According to Peter A. Facione, critical thinking involves interpretation, analysis, evaluation, inference, and self-regulation (Facione, 1990). Similarly, Robert H. Ennis defines it as reasonable and reflective thinking focused on deciding what to believe or do (Ennis, 2018). These ideas align with higher-order thinking skills described in A Taxonomy

for Learning, Teaching, and Assessing, which emphasize analysis, evaluation, and creation as key components of meaningful learning. However, instructional practices in many EFL classrooms still prioritize literal comprehension, limiting students' development of critical reading abilities.

The rapid advancement of Artificial Intelligence (AI) has introduced new opportunities in education. AI technologies can support personalized learning, automated feedback, and interactive engagement (Holmes et al., 2019; Luckin, 2018). In reading instruction, AI tools assist learners in identifying key ideas, analyzing arguments, and reflecting on their understanding. Studies by Olaf Zawacki-Richter et al. (2019) and Xiaojun Zhai et al. (2021) highlight that AI integration can enhance learning outcomes, particularly in fostering higher-order thinking skills.

Recent studies further strengthen the role of AI in education, especially after the shift toward digital learning environments. Research by Bond et al. (2021) shows that technology-mediated learning has become increasingly central in higher education, emphasizing the need for effective digital pedagogies. The emergence of generative AI tools such as ChatGPT has also created new opportunities and challenges in learning, including supporting critical thinking while raising concerns about academic integrity and over-reliance (Kasneci et al., 2023; Khalil & Er, 2023).

Moreover, AI has been shown to improve students' engagement and comprehension in reading activities. A systematic review by Li et al. (2022) indicates that AI can effectively support reading comprehension through adaptive feedback and interactive scaffolding. Similarly, automated feedback systems have been found to enhance learners' analytical skills and language performance (Ranalli, 2021). AI-supported feedback also contributes to the development of evaluative judgement, enabling students to critically assess both their own work and external inputs (Tai et al., 2023). These findings suggest that AI not only supports comprehension but also fosters deeper cognitive and metacognitive engagement.

Despite these promising developments, empirical research specifically addressing AI-assisted critical reading in EFL contexts remains limited. Most existing studies focus on general language learning outcomes rather than critical reading performance. Therefore, further investigation is needed to explore how AI can directly enhance students' ability to analyze, evaluate, and interpret academic texts critically.

In response to this gap, this study examines the effectiveness of AI-assisted learning in improving students' critical reading skills at Universitas Sultan Ageng Tirtayasa. The research is guided by the following question: Is Artificial Intelligence effective in improving the critical reading skills of EFL students at Universitas Sultan Ageng Tirtayasa?

## METHODS

This study applied a quantitative research design employing a quasi-experimental one-group pretest–posttest method to investigate the effectiveness of Artificial Intelligence (AI)-assisted instruction in enhancing students' critical reading skills. This design is frequently utilized in educational studies when random assignment to experimental and control groups cannot be implemented, but researchers still aim to observe changes occurring within the same group over a period of time. Through comparing students' achievements before and after the instructional intervention, the research intended to identify whether the integration of AI contributed significantly to the improvement of critical reading abilities.

In this study, the independent variable was the implementation of AI-assisted learning in reading instruction, whereas the dependent variable was students' performance in critical reading. The research specifically examined the extent to which AI tools could support learners in critically analyzing, evaluating, and interpreting texts within the context of English as a Foreign Language (EFL) learning.

### *Participants*

The participants of this study consisted of 30 sixth-semester students taking the Qualitative Research on English Language Teaching (ELT) course at Universitas Sultan Ageng Tirtayasa. Participants were selected through purposive sampling because they met the criteria relevant to the objectives of the study. In particular, the students were chosen as they were actively enrolled in the course and had previous experience reading academic texts in English.

Sixth-semester students were considered suitable participants because they were assumed to have intermediate to advanced levels of reading proficiency as well as familiarity with academic discourse. Such competence enabled them to engage in higher-order thinking processes, including analysis, evaluation, and inference-making. Furthermore, these students were expected to interact effectively with AI-based learning tools, making them appropriate subjects for examining the impact of AI-assisted instruction. Ethical considerations were also carefully addressed by ensuring voluntary participation, protecting participants'

confidentiality, and using the collected data exclusively for research purposes.

### *Instrument*

The primary instrument was a standardized critical reading test designed to measure higher-order reading skills. The test was developed based on established frameworks of critical thinking and reading comprehension, incorporating key components such as analysis, evaluation, and inference. It assessed five aspects of critical reading: identifying main ideas, analyzing arguments, evaluating supporting evidence, detecting bias, and drawing logical conclusions.

The instrument consisted of two types of items: multiple-choice and short-response questions. Multiple-choice items were used to measure students' ability to recognize key information and evaluate textual elements efficiently, while short-response items required students to explain their reasoning and demonstrate deeper analytical understanding. The reading materials were academic texts relevant to the students' field, selected to ensure appropriate difficulty and opportunities for critical engagement. Content validity and clarity were ensured through expert review and alignment with targeted skills.

### *Procedure*

The research procedure consisted of three stages: pretest, treatment, and posttest, conducted over four instructional sessions.

In the pretest stage, students completed the critical reading test under controlled conditions to establish baseline data. The treatment stage involved AI-assisted instruction integrated into reading activities. Students used AI tools to analyze texts, generate summaries, map arguments, and receive feedback on their responses. Importantly, students were encouraged to critically evaluate AI-generated outputs by comparing them with their own interpretations, identifying differences, and reflecting on reasoning processes. This approach aimed to promote metacognitive awareness and deeper engagement. The instructor facilitated the process by guiding discussions, clarifying misconceptions, and ensuring alignment with learning objectives.

Following the treatment, a posttest was administered using the same instrument as the pretest. Consistent testing conditions were maintained to ensure reliability and comparability of results.

### *Data Analysis*

Pretest and posttest data were analyzed through both descriptive and inferential statistical techniques. Descriptive measures, such as the mean and standard deviation, were used to summarize students' performance. To examine whether the difference between pretest and posttest scores was statistically significant, a paired-sample t-test was applied. The level of significance was set at 0.05; therefore, a p-value below 0.05 indicated a significant improvement, suggesting that AI-assisted instruction had a meaningful impact on students' critical reading performance.

## **RESULTS**

The results of this study demonstrate a significant improvement in students' critical reading performance following the implementation of AI-assisted instruction. This improvement is evident from both descriptive and inferential statistical analyses.

### *Descriptive Statistics*

Descriptive statistics were used to summarize students' performance in the pretest and posttest. The analysis revealed that the mean score increased substantially after the treatment, indicating overall progress in students' critical reading skills.

Table 1. Descriptive Statistics of Pretest and Posttest Score

| No | Test     | N  | Mean  | Standard Deviation | Minimum | Maximum |
|----|----------|----|-------|--------------------|---------|---------|
| 1. | Pretest  | 30 | 65.20 | 6.85               | 52      | 78      |
| 2. | Posttest | 30 | 78.45 | 7.10               | 65      | 90      |

As shown in Table 1, the mean score increased from 65.20 in the pretest to 78.45 in the posttest, reflecting an average improvement of 13.25 points. This indicates that students performed better after receiving AI-assisted instruction. The standard deviation values suggest that the variability of scores remained relatively stable, meaning that improvement occurred consistently across participants rather than being

limited to a few individuals.

Additionally, the minimum and maximum scores increased in the posttest, indicating that even lower-performing students showed improvement. This suggests that the intervention benefited students across different ability levels. To see the comparison mean scores between pre test score and posttest score can be seen the following graph.

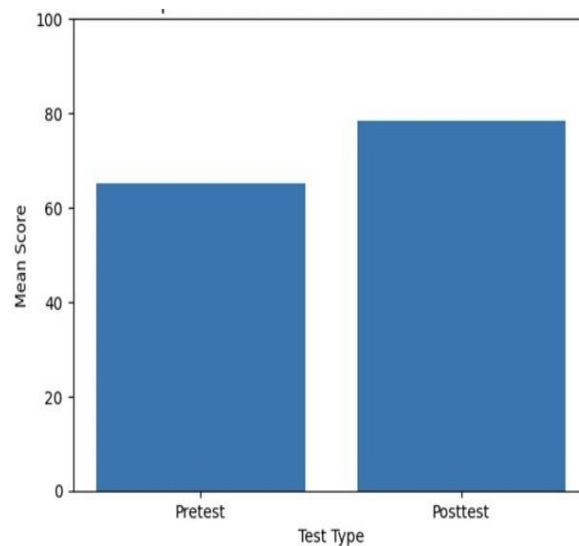


Figure 1. Comparison of Pretest and Posttest Mean Scores

#### *Inferential Statistics*

To determine whether the observed improvement was statistically significant, a paired-sample t-test was conducted. The results are presented in Table 2.

Table 2. Paired-Sample t-Test Results

| No | Variable         | Mean Difference | t-value | df | Sig. (p-value) |
|----|------------------|-----------------|---------|----|----------------|
| 1. | Pretest-Posttest | -13.25          | -9.87   | 29 | 0.000          |

The findings indicate that the p-value is 0.000 ( $p < 0.05$ ), which signifies a statistically significant difference between the pretest and posttest scores. Accordingly, the null hypothesis is rejected, leading to the conclusion that the observed improvement in students' critical reading skills was significantly influenced by the use of AI-assisted instruction.

#### *Improvement Across Reading Aspects*

Further analysis showed that improvements occurred across all five aspects of critical reading:

- Identifying main ideas
- Analyzing arguments
- Evaluating supporting evidence
- Detecting bias
- Drawing logical conclusions

Among the assessed components, the most substantial gains were observed in students' ability to analyze arguments and evaluate supporting evidence—both of which represent higher-order thinking skills. Quantitative results showed that the mean score for analyzing arguments increased from 65.20 in the pretest to 82.40 in the posttest, while evaluating supporting evidence improved from 63.75 to 80.90. These gains were higher compared to other aspects such as identifying main ideas (from 70.10 to 78.30) and drawing conclusions (from 68.50 to 76.85). The standard deviations also decreased slightly, indicating more consistent performance among students after the intervention.

Furthermore, the paired-sample t-test results confirmed that these improvements were statistically significant ( $p < 0.05$ ), suggesting that the observed changes were not due to chance. This pattern indicates that AI-assisted instruction was particularly effective in fostering deeper analytical processing rather than basic comprehension. Through AI-supported activities such as argument mapping and feedback analysis,

students were better able to examine reasoning structures, assess evidence quality, and refine their interpretations, leading to more advanced critical reading performance

## **DISCUSSION**

The findings of this study provide strong evidence that AI-assisted learning can significantly improve students' critical reading skills in an EFL context. The statistically significant difference between the pretest and posttest results demonstrates that the integration of Artificial Intelligence into reading instruction is both effective and pedagogically valuable. AI functions as an interactive learning scaffold that supports students in developing higher-order thinking skills, particularly in analyzing, evaluating, and interpreting texts. Unlike conventional teaching methods, AI systems can provide immediate, structured, and personalized feedback, enabling students to continuously reflect on their understanding. This interactive feedback process encourages learners to question assumptions, evaluate arguments critically, and refine their interpretations. These findings support Mayer's (2021) theory of multimedia learning, which argues that interactive technologies enhance cognitive processing by actively engaging learners in meaning-making activities.

In addition, the use of AI appears to strengthen students' metacognitive awareness, which is an essential component of critical thinking. By comparing their own interpretations with AI-generated responses, students are encouraged to reflect on the reasoning behind different perspectives and evaluate the quality of their own understanding. This process promotes self-regulation and deeper cognitive engagement, allowing learners to identify weaknesses in their comprehension and adjust their reading strategies accordingly. As a result, students become more active participants in constructing meaning rather than passive recipients of information. The findings also align with previous studies by Zhai et al. (2021) and Holmes et al. (2019), which highlight the role of AI technologies in supporting higher-order thinking skills such as analysis, evaluation, and problem-solving.

Furthermore, the study reveals notable improvement in students' ability to detect bias and draw logical conclusions from texts. These skills are particularly challenging for EFL learners because they require not only linguistic competence but also critical awareness. AI tools may have assisted students by providing examples of analytical reasoning and exposing them to diverse perspectives, enabling them to examine texts more critically. Consequently, students became more capable of identifying hidden assumptions, evaluating the credibility of information, and making reasoned judgments. This indicates that AI-assisted instruction extends beyond improving basic reading comprehension and contributes to the development of deeper analytical and critical reading abilities that are essential for academic success in higher education.

## **CONCLUSION**

This study concludes that the integration of Artificial Intelligence (AI) into reading instruction is effective in improving the critical reading skills of EFL students at Universitas Sultan Ageng Tirtayasa. The findings demonstrate that AI-assisted learning significantly enhances students' ability to analyze arguments, evaluate evidence, identify bias, and draw logical conclusions from academic texts. The observed improvement in posttest scores confirms that AI can facilitate meaningful learning gains, particularly in the development of higher-order thinking skills that are essential in academic contexts.

The effectiveness of AI in this study can be attributed to its capacity to provide immediate feedback, support interactive engagement, and promote reflective thinking. By enabling students to compare their own interpretations with AI-generated responses, the learning process becomes more dynamic and metacognitive. As a result, students are not only able to comprehend texts more effectively but also engage with them at a deeper analytical level. This suggests that AI functions as a cognitive scaffold that supports students in constructing knowledge rather than passively receiving information.

However, the role of AI should be carefully positioned as a complementary tool rather than a replacement for human instruction. The presence of a teacher remains essential to guide interpretation, facilitate discussion, and ensure that students maintain independent critical thinking. Effective integration of AI requires pedagogical planning so that technology enhances, rather than diminishes, the learning process.

## SUGGESTIONS

### 1. Integrate AI systematically into reading instruction

Higher education institutions, particularly in English as a Foreign Language contexts, should adopt AI-assisted learning as a regular component of reading courses. Rather than using AI sporadically, lecturers are encouraged to design structured activities—such as argument analysis, evidence evaluation, and reflective questioning—that consistently incorporate AI tools. This will ensure that students benefit from sustained exposure to AI-supported critical reading practices and develop higher-order thinking skills more effectively.

### 2. Strengthen pedagogical guidance and teacher roles

While AI has proven effective, it should remain a supportive tool under the guidance of instructors. Educators need to actively facilitate discussions, clarify misconceptions, and encourage independent reasoning when students interact with AI outputs. Training programs and professional development initiatives should be provided to help lecturers integrate AI meaningfully into their teaching while maintaining a balance between technology use and human-centered instruction.

### 3. Encourage further research and broader implementation

Future studies should expand the scope of research by involving larger samples, control groups, and longer intervention periods to strengthen empirical evidence. Researchers are also encouraged to explore AI applications across different language skills and educational levels. Broader implementation across institutions such as Universitas Sultan Ageng Tirtayasa and beyond will help validate the effectiveness of AI and support its role in advancing innovative, technology-enhanced learning environments

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## CURRICULUM VITAE

| Complete Name                         | Institution                        | Education                                                                                                                                 | Research Interests                                                                                         |
|---------------------------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Prof. Dr. Yudi Juniardi, S.Pd., M.Pd. | Universitas Sultan Ageng Tirtayasa | S1 Pendidikan Bahasa Inggris FKIP Unila; S2 Pendidikan Bahasa UNJ; S3 Pendidikan Bahasa UNJ, Diploma In Applied Linguistics REC Singapore | English Language Teaching (ELT), Critical Reading, Critical Thinking, AI in Education, Applied Linguistics |
| Tazkia Aghnia Aulia, S.Pd., M.Pd.     | Universitas Sultan Ageng Tirtayasa | S1 Pendidikan Bahasa Inggris Universitas Negeri Semarang; S2 Pendidikan Bahasa Inggris Universitas Negeri Semarang                        | Systemic Functional Linguistics, Applied Linguistics.                                                      |