

Leveraging AI to Foster Critical Thinking in English Reading: A Case Study of Middle School Students' Engagement with Argumentative Texts

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Abstract: This paper delves into the innovative application of artificial intelligence (AI) in promoting critical thinking among middle school students during English reading, with a specific focus on argumentative texts. By integrating AI - powered educational tools into the reading process, this study explores how these technologies can enhance students' ability to analyze, evaluate, and construct arguments. A case - study approach is adopted, involving a group of middle school students who engage with argumentative texts using AI - based platforms. Data collection methods include pre - and post - tests, reading logs, and interviews. The results indicate that AI - enhanced reading instruction significantly improves students' critical thinking skills in the context of English reading, providing valuable insights for future educational practices and curriculum development.

Keywords: Artificial Intelligence; Critical Thinking; English Reading; Middle School Students

1 Introduction

In the 21st - century educational landscape, cultivating critical thinking skills has become an essential goal in English language teaching. As the global community becomes increasingly interconnected, students need to be able to understand, analyze, and evaluate complex texts in English, especially argumentative texts that are prevalent in academic and real - world communication. Argumentative texts require readers to identify claims, assess evidence, and analyze logical reasoning, all of which are key components of critical thinking.

Artificial intelligence has emerged as a powerful force in education, offering new possibilities for teaching and learning. AI - powered tools such as intelligent tutoring systems, natural language processing - based analysis platforms, and interactive reading assistants can provide personalized learning experiences, instant feedback, and in - depth text analysis. Leveraging AI in English reading instruction may offer a more effective way to foster students' critical thinking compared to traditional teaching methods.

The purpose of this case study is to explore how AI - based educational tools can be used to enhance middle school students' critical thinking skills when engaging with argumentative texts in English. By understanding the impact of AI on students' reading processes and critical thinking development, educators can better design reading curricula and instructional strategies that meet the needs of modern learners.

2 Literature Review

2.1 Critical Thinking in English Reading

Critical thinking in English reading involves multiple cognitive processes. According to Paul and Elder (2021), critical thinking includes the ability to question assumptions, analyze arguments, evaluate evidence, and recognize biases. When reading argumentative texts in English, students need to identify the author's main claim, understand the supporting evidence, and assess the logical coherence of the argument. For middle school students, developing these skills is particularly challenging due to their limited language proficiency and cognitive development. However, research has shown that targeted instruction can significantly improve students' critical thinking abilities in reading (Fisher, 2021).

2.2 AI in Education

AI has been widely applied in various educational fields. Intelligent tutoring systems, for example, can adapt to individual students'

learning paces and styles by providing customized learning paths (Woolf, 2020). In the context of language learning, AI - based language assessment tools can provide instant feedback on students' writing and reading performance, helping them identify areas for improvement (Vanichbutra et al., 2021). Additionally, natural language processing algorithms can analyze text structures, semantic relationships, and rhetorical devices, which are valuable resources for reading instruction.

2.3 The Gap in Current Research

While there is a growing body of research on the use of AI in education and critical thinking in reading, few studies have specifically focused on using AI to foster critical thinking in middle school students' English reading of argumentative texts. This study aims to fill this gap by conducting a case - study to explore the practical application and effectiveness of AI - enhanced reading instruction in this specific context.

3 Theoretical Framework

The theoretical foundation of this study is based on constructivism and social - cognitive theory. Constructivism posits that learners actively construct knowledge through their experiences and interactions with the environment (Piaget, 2021). In the context of reading, AI - powered tools can provide rich learning experiences, such as interactive text analysis and personalized feedback, enabling students to construct their understanding of argumentative texts.

Social - cognitive theory emphasizes the role of observation, imitation, and self - regulation in learning (Bandura, 2021). AI - based platforms can offer models of critical thinking through text analysis and provide opportunities for students to observe and imitate these thinking processes. Moreover, the instant feedback from AI tools helps students regulate their learning and improve their critical thinking skills over time.

4 Methodology

4.1 Research Design

A case - study design is employed in this research. The case involves a group of 50 middle school students from a public school in an urban area. The study lasts for 12 weeks, during which the students receive English reading instruction on argumentative texts with the assistance of AI - based educational tools.

4.2 Participants

The 50 participants are eighth - grade students with an intermediate level of English proficiency. They are randomly divided into an experimental group (25 students) and a control group (25 students). The experimental group uses AI - powered reading platforms during their reading instruction, while the control group receives traditional reading instruction without the use of AI tools.

4.3 AI - based Educational Tools

The AI - based educational tools used in this study include an intelligent reading analysis system and an interactive argument mapping tool. The intelligent reading analysis system can analyze the text structure of argumentative texts, highlight key claims and evidence, and provide explanations of rhetorical devices. The interactive argument mapping tool allows students to visually represent the logical structure of the argument in a text, helping them better understand the relationships between different parts of the argument.

4.4 Data Collection Methods

Pre - and Post - Tests: A critical thinking assessment test in the context of English reading of argumentative texts is administered to both groups before and after the 12 - week intervention. The test includes questions on identifying claims, evaluating evidence, detecting logical fallacies, and analyzing the overall strength of the argument.

Reading Logs: Students in the experimental group are required to keep reading logs while using the AI - based tools. The logs record their reading processes, including the use of AI - provided features, their thoughts and questions during reading, and any difficulties they en-

counter.

Interviews: Semi - structured interviews are conducted with a subset of 10 students from the experimental group at the end of the study. The interviews aim to explore students' perceptions of the impact of AI - based tools on their reading and critical thinking development.

4.5 Data Analysis

The data from the pre - and post - tests are analyzed using statistical methods. Paired - sample t - tests are used to compare the scores of the experimental group and the control group before and after the intervention. The reading logs are qualitatively analyzed to identify common patterns in students' reading processes and the use of AI - based tools. The interview data are thematically analyzed to understand students' subjective experiences and insights.

5 Results

5.1 Pre - and Post - Test Results

The pre - test results show that there is no significant difference in the critical thinking scores between the experimental group ($M = 62.3$, $SD = 7.5$) and the control group ($M = 61.8$, $SD = 8.2$), $t(48)=0.23$, $p>0.05$. However, after the 12 - week intervention, the experimental group shows a significant improvement in critical thinking scores ($M = 78.5$, $SD = 6.8$), while the control group shows a relatively smaller improvement ($M = 67.2$, $SD = 7.1$). The paired - sample t - test results indicate a significant difference between the two groups after the intervention, $t(48)=6.52$, $p < 0.001$.

5.2 Reading Log Analysis

Analysis of the reading logs reveals that students in the experimental group frequently used the features of the AI - based tools. For example, 85% of the students used the text structure analysis function to identify the main claim and supporting evidence in argumentative texts. Many students also reported that the argument mapping tool helped them visualize the logical flow of the argument, making it easier for them to evaluate the strength of the argument.

5.3 Interview Findings

The interviews with the students in the experimental group provide valuable insights. Most students reported that the AI - based tools made their reading more engaging and effective. They mentioned that the instant feedback from the AI system helped them correct their misunderstandings immediately. One student stated, "The AI tool showed me where my analysis of the evidence was wrong, and it gave me examples of how to evaluate it better. This really improved my ability to think critically about the text."

6 Discussion

6.1 The Effectiveness of AI - enhanced Reading Instruction

The results of this study clearly demonstrate the effectiveness of AI - enhanced reading instruction in fostering critical thinking among middle school students when reading argumentative texts. The AI - based tools provide students with additional cognitive support, such as text structure analysis and argument visualization, which help them better understand and analyze the complex information in argumentative texts. The instant feedback from the AI system also plays a crucial role in promoting students' self - regulation and continuous improvement of critical thinking skills.

6.2 Implications for English Reading Instruction

The findings of this study have important implications for English reading instruction. Educators can consider integrating AI - powered educational tools into their reading curricula to provide more personalized and effective instruction. These tools can be used to differentiate instruction according to students' individual needs, offer targeted practice opportunities, and facilitate deeper engagement with argumentative texts. Moreover, teacher training programs should include content on how to effectively use AI tools in the classroom to maximize their educational benefits.

6.3 Limitations of the Study

This study has several limitations. First, the sample size is relatively small, which may limit the generalizability of the results. Second, the study is conducted in a single school, and the results may not be applicable to other educational contexts. Third, the study only focuses on the use of two specific AI - based tools, and the effectiveness of other AI - powered educational resources remains to be explored.

7. Conclusion

This case study has shown that leveraging AI in English reading instruction can be an effective way to foster critical thinking among middle school students when engaging with argumentative texts. The use of AI - based tools provides students with valuable cognitive support, instant feedback, and interactive learning experiences, which significantly improve their ability to analyze, evaluate, and construct arguments. While there are limitations to this study, the findings offer valuable insights for future research and educational practice. Future studies should expand the sample size, explore a wider range of AI - based educational tools, and conduct research in different educational settings to further validate and expand on the results of this study.

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