# THE COGNITIVE CATALYST: HOW GENERATIVE AI ELEVATES CRITICAL THINKING IN COLLEGE ENGLISH WRITING CLASS

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This research endeavored to explore the utilization of Generative Artificial Intelligence (AI) as a cognitive offloading tool to enhance students' critical thinking capabilities in college English writing courses. It began by elucidating the significance of critical thinking in contemporary education. The study employed a multifaceted approach, encompassing a comprehensive literature review, surveys, interviews, and an analysis of Generative AI integration in educational institutions. The main findings suggested that Generative AI, when thoughtfully integrated, significantly contributed to enhancing students' critical thinking capabilities in the context of English writing. The research underscored the evolving role of educators in this AI-augmented educational landscape. In conclusion, this study not only accentuated the potential of Generative AI in improving students' writing skills and critical thinking but also called for a proactive approach in adapting to the changing educational paradigms facilitated by AI technology.

**CCS CONCEPTS •** Natural Language Processing; • Educational technology; • Pedagogical issues and strategies

**Additional Keywords and Phrases:** Generative Artificial Intelligence, College English writing, Cognitive offloading, Critical thinking

## INTRODUCTION

In recent years, the rapid proliferation of Artificial Intelligence (AI) technology has initiated a transformative wave in the realm of global education. This technology's remarkable potential, witnessed across diverse domains, has discovered a particularly fertile ground in the field of education [1]. The integration of AI into classrooms, affording students personalized and profound learning experiences. Moreover, education's essence extends beyond mere information

transmission, emphasizing the nurturing of cognitive and problem-solving abilities. In college English writing courses, students confront challenges extending beyond the realms of grammar and structure, as they embark on the journey of cultivating independent and critical thinking skills. Effectively guiding students in this endeavor, fostering their capacity for analysis, evaluation, and expression of complex viewpoints, has become an urgent and imperative educational mission.

In this context, Generative Artificial Intelligence (AI) has entered the arena of college English writing courses as a potent cognitive augmentation tool, offering a novel avenue for cultivating students' critical thinking capabilities. Generative AI not only furnishes students with real-time feedback on grammatical and structural aspects but also catalyzes their in-depth analytical abilities by generating diverse perspectives and arguments [2]. The introduction of this technology has engendered a fresh educational landscape, one that challenges both educators and students to comprehend and navigate the multidimensional nature and complexity of issues.

This paper embarked on a comprehensive exploration of how Generative AI can function as a cognitive offloading tool to augment students' critical thinking abilities within college English writing courses. Initially, it delved into the pivotal role of critical thinking in college-level English writing, thereby establishing the imperative for the integration of Generative AI. Subsequently, it introduced the burgeoning applications of Generative AI within the realm of education, with a specific focus on its potential in writing instruction. Following this, the paper meticulously elucidated the mechanics of introducing Generative AI into English writing courses, shedding light on how it bolstered students' aptitude for profound thought and analysis. Finally, this paper scrutinized the repercussions of incorporating Generative AI into the educational milieu, scrutinizing the evolving roles of educators, and foretelling future trends in this innovative educational landscape.

## RESEARCH OBJECTIVES AND RESEARCH QUESTIONS

This paper aimed to explore how Generative AI could serve as a cognitive offloading tool to enhance students' critical thinking capabilities in college English writing courses. Here's a table presenting the research objectives and their corresponding research questions in this paper.

**Table 1: Research objectives and research questions of this paper**

| Research Objectives | Research Questions |
| --- | --- |
| 1) Outline an instructional framework for college English writing courses that integrates Generative AI. | 1) What does the instructional framework for college English writing courses incorporating Generative AI look like? |
| 2) Present and analyze three teaching cases illustrating the use of Generative AI in enhancing critical thinking in college English writing. | 2) How do specific teaching cases demonstrate the effectiveness of Generative AI in enhancing critical thinking in college English writing? |

| 3) Assess the impact of introducing Generative AI on the role of educators in the teaching process. | 3) How does the integration of Generative AI affect the roles of educators in college English writing courses? |
|---|---|

## LITERATURE REVIEW

### THE SIGNIFICANCE OF CRITICAL THINKING IN COLLEGE ENGLISH WRITING

In the contemporary era characterized by an abundance of information, critical thinking has become an indispensable core competency in college English writing. This aptitude entails not only discerning information but also represents a pivotal skill that guides students in thorough reflection, comprehensive analysis, and precise evaluation of issues. Critical thinking signifies not just questioning but also a purposeful, systematic mode of thinking that aids students in articulating their perspectives effectively in writing [3], while simultaneously enhancing their capacity to comprehend and respond adeptly to external challenges posed by information.

### Information explosion and information filtering skills

In the digital age, we are confronted with a deluge of information on a daily basis. However, the quantity of information does not equate to its quality. Students need to possess critical thinking skills to discern authentic and reliable information from false and misleading data. This ability is particularly crucial in college English writing because writing is not just about conveying thoughts but also supporting them with credible information and evidence. Critical thinking aids students in identifying and utilizing trustworthy sources while assessing the authenticity and effectiveness of information.

### Deep Thought and Multidimensional Analysis

Critical thinking demands that students delve beyond the superficial and engage in deep thought and multidimensional analysis. In college English writing, this implies that students should move beyond surface-level explanations and explore the essence of issues and the underlying causal relationships. Through deep thinking, students can better capture the complexity of problems, thereby presenting deeper insights and viewpoints in their writing. Moreover, the ability for multidimensional analysis enables students to examine issues from various perspectives, forming more comprehensive viewpoints.

### Logical Reasoning and Effective Expression

In college English writing, logic and effectiveness are paramount. Critical thinking cultivates students' logical reasoning abilities, enabling them to logically organize and present their thoughts. This not only enhances the persuasiveness of students' writing but also equips them to construct arguments and articulate viewpoints more effectively in practical applications. Through critical thinking, students can integrate logic and effective expression, producing higher-quality written work.

**THE APPLICATION OF GENERATIVE AI IN COLLEGE ENGLISH WRITING**
In college English writing courses, cultivating students' critical thinking is a challenging task. Students not only need to master writing skills but also understand the multifaceted nature of issues, think from different perspectives, and use appropriate arguments to support their viewpoints. However, the development of this ability often requires a substantial amount of time and rich experience. To address this challenge, generative AI, as an innovative cognitive offloading tool, is gradually becoming a focal point in the field of education.

**Functions and Advantages of Generative AI**
Generative AI is an artificial intelligence-based tool capable of simulating the creative thinking process of humans, generating various forms of text, viewpoints, and arguments [4]. Its application in college-level English writing is garnering increasing attention. It can provide feedback on grammar, spelling, and other aspects by analyzing students' writing content, thereby assisting students in improving their basic writing skills. More importantly, generative AI can generate diverse viewpoints and arguments, stimulating students to think deeply about issues and express richer thoughts in their writing. This functionality offers students an innovative thinking pathway, encouraging them to consider problems from different perspectives and thereby cultivating outstanding critical thinking skills.

**The Role of Generative AI**
In college English writing courses, generative AI serves as a beneficial auxiliary tool. Its role is not to replace students' thinking and creativity but to complement students' critical thinking, jointly advancing the development of writing abilities. Through generative AI, students can access viewpoints and arguments from different domains, better understanding the diversity and complexity of issues. Furthermore, generative AI can help students break free from thinking constraints, encouraging them to approach problems in new ways, thereby promoting deep thinking and innovative expression.

**Practical Applications and Teaching Strategies**
When introducing generative AI, teachers need to define appropriate teaching strategies. On one hand, teachers can guide students to use generative AI to generate viewpoints from different angles and then encourage them to select the most suitable arguments to support their viewpoints through comparison and evaluation. On the other hand, teachers can initiate classroom discussions based on the generated results from generative AI, stimulating students' critical and analytical abilities. Such teaching methods help integrate generative AI with students' thinking, making it an effective tool for fostering critical thinking.

**RELATED WORKS**
Generative AI writing systems hold promise for augmenting language acquisition by furnishing support and guidance to learners in the creation of second language (L2) texts. Hang Nguyen Thi

Thu explores EFL teachers' perspectives on the use of ChatGPT in writing classes at Van Lang University.The findings of the study reveal that EFL teachers perceive ChatGPT as a useful tool for enhancing students' writing skills and promoting creativity.However, some challenges are identified, such as the need for training and support in using ChatGPT effectively [5]. Wael Alharbi also mentioned that these AI writers offer valuable utility within language classrooms [6], analogous to calculators' historical application in mathematics education. Nevertheless, Aras Bozkurt posits that readiness for an impending AI-dominated future is imperative, given the profound transformative potential of generative AI technologies on pedagogical and learning paradigms, thus demanding novel cognitive approaches [7]. Moreover, ethical considerations must be integral to the design of AI supported writing instruction [8]. AD Puri, FXR Baskara employed a critical perspective on the use of ChatGPT, considering its advantages and limitations and the ethical and pedagogical implications of AI integration in education. Findings suggest that ChatGPT can provide a valuable resource for facilitating pragmatic competence development in global mobility contexts when combined with human-led instruction and interaction [9]. These measures ensure that AI systems comprehend and uphold the rhetorical milieu and ethical standards of communication [10]. Furthermore, AI holds the capacity to collaborate with human agents during creative undertakings and narrative construction. In light of AI, Ita Kennelly and Roisin Donnelly are developing a 5-stage writing and inquiry model that will help lecturers to support student academic writing and critical inquiry across multiple disciplines in higher education [11].

**METHODOLOGY**

The study began with an extensive literature review that established a theoretical foundation, focusing on critical thinking in English writing, the emergence of Generative AI in education, and existing AI-integrated instructional frameworks. Data were collected through surveys, interviews, and essay samples from educators and students experienced in Generative AI-assisted writing. Furthermore, the research involved the observation of Generative AI implementation in educational institutions, particularly its introduction into the curriculum and its impact on students' capacity for in-depth thinking and analysis. This comprehensive analysis culminated in the exploration of the instruction framework and three illustrative teaching cases that highlighted how Generative AI was integrated into college English writing courses and its effects on critical thinking development. Ultimately, the study aimed to shed light on the potential value of Generative AI in fostering critical thinking capabilities, offering fresh educational approaches, and anticipating future trends in enhancing students' critical thinking skills through technology integration.

**FINDINGS AND DISCUSSIONS**

## THE INSTRUCTIONAL FRAMEWORK OF GENERATIVE AI IN COLLEGE ENGLISH WRITING

This instructional framework, as shown in Table 2 below, presents a structured approach to college English writing courses, integrating Generative AI technology to enhance critical thinking skills [12]. The framework consists of three main phases:

(1) Preparation: This phase introduces essay topics and guides students in formulating clear and concise thesis statements, setting the foundation for their essays.

(2) Interactive Generative AI Activities: In this phase, students interact with the Generative AI to explore topics, develop arguments, gather evidence, structure their essays, and engage in the writing and revision process. The Generative AI plays a crucial role in providing guidance and support throughout these stages.

(3) Peer Review and Finalization: The final phase involves peer review sessions where students exchange essays and provide constructive feedback. It also includes revising essays based on feedback, reflecting on the learning experience, and emphasizing the importance of critical thinking in essay writing. This comprehensive approach leverages Generative AI to facilitate critical thinking development while enhancing the overall essay writing process.

**Table 2: Instructional framework of generative AI in college English writing**

| Phases | Steps | Activities |
|---|---|---|
| 1. Preparing for essay writing | Topic introduction and thesis statement | 1. Introduce the essay topic and provide relevant background information. 2.Instruct students to interact with the Generative AI to explore the topic 3.Instruct students to develop a clear and concise thesis statement. |
| 2. Interactive Generative AI activity and essay development | 1. Interactive Generative AI engagement | Instruct students to interact with the Generative AI for guidance on topic exploration, argument development, and evidence gathering. |
| | 2. Research and evidence gathering | Teach students how to critically evaluate sources, cite them properly, and avoid plagiarism, with the Generative AI providing assistance. |
| | 3. Essay structure and organization | 1. Provide guidance on structuring an essay, including the introduction, body paragraphs, and conclusion. 2. Instruct students to seek the Generative AI's advice on organizing their ideas and maintaining coherence throughout the essay. |

| Phases | Steps | Activities |
|---|---|---|
| | 4. Writing and revision Process | 1. Instruct students to draft their essays based on the developed thesis statement, supporting arguments, and gathered evidence.<br>2. Encourage self-reflection and revision, utilizing the Generative AI's feedback to improve their essay. |
| 3. Peer Review and Finalization | 1. Peer review and feedback | 1. Facilitate peer review sessions where students exchange essays and provide constructive feedback to their peers.<br>2. Encourage critical analysis and suggestions for improvement, while also utilizing the Generative AI's guidance in the process. |
| | 2. Final draft and reflection | 1. Instruct students to revise their essays based on the feedback received.<br>2. Allocate time for students to reflect on their learning experience, including the role of the Generative AI in enhancing critical thinking and writing skills. |
| | 3. Conclusion and wrap-up | 1. Summarize key concepts covered in the lesson and reinforce the importance of critical thinking in essay writing.<br>2. Allow students to ask questions, share insights, and provide final reflections on the lesson. |

The activities in the instructional framework were designed to build upon one another to foster critical thinking skills in writing English essays. This instructional framework delineated a step-by-step approach for fostering critical thinking in college English writing courses:

Phase 1: Preparing for Essay Writing. In this initial phase, students embark on their critical thinking journey. They delve into the essay topic by analyzing it from various angles and considering different perspectives. With the Generative AI's assistance, they craft a succinct and debatable thesis statement, honing their ability to formulate well-reasoned arguments.

Phase 2: Interactive Generative AI Activity and Essay Development. Firstly, students actively participate in dialogue with the Generative AI. They pose questions, receive prompts, and engage in discussions that stimulate critical analysis. This interaction encourages them to scrutinize information, explore multiple viewpoints, and refine their arguments. Secondly, The Generative AI plays a crucial role in guiding students through the critical evaluation of sources. It empowers them to select trustworthy and credible information, thereby nurturing their research and analytical skills. Thirdly, structuring their essays becomes an exercise in enhancing critical thinking.

Students learn to organize their ideas coherently, develop logical arguments, and maintain a clear flow. The Generative AI provides valuable guidance on structuring their thoughts, creating connections between paragraphs, and ensuring a well-structured essay. Fourthly, students engage in a reflective process where they assess their work alongside the Generative AI's suggestions. This iterative approach fosters critical thinking as they enhance the clarity, coherence, and depth of their arguments.

Phase 3: Peer Review and Finalization. Firstly, through peer review sessions, students engage in critical analysis of their peers'' essays. They identify strengths and weaknesses in the arguments and offer constructive suggestions for improvement, promoting both self and peer reflection. Secondly, students are encouraged to critically reflect on their own writing, the effectiveness of their arguments, and the overall development of their critical thinking skills. The Generative AI's consistent feedback and guidance throughout the process further enhance students' metacognitive awareness. Finally, the framework concludes by prompting students to reflect on their progress, summarize key concepts, integrate their learning, and contemplate the applicability of their honed critical thinking skills beyond the course.

All in all, this comprehensive approach, bolstered by the Generative AI's guidance, nurtures critical thinking at every stage of the essay writing process.

## THE TEACHING CASES OF GENERATIVE AI IN COLLEGE ENGLISH WRITING

Utilizing generative AI as a cognitive offloading tool can create a learning environment that encourages students to engage in deeper thinking [13]. By generating arguments that contradict their own viewpoints, students are compelled to contemplate how to counter these arguments, thereby strengthening their critical thinking. Furthermore, generative AI can provide diverse viewpoints, assisting students in conducting a more comprehensive analysis of issues.

### Generating contradictory arguments

Generative AI can generate arguments that contradict students' viewpoints based on their writing content [14]. This approach compels students to consider not only how to support their own perspectives but also how to effectively counter opposing viewpoints. Below is a specific teaching case demonstrating the role of generative AI in this process.

**Teaching Case 1:** Exploring the Impact of Technology on Society

In a writing task concerning the impact of technology on society, students are asked to elaborate on the positive effects of technology on people's daily lives, interpersonal relationships, and career prospects. The teacher initially guides students to explore the positive impacts of technology, such as convenient communication and access to information. Students are required to draft paragraphs about these influences. Subsequently, the teacher instructs students to use generative AI to generate arguments that contradict the positive effects they have proposed. Generative AI might produce arguments like, "Technology leads to reduced interpersonal interactions, as people tend to communicate through screens, lacking genuine social experiences." After receiving these

contradictory arguments, students need to analyze the reasonability of these arguments and contemplate how to effectively counter them. They must consider under what circumstances the mentioned issues might occur and find data or cases to support their counterarguments. Lastly, students must synthesize the positive effects with the contradictory arguments, demonstrating a comprehensive understanding and critical thinking regarding the issue. The whole process of this case is shown in Figure 1 below:
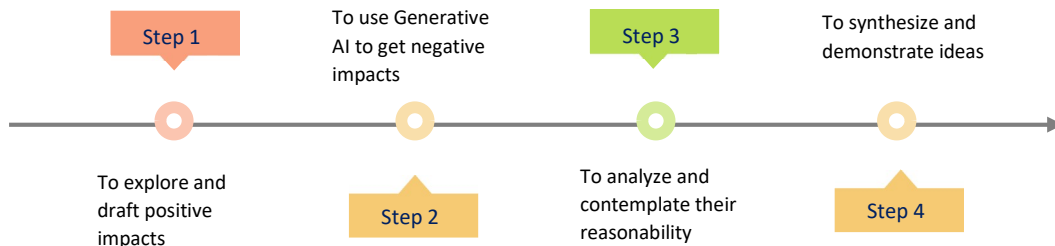
Figure 1: The process of Teaching Case 1.

Generative AI, as a cognitive offloading tool, assists students in breaking free from their cognitive frameworks, prompting them to think more deeply about the complexity of issues. During the process of analyzing and countering contradictory arguments, students develop critical thinking and debating skills while also gaining a deeper appreciation for the depth and soundness of their own viewpoints.

Providing support for diverse perspectives
Generative AI can also provide students with diverse viewpoints and arguments, expanding the breadth of their thinking on issues. When discussing complex topics, students may only consider a few perspectives, but generative AI can assist them in exploring more possibilities. By introducing different viewpoints, students can conduct a more comprehensive analysis of the issue, discover arguments with greater depth and breadth, and thereby demonstrate more critical and comprehensive thinking in their writing. Here is a specific teaching example highlighting the role of generative AI in providing support for diverse perspectives.

**Teaching Case 2:** Analyzing the Effectiveness of Environmental Policies
In a writing task concerning environmental policies, students are required to analyze and evaluate the impact of these policies on the economy, society, and the environment. The teacher recognizes that students may tend to emphasize the positive effects of environmental policies while overlooking potential negative impacts. To help students gain a more comprehensive understanding of the issue, the teacher decides to use generative AI to guide students in expanding their thinking. The teacher instructs students to begin by thinking from a positive perspective, analyzing the positive effects of environmental policies on improving air quality, reducing pollution, and so on. Next, the teacher asks students to use generative AI to generate arguments from different angles, such as how environmental policies might lead to layoffs in some companies

or how environmental measures could negatively impact certain industries. Students need to analyze these generated diverse viewpoints, consider their reasonability, and assess their potential consequences. They can incorporate real-world examples and data into their analysis to gain a more comprehensive understanding. Finally, students are required to synthesize the positive impacts with the generated diverse perspectives to present a balanced and comprehensive argument. The whole process of this case is shown in Figure 2 below:
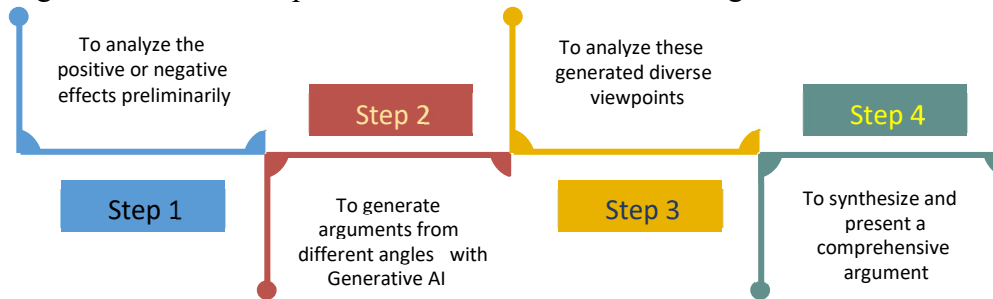


**Figure 2:** The process of Teaching Case 2.

Through this teaching example, students not only view environmental policies from a positive perspective but also understand and analyze potential negative impacts. Generative AI, as a cognitive offloading tool, provides students with various possible viewpoints, helping them expand the breadth of their thinking. Students, by analyzing the reasonability of different viewpoints, cultivate the ability to comprehensively analyze issues while enhancing their critical thinking and writing skill.

The Value of Inspiring Deep Thinking
Generative AI, as a cognitive offloading tool, not only provides technical support for college English writing but also plays a significant role in cultivating students' ability to think deeply. Below is a specific teaching example illustrating the role of generative AI in inspiring students' deep thinking.

**Teaching Case 3:** Exploring the Value of Cultural Diversity
In a writing task concerning cultural diversity, students are required to explore the value of cultural diversity to society and individuals. This topic involves complex issues related to cultural exchange, identity, and social integration, necessitating students to think deeply from multiple perspectives. Teachers can use generative AI as an auxiliary tool to guide students in engaging in deep thinking. First, the teacher encourages students to explore the contributions of cultural diversity to society, such as promoting cultural exchange and expanding people's horizons. Students are asked to write their understanding of cultural diversity. Next, the teacher instructs students to use generative AI to generate viewpoints from different standpoints, such as how cultural diversity might lead to social conflicts or threaten the preservation of traditional cultures. Generative AI provides students with arguments in favor and against. Students need to analyze these generated diverse viewpoints, consider their reasonability, and assess their potential

consequences. They can incorporate real-world cases and historical backgrounds into their analysis to gain a deeper understanding. In summary, in their writing, students need to integrate their own viewpoints with the generated diverse viewpoints to present a more comprehensive and in-depth argument. The whole process of this case is shown in Figure 3 below:
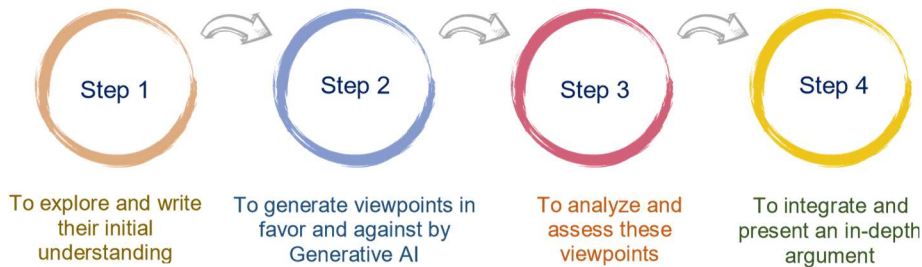


**Figure 3:** The process of teaching case 3.

Through this example, we can clearly see the role of generative AI in inspiring students' deep thinking. It helps students break free from cognitive limitations, examine problems from different dimensions, and cultivate their ability for in-depth analysis and creative thinking. Generative AI, as a guiding tool, creates a challenging and inspirational learning environment for students [15], effectively promoting their overall abilities in college English writing.

## THE TRANSFORMATION OF THE TEACHER'S ROLE

The introduction of generative AI has brought about a transformation in the role of teachers in college English writing courses. Traditionally, teachers primarily served as knowledge disseminators and correctors of errors in writing courses [16]. However, the application of generative AI requires teachers to take on more of a guiding role, guiding students in the development of critical thinking independently, as shown in Figure 4 below. This change in role has profound implications, affecting not only teaching methods but also positively influencing students' learning approaches.
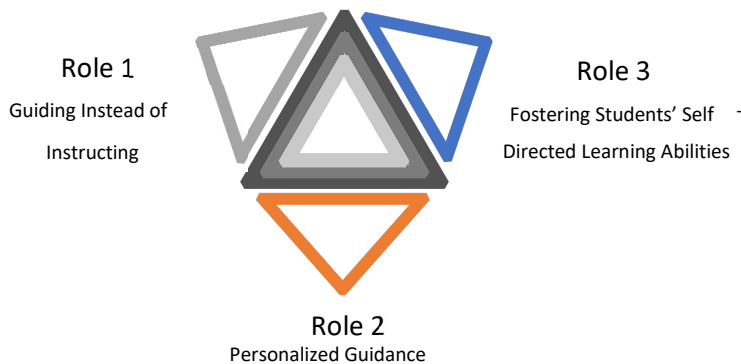


**Figure 4:** The teacher's roles in College English writing courses with Generative AI

**Guiding Instead of Instructing**

The introduction of generative AI has led to a shift in focus for teachers, emphasizing guidance over mere knowledge impartation. Teachers are no longer solely providers of information but are more like guides in the learning process. Teachers guide students on how to effectively use generative AI tools, how to analyze and evaluate generated viewpoints, and cultivate their critical thinking [17]. This guided teaching approach helps students actively explore and discover knowledge, enhancing their ability for self-directed learning. For example, in a course discussing argument structure, teachers can guide students in using generative AI to generate different arguments and pieces of evidence, then instruct them on how to select the most persuasive viewpoints, thus nurturing their argumentation skills.

**Personalized Guidance**

Generative AI can analyze the texts generated by students, identifying their writing characteristics and common mistakes [18]. Based on this analysis, teachers can determine which students have already mastered the basic knowledge and can be further challenged. Generative AI can provide these students with more complex and in-depth writing tasks [19], encouraging them to think more deeply and cultivate higher-level critical thinking skills. By analyzing the generated content, teachers can also discover students' interests and areas of strength, allowing them to provide more targeted guidance for in-depth research and thinking.

**Fostering Students' Self-Directed Learning Abilities**

Another aspect of the transformation in the teacher's role is the cultivation of students' self-directed learning abilities. The introduction of generative AI encourages students to explore and research actively, helping them develop the ability to independently acquire information, analyze problems, and solve difficulties [20]. Teachers, by sparking students' curiosity and independent thinking, foster their habits of active learning. For instance, in a research-oriented writing course, teachers can encourage students to use generative AI to collect relevant research papers and materials, then guide them on how to extract and integrate information, thus developing their information screening and integration skills.

**CONCLUSIONS**

The introduction of generative AI as a cognitive offloading tool in college English writing courses has opened up fresh possibilities for fostering students' critical thinking. By integrating generative AI with traditional writing pedagogies, educators can create a more creative and inspiring learning environment, thereby enhancing students' critical thinking abilities.

First, the fusion of generative AI with traditional writing pedagogies underscores the importance of diversity and innovation. Students not only gain fundamental knowledge and skills provided by traditional writing courses but also access various viewpoints and argumentation styles through generative AI. This integration enables students to think more flexibly, analyze arguments more profoundly, and cultivate richer and more comprehensive critical thinking.

Second, the introduction of generative AI creates an inspiring learning environment that encourages students to actively engage in the process of critical thinking. Through interaction with generative AI, students not only generate new modes of thinking but also broaden their perspectives while exploring various viewpoints and arguments. Such a learning environment sparks students' curiosity and thirst for knowledge, propelling them to think actively about issues and thus enhancing their critical thinking abilities.

Third, the application of generative AI extends beyond the enhancement of English writing skills to the overall development of students' capabilities. Through interaction with generative AI, students can improve not only their writing skills but also their abilities in information screening, logical analysis, and argumentation. This comprehensive development enables students to apply critical thinking more deeply and comprehensively across various domains.

With the continuous advancement and refinement of generative AI technology, its prospects in the field of education are increasingly promising. In the future, generative AI is expected to adapt more personalized approaches to meet students' learning needs, providing more precise feedback and guidance. Educators and students can collaborate to explore how to better utilize this tool, propelling the continuous enhancement of critical thinking skills among students.

In summary, the introduction of generative AI as a cognitive offloading tool injects new vitality into college English writing courses, offering students a more creative and inspiring learning approach.

Through creative integration, an inspiring learning environment, and the enhancement of comprehensive abilities, generative AI helps students cultivate critical thinking skills, enabling them to confidently and competently tackle the complex and ever-changing societal challenges of the future. All of this foreshadows a brighter future for the field of education with the assistance of generative AI.

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