

# Research on the Paths of AI-empowered Improvement of College Students' Critical Thinking Skills in English Reading

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**Abstract:** This paper aims to explore how artificial intelligence (AI) technology can effectively empower the improvement of college students' critical thinking skills in English reading. By analyzing the bottlenecks in cultivating critical thinking skills in current college English reading teaching, combining the characteristics and application scenarios of AI technology, it constructs a practical path of three-dimensional integration of "technology-teaching-competence", and puts forward countermeasures and suggestions for possible challenges. It is expected to provide theoretical reference and practical guidance for the reform of college English reading teaching.

**Keywords:** AI; College English reading; Critical thinking skills; Teaching paths

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## 1. Introduction

Global higher education attaches increasing importance to the cultivation of innovation and critical thinking, and critical thinking skills have become the core literacy of foreign language talents. With the rapid development of educational technology and artificial intelligence, how to use new technologies to help cultivate higher-order thinking skills has become an important topic in foreign language teaching reform.

## 2. Importance of cultivating critical thinking skills in English reading

Critical thinking skills include two aspects: critical thinking dispositions and critical thinking skills, among which analysis, reasoning, and evaluation are the core of critical thinking skills. Regarding critical thinking dispositions, Facione and his team point out that it is an inherent and continuous driving force for individuals to solve problems and make choices in the thinking process. Under this understanding, reading-based critical thinking specifically refers to in-depth thinking during reading, including the understanding and analysis of the author's intent, text logic, the meaning of words and sentences, and deep connotations. In addition, reading-based critical

thinking also requires readers to connect text content with their own experiences, realizing the transformation from language cognition to practical thinking and application. Jia Guangmao's research shows that cognitive linguistics can realize the natural combination of critical thinking skills and language abilities. Thus, reading-based critical thinking ability is a comprehensive ability based on general cognitive abilities, which involves fully understanding and in-depth thinking about words during reading. Wen Qiufang's localized framework has laid the foundation for domestic research, but traditional teaching is limited by large-class teaching and unified textbooks, making it difficult to conduct in-depth critical thinking training. Although some scholars have proposed principles for critical thinking teaching, the lack of technical support prevents teachers from accurately guiding students' critical thinking processes, forming practical difficulties<sup>[1-3]</sup>.

### **3. Technology-empowered cultivation of critical thinking skills: Integration exploration and research gaps**

The academic community has begun to explore the support of technology for higher-order thinking. For example, learning analytics technology can insight into cognitive processes, and intelligent writing prompts can promote critical thinking, but there are still deficiencies: first, most AI tools focus on language basics and do not target the core dimensions of critical thinking; second, technology application is mostly a "tool superimposition" model, failing to reconstruct a critical thinking-oriented teaching system; third, there is a lack of systematic integration path models. In short, existing research has laid the foundation for AI-empowered education, but in terms of cultivating college students' critical thinking skills in English reading, there is a lack of in-depth integration design of "technical functions-teaching activities-competence development". This study aims to make up for this deficiency, construct a three-dimensional integration path, and promote the transformation of AI from an auxiliary teaching tool to a promoter of critical thinking ability development<sup>[4]</sup>.

### **4. Paths of AI-empowered improvement of critical thinking skills in English reading**

Driven by the digital transformation of global higher education and the continuous updating of artificial intelligence technology, college English reading teaching urgently needs to break through the traditional teaching model focusing on language explanation, and realize the real improvement from single language skill transmission to higher-order critical thinking ability cultivation. Based on constructivist learning theory, cognitive development theory, and the Technology-Enhanced Learning (TEL) framework, this study systematically constructs a three-dimensional collaborative integration path of "technology-teaching-competence". Driven by an AI-based precise support system, taking a critical thinking-oriented reading teaching process as the practical carrier, and aiming at the formation of critical thinking literacy, it forms a complete education system through dynamic cooperation and circular feedback among the three. This path aims to solve the common "critical thinking deficiency" problem in current English reading teaching, that is, students pay too much attention to vocabulary and grammar while ignoring in-depth cognitive activities such as critical interpretation, logical analysis, and value judgment of texts<sup>[5,6]</sup>. Taking the text "Save the Earth, Save Life" from the 3rd edition of "New Horizon College English" Volume 2 as a teaching case, the following elaborates from three dimensions: technology empowerment, teaching reconstruction, and competence cultivation, hoping to provide operable reference for the reform of college English reading teaching in the era of artificial intelligence<sup>[7-9]</sup>.

## **4.1. Technical dimension: Constructing an AI system for precise empowerment**

The technical dimension is the core engine for the implementation of the path, realizing precise support through AI tools (such as Resophy) matched with teaching scenarios. Such tools adopt a front-end and back-end separation architecture, which can flexibly meet the needs of English reading teaching, and the local deployment model can ensure the security of learning data. Its core value is realized through three major teaching scenarios.

### **4.1.1. In-depth text analysis and bilingual adaptation**

Relying on the analytical ability of AI large language models, generate a bilingual comparison document of “Save the Earth, Save Life” to reduce the difficulty of language understanding; automatically extract the core viewpoint of “saving the earth means saving life, and protecting the environment is everyone’s responsibility”, and present the logical chain of “viewpoint-sub viewpoints (problems such as earth pollution/excessive resource development → joint response by enterprises/government/individuals) - arguments (Lego Group’s recycled plastic building blocks/global environmental protection policy cases)” with a visual mind map. At the same time, through in-depth text analysis, explore the implicit value orientation of “transforming from anthropocentrism to ecological symbiosis”, and generate critical thinking questions such as “why does the author emphasize individual environmental protection responsibilities?” and “how to improve the environmental protection countermeasures in the text combined with China’s ‘dual carbon’ strategy”, providing directions for critical reading.

### **4.1.2. Tracking and diagnosis of learning process data**

Using the built-in reading heat map, duration recording, and annotation collection functions of AI, real-time record students’ reading trajectories of “Save the Earth, Save Life” (such as short stay in the paragraph “harm of plastic pollution”), annotation content (such as shallow learning performance of only marking new words), and traces of answering critical thinking questions. By comparing preset critical thinking ability indicators through the analysis module, accurately identify core problems such as “weak argument evaluation” and “incoherent logical reasoning”, and generate personalized learning reports.

### **4.1.3. Customized feedback and training adaptation**

Relying on the open-source architecture of AI, teachers can customize a special training module for “Save the Earth, Save Life”: for students with “weak argument evaluation ability” in the learning report, push the “Guide to Evaluating the Effectiveness of Environmental Protection-themed Arguments” combined with text cases and 3 simplified bilingual texts on the same theme; after students complete the training, the system provides immediate feedback on the results, points out problems such as “failing to pay attention to the timeliness of arguments”, and pushes more complex texts through dynamic difficulty adjustment, realizing immediate feedback and training deepening relying on local reasoning capabilities, forming a closed-loop support chain of “analysis-diagnosis-feedback-improvement”.

## **4.2. Teaching dimension: Reconstructing a full-process teaching system oriented to critical thinking**

As an intermediary carrier connecting technology empowerment and competence generation, the teaching dimension is designed following the combined framework of Task-Based Language Teaching and Scaffolding Instruction. Taking “Save the Earth, Save Life” as a teaching case, it systematically reconstructs the three-stage teaching process of “pre-class driving-in-class internalization-post-class reflection”, realizing the organic unity of

the instrumental nature of AI technology and the humanistic nature of teaching<sup>[10-12]</sup>.

#### **4.2.1. Pre-class driving**

The pre-class stage adopts AI-supported personalized preview: with the help of AI text in-depth analysis tools, teachers assign basic tasks such as “sorting out the core arguments of ‘Save the Earth, Save Life’ + identifying environmental protection problem cases in the text” for students with weak foundations, and advanced tasks such as “analyzing the argumentative logic of the text + putting forward 1 critical thinking question related to campus environmental protection” for students with strong abilities.

After the preview, the platform automatically summarizes the critical thinking questions submitted by students using Natural Language Processing (NLP) technology, and identifies common class confusions through Topic Modeling, such as “difficulty in distinguishing surface environmental phenomena (such as plastic pollution) from deep institutional causes (such as the linear economic model)” and “ambiguous understanding of the dualism of economic rationality and ecological ethics in enterprises’ environmental governance motives”. These are intelligently integrated into the focus of classroom discussions, realizing the transformation of teaching difficulties from “experience-based preset” to “data-driven”.

#### **4.2.2. In-class internalization**

Classroom teaching adopts a triangular interaction model of “AI guidance-group discussion-teacher tutoring”. In the introduction session, teachers dynamically display the argumentative logic chain of the text “Save the Earth, Save Life” using the platform’s visualization components, and explain the common questions generated by AI by showing the analysis framework of “problem representation (What) → causal diagnosis (Why) → countermeasure construction (How)”. Subsequently, students are divided into groups to discuss the topics pushed by AI, such as: “When the author cites the Lego case, does he oversimplify the difficulties of enterprises’ green transformation?” and “If the Western environmental protection views in the text are placed in the context of global developing countries, what challenges does their universality face?” AI real-time transcribes group discussions through speech recognition and Semantic Role Labeling (SRL) technology, evaluates the quality of discussions using Argument Mining, and immediately pushes critical analysis including dimensions such as “cost-benefit analysis” and “stakeholder game” to groups that only stay at the level of “measure listing”. It visually displays the participation and logical rigor index of each group through the platform, providing a basis for teachers’ precise intervention. Based on the process evaluation data from AI, teachers tutor typical logical errors such as “false causality” and “slippery slope fallacy” in the discussions, guiding students to reflect on the thinking process itself, realizing the cognitive improvement from “knowing what” to “knowing how to think”.

#### **4.2.3. Post-class reflection**

Students are assigned after-class extension tasks such as “comparing the differences in argumentative logic between two texts”; the AI system analyzes students’ reports, and for students who “fail to support views with text arguments”, pushes the “Guide to Using Arguments in Critical Reports on Environmental Protection-themed Texts” and related extension resources; at the same time, guides students to write reflection journals with the help of AI feedback, recording their shortcomings in aspects such as “depth of case analysis” and “rationality of argument use”. Teachers regularly check the journals and provide personalized guidance to improve students’ critical thinking skills.

### **4.3. Competence dimension: Targeted cultivation focusing on core literacy**

The competence dimension is the core goal of the path implementation, focusing on two major dimensions: cognitive skills and emotional traits, and conducting targeted cultivation combined with the teaching practice of “Save the Earth, Save Life”<sup>[13,14]</sup>.

#### **4.3.1. Cultivation of cognitive skills**

In terms of cognitive skills cultivation, a complete training chain of “AI demonstration-practice-comment” is formed relying on AI technology and teaching activities: taking the cultivation of analytical ability as an example, the AI text analysis tool first demonstrates and displays the argumentative structure of the text “Save the Earth, Save Life”, marking “argument (saving the earth means saving life) - arguments (pollution cases/enterprise environmental protection cases/policy cases) - argumentative methods (example argumentation/total-subtotal-total structure)”; then students are asked to analyze extended texts on similar themes and independently sort out the argumentative structure; finally, combined with the students’ analysis reports generated by AI, teachers comment on typical problems such as “confusing sub-arguments with arguments (misjudging ‘harm of plastic pollution’ as a sub-argument)”, strengthening students’ text analysis ability. The cultivation of evaluation ability relies on classroom group discussions. In text teaching, the AI system pushes three types of text arguments supporting “effective individual environmental protection actions”, “limited individual environmental protection actions”, and “effective collaboration between enterprises and individuals”, guiding students to cooperate in groups to evaluate the timeliness (such as whether it is environmental protection data in the past 5 years), representativeness (such as whether cases cover different regions), and objectivity (such as whether there are stakeholders) of different arguments. Teachers’ tutor evaluation methods combined with the group evaluation process recorded by AI. The cultivation of inference and explanation ability focuses on after-class extension tasks. After students complete the task of “inferring future environmental protection trends based on the text”, the AI system evaluates the logic of their inferences, points out problems such as “failing to infer combined with the argument of ‘government policy guidance’ in the text”, and guides students to optimize logical expression.

#### **4.3.2. Cultivation of emotional traits**

In terms of emotional traits cultivation, the AI personalized learning environment is used to stimulate curiosity: for students concerned about environmental protection, the AI platform pushes the extended text “Youth-Led Environmental Movements” related to the text “Save the Earth, Save Life”, guiding them to actively explore relevant critical thinking questions; the spirit of questioning is cultivated through the design of critical thinking questions. In-text teaching, AI generates open questions such as “the text holds that ‘small individual actions can promote environmental protection’, do you agree? Please explain the reasons combined with campus environmental protection practice”, encouraging students to boldly put forward different views; an open mind is shaped through the push of multicultural texts. The AI system pushes different text interpretations of “division of environmental protection responsibilities” between China and the West (such as the West emphasizing individual responsibility and the East emphasizing collaboration), guiding students to respect diverse perspectives in group discussions, creating an inclusive critical thinking atmosphere, and ultimately realizing the coordinated development of cognition and emotion.

## 5. Effect evaluation system for path implementation

To comprehensively test the actual effect of the teaching path, a “technology-teaching-competence” trinity evaluation system is constructed, and a combination of quantitative and qualitative methods is adopted for comprehensive investigation. At the technical level, through questionnaires and teacher-student interviews, the usability, stability of AI tools and their real supporting role in teaching are evaluated; at the teaching level, relying on classroom observation and video analysis, focus is placed on whether the teaching process has been effectively reconstructed and whether students have achieved in-depth participation. Competence development is the core of the evaluation. Quantitatively, the Critical Thinking Skills Scale is used for pre-test and post-test comparison; qualitatively, through systematic analysis of students’ critical reports, classroom speeches, and reflection journals, the improvement of their thinking depth is carefully observed, and changes in students’ emotional traits are continuously tracked. Through the combination of multiple dimensions and methods, this system can comprehensively and truly reflect the overall implementation effect of the path of “technology empowerment-teaching reconstruction-competence development”. Such a multi-angle combination can more comprehensively reflect the actual effect of the entire teaching path<sup>[15]</sup>.

## 6. Conclusion

This study systematically constructs a three-dimensional integration path of “technology-teaching-competence” for AI-empowered improvement of college students’ critical thinking skills in English reading. Through the collaborative effect of the three major dimensions, the in-depth integration of AI technology and the cultivation of critical thinking skills in English reading are realized. This path accurately addresses the difficulties of traditional teaching and provides new ideas for the cognitive development of foreign language teaching in the intelligent era. In the future, it is necessary to continuously optimize technology application and teaching design in practice, continuously improve the adaptability and sustainability of the path, and help cultivate international critical foreign language talents.

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