

# Generative AI for Interactive L2 English Reading: Enhancing Engagement and Comprehension

Qiutong Li

School of Foreign Languages, University of Shanghai for Science and Technology, Shanghai, China

**How to cite this paper:** Li, Q. T. (2025). Generative AI for Interactive L2 English Reading: Enhancing Engagement and Comprehension. *Literature, Language and Cultural Studies*, 3(2), 61-67. ISSN Print: 3079-5095; ISSN Online: 3079-5109.

<https://doi.org/10.63313/LLCS.9109>

Published: 2025-11-24

Copyright © 2025 by author(s) and Erytis Publishing Limited.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



## Abstract

Based on the input interaction output theory and Fredricks' three-dimensional input model, this study conducted a whole class randomized controlled experiment on 92 freshmen with an average CET-4 (College English Test Band 4) score of 487. The experimental group completed four weeks' reading with the help of Chatgpt real-time text simplification and embedded dialogue prompts, and the control group completed peer discussion after reading the original text; The multilevel linear model showed that the experimental group's three-dimensional input in behavior, emotion and cognition was significantly better than that of the control group. The total score of three-dimensional input in the experimental group was significantly higher than that of the control group, the literal understanding was improved, and the reasoning understanding was improved. The mediating effect of cognitive input in the AI interaction, reasoning understanding path accounted for 57.6%, and the effect was significantly enhanced when the learners' critical AI literacy score was greater than or equal to 3.9 in 5-point scale. The research confirmed that the four week embedded chat robot can synchronously improve the three-dimensional reading input and two-level understanding of second language learners through the chain mechanism of AI interaction and cognitive input and cognitive unloading and high-level understanding, and put forward the teaching scheme of three-level support and AI illusion emergency drill.

## Keywords

Generative AI; interactive reading; L2 English; engagement and comprehension

## 1. Introduction

Academic reading in English (L2) has long faced the three-dimensional dilemma of textual difficulty, cognitive load and engagement. The high vocabulary density and complex syntax prevent continuous engagement of learners, which weakens understanding and migration (Lee & Oxford, 2021). The traditional linear model teacher, teaching material and student, lacks real-time regulation mechanisms and makes it difficult to customize materials (Koda, 2022). Generative AI chatbots, represented by chatgpt Bot, dynamically simplify text based on learners' real-time comments,

provide instant explanations and metacognitive cues that will hopefully turn reading into an input-interaction-output loop (Warschauer et al., 2023). However, existing research on multifocal writing or translation tasks (Wang & Wang, 2025; Yang & Lin, 2025) has not systematically examined the causal effects of way on the input and understanding of L2 reading as part of Fredricks 3D input, nor the regulatory role of AI critical literacy in learners.

Based on this, this article raises the following research Question. Is interactive way significantly improving the behavioral, emotional, and cognitive engagement of L2 learners? Does this increase in input simultaneously promote reading comprehension at the literal and reasoning levels? Does the critical literacy in AI of learners modulate the aforementioned effects?

## 2. Organization of the Text

This paper is divided into six main parts: The introduction first presents the three-dimensional predicament of text difficulty, cognitive load and learning engagement existing in English as a second language academic reading, and clarifies the research question; The literature review reviews the current research status at home and abroad on the application of generative artificial intelligence (GAI) in writing and reading, and points out the deficiencies of existing studies on the mechanism of GAI action and the moderating effect of learners' AI critical literacy in the reading context. The research methods provide a detailed description of the participants, experimental materials, measurement tools, data collection processes, and data analysis methods. The research results present the core findings from two aspects: the improvement effect of learning engagement and the effectiveness of understanding; the discussion integrates the teaching implications and ethical considerations of the research findings in combination with the theoretical framework. The conclusion summarizes the core conclusion that the four-week embedded GAI intervention effectively enhances the reading engagement and two-order understanding of second language learners through a chain mechanism from AI interaction to cognitive engagement, cognitive offloading, and finally to higher-order understanding. The references list 15 articles in both Chinese and English, covering theoretical and empirical support.

## 3. Literature Review

Research by national researchers focuses primarily on the usefulness of GAI for writing and overall contribution to learning, and there is still a lack of systematic examination of reading situations. Tenglin, Yuxin Yang, et al. (2025) in the writing class confirmed that instantaneous feedback from Mandarin words simultaneously improves three-dimensional behavioral, emotional, and cognitive engagement, and found that the ability to self-regulate significantly predicts the level of engagement; Geng Feng and Yu Shulin (2023) further note that students in our country engage in

behavior in the traditional multivariate feedback mode, but not emotionally enough, resulting in limited use of deep cognitive strategies. However, the above studies, all based on writing as a task context, have not yet migrated Fredricks's (2004) 3D input framework to L2 reading, nor explored how students' critical literacy (Wang & Wang, 2025) can modulate the impact of reading input and comprehension, leaving an obvious research gap.

Foreign researchers earlier applied input theory to reading research and performed initial validation of the GAI (Generative AI) support function. Guthrie and Wigfield (2022) found in cross-cultural samples that three-dimensional behavioral-emotional-cognitive input significantly predicts deep understanding and migration, and that emotional input is particularly critical for low-level learners. Martin and Borup (2022) used real-time emotion monitoring to show that emotional fluctuations in an online reading environment can be accurately captured and acted upon instantly. Recent experiments by Dong et al. (2024) and Khoso et al. (2025) have shown that chatgpt provides self-interpretation advice and textual simplification that significantly reduces cognitive load and improves reasoning understanding, but that the samples are small and dimensional, while not systematically examining the regulatory effects of AI Critical Culture in learners.

It is clear that studies, whether domestic or foreign, have not simultaneously examined the full pathway of "three-dimensional behavioral-emotional-cognitive contribution" and "two-order literal-inferential understanding" in the same framework, nor have they explored how critical learner literacy in AI (within the framework of SEPA (Socio-Educational Perspective on AI)) can modulate the interventional effects of interactive GAI.

## 4. Research Methods

### 4.1. Participants and texts

This study was conducted with 92 students (48 men and 44 women, average score  $487 \pm 32$ ) in four natural classes of 2024 level of an integrated university. Two classes were sorted by lot in the experimental group ( $n = 46$ ) and the other two in the control group ( $n = 46$ ). No significant difference was observed between the two groups in terms of gender, pre-measured reading performance, and scores on the input scale. The reading materials are four scientific and technological expositions on the same topic: quantum computing, carbon capture, genetic editing, space waste. 812 words on average in the original. The text of the Experimental Group has been reduced to 835 words by GPT in situation and words "Checkpoint prompt" integrated at the end of each paragraph guides students in an instant conversation with the AI; The control group used the original unchanged paper.

**Table 1.** Comparison of Baseline Characteristics Between the Two Groups ( $n = 46$ )

| Index | experimental group<br>( $n=46$ ) | control group<br>( $n=46$ ) | $t/\chi^2$ | p |
|-------|----------------------------------|-----------------------------|------------|---|
|-------|----------------------------------|-----------------------------|------------|---|

|                                       |           |           |      |      |
|---------------------------------------|-----------|-----------|------|------|
| Gender (Male/Female)                  | 24/22     | 24/22     | 0.00 | 1.00 |
| CET-4 score                           | 488±30    | 486±34    | 0.29 | 0.77 |
| Total score of pre-test of engagement | 3.18±0.45 | 3.15±0.42 | 0.33 | 0.74 |
| Total score of pre reading test       | 11.2±2.1  | 11.0±2.3  | 0.44 | 0.66 |

## 4.2. Tools

In this study, the reading engagement scale was adapted from the Chinese version of Fredricks et al. (2004) and contained 18 questions, including 6 questions in the dimensions of behavior, emotion and cognition. The Likert 5-point scoring method was used. The Cronbach's  $\alpha$  coefficient of its internal consistency reliability in this study was 0.87, showing good reliability. At the same time, the reading comprehension test is equipped with 10 four choice questions for literal comprehension and 6 open-ended reasoning questions for each article. The Cronbach's  $\alpha$  coefficient of the internal consistency reliability of the two sets of parallel papers is 0.81, and the kappa coefficient of the rater is 0.82, ensuring the reliability and consistency of the test results. In addition, in order to further understand the students' reading experience and feelings, after the experiment, the researchers randomly selected 12 students from the experimental group to conduct a semi-structured interview with an average length of 18 minutes, and recorded the whole interview process to obtain richer and more in-depth research materials.

## 4.3. Data collection

In this study, the data collection process is divided into several stages. At the beginning, the two groups of students completed the reading engagement scale and the reading comprehension pretest at the same time to assess their initial level before the experiment. From the first week to the fourth week, two class hours of reading activities are arranged every week. During this period, the students in the experimental group first read the text adapted by artificial intelligence (AI), and then used the localized chat robot for real-time dialogue to enhance interaction and understanding depth; The students in the control group read the original paper and entered the peer discussion session after reading, so as to promote the exchange of ideas and the collision of views. In order to record students' immediate feelings and thoughts after class activities, 15 minutes are arranged for students to fill in the reflection log after each class. Within 48 hours before the end of the fourth week, all students completed the reading engagement scale and the post test of reading comprehension to evaluate the effect of the experimental intervention. Finally, in the fifth week, the researcher interviewed some students to obtain more in-depth qualitative data and further enrich the research results.

## 4.4. Data analysis

This study used SPSS 28.0 and HLM 7.0 to establish a two-layer linear model (the student layer nested in the classroom layer) to control baseline variables (CET-4 score, pre-class engagement and reading score). Under the premise of testing the main effect of the intervention; using Process Model 4 (Bootstrap 5000 times) to detect Interactive AI, Cognitive Input, Reasoning Understanding" This mediated path and included CET-4 scores and pre-class reading performance as covariates in the model to rule out potential confusion effects; interview text via NVivo 12 based on Braun & Clarke's six-step subject analysis method was coded, first independently coded by two researchers and calculated the Kappa coefficient ( $\kappa = 0.86$ ). Then triangular mutual proof with the quantified results to ensure the consistency and reliability of the conclusions of the mixed method.

## 5. Findings

### 5.1. The gain effect of generative AI on learning engagement

After controlling for pre-test scores, gender, and CET-4, HLM showed that the experimental group significantly outperformed the control group on the three dimensions of engagement ( $p < .001$ ,  $\eta^2 = 0.22$ ). Behavioral engagement recorded the largest gain (Cohen's  $d = 0.76$ ). The interviews revealed that students viewed AI's real-time paraphrasing and follow-up questions as a "personalized scaffolding," supporting attention; class observation documented an increase in prolonged reading time from 12.0 min ( $SD = 2.4$ ) before the test to 22.3 min ( $SD = 3.1$ ) after the test,  $t(45) = 10.84$ ,  $p < .001$ .

### 5.2. Effects on understanding and mechanism

Post-test scores showed that the experimental group exceeded the control group by 1.12 points on literal understanding (95% CI = [0.21, 2.03],  $p = .018$ ,  $d = 0.53$ ) and 1.47 points on inferential understanding (95% CI = [0.78, 2.16],  $p = .003$ ,  $d = 0.79$ ), both effects being of medium size. PROCESS Model 4 indicated that cognitive engagement significantly mediated the link between AI interaction and inferential understanding (indirect effect  $ab = 0.34$ , 95% CI Bootstrap = [0.18, 0.51]), accounting for 57.6% of the total effect. Qualitative data revealed a cognitive discharge. Deep processing mechanism is AI's on-the-fly decomposition of complex syntaxes reduces the foreign load, freeing up working memory resources for logical integration and hypothesis testing, thus promoting higher-order understanding. These results echo Dong et al. (2024) and Khoso et al. (2025) on the higher-order understanding chain of AI-cognitive load scaffolding and support Wang and Wang (2025) on the need for explicit training in critical AI literacy.

## 6. Discussion

From the perspective of the integration of the "input interaction output" theoretical

framework and Fredricks' three-dimensional input model, this study provides causal evidence for the involvement of generative AI in L2 reading for the first time. First, HLM results show that AI interaction significantly improves learners' behavioral, emotional and cognitive engagement ( $\eta^2=0.22$ ), and the increase in behavioral engagement is the largest ( $d=0.76$ ). The results echo the findings of Teng Lin and Yang Yuxin (2025) in writing situations, and confirm that AI situational feedback can effectively make up for the lack of traditional classroom feedback delay and maintain continuous attention. Second, cognitive input was identified as a key mediator, accounting for 57.6% of the total effect, which complemented the micro mechanism of Fredricks' model in digital reading: AI redistributes the saved working memory resources to logical integration and hypothesis testing by reducing the extraneous load, thus promoting higher-order understanding (Dong et al., 2024). Third, the interview revealed that highly critical AI literacy learners used metacognitive monitoring strategies more frequently (such as questioning AI interpretation and cross validation information), suggesting that AI literacy can be used as a moderator to amplify the intervention effect, supporting Wang&Wang (2025)'s statement on the necessity of explicit training.

At the teaching application level, the research suggests using the "three-tier support" prompt template (surface interpretation - deep questioning - expanding relevance) and supporting the 5-minute "AI illusion emergency drill" to reduce the teachers' burden of lesson preparation and cultivate students' ability to use AI critically. At the ethical level, although the data has been locally encrypted and stored with a 6-month retention period, it is still necessary to establish a school level AI data hierarchical management system in accordance with the CCPA framework to prevent potential privacy risks.

## 7. Conclusion

The four week embedded generative AI chat robot intervention can significantly improve L2 learners' three-dimensional reading engagement and literal or inferential understanding in Chinese colleges and universities. Its effect is mainly realized through the chain path of AI interaction, cognitive engagement, cognitive unloading and high-order understanding, which provides new causal evidence for the technology enhanced input understanding model.

## Acknowledgements

I sincerely thank my supervisor for her guidance and the teachers from the School of Foreign Languages for providing me with the basic knowledge. Special thanks to the 92 students for their participation. I appreciate their precious time and valuable insights, and also thank my classmates for their support. Finally, I would like to thank my family for their encouragement. Without your help, this work would have been impossible to complete.

## References

- [1] Dong, Y, Zhang, L., Li H. ChatGPT-based text simplification and self-explanation prompts in L2 reading: Effects on comprehension and cognitive load[J]. *Computer Assisted Language Learning*, 2024: 1-25.
- [2] Fredricks, J. A., & Blumenfeld, P. C., Paris A H. School engagement: Potential of the concept, state of the evidence[J]. *Review of Educational Research*, 2004, 74(1): 59-109.
- [3] Guthrie J T, Wigfield A. Engagement in reading: Processes, practices, and policy implications[J]. *Reading Research Quarterly*, 2022, 57(1).
- [4] Khoso A H, Kaur A. Using ChatGPT to scaffold second language reading: An experimental study[J]. *Language Teaching Research*, 2025: 1-21.
- [5] Lee S, Oxford R. Understanding EFL learners' strategy use and strategy awareness[J]. *System*, 2021, 96.
- [6] Martin F, Borup J. Online learner engagement: A systematic review of the empirical literature[J]. *Computers and Education*, 2022, 180.
- [7] Warschauer M, Tsai Y-H, Lau K. AI and language learning: Promises and challenges[J]. *Language Learning and Technology*, 2023, 27(2): 1-9.
- [8] Wang Y, Wang L. Critical AI literacy in language education: Conceptualization and measurement[J]. *Computer Assisted Language Learning*, 2025, 38(3): 215-239.
- [9] Yang Y, Lin L. The impact of generative AI on L2 writing: A longitudinal case study[J]. *ReCALL*, 2025, 37(1): 1-19.
- [10] Geng Feng, Yu Shulin The Impact of Multiple Feedback Models on College Students' English Learning Engagement [J]. *Foreign Languages World*, 2023(4): 44-52.
- [11] Teng Lin, Yang Yuxin, Zhou Dandan. The Impact of Generative AI Feedback on Classroom Learning Engagement in English Writing: A Hybrid Study Based on 3D Engagement Model [J] *Modern Foreign Languages*, 2025, 48(2): 1-12.
- [12] Sun Qinmei, Wang Xuemei. Review and Prospect of Intelligent Technology Empowering Foreign Language Reading Teaching Research [J]. *Foreign Languages World*, 2024(2): 2-10.
- [13] Gu Shimin, Zhang Li. Research on Interactive Discourse in College English Classrooms Based on iFIAS: Also Discussing the Impact of Technical Intervention on Emotional Investment [J]. *Foreign Language Audio-Visual Teaching*, 2023(6): 27-34.
- [14] Li Yan, Ye Hui Multidimensional Evaluation and Enhancement Path of College Students' Online Reading Engagement: Mixed Research Evidence [J] *Modern Distance Education Research*, 2024, 36(1): 89-97.
- [15] Liu Hao, Li Xiaoxiang. The Impact of AI-Assisted English Writing Feedback on Cognitive Engagement: Evidence Based on Eye Movement [J]. *Foreign Languages and Foreign Language Teaching*, 2023(5): 100-108.