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Impact of ChatGPT on English Academic Writing Ability and Engagement of Chinese EFL Undergraduates

Hao Hongxia

Universiti Putra Malaysia (UPM), Malaysia, haohongxia.tesl@gmail.com

Abu Bakar Razali

Universiti Putra Malaysia (UPM), Malaysia, abmr_bakar@upm.edu.my

Although Chinese undergraduate students majoring in English as a foreign language (EFL) need to master English academic writing, they still have some challenges in learning English academic writing. ChatGPT has gradually been applied to academic writing, which play an important role in improving students' academic writing. Therefore, the purpose of this study is to explore the impact of ChatGPT as an AI tool on English academic writing ability and engagement of EFL undergraduate students in a private university in China. This study used quasi-experimental and survey questionnaire to study 70 third-year undergraduate students (experimental class=34, control class=36) majoring in English. The data were analyzed by independent sample t-test, paired sample t-test and descriptive analysis. The results revealed that ChatGPT can improve students' English academic writing ability in content, structure and coherence, grammar, linguistic range, vocabulary, spelling, and form. Furthermore, most students (>60%) believed that ChatGPT has a positive impact on their engagement in English academic writing in terms of affective engagement, cognitive engagement, social engagement, and behavioral engagement. Implications and recommendations for EFL academic writing are proposed at the end of this article.

Keywords: English academic writing, EFL, ChatGPT, writing ability, engagement

INTRODUCTION

English academic writing plays an irreplaceable role in academic research and has become an important way to participate in international academic exchanges. The Chinese National Medium- and Long-Term Education Reform and Development Plan (2010-2020) emphasizes that universities should cultivate international talents, English academic writing plays an important role in it. The English Teaching Syllabus for English Majors in Chinese Higher Education Institutions also puts forward strict requirements for English academic writing courses. The course "English Academic Writing" is an important way to cultivate English academic writing skills for Chinese English majors. However, many EFL students still face problems in their writing, such as vocabulary errors, punctuation errors, grammatical errors, sentence structure errors,

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chaotic structure, inappropriate academic expression, lack of motivation, interest, confidence, engagement and effective feedback (Li, 2023; Xu, 2012; Yu, 2014; Yu et al., 2011). To improve the academic writing skills of English majors and enable students to engage more actively in international academic exchanges, English majors's learning are listed as a top priority to adapt to the development of the situation (Xue, 2018).

However, there are urgent issues that need to be addressed to improve Chinese EFL students' English academic writing, such as vocabulary errors, punctuation errors, grammatical errors, sentence structure errors, confusing structures, inappropriate academic expressions, Chinglish expressions, lack of motivation, confidence and engagement (Yu, 2014; Yu et al., 2011). Under the traditional English academic writing teaching method, Chinese EFL undergraduates passively acquire knowledge in class, lack the ability to actively analyze and think about problems, and lack the creativity and critical thinking of English academic writing (Yuan, 2019). Traditional teacher-centered teaching methods often make it difficult for students to maintain their interest and motivation in learning throughout the writing process, resulting in students being out of writing and poor writing results (Wu, 2019). Therefore, most Chinese EFL undergraduates are not very enthusiastic about English academic writing, and even have a fear of difficulty. Students with different language expression abilities show different degrees of embarrassment (Xue, 2023). Chinese EFL undergraduates lack self-motivation factors or autonomous motivation to carry out academic writing. Chinese EFL undergraduates often use informal language in their English academic writing to make their writing colloquial, which results in their writing not conforming to the norms of academic writing (Xu, 2012).

Chinese teachers also face various challenges in teaching English academic writing. Chinese university EFL classroom teaching is generally large-class teaching. Teachers have limited time and energy, which leads to very limited feedback on students' academic writing, and it is difficult to ensure that every student can be given immediate feedback in class (Li, 2023). The academic writing textbooks used by teachers have limited knowledge, and the relevant academic vocabulary and expressions cannot cover a wide range, which is far from enough for students taking the English major's College English Test Band 4 (CET4), College English Test Band 8 (CET8), International English Language Testing System (IELTS), Test of English as a Foreign Language (TOEFL), and Pearson Test of English Academic (PTE) exams (Xue, 2023). The teacher's single feedback method and teaching methods make students lose their classroom engagement and interest (Bao et al., 2021; Xu et al., 2020). Based on the above problems faced by Chinese EFL undergraduates and teachers in English academic writing, it is an urgent problem for researchers to explore more effective methods to improve students' English academic writing ability and engagement.

Artificial intelligence (AI) tool, such as ChatGPT has become a popular educational tool and method to be applied in the field of foreign language education (Ghafar, 2023). ChatGPT can respond to queries and provide feedback on language use, which makes its interaction with people more complex (Nazir & Wang, 2023). In recent years, the academic community has different views on whether to apply ChatGPT to the field of

college English writing education (Yuan & Sawaengdist, 2024). Most studies focus on the opportunities and challenges that ChatGPT brings to ESL/EFL learners' academic writing and learners' views on ChatGPT (Bok & Cho., 2023; Han et al., 2023; Harsyah, 2024; Imran, 2023; Liu, 2023; Marzuki et al., 2023; Wu, 2024; Zebua & Katemba, 2024; Zhang et al., 2024; Zhao et al., 2024). Some studies have explored the potential of ChatGPT in academic writing, and these studies have shown that ChatGPT has a positive impact on students' English academic writing ability. It can provide students with instant writing help and feedback, such as writing suggestions, vocabulary suggestions, paragraph organization, grammar correction to improve writing quality (Bok & Cho, 2023; Ghafouri et al., 2024; Han et al., 2023; Marzuki et al., 2023; Su & Yang, 2023; Wu, 2024). However, these studies mainly focus on vocabulary, paragraphs, grammar, and few research is conducted from the content, form, structure and coherence, grammar, linguistic range, vocabulary and spelling in the PTE writing test. There are also studies that show that integrating technology-enhanced learning methods (such as ChatGPT) can enhance students' engagement in writing tasks (Bašić et al., 2023; Baskara, 2023; Yan, 2023a; Zheng & Zhan, 2023). The research is needed in China on whether using ChatGPT for teaching can improve students' engagement in academic writing classes (Zhao et al., 2024; Roy & Swargiary, 2024), and most of the research focuses on public universities (Li, 2009; Liu, 2023; Wang, 2024), while research on private universities in China is very limited.

ChatGPT has potential value in English academic writing classes (Synekop et al., 2024). Therefore, this study has profound significance for teachers, students, courses and policies. This study not only provides a more efficient teaching tool for teachers to teach academic writing, but also reduces the work pressure of teachers, to improve the classroom atmosphere and efficiency. This study provides students with timely and personalized feedback, which can not only improve English students' English academic writing ability and engagement, but also improve their self-regulation learning. This study also provides curriculum and education policy makers with specific cases of ChatGPT application in the classroom, which can further promote the reform of English academic writing classrooms and the introduction of relevant policies. This helps to enrich the theory of English academic writing teaching and make up for the deficiencies of previous research.

Based on the above mentioned, the current status of teaching and learning of English academic writing in China, gaps in literature research, and practical implications of this study aims to explore the impact of ChatGPT as an artificial intelligence assistant on the English academic writing ability and engagement of Chinese EFL private undergraduates. The research questions of this proposed study are:

- (1) What is the impact of ChatGPT on Chinese EFL private undergraduates' English academic writing ability in terms of content, structure and coherence, grammar, linguistic range, vocabulary, spelling, and form?
- (2) What is the impact of ChatGPT on Chinese EFL private undergraduates' engagement in English academic writing?

Literature Review

English academic writing has great potential for the development of scientific knowledge and the success of research work in the context of globalization of higher education (Azmar & Razali, 2024; Xie & Sun, 2024). Recognizing the importance of English academic writing to global academic exchanges, higher education institutions pay more attention to students' English academic writing. English academic writing needs to be carefully considered to make it academic, readable and rigorous. Academic writing is one of the skills that undergraduates must master in university, and it is an important way to shape students' thinking and expression (Mlundi, 2024). Undergraduates need to understand various forms of writing, have clear writing logic to organize their thoughts and ideas, and express their meaning appropriately according to the norms of the specific academic area they belong to (Flowerdew, 2000; Johns, 2008). English as a global academic lingua franca has attracted great attention from the academic community. EFL learners in higher education in China often encounter challenges such as limited language knowledge and low engagement in academic writing (Han, & Hyland, 2015; Yu et al., 2019; Zheng & Yu, 2018). Although EFL students have acquired relevant language knowledge in class, they may have difficulty applying it during English academic writing tasks (Budjalembe & Listyani, 2020). Some students have a negative attitude towards English academic writing and find it difficult to engage in the writing process (Wu & Paltridge, 2021; Zhang & Zhang, 2021; Zhang et al., 2024). Students who do not receive effective feedback on their English academic writing may not be able to improve their writing skills (Yu & Liu, 2021).

ChatGPT has received widespread attention and has developed rapidly around the world. It distinguishes itself from earlier AI tools with its advanced generative pre-trained Transformer technology, which enables it to generate highly original and coherent texts across a wide range of queries and tasks, far exceeding chatbots in terms of versatility, depth of understanding, and application potential (Bhattacharya et al., 2024; Hadi et al., 2024). ChatGPT provides a revolutionary method for English academic writing, especially in the context of higher education (Atlas, 2023; Imran & Almusharraf, 2023). ChatGPT can provide timely and personalized support, guidance and feedback for EFL learners' English academic writing, enhance learners' independence and autonomy in learning, adapt to learners' rhythm and style, and thus improve learners' interest and engagement (Maghamil & Sieras, 2024; Wang, 2024; Zhao et al., 2024). Chinese EFL college students' writing skills had been significantly improved under ChatGPT, in terms of ideas, organization, coherence, sentence structure, grammar and vocabulary (Hong, 2023; Liu et al., 2024; Song & Song, 2023; Wang, 2024; Wu, 2024). ChatGPT has great potential in improving the interest and engagement of Chinese EFL learners in English academic writing (Li et al., 2024). Although ChatGPT plays a huge role in Chinese EFL English academic writing, it also faces some challenges (Xu & Jumaat, 2024). Chinese EFL learners may rely too much on ChatGPT in their writing (Ghafar, 2023; Yuan & Sawaengdist, 2024), which may damage their creativity, autonomy, and critical thinking, and thus their writing ability (Du & Alm, 2024; Hong, 2023; Lai, 2024). Chinese EFL learners face problems such as inaccurate data and text generated by ChatGPT (Yang, 2024; Yuan & Sawaengdist, 2024). ChatGPT feedback is lengthy and complex, which reduces students' enthusiasm and engagement (Li et al., 2023; Shen, 2024).

ChatGPT has great potential in improving the students' writing ability and engagement. Studies have shown that using ChatGPT for writing can help students improve their writing quality and ability (Han et al., 2023; Faiz et al., 2023; Su & Yang, 2023; Zhu et al., 2024; Wu, 2024; Marzuki et al., 2023; Bok & Cho., 2023; Yilin et al., 2024). 85% of students believed that ChatGPT had development potential for academic writing performance (Han et al., 2023). ChatGPT can provide students with instant writing help and feedback, such as writing suggestions, vocabulary suggestions and grammar and punctuation corrections, to improve writing quality (Faiz et al., 2023; Su & Yang, 2023; Zhu et al., 2024). ChatGPT can provide students with specific ideas, content and organization thereby improving their writing quality (Marzuki et al., 2023; Wu, 2024). Additionally, there are also related studies showing that using ChatGPT for writing can help students improve their writing self-efficacy and engagement (Zhao et al., 2024; Roy and Swargiary, 2024; Song & Song, 2023; Woo et al., 2024; Bouzar et al., 2024; Ghafouri et al., 2024). By using ChatGPT, students' learning engagement in writing classes can be greatly improved (Roy and Swargiary, 2024; Woo et al., 2024; Zhao et al., 2024). ChatGPT improved writing self-efficacy by providing continuous feedback and cultivating a sense of achievement, and self-efficacy was positively correlated with long-term engagement in ChatGPT (Bouzar et al., 2024; Ghafouri et al., 2024; Kung et al., 2023).

Although ChatGPT has great potential in academic English writing, there are also related challenges. Challenges of integrating ChatGPT into language teaching include over-reliance on AI, cultural and contextual misalignment, language accuracy issues, impact on creativity, technical barriers, and ethical considerations (Alsaedi, 2024; Hieu, 2024; Liu, 2023; Salvagno et al., 2023). There are some challenges in using ChatGPT, such as lack of error descriptions, difficult to understand feedback, inconsistent responses, concerns about reduced authorship, and uncertainty about learning effects (Bok & Cho, 2023). Moreover, students are prone to over-reliance on ChatGPT, which may cause students to lose their ability to think independently (Juan et al., 2023). The lack of critical thinking may lead to the risk of perpetuating or expanding existing biases and inaccuracies in the data, thereby providing unfair results and hindering scientific development (Cardon et al., 2023; Hong, 2023; Imran, 2023; Van et al., 2023). Furthermore, ChatGPT still has limitations in academic terminology and accuracy (Basić et al., 2023; Wu, 2024). ChatGPT-assisted writing may rely on the user's previous knowledge and skills, which in some cases may cause confusion for inexperienced users, resulting in poor writing performance (Kusuma et al., 2024). Language models may produce unreliable and inaccurate research data, and that texts generated by ChatGPT may contain a large number of errors (Van et al., 2023; Garaady & Mahyoob, 2023).

ChatGPT in academic writing are diverse, with most studies showing that students have positive or mixed views on the application of ChatGPT in academic writing classes, while some studies show that learners hold negative or neutral opinions on ChatGPT. Most students (84%) did not think that using ChatGPT violated academic integrity, and they think it should be integrated into writing classes (Putra, 2023). 80.2% of students showed cautious, rational and optimistic characteristics, among which active embracers showed significantly higher ChatGPT intentions (Zhang et al., 2024). Students had high

literacy and positive attitudes in using ChatGPT (Bibi & Atta, 2024; Harsyah, 2024; Mahapatra, 2024). However, there are also studies that show that learners have negative or neutral opinions about ChatGPT. Some students (37.50%) were neutral about ChatGPT's ability to provide explanations that can improve writing skills (Zebua & Katemba, 2024). Most students appreciated ChatGPT and were neutral about it replacing teachers (Wang, 2024). ChatGPT reduced students' creativity and limited their affective growth (Bin-Hady et al., 2024). Most students were not very positive about using AI writing tools (Bulante et al., 2024). These views reflect the complexity of students' relationship with ChatGPT, affecting their acceptance or resistance to its incorporation into academic writing (Chan & Hu, 2023). Therefore, based on reviewing previous research results and filling research gaps, this study aims to explore the impact of ChatGPT as an AI assistant on the English academic writing ability and engagement of Chinese EFL private undergraduate students.

Theoretical Framework

Constructivism explains how learners acquire knowledge based on their personal experiences, beliefs and attitudes (Bada & Olusegun, 2015). Constructivism believes that knowledge is a process of creating and discovering knowledge, as well as thinking, analyzing, reflecting, understanding, applying and collaborating (Applefield et al., 2000). It emphasizes student-centeredness, and students need to actively discover, understand and construct knowledge, and actively apply knowledge (Kurteš & Kopytowska, 2014). This theory fits seamlessly with the personalized feedback function of ChatGPT, thereby improving learners' language skills. Learners' knowledge can only be constructed and internalized when they communicate and negotiate with others (Vygosty, 1978). The basic principle of constructivism requires students to adjust cognitive functions and form an understanding of existing knowledge structures from existing knowledge (Piaget, 1977). Based on the theory of constructivism, this study allows learners to reconstruct their cognitive systems based on their existing knowledge and learn academic writing based on ChatGPT feedback. Through interaction with ChatGPT, students' writing ability and engagement would be developed and improved.

Engagement theory focuses on experiential and self-directed learning. Students are motivated to learn because of the meaningfulness of the learning environment and activities, provided that students must engage in the course to achieve effective learning. Engagement is a state of engagement in learning in which students have above-average skill levels and experience, as well as task-related interests (Reinders & Nakamura, 2021). Student can improve their engagement, including time, energy, interests, learning strategies and even creative thinking that students invest in technology learning environments. Engagement is divided into four dimensions: cognitive engagement, behavioral engagement, affective engagement and social engagement (Wang et al., 2016). Using ChatGPT large classes gives students the opportunity to receive timely feedback, which changes their learning behavior and makes them more engaged (Tomović, 2021). To this end, ChatGPT provides experiential and self-directed learning opportunities, which will promote students' cognitive, behavioral, affective, and social engagement in English academic writing classes.

METHOD

This study adopted quasi-experimental and survey questionnaire, to collect and analyze data to explore the impact of ChatGPT as an artificial intelligence assistant on the academic writing ability and engagement of 70 EFL private undergraduate students majoring in English in China.

Participants

The participants of this study were 70 third-year students majoring in English from two classes in private EFL universities in China. The students were aged between 18 and 22 years old, of which 59 were female participants, accounting for 84.3%, and 11 were male participants, accounting for 15.7%. This study is conducted in the English academic writing course in the second semester of the 2023/2024 academic year. The two classes were divided into two different groups: the first group ($n=34$) was the experimental group, which used the ChatGPT feedback method, while the second group ($n=36$) was the control group, which only used the traditional feedback method. The entire study lasted for one semester, i.e., 16 weeks of courses, for a total of 32 hours (45min/hour). The sampling procedure for selecting participants in this study was a random sampling. The researchers randomly selected two classes from the 9 classes of the third year of English major in the school for research (this course is only offered to students in the third year of English major). Before the study, the researchers found that the English academic writing ability of students in both classes was similar through observation and pre-test.

Procedure and Interventions

EC students studied for 16 weeks with ChatGPT feedback. Before the intervention, the researchers conducted an academic writing pre-test on EC students to assess students' academic writing ability in content, structure and coherence, grammar, linguistic range, vocabulary, spelling, and form. The researchers also conducted a training of ChatGPT in academic writing for students, such as how to make efficient revisions in grammar, content, etc. based on ChatGPT feedback. Moreover, the teacher assigned students writing tasks related to academic topics every week (weeks 1-16), used ChatGPT to conduct writing feedback, and let students interact with ChatGPT on problems in their academic writing. The teacher provided additional feedback based on the output generated by ChatGPT, and students could revise their writing based on ChatGPT feedback and teacher feedback. Moreover, after the intervention, the researchers conducted an academic writing post-test and questionnaire on EC students to measure whether their academic writing ability and engagement had been improved.

CC students studied for 16 weeks with teacher feedback. Before the intervention, the researchers conducted an academic writing pre-test on EC students to assess students' academic writing ability in content, structure and coherence, grammar, linguistic range, vocabulary, spelling, and form. In addition, teachers assigned students writing tasks related to academic topics every week (weeks 1-16), and teachers provided written feedback to students on the structure, grammar, vocabulary, etc.. Students revised their writing based on the teacher's feedback. After the intervention, the researchers

conducted an academic writing post-test on EC students to measure whether their academic writing ability had been improved.

Data Collection

This study aims to explore the impact of ChatGPT as an AI assistant on the English academic writing ability and engagement of Chinese EFL private undergraduate students. Therefore, the data collection method was carried out through pre-test, post-test, and questionnaire. Before the experiment begins, the researchers used the pre-test method to explore the English academic writing ability of the two classes is similar before the study. After the experiment, the researchers used post-test method to explore the changes in English academic writing ability of students in the two classes under different feedback methods. The pre-test and post-test time are both 20 minutes, and the test content is based on PTE (Pearson Test of English Academic) writing test 1 and 2 to ensure the consistency and authority of the test difficulty. The test results were scored by two PTE writing training teachers with more than 10 years of experience according to the PTE writing scoring criteria. Before the study, researchers asked students to sign an academic writing integrity statement to let students understand the harm and possible consequences of academic plagiarism. During the study, researchers strengthened guidance and supervision on the use of ChatGPT in teaching practice, helping students to use ChatGPT appropriately and reasonably to give full play to its positive role. After the study, researchers judged whether students' academic writing papers have been plagiarized. Therefore, this study supervises and guides students to use ChatGPT reasonably for academic writing from the beginning, middle and end to improve students English academic writing ability and engagement, which is not only conducive to avoiding students' academic integrity problems, but also proves the significance of previous literature. After the 16-week experiment, a questionnaire survey was conducted anonymously online on 34 students in the experimental class (the questionnaire consisted of 20 questions, which students should complete within 5 minutes) to understand the students' engagement under ChatGPT feedback. The questionnaire in this study was adapted from Roy and Swargiary (2024), Tomović (2021) and Wang et al. (2016) and is adjusted according to the actual situation of the survey. The questionnaire was conducted from four dimensions: affective engagement, cognitive engagement, social engagement, and behavioral engagement, and adopted a Likert five-point scale. The response scale ranged from 1 to 5. The scale values are as follows: A=Completely disagree; B=Disagree; C=Neutral; D=Agree; E=Strongly agree.

Data Analysis

SPSS 23 was used to analyze and process the data in this study. First, in order to test whether there is a significant difference in the English academic writing ability of students in the experimental class and the control class before and after the experiment, the researchers used an independent sample t-test to detect whether there is a statistically significant difference. The researchers used paired sample t-tests to test the changes in the academic writing ability of students in the experimental class and the control class before and after the experiment and the changes in content, structure and

coherence, grammar, linguistic range, vocabulary, spelling and form. In the survey questionnaire, the descriptive analysis in SPSS was used to analyze the collected data.

Ethical Considerations

In order to conduct this study, the researchers first obtained the consent and approval of this university school. In addition, the researchers obtained informed consent from all participants and signed informed consent forms regarding the use of ChatGPT tools in English academic writing before the study. The researchers informed all participants that they could choose to join or withdraw from the study at any time, and explained the purpose, benefits, and hidden risks of this study to them. Moreover, considering the restrictions on access and use of ChatGPT in China, the researchers explained how participants could access ChatGPT before the study, which may involve the use of a virtual VPN. Finally, the researchers also assured the participants that their personal information would be kept confidential throughout the process. Throughout the process, the researchers supervised the participants' use of ChatGPT to meet ethical requirements.

FINDINGS

The researchers conducted a 16-week experiment in teaching English academic writing, using traditional feedback methods in the control class (CC) and ChatGPT in the experimental class (EC). The researchers analyzes and discusses the data from the pre-test, post-test, and questionnaire to further test the effectiveness of ChatGPT on the English academic writing ability and engagement of Chinese EFL private undergraduates.

RQ1: What is the impact of ChatGPT on Chinese EFL private undergraduates' English academic writing ability in terms of content, structure and coherence, grammar, linguistic range, vocabulary, spelling and form?

To verify the effectiveness of ChatGPT on the English academic writing skills (i.e., content, form, structure and coherence, grammar, linguistic range, vocabulary and spelling) of Chinese EFL private undergraduate students, the researchers analyzed EC and CC students in the pre-test and post-test.

Table 1
Independent Sample T-Test in Pre-test and Post-test of EC and CC

95% CI		F	Sig.	t	df	Sig. (2-tailed)	MD
EC-CC	Equal variances assumed	.002	.963	-.038	68	.970	-.026
	Equal variances not assumed			-.038	67.805	.970	-.026
Pre-test	Equal variances assumed						
	Equal variances not assumed						
Post-test	Equal variances assumed	.019	.891	3.993	68	.000	1.930
	Equal variances not assumed			3.998	67.993	.000	1.930

Table 1 was an independent sample t-test conducted in the EC and the CC in the pre-test and post-test to examine whether there was a significant difference between EC and CC before and after the experiment. In the pre-test, F was 0.002, P value was 0.970, which was greater than 0.05 and is not statistically significant. There was no significant

difference in the English academic writing ability of EC and CC students in pre-test. In post-test, F was 0.019, and P was 0.000, which was less than 0.05 and is statistically significant. There was a significant difference in the English academic writing ability of EC and CC students in the post-test. Therefore, the use of ChatGPT feedback in English academic writing class had a greater improvement in students' writing ability than traditional feedback methods.

Table 2
Paired Sample T-Test in Pre-test and Post-test of EC & CC

95% CI						
	Mean	SD	SEM	t	df	Sig. (2-tailed)
EC	-3.206	1.067	.183	-17.522	33	.000
CC	-1.250	.937	.156	-8.002	35	.000

Table 2 showed the paired sample t-tests in the EC and the CC in the pre-test and post-test to explore the effects of different writing feedback on students' English academic writing ability. It showed that the mean difference between the pre-test and post-test of EC was 3.206, SD was 1.067, P value was 0.000, which was less than 0.05 and was statistically significant. Mean difference of CC was 1.250, SD was 0.937, P value was 0.000, which was less than 0.05 and was statistically significant. Therefore, there were significant differences in the English academic writing ability of EC and CC students in both the pre-test and post-test, but EC students had made greater progress under the ChatGPT feedback.

Table 3
Paired Sample T-Test in Pre-test and Post-test of EC and Items

95% CI						
	Mean	SD	SEM	t	df	Sig. (2-tailed)
EC						
Content	-.971	.388	.067	-14.582	33	.000
Structure	-.941	.343	.059	-16.000	33	.000
Grammar	-.324	.475	.081	-3.973	33	.000
Linguistic range	-.471	.507	.087	-5.416	33	.000
Vocabulary	-.206	.538	.092	-2.231	33	.033
Spelling	-.147	.436	.075	-1.968	33	.058
Form	-.147	.359	.062	-2.385	33	.023
CC	Mean	SD	SEM	t	df	Sig. (2-tailed)
Content	-.194	.401	.067	-2.907	35	.006
Structure	-.389	.494	.082	-4.719	35	.000
Grammar	-.056	.410	.068	-.813	35	.422
Linguistic range	-.083	.368	.061	-1.357	35	.183
Vocabulary	-.083	.368	.061	-1.357	35	.183
Spelling	-.194	.401	.067	-2.907	35	.006
Form	-.250	.439	.073	-3.416	35	.002

The paired sample t-test (see Table 3) showed that the students in EC and CC had different degrees of improvement and progress in 7 aspects of English academic writing, namely content, structure, grammar, linguistic range, vocabulary, spelling, and form in the pre-test and post-test. Mean differences of EC students in content, structure, grammar, linguistic range, vocabulary, spelling, and form were 0.971, 0.941, 0.324,

0.471, 0.206, 0.147 and 0.147, respectively. SD values were 0.388, 0.343, 0.475, 0.507, 0.583, 0.436, and 0.359, respectively. P values were 0.000, 0.000, 0.000, 0.000, 0.033, 0.058 and 0.023, respectively, which were less than 0.05 and were statistically significant. Therefore, the ChatGPT feedback had a more significant effect on the content, structure, grammar, linguistic range, vocabulary, spelling, and form of EC students' English academic writing.

Mean differences of CC students in content, structure, spelling and form were 0.194, 0.389, 0.194 and 0.250, SD values were 0.401, 0.494, 0.401 and 0.439. P values were 0.006, 0.000, 0.006 and 0.002, which were less than 0.05 and were statistically significant. However, mean differences of CC students in grammar, linguistic range, and vocabulary were 0.056, 0.083 and 0.083, SD values were 0.410, 0.368, 0.368. P values were 0.422, 0.183, 0.183, which were great than 0.05 and were not statistically significant. Therefore, CC students made more significant progress in content, structure, spelling and form under the traditional feedback, and made less progress in grammar, linguistic range, and vocabulary.

Therefore, students' English academic writing ability has been effectively improved of 3.206 with ChatGPT feedback, and it is higher than the traditional feedback of 1.250. In addition, EC students improved more significantly in content, structure, grammar, linguistic range, vocabulary, spelling, and form with ChatGPT feedback. Moreover, CC students made significant progress in content, structure, spelling, and form after traditional feedback, and improved less in grammar, linguistic range, and vocabulary.

RQ2: What is the impact of ChatGPT on Chinese EFL private undergraduates' engagement in English academic writing?

To verify the impact of ChatGPT on Chinese private EFL undergraduates' engagement in English academic writing, the researchers collected and analyzed the survey questionnaire of EC students. The questionnaire was divided into 4 aspects: affective engagement, cognitive engagement, behavioral engagement, and social engagement.

Table 4
EC students affective engagement

Affective Engagement		CD (N, %)	D (N, %)	N (N, %)	A (N, %)	SA (N, %)
N	Items					
1	ChatGPT can improve my interest in English academic writing.	4 (11.76%)	0 (0%)	4 (11.76%)	15 (44.12%)	11 (32.35%)
2	ChatGPT can improve my engagement in English academic writing.	2 (5.88%)	1 (2.94%)	6 (17.65%)	17 (50%)	8 (23.53%)
3	ChatGPT can improve my enjoyment in English academic writing.	3 (8.82%)	1 (2.94%)	5 (14.71%)	15 (44.12%)	10 (29.41%)
4	ChatGPT can improve my motivation for English academic writing.	3 (8.82%)	0 (0%)	5 (14.71%)	13 (38.24%)	13 (38.24%)
5	ChatGPT can create a positive learning atmosphere in English academic writing classes.	3 (8.82%)	1 (2.94%)	5 (14.71%)	12 (35.29%)	13 (38.24%)

Table 4 showed the impact of ChatGPT on Chinese private EFL undergraduates' affective engagement in English academic writing. The researchers found that most students had a positive attitude towards ChatGPT could improve interest, engagement,

pleasure, motivation and atmosphere in English academic writing. Most students (76.47%) had a positive attitude towards ChatGPT could improve interest in English academic writing, while 11.76% were disagree and neutral. Most of students (73.53%) believed that ChatGPT could improve their engagement in English academic writing classes, while 26.47% were neutral and disagree. Most students (73.53%) had a positive attitude towards ChatGPT can enhance their pleasure, while 11.76% disagreed. Most students (76.48%) have a positive attitude towards ChatGPT could enhance their motivation, while 23.53% were neutral and disagree. Most students (73.53%) had a positive attitude towards ChatGPT could create a positive atmosphere, while 26.47% were neutral and disagree. Therefore, after a 16-week experiment, more than 70% of students believed that ChatGPT could enhance their affective engagement in English academic writing.

Table 5
EC students cognitive engagement

Cognitive Engagement	N	Items	CD(N, %)	D(N, %)	N(N, %)	A(N, %)	SA(N, %)
6	ChatGPT can improve my engagement and focus in English academic writing.	3 (8.82%)	0 (0%)	6 (17.65%)	15 (44.12%)	10 (29.41%)	
7	ChatGPT can help me solve the problems I encounter in English academic writing.	2 (5.88%)	2 (5.88%)	9 (26.47%)	12 (35.29%)	9 (26.47%)	
8	ChatGPT can improve my critical thinking and creativity in English academic writing.	3 (8.82%)	1 (2.94%)	8 (23.53%)	10 (29.41%)	12 (35.29%)	
9	ChatGPT can provide me with personalized learning experience options and opportunities for English academic.	3 (8.82%)	0 (0%)	5 (14.71%)	17 (50%)	9 (26.47%)	
10	ChatGPT can meet my needs for English academic writing skills.	3 (8.82%)	1 (2.94%)	5 (14.71%)	13 (38.24%)	12 (35.29%)	

Table 5 showed the impact of ChatGPT on Chinese private EFL undergraduates' cognitive engagement in English academic writing. Most students believed that ChatGPT could improve the engagement and concentration, solve problems, improve critical thinking and creativity, provide personalized experience. Most students (73.53%) had a positive attitude towards ChatGPT in improving engagement and focus in English academic writing. Most students (61.76%) believed that ChatGPT can help them solve problems encountered in English academic writing. However, 26.47% were neutral, and 11.76% were disagree. Most students (64.71%) believed that ChatGPT could improve their critical thinking and creativity, while 23.53% were neutral, and 11.76% were disagree. Most students (76.47%) believed that ChatGPT could provide them with choices and opportunities for personalized learning experiences, 14.71% were neutral, and 8.82% were disagree. Most students (73.53%) believed that ChatGPT could meet their needs for English academic writing skills, 14.71% were neutral, and 11.76% were disagree. Therefore, after a 16-week experiment, more than 60% of the students believed that ChatGPT could improve their cognitive engagement in English academic writing.

Table 6
EC students social engagement

Social Engagement		CD(N, %)	D(N, %)	N(N, %)	A(N, %)	SA(N, %)
N	Items					
11	I appreciate ChatGPT feedback and suggestions in English academic writing	2 (5.88%)	0 (0%)	3 (8.82%)	20 (58.82%)	9 (26.47%)
12	I have a closer interaction and connection with ChatGPT in English academic writing	2 (5.88%)	0 (0%)	8 (23.53%)	15 (44.12%)	9 (26.47%)
13	I am more interested in using ChatGPT to explore various topics of English academic writing	3 (8.82%)	2 (5.88%)	6 (17.65%)	14 (41.18%)	9 (26.47%)
14	ChatGPT makes me not care about what others think when writing in English academic writing class	2 (5.88%)	2 (5.88%)	5 (14.71%)	14 (41.18%)	11 (32.35%)
15	ChatGPT makes me try to solve the difficulties I encountered in English academic writing	3 (8.82%)	1 (2.94%)	7 (20.59%)	13 (38.24%)	10 (29.41%)

Table 6 showed the impact of ChatGPT on Chinese private EFL undergraduates' social engagement in English academic writing. Most students believed that ChatGPT can improve the attitude towards feedback, connect with ChatGPT, explore various topics, care about other people's ideas and solve the difficulties encountered in English academic writing. Most students (85.29%) had a positive attitude towards the feedback and suggestions provided by ChatGPT, and only 14.7% were neutral and disagree. Most students (70.59%) believed that they have a closer interaction and connection with ChatGPT, while 23.53% were neutral, and 5.88% were disagree. Most students (67.65%) showed a positive attitude towards using ChatGPT to explore the topics, while 17.65% were neutral, and 14.71% were disagree. Most students (73.53%) didn't care about other people's thoughts after using ChatGPT, while 14.71% were neutral, and 11.76% were disagree. Most students (67.65%) had a positive attitude towards ChatGPT in solving difficulties, while 20.59% were neutral, and 11.76% were disagree. Therefore, after a 16-week experiment, more than 60% of the students believed that ChatGPT could improve their social engagement in English academic writing.

Table 7
EC students behavioral engagement

Behavioral Engagement		CD(N, %)	D(N, %)	N(N, %)	A(N, %)	SA(N, %)
N	Items					
16	I can actively attend English academic writing class under the ChatGPT teaching	3 (8.82%)	1 (2.94%)	9 (26.47%)	14 (41.18%)	7 (20.59%)
17	I can gradually abandon bad behavior in class under the ChatGPT teaching	2 (5.88%)	2 (5.88%)	9 (26.47%)	11 (32.35%)	10 (29.41%)
18	ChatGPT makes me an active participant in English academic writing class	2 (5.88%)	2 (5.88%)	7 (20.59%)	14 (41.18%)	9 (26.47%)
19	ChatGPT encourages me to work harder to complete English academic writing	2 (5.88%)	1 (2.94%)	6 (17.65%)	15 (44.12%)	10 (29.41%)
20	ChatGPT motivates me to find opportunities to use ChatGPT for English academic writing practice	3 (8.82%)	1 (2.94%)	7 (20.59%)	17 (50%)	6 (17.65%)

Table 7 showed the impact of ChatGPT on Chinese private EFL undergraduates' behavioral engagement in English academic writing. Most students believed that they could abandon bad behaviors in class, become active participants, work harder to complete English academic writing, and find more opportunities to use ChatGPT. Most

students (61.77%) had a positive attitude towards actively attending English academic writing classes under ChatGPT, while 26.47% were neutral, and 11.76% were disagree. Most students (61.77%) believed that the ChatGPT could help them gradually abandon bad behaviors in class, while 26.47% were neutral, and 11.76% were disagree. Most students (67.65%) had a positive attitude towards ChatGPT enabling them to become active participants, while 20.59% were neutral, and 11.76% were disagree. Majority of students (73.53%) believed that ChatGPT encouraged them to work harder, and only 8.82% were disagree. Most students (67.65%) had a positive attitude towards using ChatGPT for academic writing, while 20.59% were neutral, and 11.76% were disagree. Therefore, after a 16-week experiment, more than 60% of the students believed that ChatGPT could improve their behavioral engagement in English academic writing.

DISCUSSION

Students' English academic writing ability (i.e., content, form, structure and coherence, grammar, linguistic range, vocabulary and spelling) improved more significantly under the 16-week ChatGPT feedback than under the traditional feedback. This finding further verified the results of Mahapatra (2024). After one-way RM ANOVA comparison, it proved that students' writing scores improved significantly after ChatGPT. The results of Song and Song (2023) also showed that students' writing ability improved significantly under ChatGPT. This finding was consistent with the research of Marzuki et al (2023), which found that the AI writing tool ChatGPT can improve the quality of students' academic writing, especially the quality of writing content and structure and coherence, Tseng and Lin (2024) also proved this point. Wang (2024) also confirmed that ChatGPT can help students solve problems such as spelling, grammar, vocabulary and sentence cohesion. Additionally, students' English academic writing ability improved in structure, form, content under the 16-week traditional feedback, but limited in spelling, and grammar, linguistic range, and vocabulary. This result was similar to Huisman et al (2018) findings' that students improved in both structure and content in academic writing. This result confirms Budianto et al (2020) traditional feedback methods had a positive impact on students' language use, vocabulary, skills, content, and organization. Therefore, ChatGPT has a positive impact on the improvement of English academic writing ability of English majors in private EFL undergraduates in China in terms of content, structure and coherence, linguistic range, grammar, vocabulary, spelling and form. Finally, constructivism theory emphasized the process of actively discovering, understanding and constructing knowledge in a specific environment with students as the center, and was also a process of thinking, analysis, reflection, understanding and application. This theory fits seamlessly with the personalized feedback function of ChatGPT, thereby improving students' English academic writing ability. Students actively constructed their own English academic writing based on ChatGPT in terms of content, structure and coherence, linguistic range, grammar, vocabulary, spelling and form, thereby improving their English academic writing ability.

The following findings could be drawn and discussed from the questionnaire. Firstly, most students (>70%) had a positive attitude towards the affective engagement of ChatGPT in English academic writing. This finding was consistent with the findings of

Syafi'i et al (2024) that most students (91%) had positive affective engagement in incorporating AI-driven feedback into their writing. Additionally, most students (>60%) had a positive attitude towards the cognitive engagement of ChatGPT in English academic writing. This study was consistent with the results of Wang and Xie (2024), found that AI-assisted teaching can improve students' language learning process in cognitive engagement. Moreover, most students (>60%) had a positive attitude towards the social engagement of ChatGPT in English academic writing. Consistent with the study by Koltovskaia et al (2024), it found that students showed high satisfaction in behavioral engagement, cognitive engagement, and affective engagement. Furthermore, most students (>60%) had a positive attitude towards the behavioral engagement of ChatGPT in English academic writing. Suciati et al (2024) found that incorporating ChatGPT into an English writing course can significantly improve students' behavioral engagement. Bakare and Jatto (2023) found that incorporating AI into course teaching can significantly improve students' engagement in cognitive, behavioral, and affective aspects. Finally, engagement theory emphasized experiential and self-directed learning, including affective engagement, behavioral engagement, cognitive engagement, and social engagement. Students' affective engagement in the classroom receiving ChatGPT feedback had been improved, which had enhanced students' interest, engagement, enjoyment, motivation in academic writing, and created a positive learning atmosphere. Cognitive engagement could improve students' attention under ChatGPT feedback, solve academic writing problems, and meet personalized learning experiences. Social engagement allowed students to interact more closely with ChatGPT, explore various academic writing topics, and resolve academic writing difficulties. Behavioral engagement helped students actively attend academic writing classes, gradually abandon bad academic behaviors, strive to complete academic writing tasks, and practice under the ChatGPT. To this end, engagement theory plays a positive role in improving students' affective engagement, behavioral engagement, cognitive engagement, and social engagement.

CONCLUSION

This study found that both ChatGPT and traditional feedback methods could improve students' English academic writing ability and engagement, but ChatGPT had a greater positive impact on students' English academic writing ability and engagement. First, after 16 weeks of teaching practice, the English academic writing ability of EC and CC students had improved to varying degrees, but the English academic writing ability of EC students had improved more significantly than that of CC students. In addition, after 16 weeks of teaching practice, the English academic writing ability of EC and CC students had improved to varying degrees in 7 aspects. Under the ChatGPT feedback, EC students had made more significant progress in content, structure, linguistic range, grammar, vocabulary, spelling and form. Under the traditional feedback, CC students had made more significant progress in content, structure, spelling and form, but less progress in grammar, linguistic range, and vocabulary. This shows that the two teaching methods are complementary to a certain extent. In the future teaching process, teachers can use the two methods in combination to give full play to their greatest advantages. Finally, most students have a positive attitude towards the impact of ChatGPT on engagement (affective engagement, cognitive engagement, social engagement,

behavioral engagement). Based on the above analysis, it can be seen that ChatGPT can improve students' English academic writing ability and engagement.

IMPLICATIONS, LIMITATIONS AND RECOMMENDATIONS

This study provides a reference for researchers who will conduct experimental or quasi-experimental research in the future. The method of combining constructivism theory and engagement theory adopted in this study could also provide direction and basis for future research. In addition, this study had a profound impact on teachers, students, courses, and policies. This study provided a method ChatGPT for English teachers to guide students from different groups to enrich English academic writing teaching, which could reduce the work pressure of teachers in writing teaching. Students could improve their English academic writing ability through ChatGPT and stimulate their engagement. The application of ChatGPT in English academic writing classroom could update traditional teaching methods, promote the reform of classroom and English academic writing policy.

This study had some limitations. This study was conducted for only 16 weeks, and the research time was relatively short. In addition, participant of this study was only 70 students in two classes, and the participant was relatively small. Moreover, this study only used a quasi-experimental research method, and it was single. This study was conducted on students majoring in English at one university in China, and its research results had limitations. Another limitation of this study is that ChatGPT is not accessible in China. Finally, this study only studied students' writing ability and engagement, but students' English academic writing was affected by many other factors.

Future research can further expand the sample size for longer teaching practice, for example, conduct a long-term follow-up and investigation of undergraduate or graduate students majoring in English and non-English in other cultural backgrounds. In addition, students' potential bias based on previous exposure to ChatGPT may affect their views, and future initiatives should be cautious, including initial guidance sessions with ChatGPT to ensure that feedback is based on first-hand experience. Future research can pay more attention to the ethical impact of ChatGPT in writing instruction, such as data privacy issues or algorithmic bias. Future research in China could use other AI systems with similar functionality to ChatGPT, such as the ERNIE bot. Finally, future research can pay great attention to the fact that students' English academic writing ability and engagement may also be affected by other factors, such as students' learning methods, students' favorability towards teachers, which will interfere with the final experimental results.

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