

RESEARCH ARTICLE

Student Engagement with ChatGPT and Teacher Feedback in L2 Writing

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Abstract: The emergence of ChatGPT has stimulated interest in its application to second language writing in higher education. While previous studies have compared ChatGPT feedback with that of teachers and examined student engagement with automated, teacher, and peer feedback, little attention has been paid to student engagement specifically with ChatGPT feedback. This study explores student engagement with both ChatGPT and teacher feedback in a college EFL (English as foreign language) argumentative writing class. The participants were 46 second-year English majors who completed two writing tasks. One essay received feedback from ChatGPT, generated with prompts related to both content and language, while the other received teacher feedback. Students revised their essays based on these two feedback types. Analysis of students' revisions, questionnaire responses, and interview data indicated that students actively engaged with both forms of feedback. Interviews further revealed that students found both ChatGPT and teacher feedback to be understandable and acceptable. In light of these findings, the study suggests that teachers can effectively integrate ChatGPT feedback into teacher feedback in L2 writing classrooms to enhance student engagement and writing proficiency.

Keywords: feedback, ChatGPT, student engagement, second language writing

1. Introduction

Corrective written feedback has long been a focal point of research in L2 writing, as it plays a crucial role in enhancing students' writing abilities. Different types of feedback serve distinct functions in the writing process. With the advancement of technology, the use of automated writing evaluation (AWE) systems in second language writing has increased. Commonly used tools include *iWrite*, *Pigai System*, *Criterion*, and *Grammarly*. The effectiveness of AWE tools has been demonstrated by several studies [1]. For instance, AWE systems have been shown to enhance students' language complexity, positively affect their revision processes, and improve the quality of their essays. In recent years, ChatGPT has attracted great attention in the field of second language writing due to its capacity to generate text based on large language models. The quality of ChatGPT's generated text has also been explored [2, 3]. Due to the feature of artificial intelligence (AI), ChatGPT can support L2 learners by helping them generate ideas, paraphrase sentences, and receive feedback on both language and content. Additionally, ChatGPT provides students with the opportunity to revise their essays with less pressure, as many students feel nervous seeking feedback from teachers [4]. Hence, ChatGPT may serve as a promising tool for improving students' writing skills, offering certain advantages over traditional AWE tools.

While feedback can facilitate students' writing performance, the way students engage with feedback is related to students' cognitive processes instead of simply evaluating the effectiveness of different types of feedback. Researchers have increasingly focused

on students' engagement in L2 writing, as it is closely linked to their understanding of the feedback and their strategies for incorporating and revising based on the provided suggestions [5, 6]. A growing body of research has examined how students engage with teacher, peer, and automated feedback, highlighting varying degrees of engagement in these feedback types [7, 8]. However, limited attention has been paid to students' engagement with emerging tools such as ChatGPT. Thus, this study aims to investigate students' engagement with both ChatGPT and teacher feedback, as well as to explore students' perceptions of these two types of feedback.

2. Literature Review

2.1. AWE feedback in L2 writing

The trend of exploring feedback in L2 writing has shifted toward AWE systems, driven by technological advancements, although teacher feedback still remains a focus in L2 writing. This emerging research topic explores AWE's impact on multiple dimensions of L2 writing development. McCarthy et al.'s [1] study using *Writing Pal* underscored that gains in language performance were specific but limited. The finding showed that significant improvements were observed in mechanics, word choice, voice, conclusion, and organization after revision, but not in other areas. Apart from the exploration of language improvement, AWE's influence on learners' cognitive processes and motivation is an increasing topic in L2 writing research. Barrot [9, 10] argued that AWE feedback could promote noticing of errors and provide valuable metalinguistic explanations, potentially fostering greater learner autonomy in the writing process. Although the presence, nature, and students' cognitive processing of the automated feedback prompted the gains

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in accuracy, some challenges were reported, such as overcorrection, cognitive overload, and limited metalinguistic explanation. Yao et al.'s [11] longitudinal study further supported the potential for effects on learners' mindsets and motivation when using AWE. However, as Yao et al. [11] mentioned, the impact on students' writing performance was not constant and could be mediated by individual factors like prior experiences and perceptions of the tool's usefulness. Recognizing the limitations of AWE, researchers advocated for integrated feedback approaches. However, students adopted a proofreading instead of a learning orientation toward automated feedback, perhaps because most of it included specific corrections, thus requiring little work on their cognition [12].

The impact of AWE in L2 writing involves different aspects, such as influencing teacher practices in integrating AWE and revealing effects on writing quality based on learners' proficiency. Jiang et al. [13] highlighted that adoption of AWE could reshape teacher feedback practices, affecting its mode, quantity, type, level, and even deeper aspects such as intention and meaning, and the different practices were mediated strongly by teacher beliefs. From the student's perspective, an investigation into integrated feedback, including teacher, peer, and automated feedback, demonstrated the value of leveraging AWE's strengths, such as language and spelling correction, and this integration of different feedback can enhance students' writing skills effectively [14].

2.2. ChatGPT in L2 writing

The advent of AI has introduced new possibilities and challenges into the field of second language writing. Studies on perceptions of AI reveal both support and concerns among students and teachers in L2 writing. Students generally view AI tools such as ChatGPT positively, satisfied with their ability to generate ideas, provide examples, and gather information, considering them as valuable assisted tools [15]. These perceptions are not merely opinions but actively affect students' writing process. Apart from the student's perspective, studies comparing educators' and students' views, such as the study by Barrett and Pack [16], showed subtle disagreements on the acceptable use of AI throughout the writing process. These viewpoints require teachers' consideration in designing class activities with the integration of AI in teaching. Furthermore, Shen and Guo [17] show that teachers experience complex reactions of both positive and negative emotions when using AI in their classrooms. However, teachers are more prone to negative emotions because AI is a new concept and approach for most of them. The newness of AI chatbots brings about fear, stress, and anxiety to teachers, especially novice teachers with low technological experience and pedagogical knowledge.

Generative AI tools represent a distinct form of automated feedback, characterized by their interactive chatbot function. Recent studies have increasingly explored the application of AI in L2 writing, mainly through comparative analyses with teacher feedback. Studies revealed that tools, such as ChatGPT, could generate more pieces of feedback than teachers, frequently addressing organization, metalinguistic comments, and text reformulation as well as content and language concerns [18, 19]. This contrasts with teacher feedback, which often focuses on content and language with emphasis on direct correction and indirect feedback forms, addressing both local and global issues. The differences between ChatGPT and teacher feedback in quantity and quality have also been supported by Lu et al. [20]. However, there are contradictions regarding feedback quality. While some researchers argued that ChatGPT offered higher relevant feedback on language, content, and organization [21],

others contended that teacher feedback demonstrated overall higher quality and adaptability to learner proficiency [22].

Previous studies highlight AI feedback's pedagogical value in collaborative contexts. AI feedback can enhance students' revision and editing stages in the L2 writing process [23]. When integrated with teacher feedback, ChatGPT can mitigate challenges in large classrooms, addressing diverse error categories and including more helpful comments, which makes students incorporate more of the feedback into their revision [24]. Furthermore, researchers suggest the potential of using AI for evaluating student writing and supporting teacher feedback. EFL (English as foreign language) teachers can integrate ChatGPT feedback and their own feedback on student essays. During the process, teachers may make use of the advantages of ChatGPT feedback while paying attention to its limitations and addressing them using their own strengths [18]. This integration appears to foster greater improvement in task achievement, cohesion, and linguistic accuracy than teacher feedback alone [25], suggesting an integrated feedback approach may facilitate L2 writing development by leveraging the productivity of AI and the contextual insight of teachers.

Despite a growing number of studies on ChatGPT in L2 writing, which have investigated its value, teacher and student perceptions, and comparisons between AI and teacher feedback in terms of quality and quantity and explored pedagogical implementations, there remains a scarcity of longitudinal studies. Specifically, the long-term effects on students' writing performance and the mechanisms of student feedback uptake and the dynamics of how students engage with ChatGPT during drafting and revision have received limited attention.

2.3. Student engagement with feedback

Student engagement refers to how students attend to learning, and it is a key concept in their uptake of feedback. This term describes students' focus, curiosity, interest, and desire to use their language skills and ways of learning to make progress [26]. The widely used conceptualization of student engagement was established by Ferris et al. [27], who identified three types of engagement: behavioral, emotional, and cognitive. Ellis [28] further refined the concept by conceptualizing student engagement with feedback in three categories: (1) cognitive engagement, which focuses on how learners attend to feedback; (2) behavioral engagement, which focuses on whether and how learners take up feedback into their revisions; and (3) affective engagement, which focuses on learners' attitudinal responses to feedback. However, this explanation is more concerned with error correction than with students' use of feedback in writing. Building on the work of these scholars, Zhang and Hyland [26] proposed more detailed and comprehensive conceptualization of student engagement: (1) behavioral engagement, referring to students' physical reactions to feedback, such as revision actions and time spent on revision; (2) affective engagement, which encompasses students' emotional responses and attitudinal reactions to feedback, as evidenced through retrospective interviews; and (3) cognitive engagement, which involves how students respond to feedback through revision processes (rewriting and reorganization) and cognitive strategies (evaluating and monitoring). This conceptualization of engagement focused more on the students' use of feedback and revision strategies. Based on the above discussion, this study follows the framework of Zhang and Hyland [26] to explore student engagement with AI feedback in L2 writing.

The specific type of feedback plays a critical role in shaping student engagement. A key distinction lies between direct and

indirect corrective feedback. Direct feedback explicitly supplies the correct form, whereas indirect feedback merely indicates the types and location of an error, requiring students to self-correct [27]. According to Bitchener [5], indirect feedback may be sufficient for advanced learners, while direct correction is more beneficial for lower-proficiency learners with a more limited linguistic performance to address errors. For writing development, indirect feedback may be more valuable for the long term than direct feedback because it requires deeper cognitive engagement to actively figure out the reason and formulate revision strategies [27].

Research on student engagement with feedback has increasingly diversified instead of teacher-centered corrective feedback in L2 writing. When examining student engagement with teacher feedback, Bitchener [5] revealed nonlinear relationships among cognitive, behavioral, and affective engagement dimensions, mediated by language proficiency and feedback focus, highlighting how learner differences affected engagement levels. However, more researchers investigated student engagement with peer feedback. For instance, Cheng and Zhang [29] demonstrated that teacher scaffolding in L2 writing processes enhances affective, behavioral, and cognitive engagement. Similarly, Zhang et al. [30] demonstrated both initial engagement differences and extensive gains in engagement across all three learners despite challenges in proficiency and self-efficacy. The dynamic features of engagement with peer feedback are also revealed in Zhang and Gao's [31] study, which are influenced by individual and contextual factors. Additionally, translanguaging impacts peer feedback engagement. To be specific, students' affective engagement improved when students used L1 to provide content-related issues in peer assessment [32]. The comparative studies indicate peer feedback engagement exhibits greater complexity and inconsistency than teacher feedback engagement [33].

Engagement with AWE feedback has also drawn increasing attention in L2 writing, driven by advancements in technology. For example, Zhang [6] observed differences in students' revision operations and perceptions of AWE feedback. Similarly, Li and Ke [34] reported changes in engagement in students with different language proficiency by using *Youdao Writing*, attributing these to different personal experiences, perceptions, and emotional responses. In Koltovskaia's [35] study, students demonstrated greater cognitive engagement by questioning the feedback, while others showed overreliance on AWE feedback with limited cognitive engagement. To enhance student engagement in L2 writing, Zhang and Hyland [8] implemented integrated teacher-peer-AWE feedback, demonstrating effective promotion across three engagement dimensions. Regarding the evolution of engagement, Cheng and Zhang [7] examined AWE-teacher integrated feedback, revealing profound behavioral and cognitive engagement, though affective engagement did not show significant differences in teacher feedback and integrated feedback conditions.

Studies on student engagement with generative AI tools have expanded as these technologies have been introduced in educational contexts. Studies reveal complex and multidimensional engagement patterns. Students demonstrated promoted cognitive engagement when critically evaluating AI feedback accuracy, though behavioral engagement often centered on lower-order concerns, accompanied by generally positive affective responses [36]. Importantly, students' engagement manifested diversity across individuals and writing process stages, influenced by factors such as prior experience with AI writing platforms [37]. Study on AI intervention further indicated that AI writing tools could enhance all three engagement dimensions, correlating with measurable writing improvements [38, 39]. However, the degree of different dimen-

sions of engagement remains individualized, and studies showed collective engagement of students in L2 writing and uncovered emotional complexity with AI-assisted feedback [40].

Although prior research has investigated students' engagement with automated feedback, studies focusing specifically on ChatGPT feedback remain limited. Therefore, this study aims to explore student engagement with both ChatGPT and teacher feedback in a college EFL writing class and addresses the following research questions:

- 1) How do students engage with ChatGPT and teacher feedback behaviorally, affectively, and cognitively?
- 2) How do students perceive ChatGPT feedback and teacher feedback in the process of revision?

3. Methodology

3.1. Context and participants

Utilizing a convenience sampling technique, this study was conducted in a comprehensive university in central China, and participants were 46 sophomores majoring in English in two intact classes, with 13 males and 33 females. All of the participants have learned English for at least 9 years, and their proficiency was at an intermediate level, corresponding to their ongoing preparation for the Test for English Majors Band 4 (TEM-4). TEM-4 is a nationally standardized test for English major sophomores in Chinese universities, assessing students' integrated skills in listening, reading, writing, and translation. They attended argumentative writing courses weekly this semester, and each class lasted for 45 minutes. Before the data collection, students were informed that they would finish two timed writing tasks and revise their essays with ChatGPT and teacher feedback. Most students have experience in using AI in their L2 learning, but few of them collect AI feedback, especially ChatGPT feedback, and revise according to it. They signed the consent form before the procedure began.

3.2. Study design and procedure

This study utilizes a within-subject design to investigate student engagement with ChatGPT and teacher feedback in two writing tasks. All participants are exposed to both experimental conditions: revising writing based on ChatGPT feedback and revising writing based on teacher feedback. The feedback from both sources was collected for a comparative analysis. To examine behavioral and cognitive engagement, students' writing drafts and revised essays were analyzed to document their revision operations. Additionally, open-ended questionnaires and semi-structured interviews were administered to investigate students' perspectives on the feedback and to explore the behavioral, cognitive, and potentially affective dimensions of their engagement.

In the first week of the experiment, students completed a timed writing task in 45 minutes on the topic of "Intelligent Machines and Our Brain." In the second week, they revised their essays based on feedback from ChatGPT. In week three, they completed a second timed writing task on the topic of "Loneliness and Wisdom," and in week four, they revised their essays according to feedback from the teacher. The procedure is illustrated in Figure 1. The topics for writing tests were selected from the past TEM-4 battery, which is a well-established test, and the difficulty remains consistent. The selected TEM-4 writing topics were designed to be cognitively accessible and drawn from students' life experiences. This relevance was intended to facilitate a clear understanding of

Figure 1
The procedure of writing tasks



the task requirements and enable students to show their insights in their essays.

3.3. Data collection

First, students' drafts were collected to generate feedback. Regarding the feedback from ChatGPT, the researchers collected responses by submitting prompts to ChatGPT. Given the features of the writing task, the feedback focused on both content and language. After trying different prompts on content and language, we compared the responses and selected the one that was most tailored to this study. The prompts used were: *“Please provide feedback on areas for improvement in the content of this essay,”* and *“Please provide feedback on areas for improvement in the language of this essay.”* The primary aim was to offer students guidance on how to enhance their writing skills and the overall quality of their work. After ChatGPT generated the feedback, the researchers reviewed each response and selected the most effective suggestions, which were related to the writing topic and students' writing content. The criteria for feedback selection were established based on four key dimensions: appropriateness for student adoption, specificity and relevance to the student's essay, accurate identification of the essays' issues, and the capacity of the revised samples to demonstrate substantive and meaningful improvements. These pieces feedback provided useful for students to revise their grammatical mistakes, polish their language, and enrich their evidence. For language, the feedback format included both the original drafts and revised samples, which allowed students to easily compare the two versions. On average, each student received 10 pieces of feedback from ChatGPT (Figure 2).

Regarding teacher feedback, the researchers assessed students' essays by providing both marginal and end comments on content and language. This feedback was delivered by the instructor of the writing class. Although the forms of feedback from ChatGPT and the teacher differed, both focused on similar aspects, including content and language. The number of feedback comments varied across students due to differences in writing quality; however, on average, each student received 10 pieces of feedback (Figure 3).

Second, students' writing drafts were collected for analysis of the revision processes. Following each revision, two questionnaires were distributed to examine students' engagement with and perceptions of different types of feedback. Questionnaire 1 included four open-ended questions regarding students' use of ChatGPT feedback, the challenges they encountered, and their reflections and perceptions. Questionnaire 2 comprised five open-ended questions focused on students' use of teacher feedback, the issues they faced, and their comparative perceptions of teacher feedback and ChatGPT feedback in different aspects (Appendix A).

Semi-structured interviews were conducted to explore students' understanding of feedback, their strategies of revision, and their perceptions of the feedback. Six participants, comprising three males and three females, were selected from different academic levels, with two participants from each level. The interviews lasted

20 minutes for each participant and were recorded for subsequent data analysis. To reduce participants' nervousness and concerns, the interviews were conducted in Chinese. Students were informed that their participation in the interview would not affect their final scores. In this section, the revision processes were examined in detail, focusing on specific revised sentences. Additionally, the interview explored participants' revision strategies and their perceptions of using ChatGPT and teacher feedback (Appendix B).

3.4. Data analysis

First, the texts of two types of feedback, along with students' writing drafts, were analyzed to investigate which suggestions from ChatGPT and teacher feedback students incorporated into their revisions. The researchers categorized the feedback into two groups: adopted feedback and non-adopted feedback. Additionally, the adopted feedback was further divided into content-related feedback and language-related feedback.

Second, students' essays were analyzed to examine their revision operations (Table 1) [26], which provided insights into their cognitive engagement. The researchers identified and categorized each revision operation and then calculated the frequency of each type to determine which cognitive strategies students were most likely to use during the revision process.

Third, students' responses to the questionnaires were collected to explore their affective and cognitive engagement. The questionnaire responses were analyzed from different aspects. For affective engagement, the words used by students were categorized as either “positive” or “negative.” Regarding cognitive engagement, students' use of feedback and the strategies they employed to address problems during the revision process were classified into different categories. To examine students' perceptions, their comments on ChatGPT and teacher feedback were analyzed and summarized, especially focusing on specific adjectives.

Fourth, the recordings of the interviews were transcribed for analysis, and the Chinese transcriptions were subsequently translated into English. In this section, students' understanding of the feedback, their reasons for specific revisions, and their cognitive strategies were thoroughly analyzed to assess their cognitive engagement. Additionally, students' affective engagement was examined through the transcriptions, with relevant words, particularly adjectives, categorized as “positive” or “negative.” Students' comments on both ChatGPT and teacher feedback were also coded for further analysis.

4. Results

4.1. Behavioral engagement

Students' behavioral engagement was demonstrated through their adoption of ChatGPT and feedback, as well as the time spent on revisions (Table 2).

Figure 2
Example of ChatGPT feedback

Content:

1. Acknowledging and addressing potential counterarguments can enhance the strength of your argument. For example, some might argue that intelligent machines free humans from repetitive tasks, allowing them to focus on more creative and fulfilling activities. Addressing such counterarguments shows a deeper understanding of the issue.
2. You briefly mention that the invasion of artificial intelligence spawns incapability, but you could expand on this point to provide more depth. Exploring how overreliance on intelligent machines affects human problem-solving skills, critical thinking abilities, and overall cognitive development would enrich your argument.
3. While you emphasize the importance of maintaining human uniqueness in a world run by machines, offering specific solutions or recommendations for mitigating the potential negative effects of AI would strengthen your essay. This could include suggestions for incorporating AI responsibly or promoting lifelong learning and skill development to adapt to technological advancements.
4. Work on improving the flow between sentences and paragraphs to enhance the coherence of your essay. Use transition words and phrases to connect ideas and guide the reader through your argument smoothly.

Language:

1. Original: Due to its advanced technology, artificial intelligence replaces humans in numerous occupations, including the operation of planes and controlling of air traffic.
Revised: Advanced technology, such as artificial intelligence, has led to the replacement of humans in various occupations, including aircraft operation and air traffic control.
2. Original: It also invades our modern life for its outstanding performance ability.
Revised: Additionally, artificial intelligence has become pervasive in modern life due to its exceptional performance capabilities.
3. Original: Even more shockingly, machines can play the role of coming up ideas for us.
Revised: More surprisingly, machines are now capable of generating ideas for us.
4. Original: Our struggle against technology may come to an end as our brains regress.
Revised: Our resistance to technology may diminish as our brains regress.
5. Original: From my part, I harbor the view that our brains will get lazier in an intelligent machines' world.
Revised: Personally, I believe that our brains will become lazier in a world dominated by intelligent machines.
6. Original: The invasion of artificial intelligence in our daily life brings about a higher efficiency while it also, to some extent, spawns our incapability.
Revised: The integration of artificial intelligence into our daily lives improves efficiency but also, to some extent, diminishes our capabilities.

Regarding ChatGPT feedback, students adopted more than half of the provided feedback, incorporating both language and content suggestions. In contrast, students adopted a greater number of teacher feedback suggestions than ChatGPT feedback, revising their essays based on both content and language comments. The percentage of feedback adoption by students serves as an indicator of their behavioral engagement, suggesting that students generally engaged behaviorally with both ChatGPT and teacher feedback. The higher adoption rate of teacher feedback can be attributed to its more specific and concise features, which made it easier for students to understand and apply in their revisions. Conversely, students adopted fewer pieces of ChatGPT feedback, likely due to its generality, particularly with respect to content-related comments. While

ChatGPT provided both original drafts and revised samples, students often struggled to understand why certain changes were made to their original versions, which contributed to the lower adoption rate of ChatGPT feedback.

In terms of the time students spent on revision, those who participated in the interview reported that they spent 40 minutes to 1 hour revising their essays based on ChatGPT feedback, whereas they typically spent only 30 minutes revising their writing with teacher feedback. The additional time spent on ChatGPT feedback can be attributed to the fact that its suggestions were not targeted at specific sentences requiring content revision. As a result, students had to go through all the feedback and reread their essays to identify which sentences or expressions ChatGPT was suggesting for

Figure 3
Example of teacher feedback

Say good-bye to Loneliness, Say hello to Wisdom
While it is acknowledged that loneliness is prevailing in this era, a newly published research shows that late 20s, mid-50s and late 80s are three peak periods of loneliness. Additionally, it is affirms that the general sense of isolation is beyond expectation supported with a high rate of high levels of loneliness study. It is noted that loneliness is a subjective distress which occurs when there is a gap between the expected social relationship and reality. What's more, further findings show that the more wisdom a person accumulates, the less lonely they feel. From my perspective, I firmly believe that the wiser people feel less lonely, for they expect less social relationship and have more friends in real life.

Initially, the wiser people expect less social relationship in real life and spend more time to reflect on themselves. Since it is confirmed that loneliness is defined as 'subjective distress', which means people play the dominant role in relationship with loneliness. To be precise, it is the disappointment of ideal social relationship and reality that mainly lead to the cause. Therefore, the person who overcomes the loneliness, is the ones who lays less expectations on social relationship. The wiser people are good at communicating with themselves and concern less about socializing, so it is not necessary for them to access the dismay of loneliness.

Besides, there is no denying that the wiser people are often more popular. The more wisdom a person gains, the more appropriate their behaviors will be in communications, accommodations and amusements, etc. Throughout my life, I have found that those who are wise and intelligent not only perform well in academy but also are considerate and careful when getting along with others. In this way, there is no wonder that people want to sustain friendships or social relationships with them.

In conclusion, loneliness is closely related with wisdom and they are in an inverse relationship. In this way, to bid farewell to loneliness or to become popular in social relationship, it is strongly suggested to communicate with inner world, expect less on socializing and accumulate more wisdom.

Good summary and comments, but some sentences are not clearly expressed.

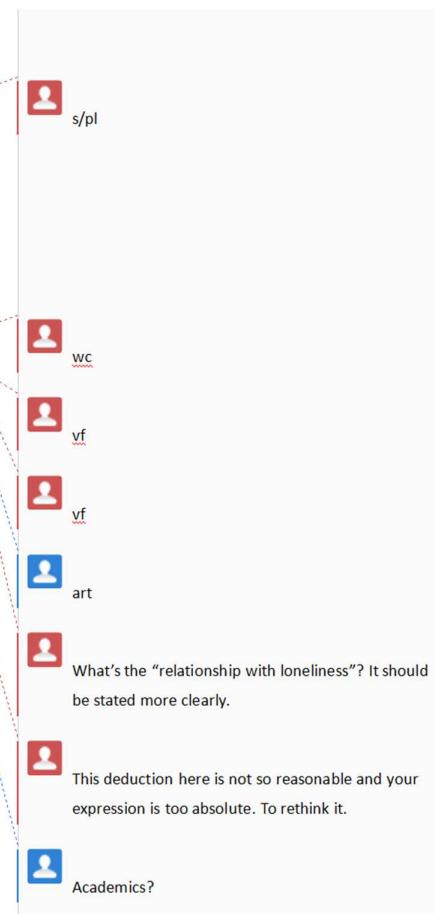


Table 1
Revision operations

Revision operations	Descriptions
Zero operation	No response to feedback
Effective correction	Errors in grammar (e.g., verbs and nouns) and mechanics (e.g., spelling and punctuation) are correctly addressed.
Ineffective correction	Errors in grammar (e.g., verbs and nouns) and mechanics (e.g., spelling and punctuation) are incorrectly addressed.
Addition	Provision of additional words or phrases excluding error correction (e.g., I'm shocked → I'm extremely shocked)
Deletion	Removal of identified errors or problem areas
Substitution	Replacement of original words or phrases with new ones, excluding error correction (e.g., rich family → affluent family)
Rewriting	Changes made at the syntactic and discoursal levels, excluding error correction

Table 2
Types of feedback adopted by the 46 students

Feedback	ChatGPT feedback (%)	Teacher feedback (%)
Adopted feedback	Content	27.6
	Language	30.5
		58.1
Not adopted feedback		65.2
Total	41.9	34.8
	100	100

revision. This process proved to be time-consuming. Furthermore, some of the content-related suggestions from ChatGPT were unclear with complex vocabulary and sentence structures, which required students to spend extra time interpreting the meaning and intention behind the feedback. In contrast, teacher feedback was more explicit, as it included marginal comments that highlighted the specific words and sentences needing revision. This allowed students to follow the feedback more directly and efficiently, resulting in less time spent on the revision process.

4.2. Affective engagement

Students' affective engagement with feedback was reflected in the questionnaire and interview data. Overall, students exhibited both positive and negative attitudes toward ChatGPT feedback, with a predominance of positive responses. In contrast, the majority of students displayed positive attitudes toward teacher feedback. In both the questionnaires and interviews, students used a range of positive adjectives, such as "happy," "grateful," "helpful," and "useful," to describe their feelings toward ChatGPT feedback. For instance, one student commented, "*I am very happy that the feedback was detailed and provided specific revision suggestions, even including case studies.*" This statement reflects a positive response to ChatGPT feedback. However, some students expressed negative reactions, using adjectives such as "disappointed" and "tired" and showing doubts about the feedback. One student remarked, "*I felt a bit disappointed with its feedback. It seemed that it was not satisfied with my essay.*" This suggests that ChatGPT's feedback may have had a discouraging effect on some students, leading to feelings of frustration or disappointment. Additionally, a student interviewed stated, "*I feel stressed when revising my essays because I have to spend a lot of time understanding ChatGPT's feedback, which also makes me feel tired during the revision process.*" This response indicates that ChatGPT's feedback can contribute to stress and fatigue in students. Therefore, while students generally expressed positive feelings toward ChatGPT feedback, there were also instances of negative emotional responses.

In terms of teacher feedback, the majority of students expressed positive responses, often using adjectives such as "relaxed," "happy," and "enlightening." For instance, one student remarked, "*Teacher feedback is very clear, and I can revise my essay smoothly. Compared to ChatGPT feedback, I felt more relaxed using the teacher's suggestions than ChatGPT's.*" This suggests that students were able to revise their essays effectively with positive emotional responses during the process. Additionally, another student commented, "*I feel happy to have the opportunity to receive my teacher's suggestions on my writing; it is valuable.*" This indicates

that students were satisfied with teacher feedback and perceived it as beneficial for improving their writing performance.

4.3. Cognitive engagement

Cognitive engagement can be observed through students' revision operations. After collecting and coding the data, the percentages of students' use of different types of revision operations are presented in Table 3.

Table 3 illustrates that most students did not revise their essays following the feedback and they rewrote during their revision process when utilizing ChatGPT feedback. Similarly, when receiving teacher feedback, students also favored zero operation, although they demonstrated more effective corrections compared to the zero operation. While zero operation does not reflect students' behavioral engagement, it does offer insights into their cognitive engagement. This is because students chose not to revise the identified areas after careful consideration. In the interview, one student explained, "*ChatGPT feedback asked me to rewrite my thesis statement more clearly, but I believe I had already written a very direct and clear statement. Therefore, I did not find it necessary to revise it. Moreover, some of the revised suggestions were similar to my original version. As a result, I chose not to adopt these pieces of feedback and kept my original sentences.*" A similar example of zero operation was provided in response to teacher feedback. One student stated, "*I did not change the word 'maintain' because I believe it is appropriate in this context.*" Based on these interview responses, students' cognitive engagement can be inferred from their understanding of the feedback, their comparison of the revised versions with their original texts, and their consideration of whether to modify their expressions.

When revising their writing using ChatGPT feedback, students restructured their texts based on feedback related to content and adopted suggestions for language improvements. In terms of content, students encountered challenges when interpreting ChatGPT's feedback. One student explained, "*I felt confused about what ChatGPT wanted me to revise in my essay. I didn't know which parts it referred to. I spent a lot of time trying to understand the feedback and reread my essay. I realized that I had combined two separate points in one paragraph, so I split it into two paragraphs and added more details and evidence to support each point.*" In this case, the student revised his essay by restructuring the paragraphs, reflecting on the feedback, and employing strategies to improve the clarity and organization of his writing. Additionally, some students incorporated ChatGPT's language suggestions, which mainly involved syntactic adjustments, such as changes in word order, the use of clauses, and the application of non-finite verb forms.

In teacher feedback, students were able to effectively correct most grammatical errors. For example:

1) feedback: *art*

revision: *acting as an effective and favorable way* → *acting as an effective and favorable way*

2) feedback: *vt*

revision: *they knew clearly* → *they know clearly*

Students were able to follow teachers' feedback on grammar and make revisions as required. This indicates that students could understand the marked suggestions, such as "*art*," which referred to errors in article usage, and "*vt*," which pointed to mistakes in verb tense. They were able to recognize these errors and make corrections based on their understanding, demonstrating cognitive engagement with the feedback. According to the data in Table 3, there was no

Table 3
Types of revision operations elicited by ChatGPT and teacher feedback

Revision operations	Revised timed writing 1 (%)	Revised timed writing 2 (%)
Zero operation	41.9	30.4
Effective correction	5.3	41.6
Ineffective correction	0.4	2.5
Addition	0.4	0.0
Deletion	7.6	11.5
Substitution	5.8	0.8
Rewriting	38.6	13.2
Total	100	100

evidence of addition following the adoption of teacher feedback. The reason is likely that the teacher did not include this type of suggestion in the feedback, given the nature of the grammatical mistakes. In one instance of revision based on teacher feedback, a student stated, “*The teacher’s suggestions required me to express my statement more directly and clearly. I agree with this because my original draft had a thesis statement that was somewhat general. By incorporating this feedback, I can present my point more clearly and directly.*” This example demonstrates that students were able to follow content-related suggestions from the teacher and improve their essays through revision.

4.4. Students’ perceptions of ChatGPT and teacher feedback

Based on the data from the questionnaires and interviews, students expressed their perceptions of ChatGPT and teacher feedback, as well as their suggestions for utilizing these two types of feedback in the L2 writing classroom. Regarding the strengths of ChatGPT feedback, students noted that it is more systematic, as the feedback covers various aspects of writing improvement. For example, ChatGPT provided suggestions on how to enhance writing quality, such as by incorporating more specific examples, reorganizing essays, and presenting counterarguments. One student in the interview stated, “*I have improved my language use by adopting ChatGPT’s feedback, particularly due to its multiple options for advanced vocabulary and collocations.*” This suggests that students can benefit from adopting ChatGPT’s language-related suggestions. Additionally, students found that ChatGPT offered more useful advice on language use, including varied word choices, diverse sentence structures, academic expressions, and revised samples without errors.

However, students identified several weaknesses in ChatGPT’s feedback. One significant issue was that the feedback was often perceived as general and abstract. For instance, ChatGPT suggested that students “*ensure that your argument is clearly articulated and supported throughout the essay,*” but students showed confusion about how to achieve this specific goal and meet the standards mentioned by ChatGPT. Another weakness was that some of ChatGPT’s feedback did not meet the requirements of the writing task. For example, in the conclusion section, ChatGPT suggested that students provide solutions to the problems discussed in the essay. However, according to the writing task instructions, offering solutions was not necessary in the conclusion; thus, most students ignored this feedback. Furthermore, ChatGPT was unable to provide suggestions for the summary section because the prompt did not include relevant excerpts or materials.

Regarding teacher feedback, most students argued that it was targeted and clear, as it typically consisted of marginal comments on specific words or sentences. As a result, students were able to follow the feedback more easily to correct their essays. Additionally, revising essays with teacher feedback was perceived as more efficient, as the feedback was generally shorter than that provided by ChatGPT, allowing students to spend less time reading, understanding, and incorporating the suggestions. Furthermore, students found that teacher feedback helped them identify their weaknesses, particularly in areas such as providing evidence and improving logical coherence. One student interviewed stated, “*I have noticed my weaknesses in presenting my thesis statement by reviewing teacher feedback. Next time, I will pay more attention to my points and how to relate my evidence to my thesis.*” This process encouraged students to engage in reflective thinking, thereby improving their writing performance. Lastly, students viewed teacher feedback as

more acceptable and understandable because teachers evaluated their essays based on the specific writing requirements and students’ individual writing styles. Furthermore, students felt that teachers’ comments were more closely consistent with their own thinking, reducing the risk of misinterpretation of their intended meaning.

5. Discussion

This study examined students’ engagement in revising their essays assisted by feedback from both ChatGPT and teachers. Overall, students showed positive engagement with both types of feedback, which accords with the findings of Wang and Xue [39], suggesting that AI-driven chatbots can positively impact students’ academic engagement in Chinese EFL classrooms. Students implemented feedback more frequently than ChatGPT feedback in all dimensions, which is consistent with Lu et al.’s [20] results.

5.1. Behavioral engagement

Behaviorally, students showed profound behavioral engagement with ChatGPT and teacher feedback, echoing the finding of Yeung [37]. Students accepted more than half of the feedback provided by both ChatGPT and their teachers, successfully revising most of the grammatical errors. The revision process revealed that students generally considered both teacher and ChatGPT feedback. Their adoption of this feedback was not automatic, but the result of a decision-making process in which they considered factors like intelligibility, practicality, and relevance. However, the proportion of feedback incorporated in the revisions was not consistent with the findings of Han and Li [24], who reported that students integrated a greater proportion of the feedback, resulting in fewer instances of zero operation. This discrepancy may be attributed to the limitations of ChatGPT in meeting the specific requirements of the writing tasks in this study, which could explain the lower adoption rate compared to the previous study. The relatively lower rate of ChatGPT feedback uptake in this study can be attributed to two primary factors. First, participants perceived that the ChatGPT feedback is not targeted to the specific requirements of the TEM 4 assessment and sometimes misinterpreted the students’ intended meaning of their writing. Second, a portion of the ChatGPT feedback was not specific, providing general suggestions that lacked tailoring to the individual student’s essay, limiting its relevance and applicability.

5.2. Affective engagement

Affectively, students expressed both positive and negative feelings about ChatGPT feedback, with a predominance of positive attitudes overall. These findings align with those of Koltovskaia et al. [36] and Li and Ke [34]. A majority of students expressed appreciation for receiving feedback from both ChatGPT and their teacher, reporting that this guidance enhanced their motivation to revise. They perceived this approach as a valuable instructional support. Koltovskaia et al. [36] suggested that students’ reactions to ChatGPT feedback were generally positive, although some negative feelings were also reported. Li and Ke [34] reported that AWE systems are very time-saving and handy but too rigid. However, there was a divergence in the reasons for the negative attitudes between the two studies. In this study, students found ChatGPT feedback to be overly general and time-consuming, whereas participants in Koltovskaia et al.’s [36] study reported that ChatGPT occasionally provided inaccurate feedback. Few students in this study highlighted concerns regarding the accuracy of ChatGPT’s feedback. More broadly, ChatGPT feedback was frequently

characterized as general, lacking in specificity. Consequently, students reported that the process of interpreting and adopting this feedback required considerable time and cognitive effort. Besides, AWE systems may twist students' meaning in providing suggestions [34]. Students show more positive affective engagement in teacher feedback, in agreement with Cheng and Zhang's [7] finding, showing similar affective engagement with teacher and automated feedback. Students demonstrated a preference for teacher feedback, attributing it to the established trust in their teacher's subject expertise and pedagogical guidance, particularly on the specific skills and assessment for improvement in L2 writing.

5.3. Cognitive engagement

Cognitively, students demonstrated profound engagement in revising their essays following ChatGPT and teacher feedback. With regard to ChatGPT, these results are in agreement with those of Koltovskaia et al. [36], who found that students were able to notice and comprehend most of the suggestions, although they sometimes felt confused by inaccurate feedback, which they subsequently recognized and rejected. In the present study, students also reported that some feedback deviated from the task requirements, leading them to neglect it and retain their original versions. This is the reason for the high proportion of zero operation in students' revision with ChatGPT. Zero operation still shows their cognitive engagement for their consideration and comparison of the feedback and their original draft. The higher rate of effective corrections with teacher feedback can be attributed to its direct marginal comments on localized errors in grammar and spelling, which facilitated a straightforward revision process. A few revision operations on ineffective correction showed that students can understand both ChatGPT and teacher feedback, revising correctly based on the feedback. For the addition, deletion, and substitution, a few revision operations on these two types were conducted due to the feedback collected from ChatGPT and teacher feedback, which means little feedback suggests students to add more words, delete some words, or substitute certain words. However, more cases of deletion in teacher feedback are attributed to difficulties of revision. The reason for more revision operations on rewriting can be students' acceptability of the syntactic change of the provided samples, which mostly rewrite their original sentences. However, this study is inconsistent with the finding of Yeung [37], which illustrates a relatively limited level of cognitive engagement. The reason is that the response of ChatGPT and students' attitude toward ChatGPT affect their cognitive engagement. In this study, students' feelings and attitudes do not affect much on their engagement.

5.4. Students' perceptions of ChatGPT and teacher feedback

In terms of students' perceptions of the two types of feedback, they identified both advantages and disadvantages of ChatGPT feedback. When compared to ChatGPT feedback, teacher feedback was perceived as having more strengths. In terms of advantages, ChatGPT was able to generate more systematic and quantitative suggestions, a finding that echoes the results of Guo and Wang [18], who reported that ChatGPT's feedback was created in just a few seconds. However, regarding ChatGPT's feedback on content-related feedback, limitations are shown in this study. First, ChatGPT lacks specificity in content-related issues. For example, most of the ChatGPT feedback on the examples is "*Incorporating specific examples or case studies could strengthen your argument.*" This feedback required students to add more examples that can be suitable for every

argumentative writing. Besides, Feedback on counterargument is also quite general, stating "*Acknowledge potential counterarguments and provide rebuttals to strengthen your argument.*" It is more like a reminder for students in writing without providing specific ideas on how to write a counterargument. In this study, students expected that ChatGPT feedback could provide more details on how to revise based on the suggestions. In contrast to ChatGPT, teacher feedback provided suggestions that encouraged students to think critically, rather than directly correcting their essays. This supports the perspectives of Guo and Wang [18], who argued that ChatGPT tended to offer more directive feedback than the teachers, while the teachers used informative and query feedback more frequently. Students prefer teacher feedback and show greater understanding with teacher feedback, resonating with Lu et al.'s [20] findings, demonstrating readability, clarity, and specificity of teacher feedback. Teacher feedback involved local and global issues, which are inconsistent with the results of Lin and Crosthwaite [19], arguing that there is a degree of inaccuracy in teacher feedback.

6. Conclusion

This study investigated student engagement with ChatGPT and teacher feedback by analyzing students' writing drafts, questionnaire data, and semi-structured interview responses. The findings revealed that students exhibited positive engagement across behavioral, affective, and cognitive dimensions. The features of the two types of feedback contributed to slight variations in the degree of student engagement. Furthermore, both ChatGPT and teacher feedback facilitated students' revision processes, and for some students, it led to improvements in their writing skills through the learning derived from the feedback.

Despite its contributions, this study has several limitations, which suggest directions for future research. First, the prompts used to generate feedback from ChatGPT should be clearer and more specific, as some of the feedback collected deviated from the topic, while other feedback was overly general and applicable to all contexts. Thus, future studies should focus on refining the prompts to generate more accurate and context-based feedback from ChatGPT, as well as ensuring that the prompts are tailored to the specific writing tasks. Second, this study did not examine changes in students' engagement, which limits the understanding of the effectiveness of ChatGPT and teacher feedback. Future research could investigate how student engagement evolves over time and explore the impact of ChatGPT feedback on students' writing performance.

In terms of pedagogical implications, teachers can utilize ChatGPT-assisted feedback to make their comments more comprehensive and provide students with more efficient suggestions in L2 writing classrooms. Furthermore, instructors can introduce ChatGPT to students, teaching them how to identify valid feedback and assess whether it should be incorporated into their revisions. In other words, the merits and demerits of ChatGPT feedback should be carefully considered in L2 writing instruction. Overall, ChatGPT is a powerful AI tool that can be integrated into L2 writing practices; however, further efforts are needed to explore its full potential and to enhance students' writing skills.

Ethical Statement

This study involving human participants was reviewed and approved by the Ethics Committee of Wuhan University of Technology. All participants of the study provided their written consent before participating in the study.

Conflicts of Interest

The author declares that she has no conflicts of interest to this work.

Data Availability Statement

The data that support this work are available upon reasonable request to the corresponding author.

Author Contribution Statement

Jiaying Liang: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization.

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How to Cite: Liang, J. (2026). Student Engagement with ChatGPT and Teacher Feedback in L2 Writing. *International Journal of Changes in Education*. <https://doi.org/10.47852/bonviewIJCE62026891>

Appendix A

Questionnaire 1

- 1) What suggestions did you use from ChatGPT's feedback in revising Timed Writing 1? How did you use these suggestions?
- 2) What problems did you meet when using ChatGPT's feedback in the revision? How did you solve these problems?
- 3) What have you learned from using ChatGPT's feedback in revising your essay? What do you think of ChatGPT's feedback? Do you find it useful in revising your essay and improving your writing skills?
- 4) What are the strengths and weaknesses of your revised Timed Writing 1? In which aspects do you think you have improved compared to the draft finished in class?

Questionnaire 2

- 1) What have you learned from using the teacher feedback in revising your essay? What do you think of teacher feedback? Do you find it useful in revising your essay and improving your writing skills?
- 2) What problems did you meet when using teacher feedback in the revision? How did you solve these problems?
- 3) Which one is easier for you to accept and understand, ChatGPT feedback or teacher feedback? Why?
- 4) In terms of content, which do you think is more useful for revising your writing, ChatGPT feedback or teacher feedback? Why?
- 5) In terms of language, which do you think is more useful in revising your writing, ChatGPT feedback or teacher feedback? Why?

Appendix B

Interview

- 1) Let's discuss this specific piece of feedback. Why didn't you address the issue identified by the feedback?
- 2) Why did you decide to remove this error or section as identified by the feedback?
- 3) Why did you substitute this particular word or phrase?
- 4) Why did you add this word, phrase, or sentence?
- 5) Why did you make this organizational change?
- 6) Did you use any specific strategies during the revision process? Can you describe what the process was like?
- 7) What were your first impressions of ChatGPT feedback and teacher feedback? (What do you think of...?)
- 8) How did you use ChatGPT and teacher feedback to revise your essay?
- 9) How did you revise your essays after receiving ChatGPT and teacher feedback? Can you give any specific examples?
- 10) How much time did you spend revising your essay based on the feedback?
- 11) How do you feel about ChatGPT and teacher feedback? Can you give any specific examples?
- 12) Did you make the most improvement in your draft? (e.g., grammar, organization, wording, spelling)?
- 13) Which type of feedback did you find most helpful in improving your writing ability?
- 14) Can you identify your writing strengths and weaknesses based on the ChatGPT and teacher feedback?
- 15) Do you see any differences between the ChatGPT and teacher feedback? If so, what are they?
- 16) Do you have any comments or suggestions for improvement in using ChatGPT and teacher feedback in the future?