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Enhancing Chinese Efl College Students' Engagment In Academic English Writing Through Ai-Supported Tools: Student Exeriences and Insights

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Abstract

This research explores the effects of AI-driven tools—Grammarly, Wenxin Yiyan, and Turnitin—on the academic English writing engagement of Chinese undergraduates. The study was carried out in one public university in China and in total 50 sophomore students were participated. A mixed-methods approach was adopted, incorporating a quasi-experimental study (N=50) with pre- and post-tests to measure student engagement, alongside semi-structured interviews (N=4) to explore student perceptions. The findings indicate that AI tools substantially improve students' emotional and cognitive engagement in academic writing, providing personalized learning experiences and prompt feedback. The implementation of these tools promotes an interactive and supportive learning environment, thereby encouraging increased participation and critical thinking. Nevertheless, the study also identifies potential issues related to over-dependence on AI tools, which could impede the development of critical thinking ability, including problem-solving and innovation. This study underscores a balanced teaching approach for integrating AI supported technologies into academic writing pedagogy, recommending their use as supplementary resources that augment conventional instructional methods. The results provide significant implications for educators and policymakers in optimizing English writing instruction through technology while mitigating potential negative consequences.

Keywords: AI-supported tools, Chinese EFL students, Academic writing, Student engagement, Critical thinking, Educational technologies

INTRODUCTION

The proliferation of technology has led to the integration of AI-driven tools across diverse disciplines, including education. Within the context of Chinese language acquisition, platforms such as Grammarly and Wenxin Yiyan provide automated feedback and individualized support, potentially reshaping student interactions with academic writing (Wang et al., 2024). The importance of student engagement in enhancing learning outcomes is well-established. Prior studies have extensively studied the effect of student engagement on their academic performance, particularly in the second or foreign language acquisition (Fathi et al., 2024).Many have investigated how academic engagement impacts language acquisition (Wang, 2023; Asif et al., 2022). Information technology advanced with high speed, artificial intelligence (AI) has also gained notable attention and application in language learning. This undoubtedly expands the evaluation of student engagement under the support of AI technology. AI-driven tools augment student engagement by fostering interactive learning environments and consistently promoting focus and participation through precise, timely, and personalized feedback, as well as conversational interfaces (Chiu et al., 2023; Huang et al., 2023). Moreover, AI-supported tools play a key role in delivering personalized and adaptive learning

experiences, which significantly boost sustained student engagement throughout the learning process (Berendt et al., 2020; Xu et al., 2023). The integration of AI into education also facilitates deeper learning by tailoring lea rning pathways to individual needs and preferences (Strobl et al., 2019). Through the analysis of engagement and performance data, these advanced systems can pinpoint areas where students struggle and provide targeted interventions. This enables AI tools to optimize the learning experience and offer educators valuable insights into students' learning behaviors and engagement levels. This study aims to examine the impact of

AI-supported tools on the engagement of Chinese EFL college students in their academic writing processes. By adopting a mixed-method approach, this research seeks to provide an integral understanding of both the benefits and limitations when integrating AI tools into academic writing instruction.

Problem Statement

Chinese EFL students encounter several challenges in academic English writing, including issues with grammar, coherence, and the inherent complexity of academic language (Zhang & Liu, 2022). These difficulties often reduce students' motivation and engagement, ultimately affecting both their learning outcomes and academic performance. While AI-supported tools have the potential to help students address some of these challenges, their use in educational settings is still relatively new. As a result, there is limited experimental evidence regarding the effectiveness of AI tools in enhancing student engagement, particularly in the context of academic writing. This study aims to fill this gap by exploring how AI-supported writing tools—such as Grammarly, Wenxin Yiyan, and Turnitin, which are widely accessible and used in China—impact the engagement of Chinese EFL students in academic English writing. The findings of this research provide valuable insights for educators and policymakers seeking to improve English writing instruction and foster greater student engagement.

Research questions

1. How does the use of AI-supported tools（Grammarly, Wenxin Yiyan and Turnitin) influence the engagement levels (behavioral, emotional, and cognitive) of Chinese EFL college students compared to traditional writing methods?
2. To what extent do AI-supported tools （Grammarly, Wenxin Yiyan and Turnitin) enhance the engagement of Chinese EFL college students in their academic writing processes?
3. What are the learning experiences of Chinese EFL college students utilizing AI-supported tools in the context of academic English writing?

LITERATURE REVIEW
AI-supported Tools

AI-supported tools represent advanced systems that not only stimulate human intelligence but also showcase various forms in recent high-tech developments (Wang et al., 2021). In language education, four commonly used types of AI systems exist: "intelligent tutoring systems", "chatbots", "dashboards", and "automated assessment systems" (Chen et al., 2022). To explore the impact of AI-assisted tools on student academic

engagement, two types were utilized in the current research: chatbots and automated assessment systems. First, AI-supported chatbots are considered "a software tool that can interact with users by means of text or voice using natural language" (Hew et al., 2023, p50).The widespread application of AI-supported chatrooms in language learning environments stems from their use of advanced computer systems, which create authentic and direct language contexts for students (Khalifa & Albadawy, 2024) and improve their higher order thinking ability (Borge et al., 2024). According to Labadez et al., (2023), AI-supported chatrooms can quickly understand and respond to user inquiries, greatly assisting students in overcoming limited opportunities for practicing the target language. In this study, the AI chatbot Wenxin yiyan was employed to facilitate the language learning process.

Another major type of AI system is the automated assessment system. This system can identify and recognize the work of language learners and provide automatic evaluations (Wilson et al., 2021). Automated Writing Evaluation systems (AWEs) represent a significant application of this automated assessment system (Strobl et al., 2019). AWE leverages natural language processing algorithms to automatically monitor, assess, and provide feedback on student writing (Barrot, 2023). Common examples of AWEs include Criterion, Pigai, and Grammarly. Previous research has shown that AWE systems can help students improve their writing performance and scores (Chen et al., 2022; Link & Rahimi, 2022), positively impacting the quality of their writing (Ou et al., 2024). In this research, Grammarly and Turnitin were employed in the academic English writing learning process to provide timely grammatical error correction and general feedback and evaluation on students' writing.

Affordances and Limitations on AI-Supported Tools in Foreign Language Learning

With the continuous advancement of artificial intelligence (AI) technologies and the ongoing innovation of AI tools, their development within the domain of second language acquisition (SLA) and foreign language learning has garnered significant attention and investigation from researchers. Prior studies have indicated that numerous researchers have explored the impact of AI-assisted tools on student learning outcomes(Song et al., 2023; Wang et al., 2024). For instance, an experimental study conducted by Han (2020), she studied the impact of AI-assisted chatbox on the language proficiency of Korean EFL learners. The results revealed that participants' speaking abilities improved through the assistance of the AI chatbox. Song et al., (2023) found that Chat GPT influences students' English writing skills. In addition to these studies on language competencies, some researchers focus on how

AI-supported educational tools affect students' learning attitudes and behaviors (Fathi et al., 2024; Zhang et al., 2024). A study by Xu et al. (2023) examined the impact of AI-supported tools on students' classroom engagement, finding that engagement levels increased under AI-supported instructional guidance. Another experiment by Fazil et al., (2024) investigated the use of AI-supported tools in enhancing academic engagement among Indonesian students, showing that AI-supported tools can indeed facilitate academic involvement. Researches in the past confirmed that AI-supported tools have been increasingly integrated into language learning, especially in providing real-time feedback (Zhang et al., 2024), personalized learning experiences (Huang et al., 2023), and enhanced engagement (Wang et al., 2024). Studies have shown that tools like Grammarly can improve writing accuracy and confidence among EFL students (Wei, 2023). Similarly, AI-driven platforms like Wenxin Yiyan offer context-aware suggestions, helping students to refine their writing (Zhang & Li, 2021). Xu et al. (2023) noted that AI-assisted tools offer language learners opportunities to tackle monotonous tasks or activities that can hinder academic engagement.

Despite these mentioned benefits, AI-supported tools have transformed the language learning process, presenting challenges for both students and teachers (Zou et al., 2020; Vall & Araya, 2023). For instance, due to insufficient technical knowledge regarding AI-assisted tools, students and teachers may struggle to effectively utilize these systems in language learning process (Vall & Araya, 2023). Furthermore, excessive reliance on AI tools in language courses may impair students' creativity and critical thinking skills, leading to a dependency on AI resources among both students and teachers (Zou et al., 2023). From this perspective, a comprehensive understanding of the affordances and limitations of AI-assisted tools in language education is essential for enhancing educational effectiveness and learning engagement (Borenstein & Howard, 2020; Wang et al., 2024). Despite the widespread research interest in AI-supported tools, few studies have explored their effects on students' academic English writing, particularly in the context of Chinese universities. This gap in research highlights the need for further empirical studies that specifically target the intersection of AI utilization and academic writing in diverse educational settings.

Engagement in Academic Writing

Engagement has been a widely researched factor in promoting learning. Engagement generally refers to the extent to which students engage in learning tasks or activities (Reeve, 2012). Skinner (2016) defines engagement as the ways students applied in learning activities, including active learning, seeking advice, and collaborating with peers. Zhou (2021) further suggests that in the language learning realm, engagement relates to the contributions students make towards completing a task during class time. Sang & Hiver (2021) propose that engagement in second language or foreign language learning can be understood from three aspects: Emotional engagement, referring to students' attitudes toward learning tasks or classroom experiences; Cognitive engagement, encompassing students' efforts and strategic approaches during learning, such as perseverance and self-regulation; Behavioral engagement, involving the time and energy students invest in learning, including attendance and participation in classroom activities. Past researches indicates that students' participation during the learning process significantly impacts language learning outcomes (Fathi et al., 2024; Wang et al., 2024) , that is higher participation correlates with improved results. It further proved that engaged students are more likely to invest time and effort in writing tasks, seek feedback, and demonstrate persistence (Ou et al., 2024). Research indicates that technology has a significant role in fostering engagement by creating interactive and immediate feedback (Kim et al., 2020).

The Chinese EFL Context

Academic writing plays a crucial role in achieving success in higher education. Yet, it often presents substantial difficulties for many university students. Chinese EFL learners frequently encounter obstacles in academic writing due to linguistic and cultural disparities (Zhang et al., 2022; Li & Han, 2023). The longstanding focus on rote memorization and exam-centric education compounds these challenges (Wilson et al., 2022). The intricate nature of academic English mainly limits students' performance (Jiang & Peng, 2023). Writing in academic English necessitates that students articulate their arguments in a formal and serious manner (Zaki & Yunis, 2015). Furthermore, academic writing skills require students to interact with, analyze, organize, and cultivate their own ideas grounded in pertinent information, while also expressing those ideas coherently (Al Fadda, 2012). In light of these considerations, it is not surprising that students from non-English-speaking backgrounds often confront various challenges (Mallia, 2017).

Prior research on English writing indicates that integrating technology into education yielded favorable outcomes (Chen et al., 2022; Nguyen et al., 2021). The integration of technology facilitates collaborative learning environments (Tang et al., 2024), allowing students to engage with their peers and share constructive feedback (Kim et al., 2020). By leveraging digital platforms, students can enhance their writing through real-time revisions and access a plethora of resources that

support their academic endeavors (Haristani et al., 2020). Employing AI-supported tools in this context may alleviate some issues by providing customized assistance and fostering a more engaging learning environment. Furthermore, these tools facilitate personalized learning experiences tailored to individual student needs, offering assistance and support when challenges arise (Miradad et al., 2024). Ultimately, a pedagogical approach that integrates traditional instructional methods with advanced technological tools can enhance student engagement and performance in academic English writing.

METHOD

Research Design

The current research aims to detect the impact of AI-supported tools on enhancing the engagement of Chinese EFL college students in learning academic English writing. This research employed a mixed-method design, which includes a quasi-pre and post-test experiment to assess the effects of AI-supported tools on student engagement. Additionally, another qualitative study utilized semi-structured interview to gather participants' experience and understanding of using AI-supported tools in learning academic English writing. This mixed-method approach provided a comprehensive insight and exploration of the research.

Context and Participants

This mixed-method research was conducted at a public university in one eastern province of China. The university's English department is well-established and offers relevant courses in academic English writing. The teaching environment is modern, featuring computer labs and internet facilities that fully implement AI-assisted tools.

In this research, 50 second-year students from enrolled academic English writing courses participated. These students were randomly divided into two groups. The experimental group consisted of 25 students who received traditional academic English writing instruction, supported by AI tools, while the control group continued with traditional academic English writing instruction without any AI assistance. Another 4 participants (randomly selected from experiment group) were interviewed after the treatment.

Utilization of AI-Supported Tools

In this study, three distinct AI-supported tools were utilized by the experimental group to support their academic English writing development. The selected tools include Grammarly, Wenxin Yiyan, and Turnitin. While AI-based tools for language learning are common in many Western countries, access to these tools in China is often limited due to various restrictions on international platforms. As such, the choice of tools for this study was guided by their availability, functionality, and cost-effectiveness, as all three tools offer free versions that are easily accessible to students in China.

Grammarly is an AI-driven writing enhancement tool that provides authors with immediate feedback on grammar, lexicon, syntax, and overall text structure.It is widely known for its user-friendly interface and detailed explanations of language errors, which support students in improving both the accuracy and fluency of their writing. Grammarly also offers suggestions for enhancing writing clarity and conciseness, encouraging students to refine their academic English skills.

Wenxin Yiyan is an AI-driven chatbot developed by a leading Chinese technology company, which enables students to interact with the AI through either voice or text. This tool facilitates a more dynamic and communicative learning environment by engaging students in conversation around their academic writing challenges. Students can ask questions, clarify doubts, and receive tailored suggestions on their writing, making it particularly useful for addressing individual challenges and improving their understanding of complex writing concepts. This interaction allows for an authentic language experience that mirrors real-world academic discussions.

Turnitin is a widely recognized tool primarily used for plagiarism detection, but it also provides valuable feedback on text coherence, citation practices, and overall writing quality. Students upload their written work to the Turnitin platform, where they receive comprehensive reports that highlight areas of concern, such as potential plagiarism, structural issues, and areas requiring improvement in academic writing. Turnitin's automated feedback is timely, which supports ongoing revision and refinement of writing skills.

By incorporating these three AI-supported tools, the study aimed to provide students with a comprehensive suite of resources that target different aspects of academic writing. Grammarly and Turnitin focus on technical aspects like grammar, syntax, and plagiarism, while Wenxin Yiyan offers a more interactive, conversational approach to resolving writing-related challenges. Together, these tools helped create an engaging, supportive, and personalized learning environment for the participants, promoting increased involvement in the writing process and facilitating the development of their academic English skills.

Procedures

Before the research and data collection began, informed consent forms were distributed to all participants to ensure their voluntary participation in the study and to obtain
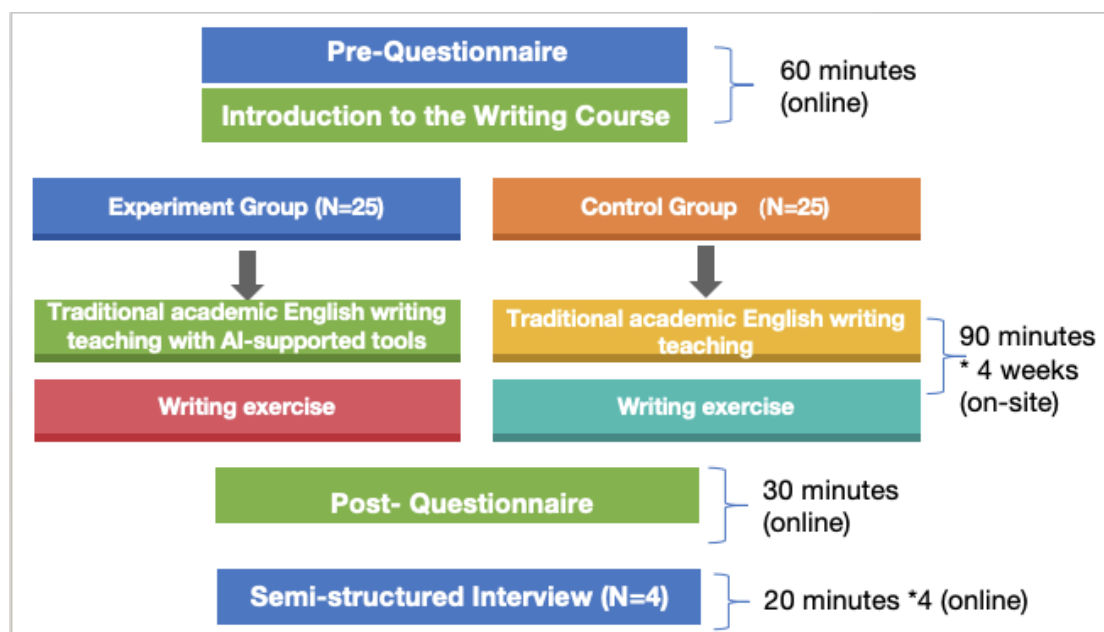
Fig. 1: Summary of Research Procedures

their authorization for the use of their data. The experiment was conducted over a period of 6 weeks, and the specific procedures followed throughout the study are outlined below (see Figure 1).

Pre-Intervention Phase (Week 1):

One week prior to the start of the intervention, 50 participating students were randomly assigned to two groups: a control group (N = 25) and an experimental group (N = 25). To assess their initial levels of engagement in second language learning, participants completed a pre-test survey. The survey measured three key dimensions of student engagement: cognitive engagement, behavioral engagement, and emotional engagement. These dimensions were evaluated based on students' self-reported levels of interest, effort, and emotional investment in their academic English writing tasks.

After the completion of the pre-test survey, the teacher leading the experimental group conducted a 30-minute introduction to the intervention course. This session included a comprehensive overview of the course content, as well as detailed instruction on the features and functions of the AI-supported tools to be utilized in the study: Grammarly, Wenxin Yiyan, and Turnitin. The teacher explained how these tools would be incorporated into the course to support academic writing and improve student engagement, highlighting their personalized feedback and real-time assistance.

Intervention Phase (Weeks 2-5):

Over the course of four weeks, both groups received their respective academic English writing instruction.

The experimental group engaged in 90-minute sessions that incorporated the use of AI-supported tools. During these sessions, students utilized Grammarly for grammar and style corrections, Turnitin to check for plagiarism and provide feedback on academic writing structure, and Wenxin Yiyan for interactive, real-time assistance with writing challenges. Students were encouraged to use these tools both during the sessions and independently outside of class to improve their writing assignments.

Conversely, the control group received conventional academic English instruction devoid of AI tool integration. This cohort adhered to a consistent 90-minute weekly schedule, emphasizing traditional writing pedagogy, including lectures, discussions, and instructor-led feedback. The control group was denied access to the AI tools throughout the intervention.

Post-Intervention Phase (Week 6):

Upon completion of the four-week instructional period, both the experimental and control groups undertook a post-test survey designed to evaluate shifts in engagement levels. This survey replicated the pre-test's assessment of second language engagement dimensions (cognitive, behavioral, and emotional), facilitating a comparative analysis of the AI-supported tools' influence on student engagement in academic English writing.

Furthermore, to obtain a more comprehensive dataset regarding students' learning experiences with AI-assisted tools, semi-structured interviews were conducted with four participants (N=4) randomly selected from the experimental

group. These online interviews aimed to explore and understand, from the students' perspectives, the affordances of AI tools, their satisfaction with the overall learning process, and the impact and significance of such tools on their academic writing.

Data Collection

Quasi-Pre and Post Experiment

Instrument: The "L2 Engagement Scale" self-report developed by Zhou et al. (2021) was used to measure student engagement. This online questionnaire was administered to all participants before and after the experiment to assess their engagement levels. It consists of 24 items that cover three dimensions: behavioral, cognitive, and emotional engagement in second language learning, using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). A pilot test was conducted with 11 participants to ensure that the instrument was representative of the target sample. Reliability analysis using Cronbach's alpha revealed high consistency, with engagement levels for behavioral, emotional, and cognitive aspects scoring 0.725, 0.825, and 0.738, respectively (see Table 1). These results suggest that the survey items are highly reliable.

Table 1 Caption: Reliability Test Results

No.	Domains	Number of items	Reliability
1	Behavioral engagement	1-8	.725
2	Emotional engagement	9-16	.825
3	Cognitive engagement	17-24	.738
Total		24	.763

Data Analysis: To ensure the reliability of the experimental results, the initial data analysis involved assessing the normality of the acquired data, a critical assumption for parametric statistical analyses. This step was undertaken to confirm that the pre- and post-test scores exhibited a normal distribution. The Shapiro-Wilk test was used for this normality check, given the sample size.

Following the confirmation of normality, descriptive statistical analyses were conducted to summarize participant demographics and the outcomes of the intervention. This phase included the computation of mean, median, and standard deviation (SD) values for the three engagement scores from both the experimental and control groups. Descriptive statistics provided a clear overview of score distributions, allowing for the identification of significant variations or trends in engagement levels within each group.

To address the first research question, which concerned the changes in student engagement during the intervention, a paired samples t-test was employed to examine the pre- and post-test score variations within each group. The paired-samples t-test was chosen for its ability to compare means from the same participants before and after the intervention, making it suitable for evaluating the impact of the AI-supported tools on individual engagement levels. This test was conducted separately for each group (experimental and control) and for each engagement dimension (cognitive, behavioral, and emotional).

Furthermore, to investigate potential differences in engagement levels between the experimental and control groups, an independent samples t-test was utilized to compare the post-test scores of the two groups. This analysis aimed to determine whether the AI-assisted tool had a significant impact on student writing engagement compared to traditional teaching methods.

Semi-Structured Interviews

Instruments: To gain a comprehensive understanding of Chinese EFL students' perceptions and experiences regarding the use of AI-assisted tools in English academic writing classrooms, this study employed semi-structured interviews. Following Mackey and Gass (2005) assertion of the value of semi-structured interviews in providing a holistic understanding of the study, these interviews were conducted after the experimental intervention to allow the investigators to better understand the students' learning experiences and to conduct a more comprehensive analysis of the experimental results. The interviews primarily focused on students' feedback on how AI tools enhanced classroom engagement and their experiences with these tools in academic writing, including both advantages and disadvantages. To ensure the validity and reliability of the interview instrument, a pilot test was conducted with English learners to compare the responses with those from the research participants. Based on the results of the pilot test, the interview prompts were refined and finalized.

Data Analysis: Four participants (N=4) from the experimental group were randomly selected for online interviews lasting 20 minutes. All interviews were audio-recorded and transcribed with the participants' consent. The qualitative data obtained from the interviews were analyzed using thematic analysis, which enabled the researchers to gain a better and more comprehensive understanding of how students interacted with AI tools, building upon the quantitative findings. Specifically, the interview responses were transformed and coded into emergent themes, reflecting students' understanding of AI-assisted tools in academic writing. These themes were grouped into categories based on

experiences in classroom engagement, integrated AI-tools effectiveness, and challenges faced.

3.6   Ethical Considerations

In accordance with the ethical guidelines established by the Research Ethics Committee, all participants voluntarily engaged in this study. Prior to the commencement of the experiment, each participant received a comprehensive explanation of the study, encompassing its objectives and procedural steps. Detailed information, including the study's protocol and informed consent forms, was provided to each participant, and their consent was obtained. Participants were assured of their right to withdraw from the study at any point, and the confidentiality of all collected data was guaranteed.

Timeline

1. **Week 1-2:** Participant recruitment, Experiment guidelines and pre-test assessment.
2. **Week 3-6:** Implementation of the quasi-experiment (control and experiment groups).
3. **Week 7:** Post-tests and semi-structured interviews.
4. **Week 8-9:** Data analysis and interpretation.
5. **Week 10:** Reporting and dissemination of findings.

FINDINGS
Findings on Engagement Questionnaire

The normality test assessed whether the collected data follows a normal distribution (see Table 2). In the pre-test, the Kolmogorov-Smirnov and Shapiro-Wilk p-values for both control group were non-significant (P > .05), confirming the data's normal distribution. Similarly, in the post test, the p-values for control group (p=0.273) and experiment group (p= 0.209), remained above 0.05, indicating normal distribution in the collected data (Table 2).

Descriptive analysis was employed to evaluate the outcomes of participants before and after the testing (see table 3). This result demonstrates that AI-supported tools can positively influence Chinese EFL students' engagement when learning English academic writing. Notably can be seen in the table, both control and experiment groups experienced a certain level of improvement in engagement before and after the test. The experiment group showed greater enhancement in three distinct dimensions of engagement—behavioral, emotional, and cognitive—compared to the control group. Specifically, the post-test behavioral engagement of the experimental group (M=2.729, SD=0.333) exceeded that of the control group (M=2.646, SD=0.408). In terms of emotional

Table 2 Caption: Normality Test Results

Test	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	Control	0.171	25	0.072	0.935	24	0.133
	Experiment	0.160	25	0.121	0.933	24	0.124
Post-test	Control	0.151	25	0.114	0.947	24	0.273*
	Experiment	0.160	25	0.138	0.941	24	0.209*

Table 3. Descriptive Analysis Results

	Pre-test			Post-test		
	Mean	SD	Std. Error Mean	Mean	SD	Std. Mean
Behavioral Engagement						
Control G	2.547	0.351	0.072	2.646	0.408	0.083
Experiment G	2.646	0.319	0.065	2.729	0.333	0.067
Emotional Engagement						
Control G	2.510	0.389	0.080	2.541	0.399	0.082
Experiment G	2.473	0.423	0.086	3.542	0.498	0.101
Cognitive Engagement						
Control G	2.583	0.333	0.068	2.729	0.333	0.068
Experiment G	2.286	0.298	0.061	3.426	v	0.079

N=50 (each group N=25)

engagement, the experiment group's score exhibited a slight increase (M=3.542, SD=0.498), indicating that AI-assisted tools can enhance students' emotional involvement. For cognitive engagement, the experimental group also showed significant improvement (M=3.426, SD=0.387), suggesting that AI-supported tools facilitate deeper learning and critical thinking in academic writing tasks.

A paired samples t-test (See table 4 and 5)was employed to examine w hether statistically significant differences existed in engagement data (namely behavioral, emotional and cognitive engagement) between pre- and post-test assessments within both the control and experimental groups.The table indicates that, regarding behavioral engagement, there were no statistical significant differences either in the control group (p= 0.326, p > .05) or in the experiment group (p= 0.415, p > .05) before and after the intervention. Notably, the use of AI-supported tools enhanced emotional and cognitive engagement among Chinese EFL students in academic English writing. Specifically, in emotional engagement, there was a slight increase in the experimental group (p=0.000.

p < .05) before and after the intervention, whereas no such increase occurred in the control group (p=0.110, p > .05). In cognitive engagement, the experimental group (p=0.000, p < .05) showed a notable increase before and after the test, while the control group (p=0.143, p > .05) did not exhibit similar results.

The above results examined the impact of AI-supported tools on the engagement (behavioral, emotional and cognitive) of Chinese EFL students in academic English writing. In terms of behavioral engagement, both the experimental and control groups showed some enhancement in behavioral involvement, but the improvements were not statistically significant. This indicates that increasing behavioral participation through AI-assisted tools is the most challenging and additional support for the learning environment should be considered. However, in emotional engagement, the experimental group demonstrated considerable improvement compared to the control group. This suggests that AI-assisted tools effectively foster emotional engagement during the writing process. In cognitive engagement, the experimental group also exhibited

Table 4: Paired t-test result in control group

	Mean	SD	Lower	Upper	t	df	Sig
Behavioral Engagement							
Pre-test	2.547	0.351	-0.303	0.105	-1.003	23	0.326
Post-test	2.646	0.408					
Emotional Engagement							
Pre-test	2.510	0.389	-0.070	0.007	-1.661	23	0.110
Post-test	2.541	0.399					
Cognitive Engagement							
Pre-test	2.583	0.333	-.0.345	0.053	-1.515	23	0.143
Post-test	2.729	0.333					

N=25 (each group)

Table 5: Paired t-test result in experiment group

	Mean	SD	Lower	Upper	t		df	Sig.
Behavioral Engagement								
Pre-test	2.646	0.319	-0.291	0.124	-1.003		23	0.415
Post-test	2.729	0.333						
Emotional Engagement								
Pre-test	2.473	0.423	-1.367	0.007	-0.768	23	23	0.000
Post-test	3.542	0.498						
Cognitive Engagement								
Pre-test	2.286	0.298	-.1.347	0.053	-0.931		23	0.000
Post-test	3.426	0.387						

N=25 (each group)

significant gains over the control group, indicating that AI-supported tools contribute to deeper cognitive assistance in students' academic English writing.

Findings on Semi-structured Interview

Thematic analysis was utilized to explore the findings derived from the interviews. Respondents （N=4） were randomly selected from the experiment group. The data from their interview content, including themes, key codes, and direct quotes from participants, are presented in Table 6.

Regarding how participants understood engagement, students indicated that the incorporation of AI-supported tools (specifically Wenyan Yixin) had enhanced their classroom engagement, particularly evident in their increased participation in activities and a higher willingness to complete after-class tasks.

When asked about how AI-assisted tools, such as Wenyan Yixin, Grammarly and Turnityin, aid in their academic English writing learning, the survey found that the primary benefits of these tools center on personalized learning experiences, timely feedback, and abundant learning resources. Students indicated that AI-assisted tools provide personalized support aligned with their needs, ideas, and personal challenges—an aspect that traditional classroom settings struggle to achieve, yet is deemed crucial for students. Likewise, timely feedback enhances their writing content and conceptualization, thereby boosting their academic English proficiency. This immediacy of feedback showcases the interactivity of AI and reflects students' desires for an engaging teaching and learning process. Furthermore, the vast array of learning resources, including writing templates, guidance, and other relevant online materials, transcends the limitations of textbooks in

traditional education, making it highly beneficial in students' learning journeys. Additionally, the survey highlighted that students who actively utilized these tools reported a marked improvement in their confidence levels regarding academic writing. Two participants expressed that the iterative process facilitated by AI tools—where they could revise their drafts based on feedback—significantly contributed to their skill development. This iterative feedback loop not only allowed for deeper engagement with the writing material but also fostered a sense of ownership over their learning outcomes.

When asked about difficulties or challenges encountered during AI-assisted learning process, participants expressed their concerns. Four respondents identified a potential issue: reliance on AI tools. Students acknowledged the usefulness of these tools; however, they reported that their confidence wanes and anxiety increases in the absence of such support, undoubtedly affecting their writing performance. Additionally, they worried that using AI might hinder the development of their critical thinking skills. They tended to follow the paths suggested by Wenyan Yixin rather than engaging in independent thought. Specifically in writing tasks, they showed a preference for adopting AI-generated ideas instead of exercising their own creativity and critical writing skills. Furthermore, findings highlighted that while AI tools provide immediate assistance, students may inadvertently create a dependency that could stifle intellectual growth. This dependence is particularly evident during collaborative projects, where students expressed a desire for autonomy yet found themselves gravitating towards AI suggestions for convenience and efficiency. Participants articulated a fear that this reliance could ultimately lead to a superficial understanding of complex topics, as the depth of

Table 6. Summary of Thematic Analysis

No.	Themes	Codes	Meaningful Units
1	Engagement	Participation	"participate in/join the class activity", "attend the class", "play active in the class"
2		Interest	"willing to do the task", "interested in learning content", "focused in the learning", "happy to discuss"
3	Advantages	Tailored learning experience	"Learning experience based on my own needs", "not a problem for others but suitable for me", "my own writing problems", "support my own logical thinking" ,"varied needs and interests"
4		Immediate feedback	"timely feedback", "quick in pointing out my grammatical faults" "find out my vocabulary errors immediately" "within several minutes"
5		Sufficient resource	"a wider range of suitable resources" "various writing samples" "literature review resources" "resources in writing template and guidelines"
6	Potential	Over-reliance	" addicted to AI" "turn to AI's help constantly" "first ask AI then think" "less confident without using it"
7	Problems	Critical thinking	"follow what AI has already provided me" "don't help my critical thinking" "hinder my creative and critical thinking"

inquiry might be sacrificed for quick solutions. Consequently, educators are encouraged to strike a balance, integrating AI as a supplemental resource while fostering an environment that challenges students to cultivate their own analytical skills and creative prowess.

Overall, the findings suggest a multifaceted impact of AI integration on student engagement, necessitating further investigation into long-term academic outcomes. Addressing the mentioned concerns is also critical to developing a more robust learning experience that prepares students for the multifaceted demands of the academic and professional landscapes they will face.

DISCUSSION

Using a mixed-methods research design, this study examined the impact of AI-driven tools (specifically Wenyan Yixin, Grammarly, and Turnitin) on the academic English writing engagement of Chinese EFL university students. Additionally, it explored students' perceptions of these tools. The findings suggest that incorporating AI-supported tools into academic writing instruction significantly boosts student engagement. The use of AI tools creates a more interactive, personalized, and collaborative learning environment, positively influencing the cognitive, behavioral, and emotional aspects of engagement. These results align with previous studies, which show that AI-enhanced instruction significantly increases student participation and overall engagement (Huang et al., 2023; Fazil et al., 2023).

Cognitive Engagement

In terms of cognitive engagement, students exhibited greater levels of engagement as AI tools encouraged them to think more critically and creatively during the writing process. Students were motivated by timely feedback and suggestions from the AI tools, which helped them refine their writing. This aligns with Song's (2023) findings, which indicated that AI tools could address the limitations of traditional teaching, especially in terms of providing timely and adequate feedback, ultimately boosting student engagement. AI tools' ability to tailor learning experiences to individual students' needs fosters deeper cognitive engagement (Wang et al., 2024). By personalizing the learning content, these tools also help alleviate anxiety associated with standardized learning environments. As Kim and Sue (2022) pointed out, AI applications' adaptability ensures that students receive appropriate challenges that align with their cognitive levels and personal interests, further enhancing engagement.

Emotional Engagement

Regarding emotional engagement, AI tools offered students a supportive and responsive learning atmosphere, enhancing their connection to both the content and the learning process. Students expressed increased willingness to participate in academic writing tasks, driven by the authentic language environment provided by AI tools (Smutny et al., 2020). This authentic setting emotionally engaged students and motivated them throughout the learning process, which is in line with the findings of Xu et al. (2023), who emphasized the positive impact of AI in creating an engaging learning environment. Wang et al. (2023) and Kim and Sue (2024) also confirmed that such emotionally supportive AI environments foster improved communication and self-expression in English language learning.

Behavioral Engagement

Although this study did not show significant changes in behavioral engagement before and after using AI tools, students expressed a belief that AI tools facilitated greater engagement. Notably, AI tools encouraged students to participate more regularly and put more effort into their tasks. This aligns with Khalifa & Albadawy (2024), who found that AI-assisted learning environments are beneficial in promoting both personalized learning and collaborative engagement. AI tools' ability to foster consistent engagement was also validated by Wang et al., (2024), who found that AI-assisted instruction helps students become more involved in their learning processes and task completion.

Concerns Regarding Over-reliance on AI

Beyond the positive experimental outcomes, interview data revealed an overreliance on AI-assisted tools among participants. A majority of students reported becoming reliant on and somewhat addicted to these AI tools, which had a notable effect on the development of their critical thinking and creative abilities. This concern is supported by Wang et al., (2024), who observed that AI systems often increase students' dependency on such tools, which can diminish their cognitive independence. Similarly, Guan (2023) cautioned that excessive use of AI in educational settings might distract students from meaningful learning, resulting in superficial engagement with the content. Spector and Ma (2019) also highlighted that overreliance on AI technology can hinder the development of students' higher-order thinking skills, such as critical thinking and problem-solving. Compared to traditional resource acquisition methods, such as consulting materials and group discussions, students can now quickly obtain relevant external data by simply entering queries into a dialogue box. Over time, this dependence undermines students' independent problem-solving skills.

These findings highlight the importance of adopting a balanced approach when integrating AI technology into education. While the use of AI tools can significantly enhance student engagement, it is crucial that schools present these tools as supplementary resources rather than substitutes for students' independent cognitive processes. Educators should create an environment that encourages thoughtful interaction with AI tools, ensuring that they support rather than replace independent learning. A well-rounded approach to AI integration can help students develop critical thinking skills while benefiting from the personalized and timely support provided by these tools. By fostering a deeper understanding of AI's role in education, institutions can better equip students for a future increasingly influenced by technological advancements.

LIMITATION

While this mixed-methods study provides valuable insights into the impact of AI-assisted tools on English language learners' engagement, several limitations must be acknowledged. The primary limitation is related to sample representativeness, as the study involved only 50 sophomore students from a single public university in China. The generalizability of this study's findings regarding Chinese EFL learners is limited by the sample size and the experimental context. Future research should incorporate larger and more diverse samples from various educational institutions to enhance the external validity of the results. A second limitation of this study is the relatively short duration of the experiment, which was only four weeks. This period may not be sufficient to capture the long-term effects of AI-assisted tools on students' academic English writing engagement and development. Future studies should extend the intervention period to assess the sustained impact of these tools over time. Additionally, the study did not explore how AI-assisted tools interact with other pedagogical practices, and future research could examine how such tools might complement or compete with traditional writing instruction. Finally, it is essential to investigate strategies for mitigating the potential negative consequences of excessive reliance on AI tools, particularly in terms of fostering critical thinking and independent problem-solving. This could help in developing more comprehensive and balanced educational technologies that support students' long-term learning and cognitive development.

CONCLUSION

This study employed a mixed-methods approach to investigate the engagement of Chinese EFL undergraduates in academic English writing classes with the assistance of AI tools, namely Grammarly, Wenyan Yixin, and Turnitin. The findings indicate that the AI tools utilized were beneficial in positively influencing students' emotional and cognitive engagement by creating personalized learning environments, delivering timely feedback, and fostering more interactive learning experiences. However, the results also underscore the potential risks of students over-relying on AI tools, including the detrimental impact on the development of critical and creative thinking in writing.

Based on the outcms of findings, recommendation is that a balanced approach be adopted when integrating AI tools into classroom instruction, maximizing the benefits of student engagement and positive learning experiences while mitigating potential challenges. Educators can judiciously leverage AI-assisted tools to promote student participation and enhance group discussions, thereby fostering the development of critical thinking, ensuring that these tools serve as a complement to, rather than a complete replacement for, traditional teaching methods. Policymakers should consider the results of this study when developing policies for the integration of AI into educational systems, ensuring that these technologies are utilized in a balanced and effective manner.

For future research, this study opens new avenues for exploring the long-term effects of AI tools on student engagement and learning outcomes. Additionally, the ethical implications of AI use in education must be carefully considered, particularly with regard to algorithmic bias and transparency. As AI continues to shape educational practices, collaborative efforts between educators, researchers, and policymakers will be essential to establish best practices that prioritize both innovation and the well-being of students. Further studies should examine the perspectives of both students and educators in diverse learning contexts to deepen our understanding of AI's impact on education.

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