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PAPER

ChatGPT-Empowered Writing Strategies in EFL Students' Academic Writing: Calibre, Challenges and Chances

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ABSTRACT

ChatGPT's remarkable ability to produce academic texts has generated significant interest in educational and academic circles. This study provides a specific overview of ChatGPT's current usage and explores its potential applications, limitations, and implications in English academic writing for EFL students, who often face challenges in language proficiency, content organization, and critical thinking. Using a mixed-methods research approach, this study employed a CSE-based questionnaire and focus group interviews to investigate how ChatGPT can empower academic writing strategies (WS) and how respondents perceive its assistance. Data was collected from 60 Chinese university juniors majoring in English. Quantitative data were analyzed using descriptive statistics and regression analysis, while qualitative data underwent thematic analysis. Findings indicate that ChatGPT can help students apply academic WS more effectively by comprehending research trends, generating writing outlines, enriching writing content, synthesizing literature, and refining papers. However, issues such as potential plagiarism, inaccurate output, improper citations, and the digital gap between users and non-users must be addressed. The study suggests that while ChatGPT-empowered writing can better equip academic WS in planning, composing, and revising, respectively, it is crucial to scrutinize the quality of AI-generated texts. Further research will be urgently expected regarding ChatGPT's long-term impact on academic integrity, the development of educational policies for ethical AI use, and the integration of ChatGPT into pedagogical approaches to enhance EFL students' writing and critical thinking.

KEYWORDS

ChatGPT, academic writing strategies (WS), application, challenges

1 INTRODUCTION

Writing academic papers in English requires a high level of language proficiency and academic writing strategies (WS) from writers. Many non-native university students are unable to get their research study published due to insufficient English proficiency and writing strategies, thus limiting their academic and professional

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growth [1–3]. The development of artificial intelligence (AI) technology has given rise to AI-based writing aids that can help academic writing beginners (especially non-native English writers). Applying these tools can not only improve the quality of students' papers through spontaneous feedback but may also enable beginners to learn academic writing methods and improve academic writing skills [4], thereby reducing writing anxiety and raising writing motivation.

ChatGPT, launched by OpenAI in November 2022, can generate responses to input prompts to engage with humans on various topics to carry out dialogues and exchanges. The text output by ChatGPT has clear logic and sufficient argumentative points; it is possible to replace human beings as the main authors of writing, which can easily lead to plagiarism and cheating in academics and therefore has caused widespread concerns among teachers and scholars of educational institutions. It is even considered by some scholars to be the death knell of traditional educational assessment [5].

Since the ChatGPT text output is extremely powerful, the ensuing issue of plagiarism has sparked widespread controversy. There is growing opposition to simply disabling Chat-GPT, for it cannot be banned absolutely. Besides, current AI writing tools can only generate mechanical and formulaic texts instead of advanced writing tasks that require insights, critical thinking, and innovation. Despite it being immature enough to fear, academic writing has already been hit by ChatGPT since scientific papers with a complete structure, clear logic, and rich content could be produced by AI completely [6], [7]. According to Nature statistics, by January 18, 2023, ChatGPT had been listed as the first author or co-author on at least four research papers. Though this trend has been opposed by many researchers and major publishers, the editor-in-chief of main scientific journals such as Nature and Science also indicated that AI aid must be included in research methods or in acknowledgment, or that using AI-generated text without attribution may be considered plagiarism [5]. In other words, despite the strict rules regulating AI use, it is unavoidable for its application in the field of scientific research.

Therefore, scholars all over the world have paid due attention to the advantages and potential of ChatGPT in educational applications. Papadakis et al. [8] present a systematic review of the current literature on the educational applications and potential impacts of the AI chatbot system ChatGPT, examining its positive and negative aspects as well as its implications for various subject areas and educational processes. Samala et al. [9] provide a comprehensive analysis of the advantages and disadvantages of using ChatGPT in educational settings, highlighting its potential to enhance personalized learning and provide instant feedback while also addressing concerns about misinformation, a lack of emotional intelligence, and privacy issues. Among the latest research efforts, there is still a gap on how ChatGPT could impact the academic writing courses of non-native university students. Based on the discussion, this study intends to explore the caliber of ChatGPT on academic WS for business English writing courses and examine its challenges and chances from an educational perspective as follows:

1. To what extent could ChatGPT improve EFL university students' academic WS through the process of writing?
2. From which aspects do EFL university students think ChatGPT could empower them by applying academic writing strategies?
3. What are the potential challenges and chances of using ChatGPT as an academic writing tool in students' academic writing learning?

2 LITERATURE REVIEW

2.1 Writing strategies of EFL

In order to assist EFL learners in addressing their challenges while engaged in the writing process, various methods have been put forth as valuable resources. These methods, often referred to as writing strategies, encompass tools, techniques, and actions that learners can adopt to enhance their writing effectiveness. Graham et al. [10] characterized WS as consciously employed techniques that writers use to generate ideas, outline, structure, revise, and contemplate while writing. Given that WS entails a dynamic and intricate process and holds significance in second language (L2) or foreign language (FL) writing, there has been an extensive array of research delving into the WS employed by EFL learners over the last two decades.

Based on the definition and characteristics of learning strategies, refer to the writer's conscious adoption of methods, techniques, or activities to address writing difficulties or enhance writing effectiveness. Previous studies have further scrutinized and methodically categorized an array of WS. For instance, Arndt [11] delineated a plethora of distinct WS, including global planning, rehearsing, repeating, re-reading, questioning, revising, and editing. Wenden [12] bifurcated WS into two principal categories: metacognitive (planning, evaluation, and monitoring) and cognitive (clarification, retrieval, resourcing, deferral, avoidance, and verification). Subsequent inquiries witnessed a progression in the sophistication of the WS taxonomy, marked by the incorporation of supplementary groupings such as social tactics and translation [13]. Notably, Mu [13] merits special consideration for synthesizing insights from prior research grounded in a diverse array of theories, thereby formulating a comprehensive WS taxonomy encompassing rhetorical, metacognitive, cognitive, communicative, and socio-affective writing strategies.

A scarcity of research endeavors has been devoted to scrutinizing the factors influencing the utilization of English by EFL learners. Nevertheless, within the limited scope, certain learner-related factors have been discerned, including self-efficacy, gender, academic specialization, and language proficiency [14]. These factors exert an impact on the deployment of WS, with the predominant proportion of these studies adopting questionnaire-based methodologies. The classification of WS exhibits diversity and variation. Based on the cognitive process of second language writing, Petrić and Czárl [15] categorized WS into three types: pre-writing strategy, drafting strategy, and revising strategy. Hwang and Lee [16] employed a mixed-method approach to establish a checklist of university students' English WS, encompassing meta-cognitive, cognitive, memory, L1 use, revision, L2 use, social strategies, and compensatory strategies. According to the common European framework of reference for languages (CEFR) and its theory of strategic competence within the communicative language ability model, expressive strategies (writing and speaking strategies) are divided into four categories: planning, executing, evaluating, and remedy [17]. However, this classification only pertains to meta-cognitive strategies and does not differentiate between the conceptualizations of writing and speaking strategies.

2.2 ChatGPT in academic writing

ChatGPT is a public tool developed by OpenAI that is based on the GPT technology [18]. Known as ChatGPT, the Chat Generative Pre-Trained Transformer has drawn attention to two approaches to conceptual expression, which can be

summarized as “chat robot theory” and “model theory.” “Chat Robot Theory” mainly focuses on the powerful human-computer dialogue interaction and text generation functions displayed by ChatGPT and believes that its essence is a chat robot, chat tool, or chat app. Essentially, it is a highly sophisticated chatbot that can fulfill almost any text-based request [19]. “Model Theory” is supported by the powerful technology models behind ChatGPT, such as large-scale language models and deep learning models. It has been defined as a large-scale language model and explained its main functions as it can learn from data autonomously and can generate complex language models and seemingly intelligent text after training on a large amount of text data.

In a minute, ChatGPT has the capability to craft extensive essays, exhibiting the proficiency of a seasoned researcher. ChatGPT’s capacity can be fully harnessed by dividing the main subject into subtopics, thereby enabling the generation of each section. If ChatGPT’s potential is maximized, with a complete version allowing responses spanning several thousand words, it could facilitate the rapid creation of entire papers with minimal prompts from researchers. This innovation has the potential to drastically reduce the time needed for composing academic writing from numerous hours to mere seconds, possibly rendering professional authors and researchers obsolete.

Functioning as the foundational elements within academic databases and the research domain, journals play a pivotal role in the peer review and ethical scrutiny of published articles. ChatGPT can aid editors in accomplishing repetitive or monotonous tasks, such as rectifying grammatical errors, and in avoiding biased evaluations of articles [5]. Synekop et al. [20] explore the differing perspectives of students and teachers on the integration of ChatGPT into engineering English courses, highlighting students’ generally positive attitudes towards its educational benefits and teachers’ concerns regarding academic integrity and the development of essential language skills. Given that the collaborative review process is the primary mechanism for shaping a cognitive community through input from peer reviewers, editors, and other contributors [21], ChatGPT’s constructive role in this process could potentially benefit the academic community, research environment, and society at large. Furthermore, ChatGPT can facilitate the dissemination and propagation of novel research concepts by enhancing metadata creation, indexing, and summarization of research findings [22]. Additionally, ChatGPT could function as a recommender system, aiding users in identifying pertinent research studies based on their queries. This could be particularly valuable for interdisciplinary subjects, streamlining searches across diverse indices and using synonymous terms from various disciplines’ jargon via an interface such as ChatGPT. For example, Kostikova et al. [23] outline how ChatGPT was utilized to develop a professional English course for law students at the university level, detailing the creation of a curriculum, syllabus, and textbook through AI-generated content and highlighting the integration of traditional and AI-driven educational methods.

While the precision of natural language processing models is generally commendable, occasional errors arise in the interpretation of meaning or the generation of accurate information. These models are not without flaws, and GPT has certainly faced its own set of challenges. For instance, terms with ambiguity, those with multiple interpretations (such as “work”), and compound terms (such as “breakdown”) can lead to difficulties in the GPT model’s understanding of their intended meaning. Moreover, the operation of these algorithms and data repositories demands substantial energy, particularly at the scale at which OpenAI employs them [24]. American linguist Noam Chomsky [25] stated in an interview that ChatGPT is essentially “high-tech plagiarism” and students cannot learn real knowledge from it, despite the fact that ChatGPT and the strong technical advantages it displayed have been seen as having great potential and wide application prospects in the field of education. From an ethical viewpoint,

research papers produced using ChatGPT might be perceived as unoriginal and potentially troublesome. Multiple studies have unveiled that the training data and coding procedures of ChatGPT, typically drawn from vast web-based datasets, can harbor biases related to gender, race, ethnicity, and disability status [26], [27]. These biases could inadvertently persist when such models are employed for generating academic research, leading to the propagation of concealed and unwitting prejudices.

2.3 CSE as a yardstick

"China's Standard of English Language Ability" (CSE) is the nation's pioneering English language proficiency assessment framework and has been comprehensively implemented nationwide. The WS proficiency scale constitutes a crucial component of CSE, and the conceptual validity of this scale significantly influences the development of English WS instruction, learning, and evaluation among Chinese university students. Hence, this study investigated learners' performance by using the CSE proficiency WS scale to validate its conceptual validity, aiming to provide a foundation for the measurement of students' enhancement and application in academic WS with ChatGPT.

China's Standard of English Language Ability is grounded in the communicative language competence model, categorizing strategic competence into three overarching domains: planning, execution, and evaluation/remediation [28]. Writing is further segmented into skill-specific strategy descriptions based on its inherent characteristics. By considering the cognitive processes of writing, CSE subdivides WS into planning, composing, and revision, aligning respectively with the planning, execution, and evaluation/remediation dimensions of the CSE strategic competence framework. Planning is further divided into extraction and organization, while composing is subdivided into transformation and transcription, and revision is classified into inspection and editing, yielding a total of six subcategories of strategies. The widespread integration of computers in writing assessment has led to certain conceptual shifts in WS proficiency, prompting CSE to independently devise six computer-based WS descriptors to address gaps in similar scales. The development of these descriptors requires multi-round validation before deployment [29]. The CSE WS scale must continue its ongoing validation efforts during utilization.

3 RESEARCH METHOD

This study employs a quantitative approach, combining both quantitative and qualitative data. A quantitative method was chosen due to its ability to effectively capture the extent of students' acceptance or rejection of the given approach. Given the likelihood of diverse perspectives within the population, the quantitative method could offer insights into the viewpoint of the majority, their primary concerns, and the overall level of technological awareness. Furthermore, the quantitative approach facilitates the exploration of the impact of specific sub-factors on the overall outcome. Its straightforward analysis process and respondent-friendly nature make it a suitable choice [30]. To achieve this, a questionnaire with an official and mature scale is utilized (which is also verified in the initial step), generating statistical data that can be organized and subjected to further analysis for informed conclusions.

Simultaneously, the qualitative data are subsequently collected to enhance comprehension of respondents' sentiments and their general awareness regarding ChatGPT-aided WS. By delving into deeper feelings and opinions, the qualitative data reveals underlying thought trends and provides profound insight into the

research context. It also offers a platform to illuminate respondents' experiences and interpretations of the ChatGPT approach. Employing a "qualitative method," the research leverages compact survey questionnaires and experiments, such as activities within a series of focused group interviews centered on ChatGPT-aided WS. Moreover, focus group research was conducted to capture the sentiments and thoughts of stakeholders involved in the ChatGPT-aided writing strategies.

3.1 Research design

This study takes the "Business English Writing" course as the research context. This is a compulsory course for junior English major students in many comprehensive Chinese universities. It lasts one semester in total, with 16 teaching weeks, and usually classes for lectures count half the syllabus while simulating practice classes for another half. The students involved in this study come from two classes of the same grade. Among them, 92.59% are female students, and the rest are male students due to the major being language-related. Direct access to the target population of EFL university students enrolled in the course within the same institution makes it logistically feasible to choose convenience sampling. While convenience sampling may not provide the most representative sample, the homogeneity of the participants, who are all junior English majors with similar academic backgrounds and proficiency levels, helps ensure the sample is appropriate for addressing the specific research questions related to the use of ChatGPT in academic writing. Additionally, the convenience sampling approach allows the researchers to collect in-depth qualitative data through focus group interviews in a practical and cost-effective manner, which is well-suited for the exploratory nature of the study. Students from this major in grade three at the university have greater capability in academic writing than average university students in China. According to the scale of China's standards of English ability, students who passed TEM-4 generally reached English ability at level 5 out of 9 bands. The average age of participants is 20.5. Sixty questionnaires have been put out for survey, and all are finally collected for data analysis. Then three focus groups with 15 students each were organized to interview, with themes mainly on the advantages, inconveniences, and preferences of taking ChatGPT as part of their academic WS. Table 1 below outlines the learning activities in this one-semester's BE writing syllabus and anticipates the roles of ChatGPT in supporting various writing activities within the academic writing course, ranging from content generation and formatting assistance to language guidance, summarization, and composition aid.

Table 1. Learning activities of EFL business writing course involving ChatGPT

Lectures Part (Odd Weeks)	Practice Part (Even Weeks)	ChatGPT's Possible Roles in Writing Activities
Introduction	Generate "Company" information	Information provider
Emails and Memos	Write to know business writing format	Formatting, templates
Inquiries and Replies	Write to make potential deals	Language assistance, negotiation
Meeting Minutes	Write to record business meetings	Summarization, organization
Feasibility Report	Write to provide feasible business plans	Research, analysis, synthesis
Business Proposal	Write to elaborate corporation intention	Structuring, composing
Executive Summary	Write to get permissions	Concision, impact

3.2 Research instruments

Interview protocols and questionnaires are the two instruments used in this study, which were used to gather information dealing with the problems of the study. This study collected both quantitative and qualitative data through questionnaire surveys and focus group interviews. The self-assessment questionnaire consisted of descriptors from sub-tables 49, 50, and 51 of the CSE Writing Strategy Proficiency Scale, ranging from level 4 to level 9. In total, there were 43 items, encompassing 15 planning strategy descriptors, 15 composition strategy descriptors, and 13 revision strategy descriptors. In terms of the target respondents, CSE4 to CSE9 are broad enough to cover the spectrum of junior English major students in China. Based on CSE, the questionnaire is used to investigate the structural competence of WS by using ChatGPT at different difficulty levels of these descriptors. Each of the 43 WS descriptors was scored using a Likert 5-point scale, with 5 being the highest score (meaning "strongly agree") and 1 being the lowest score (meaning "strongly disagree"). The reliability coefficient (Cronbach's α) for the questionnaire was 0.967, indicating high overall reliability.

To further explore the students' experiences and perspectives, the researchers organized three focus group interviews, each with 15 students participating voluntarily. This qualitative approach allowed for a deeper understanding of the advantages, inconveniences, and preferences associated with using ChatGPT as part of the participants' academic writing strategies. The focus group discussions were structured around these key themes, providing the researchers with rich, contextual data to complement the quantitative findings. The qualitative data from the focus group interviews was analyzed using thematic analysis, a well-established method for identifying, analyzing, and reporting patterns within the data. This process involved coding the interview transcripts, categorizing the codes into broader themes, and examining the relationships and insights that emerged from the participants' perspectives and experiences.

3.3 Data analysis

The researchers administered a questionnaire at the end of the semester. The questionnaire data were analyzed using SPSS 23.0. Exploratory factor analysis, statistics, and description were employed for analysis. Focus group interviews were conducted after the questionnaire survey. The researchers recorded and transcribed the process. Textual variables were extracted based on participants' perspectives regarding descriptor classification, influence levels, and comprehension of descriptors, aiming to explore underlying findings and reasons.

4 RESEARCH FINDINGS

4.1 Reliability of ChatGPT empowering WS descriptors of CSE framework

For the sake of statistical analysis, an alphanumeric coding system was employed by using English letters along with numbers, to label the items in the questionnaire. In this system, 'P' represents planning strategies, 'C' signifies composition strategies, and 'R' denotes revision strategies. Prior to conducting exploratory factor analysis, the research first conducted the Kaiser-Meyer-Olkin (KMO) measure of sampling

adequacy and Bartlett's sphericity test to assess the suitability of the questionnaire data (N = 60) for factor analysis. The results indicated a KMO value of 0.955 (> 0.9), signifying a favorable level of adequacy. Bartlett's test yielded $X^2 = 33647.010$, $p = 0.000$ (< 0.001), implying the appropriateness of the questionnaire items for factor analysis. Then the research employed the principal component analysis method to extract common factors from the questionnaire data and utilized the orthogonal rotation with the maximum variance method to obtain the final factor loading matrix, as presented in Table 2.

Table 2. ChatGPT-aided writing strategies total variance explained results

Factor	Initial Eigenvalue			Rotated Sum of Squares Factor Loadings		
	Eigenvalue	Variance (%)	Cumulative (%)	Eigenvalue	Variance (%)	Cumulative (%)
1	24.93	57.98	57.98	7.64	17.77	17.77
2	2.39	5.56	63.54	7.63	17.74	35.51
3	2.03	4.71	68.25	7.51	17.46	52.97
4	1.7	3.96	72.22	5.46	12.69	65.66
5	1.31	3.05	75.26	4.13	9.60	75.26

Note: *p = 0.000 (<0.001).

From Table 2, it can be observed that the utilization of ChatGPT has led to the extraction of five WS factors with each eigenvalue greater than 1, which are acceptable criteria. The cumulative variance contribution of these five factors amounts to 75.26%, surpassing the desirable threshold of over 60%. The commonality of all the items is above 0.5, and the factor loadings exceed 0.4, indicating that the extracted five factors are effective and capable of comprehensively explaining WS proficiency. These five factors can be categorized under the three major domains of planning, composition, and revision, which correspond to the planning, execution, and evaluation/remediation dimensions of the CSE writing strategy framework. Empirically, the research outcomes substantiate the rationality of ChatGPT, which efficiently improves WS proficiency within the classification framework of China's Standard of English Language Ability.

4.2 Exploratory factor analysis of ChatGPT on writing strategies

When analyzing the characteristics of the descriptors regarding the five factors, Factor 1 corresponds to "Revision Strategies." This reflects that ChatGPT is effective in assisting writers to utilize AI for proofreading their articles, employing strategies such as supplementing, merging, and adjusting to edit the content. Factors 2 and 3 correspond to "Planning Strategies" and encompass "Extraction Strategies" and "Organization Strategies," respectively. This signifies that ChatGPT aids writers in effectively planning their writing goals and steps, searching for information, and conceptualizing content and structure before writing, thus enhancing the speed and efficiency of the writing process. Factors 4 and 5 correspond to "Composition Strategies" and encompass "Transcription Strategies" and "Transformation Strategies," respectively. Factor 1 has not been divided into more specific sub-themes due to the revision process and strategy use, which are affected by factors such as

writing environment, motivation, emotion, language ability, and so on [31]. This indicates that ChatGPT aids writers in the composition process by facilitating the reasonable use of various strategies such as paraphrasing, illuminating topic sentences, and rhetorical devices at the word, sentence, and discourse levels, thereby improving the quality of writing expression.

4.3 Statistics and description of ChatGPT's impact on academic writing strategies

Based on the survey conducted in June, it was found that students exhibit an overall agreement level of 75.6% regarding the positive impact of ChatGPT on their academic WS within the framework of the CSE descriptors. Exploring various descriptors tied to competence in academic writing (see Figure 1), it becomes evident that two aspects of planning strategies received the highest endorsement. Over 85% of students either strongly agree or agree that ChatGPT aids them in effectively structuring their introduction, development, and cohesion, ensuring a coherent framework. Furthermore, it supports outlining the writing process by identifying key points before commencing the composition.

Subsequently, 79.6% of students express the belief that ChatGPT substantially improves the collection of evidence from diverse sources to substantiate arguments, thereby enhancing their composition strategy competence. In relation to competence in revision strategies, two items are noteworthy among the top five identified by respondents as greatly influenced by ChatGPT. These items pertain to adjusting sentence structures to achieve more precise expressions (81.5%) and conducting proofreading using word processing software (83.3%). On the whole, throughout the academic writing course, a significant majority of students—more than three-fourths—acknowledge the valuable role played by ChatGPT in their application of academic writing skills. This is particularly pronounced during the planning and revision phases of their work.

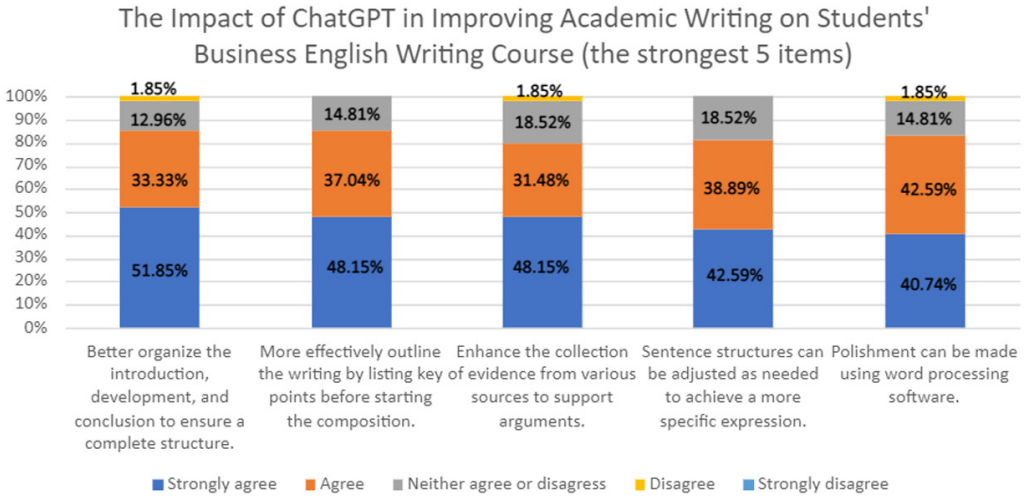

Fig. 1. ChatGPT-aided academic writing strategies (the strongest five descriptors)

Out of the 43 items investigated, descriptors associated with both the planning stage and the revision stage garnered a higher level of agreement (above 81%) compared to those linked to the composition stage (79%). Despite this minor variation,

it is worth noting that among the weakest five items in terms of overall impact, four of them pertain to the sub-theme of the composition stage. This observation is depicted in Figure 2. Specifically, only 57.4% of students concur that with the assistance of ChatGPT, discourse can be enriched through the adept incorporation of logic, theory, and emotion, striking a harmonious balance between emotional appeal and rational enlightenment.

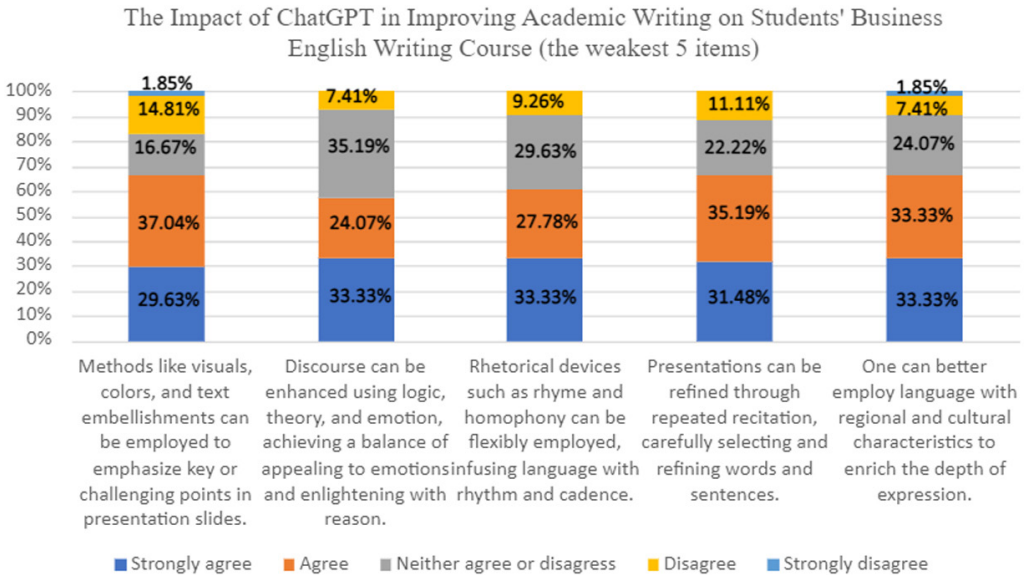

Fig. 2. ChatGPT-aided academic writing strategies (the weakest five descriptors)

Furthermore, approximately 60% of students agree that rhetorical devices such as rhyme and homophony can be flexibly employed, infusing language with rhythm and cadence. Meanwhile, 66% of students deem those methods such as visuals, colors, and text embellishments can be employed to emphasize key or challenging points in presentation slides, and one can better employ language with regional and cultural characteristics to enrich the depth of expression. Nonetheless, ChatGPT still falls short of fully capturing the unique expressive characteristics of individual authors. Another descriptor indicates that 66% of students agree that presentations can be refined through repeated recitation, meticulous word and sentence selection, and refinement. This indicator might be attributed to the limited opportunities respondents had for delivering presentations during their learning journey.

4.4 Focus group interviews on respondents' perception towards ChatGPT-aided writing strategies

The qualitative data dealing with the students' perception of ChatGPT-aided WS was yielded from the focus group interviews. 45 students are willing to attend the focus group, so they are randomly grouped into three groups, with 15 students evenly in each group. In order to track the source of respondents, the excerpts from the interview transcription will be labeled by their group and talking sequence, such as G1S1, which means the first speaking student from group 1. The researcher raised some questions relevant to academic WS in their business English course (mostly applied to their experimental classes rather than lectures) during and after the implementation of ChatGPT-aided WS. The results of the focus group interviews from the three groups were mostly similar. The results are described in Table 3.

Table 3. Major themes reflected from respondents' perception of using ChatGPT in academic writing

Themes	Sub-Themes	Ratio of Mentioning	Stage of Writing Strategies (P = Planning, C = Composition, R = Revision)
Utility	Efficiency	76%	P+C+R
	Language affordance	46%	C+R
	Template engine	43%	P
	Content generator	33%	P+C
Attitude	Powerful	62%	P+C+R
	Useful	32%	P+C+R
	Doubtful	6%	P+C
Inconvenience	Operational barrier & Extra workload	34%	P+C+R
	Ethical problems	45%	P+C
	General answers	41%	P+C
	Unreliable answers	10%	P+C
Intention to use	Expectancy of higher compatibility	40%–100%	P+C+R

Utility. Approximately 76% of students participating in the three focus groups highlighted the evident improvement in their writing efficiency upon utilizing ChatGPT. As indicated by the transcripts of student interviews, this enhanced efficiency resonated across all three writing stages, consequently impacting their overall WS prowess. As for language assistance, ChatGPT also gains preference from 46% of students' votes when they are trying to polish their linguistic quality. The subsequent (refer to Table 4) excerpts are drawn from student statements, directly conveying their sentiments regarding the accelerated pace of their writing process.

Table 4. Utility of ChatGPT in business English writing

Category	Student Comments	Student ID in Focus Group
Business Writing Templates	"ChatGPT can not only provide me all kinds of business writing templates, in just several minutes, but also can find and correct language problems once I submit my writing, which is much faster than previous feedback from teachers or other software."	G2S4
	"ChatGPT can provide me with common business writing templates such as emails, proposals and executive summary, as well as incorporate my general idea into these templates, which means the draft ready upon my questions is ready."	G3S1
Writing Efficiency	"It greatly saves my time in business writing, for example, it helps to outline my idea into demanded business writing format, and it helps analyze relevant data and synthesize information, it is also capable of translation, searching and generating details, and all these can be completed in just one or two minutes. It is definitely a smart assistant for my writing."	G1S6
Language Assistance	"ChatGPT is so versatile, it helps in writing from framework, to paragraphs and sentences and even wording, I often ask it to improve my coherence by adding transitional phrases, it depicts more precisely than I do too."	G1S2
	"It helps match my Chinese writing, which is superior to my English expression, with appropriate English writing, yet it is more powerful than a translation tool because it knows more about context so we can have continuous rounds of chatting to achieve my ideal writing. Though at first it may appear stereotypical, it could be guided and adjusted quickly and it is good at rhetorical devices so I could learn from it to improve my language too."	G2S8

(Continued)

Table 4. Utility of ChatGPT in business English writing *(Continued)*

Category	Student Comments	Student ID in Focus Group
Convenience and Flexibility	"Our team is left with no partner due to our unique product. We couldn't finish the business project without ChatGPT. It not only serves as a perfect partner which works with us to brainstorm and promote the business plan like with other student groups, but also powerful enough to make our cooperation smoother and more entrepreneurial."	G2S3
	"ChatGPT is very good at writing business reports of different genres and styles. It can be either proactive and ambitious or modest and collaborative. Its act could be even more flexible than inexperienced business person."	G1S5
	"Prompts to ChatGPT can be given by document title or URL link, to ask it to summarize one piece of document or to integrate or synthesize two or several pieces of articles. After completing the literature summary and integration, I can also request ChatGPT provide citation and reference information."	G1S10

Convenience is also significantly noted in matching templates and generating content in students' writing especially during the planning and composition stages. Business writing is a typical academic writing that has several fixed sets of formats to follow. However, previous studies have argued that it is impossible for students to master those formats given the limited time and class context on campus. Meanwhile, whether it is necessary or not to carve these templates in the brain is still under discussion for it's purely functional instead of creative texture. Based on these perspectives above, what ChatGPT can bring students is redundancy of repeated file work thus leaving them more space for meaningful and characteristic writing.

Inconvenience. Regarding the weaknesses or inconveniences highlighted during the focus group interviews, there was a notable prevalence of general responses, accounting for 40%. Besides, unreliable responses constituted an additional 10%. Clearly, close to half of the students expressed some level of dissatisfaction with the outputs generated by ChatGPT. Noteworthy extracts from their feedback include:

"ChatGPT gives me weird answers which are totally irrelevant to my questions, just copied single words in my questions separately." (G1S7)

"Sometimes it gave us similar and stereotypical answers to different questions, if there are universal keys to all questions, on one bother thinking." (G2S5)

"I asked ChatGPT for literature reference about the topic I want to explore, but the reference it provides is totally something fabricated, and there is more than once this situation happened. So, is it really accountable for learning?" (G3S12)

Except for the extracts, respondents also discussed the possible main reasons behind these unsuccessful trials, which might be: 1) prompts did not accurately display students' intentions. 2) ChatGPT's database is partly irrelevant to students' demands. 3) ChatGPT is not intelligent enough to deal with some difficult problems. However, the exact causes are needed through another specific study.

Attitudes and intention to use. Though all students reveal their intention to continue applying ChatGPT in their academic writing, the rate of using preference varies from 40% to 100%. Due to different using experiences and initial impressions from different users, 90% of student think highly of ChatGPT's power in helping them with WS while another 10% have doubts about its accountability and are apt to have more tests to verify whether or how to use it as a tool to improve academic WS. What's more, among the 90% of potential users, there are 62% have an affirmative attitude towards ChatGPT in applying WS in their academic writing, with reasons mainly listed above, while another 32% of students acknowledge its usage and hold a positive attitude toward using and taking it as a common writing tool.

Still, 6% of participants showed their doubts and worries directly in the focus group interview, whose causes will be discussed further in the following part.

5 DISCUSSIONS

As the prevalent use of ChatGPT as a text generating tool, discussion about its facility on EFL writing regarding writing feedback [32], [33], multimodal writing [34], writing instruction [35], multilingual and multicultural writing [36] and writing ethics [37] are put into research scope recently, apart from its impact on the EFL WS to a specific discipline. In order to fill the research gap, this study aimed to investigate the impact of ChatGPT on improving EFL university students' academic WS, the specific aspects in which ChatGPT could empower their writing, and the potential challenges and opportunities of using ChatGPT as an academic writing tool. Based on the comprehensive analysis of both quantitative and qualitative data derived from the investigation into ChatGPT's influence on business English writing course, it is imperative to engage in a thorough discussion on its practical implementation, associated challenges, and the untapped potential it holds for enhancing the proficiency of academic writing strategies.

The key findings indicate that ChatGPT has the potential to significantly enhance EFL students' academic WS across various stages of the writing process. Quantitative data analysis revealed that students perceived ChatGPT to be highly effective in improving their WS, with an overall agreement level of 75.6% regarding the positive impact. Specifically, the study identified three key stages in which ChatGPT can empower students' academic WS, per as: 1) Planning strategies: aiding students in setting clear writing goals, conceptualizing content and structure, and organizing their writing process more efficiently, which enhanced the speed and effectiveness of their writing; 2) Composition strategies: helping students improve their writing composition by facilitating the use of various strategies, such as paraphrasing, developing topic sentences, and employing appropriate rhetorical devices at the word, sentence, and discourse levels; 3) Revision strategies: being effective in assisting students with proofreading, editing, and refining their written work through strategies such as supplementing, merging, and adjusting content. The qualitative findings from the focus group interviews further corroborated the quantitative results, with students highlighting the benefits of using ChatGPT in various aspects of their academic writing process.

5.1 Application and potentials

Application. Given the CSE questionnaire on ChatGPT's impact on business English WS, through the statistics of a one-sample t-test, students have agreement on ChatGPT's help in their academic WS in terms of planning ($M = 4.15$), composition ($M = 3.96$) and revision ($M = 4.06$), the mean standard of the three stages are all close to or greater than 4.0 ($p < 0.001$), showing that there is a significant impact of applying ChatGPT on strengthening academic WS among university students. The analysis of the two figures in Part 4 elucidated that ChatGPT leads to varied degrees of enhancement in distinct strategies across the three stages of academic writing. Broadly, there is a notable and substantial enhancement in planning strategies, particularly in terms of structural organization, highlighting key elements, and

sourcing evidence. In the sphere of composition strategies, improvements are primarily concentrated on refining sentence structures, rephrasing expressions, and illuminating examples. Moreover, significant strides are observed in the arena of revision strategies, encompassing both structural and linguistic editing and proofreading, ultimately culminating in more precise and refined expressions.

Apart from those phased support of ChatGPT on students' WS, the focus group interviews also reveal that ChatGPT's assistance in empowering WS mainly lies in efficiency, language affordance, template engine and content generator. This study has no specific measurement of how much each dimension could be changed, but within the investigation pool, efficiency and language affordance are the biggest two indicators that impressed the users most.

Potentials

1. To tap the cutting-edge research topics: In the business writing course, students are divided into several groups and each group builds a commercial company, featuring any business they want to practice. In order to give the course authentic context, every two groups will have further business cooperation as a foundation of a series of business writing. In order to understand the possible hotspots in a certain field, which is not part of students' academic background, research questions prompt ChatGPT could bring students closer to their goal thus convert the learning situation into as authentic as the real business world. Take "joint brand venture" as an example, students have questions such as "Do you have some ideas for trends in the research area of joint brand?" Based on this prompt, ChatGPT provides seven potential research trends (co-creation and co-branding, cross-industry collaborations, cause-related partnerships, influencer collaborations, international collaborations, technological integration and data sharing and analytics). Going further, students asked ChatGPT to provide more details about technological integration (e.g., venture of a milk tea brand and a hotpot brand), again, ChatGPT provided five tips for immersive dining experience by using augmented reality (AR) technology, namely AR Menu, Customizable Flavors, Virtual Tasting, Interactive Dining Environment and Social Sharing. If students would like to know more examples of each tip, they could raise more prompts.

   It is noteworthy that the quality of the prompt largely determines the quality of the ChatGPT output text. To make full use of this tool in the process of academic writing, prompts should be as formal, straightforward, and concise as possible. Users can try different prompts from multiple angles to find the best combination of prompts, thus giving full play to the potential of applying ChatGPT in research trend exploration.
2. To generate an outline and provide concrete ideas: When giving prompts to ChatGPT for the outline of any business writing, students would immediately get an extremely detailed format of standard modern business writing, e.g., a business proposal composed of ten main parts and affiliated with three or four subtitles under each part, which is quite adaptable to the context given and usually superior to the universal template in terms of content and subjects. After making the outline, students need to elaborate on each point. If they encounter barriers in some parts of the outline, they can also turn to ChatGPT for help. For example, one student proposed, "Write a review about 'milk tea brands market size, growth, and trends', and in turn, she got five paragraphs of responses with a total of 482 words. In addition to the general description and conclusion, the body

paragraphs respectively describe the market size and growth of milk tea brands (robust growth with great market value, dominant in Asia-Pacific), key factors driving growth (such as social media and retail channels), and emerging trends (such as customization and culture fusion). If a student has any doubts about one of them, they can continue to ask ChatGPT for further explanation, and they can even set a prompt of "Write a 300-word piece about" to limit the writing scale.

5.2 Challenges and possible solutions

Plagiarism. One major concern in the academic community is the possibility that users might present the text generated by ChatGPT as their study content. Various detection tools have emerged to determine whether the text is produced by tools similar to ChatGPT. Researchers are also comparing machine-generated and human-completed academic papers [38]. To prevent plagiarism issues, it is recommended that when referencing text generated by ChatGPT, one should compare it extensively with their content, drawing inspiration from its strengths rather than directly copying the generated text. If a paper includes portions of text generated by ChatGPT, it is necessary to perform plagiarism checks and modify overlapping sections with existing literature. It's essential to stay updated on the latest guidelines from journals and conferences regarding tools such as ChatGPT. If disclosure is required, any use of these tools in the paper must be disclosed as per the provided guidelines.

Absurd answers and wrong reference. OpenAI acknowledges on its official website that this tool has its flaws, with the first point being that the text generated by ChatGPT may sometimes appear plausible but is actually incorrect or even absurd [39]. The company also admits that ChatGPT can occasionally fabricate facts or provide irrelevant responses. Additionally, it operates without internet access, and its knowledge is limited to information up until 2021, thus being largely unaware of events that have occurred thereafter. Replies from ChatGPT often contain errors. Due to the powerful capabilities of ChatGPT, it could potentially aid non-experts in producing "professional papers." Without proper verification of its output, users might be misled, leading to inaccuracies in their produced content. Incorrect study outcomes could misguide policy decisions, thereby causing significant adverse effects on society as a whole [40]. To avoid being misled by ChatGPT, caution is necessary when using the generated text. This caution extends to verifying whether the refined content aligns with the original intent, checking for repetition between different sections, ensuring the completeness of literature reviews, and assessing whether the generated text contains irrelevant, illogical, or incorrect information.

One common criticism of ChatGPT is its lack of proactive provision of source references, and even when prompted by users, the provided references may be incomplete or inaccurate [41]. The author attempted to explicitly request the inclusion of references within prompts, and each time, ChatGPT supplied four references. However, these references often lack credibility, as among the four references, two are typically unrelated and the other two are non-existent. Since the text provided by ChatGPT does not include citation information, novice paper writers might be influenced by it, potentially disregarding proper citations to existing literature and inadvertently engaging in plagiarism [42]. Some studied have endeavored to combine ChatGPT-such as tools with citation tools or have trained ChatGPT-such as tools using specialized texts within certain fields [43]. However, until these endeavors

prove successful, relying on ChatGPT for source references remains questionable. Nonetheless, keywords can be extracted from the text generated by ChatGPT and then employed using traditional methods to search for relevant literature in specialized databases. In this way, the content generated by ChatGPT can serve as a starting point and a source of inspiration for our study and writing, rather than a directly usable final product.

Emergence of digital gap. Against the backdrop of rapid technological advancements, there exists a significant disparity in information literacy among university faculty and students. This variance contributes to the diverse digital divide, predominantly manifesting across three dimensions: accessibility, proficiency in tool usage, and outcomes of tool employment. In terms of accessibility, while ChatGPT has made its appearance relatively recently and many educators and students have incorporated it into teaching and study, there are still many who are unable to utilize it [44]. In terms of skill utilization, although many individuals can employ ChatGPT, differences in proficiency exist, particularly in the ability to generate effective prompts and discern information quality. Concerning outcomes, the quality of ChatGPT-generated text varies based on different prompts or combinations of prompts. Diverse information discernment abilities also lead to varied usage of ChatGPT-generated text, influencing the quality of student papers and the instructional design of educators.

In light of this, both students and educators must strive to enhance their information literacy. They should actively embrace new technologies in the teaching and learning process, all while maintaining a critical mindset. It is essential to utilize ChatGPT as an aid rather than a primary driver in various activities. Educators should pay special attention to students with lower information literacy levels and assist them in bridging the digital divide across the first two dimensions.

6 CONCLUSION AND LIMITATIONS

6.1 Conclusion

This study has shed light on the current utilization of ChatGPT, its prospective applications, and the inherent constraints within the realm of academic English writing. Through a meticulous amalgamation of quantitative and qualitative lenses, the study employed a CSE-based questionnaire and orchestrated focused group interviews, all aimed at elucidating the empowerment of academic WS through ChatGPT and gauging respondent perceptions. The findings underscore a growing awareness of ChatGPT among students, although the need for additional training in AI-assisted academic writing tools and concepts is evident. Notably, ChatGPT emerges as a facilitator in the application of academic WS, aiding students in comprehending study trends and focal points, formulating writing outlines, enriching ideas, synthesizing literature, and refining papers. However, it is imperative to consider a gamut of challenges, including the specter of plagiarism, output text inaccuracies, mismanaged citations, and the potential for a digital divide between users and non-users. The implications of this study posit that ChatGPT's integration into WS is a promising endeavor within the realm of academic English writing. By addressing the aforementioned issues and embracing solutions, we can harness its positive attributes while navigating around its limitations. It is paramount to maintain a vigilant stance on the quality of AI-generated content, leveraging its capabilities while safeguarding against its shortcomings.

6.2 Limitations

While this study has garnered significant insights into the integration of ChatGPT within academic writing strategies, certain limitations merit consideration. The study scope was confined to a specific demographic, namely Chinese university juniors majoring in English. This limited scope might restrict the generalizability of the findings to a broader student population with varying linguistic and cultural backgrounds. Additionally, the study primarily relied on the self-reported perceptions and experiences of the participants, which could introduce bias or inaccuracies in their responses. Furthermore, the rapidly evolving landscape of AI and its applications implies that the observations of this study might be subject to change as technology advances. The study focused predominantly on the potential benefits and challenges of ChatGPT's integration into academic writing, yet other aspects such as the ethical implications of using AI-generated content and the socio-cultural impact warrant further exploration. Despite these limitations, the study's outcomes provide valuable insights into the evolving landscape of AI-assisted academic writing. As the technological landscape continues to evolve, it is imperative to undertake comprehensive and multi-faceted investigations to holistically understand the implications, benefits, and challenges that AI technologies such as ChatGPT bring to educational and scholarly domains.

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