

# Incorporating Artificial Intelligence into Student Academic Writing in Higher Education: The Use of Wordtune by Chinese international students

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## Abstract

*Academic writing can be challenging for international students, especially if English is not their first language. Artificial intelligence (AI) writing assistants have received considerable attention in recent years as a new means to enhance students' academic writing. However, limited research has been conducted on how they are actually used in practice. This paper examines the use of Wordtune, an AI-powered writing assistant, by Chinese international students in higher education through interviews (n=30). The study explored the challenges these students faced in academic writing and how they already used a variety of digital tools during the writing process to address these issues. Specifically in relation to Wordtune students found the rewriting options useful, especially the function to rewrite in formal language. Students self-identifying as beginners in English used all the functions, but rather indiscriminately. Students with higher-level skills used it more selectively and learned to improve their writing through examining alternative rewrites. All users wanted the function to rewrite sentences more formally to suit an academic writing style. The paper contributes to our understanding of how international students use digital tools in the writing process*

**Keywords:** Artificial Intelligence (AI), AI-powered writing assistants, digital writing tools, academic writing, international students experience

## 1. Introduction

Researchers report that both native speakers and non-native speakers of English face challenges when writing academically (Campbell, 2019). International students whose native language is not English face numerous additional challenges (Jing, 2016). In the search for new avenues for academic writing support, there has been a growing trend for the use of writing technologies. One of the emerging technologies are AI-powered writing assistants. AI-powered writing tools typically use Natural Language Processing (NLP) trained on large datasets of human-generated text.

Research suggests that AI-powered assistants have shown potential for improving student writing skills as well as increasing student confidence and writing productivity in the writing process (Gayed et al., 2016; Sandoval et al., 2014; Syafi'i, 2020), but there are also concerns about them creating dependence or being used inappropriately.

Wordtune is one of the AI-powered writing assistants that provides rewrite options on original phrases or sentences by altering the sentence structure or replacing words with synonyms. It also has a translation feature that helps non-native speakers to translate multiple languages into English. Research suggests that Wordtune not only helps users to enhance their writing but might also provide language learning opportunities when users notice the dissonance between their original writing and the more effective rewrite provided by the tool (Zhao, 2022). However, like other AI-powered digital tools, Wordtune has limitations, including occasional error messages, inaccuracy of rewrites, and it has prompted concerns about overreliance on digital tools and their impact on academic integrity. This paper examines the use of AI-powered writing assistants for Academic Writing by Chinese international students in higher education, with a focus on Wordtune. Its objectives are:

- To establish the context by exploring the challenges that Chinese international students at universities have in writing and their use of digital tools in the academic writing process as a whole
- To examine how Chinese international students used Wordtune specifically
- To identify the concerns associated with using Wordtune

## 2. Literature review

### 2.1. Academic writing for international students

The increasing numbers of students travelling to countries such as the USA or UK for Higher Education

face many challenges such as language barriers. (Alsuhaibani, et al., 2019; Meier & Daniels, 2013). Research has shown that international students whose first language is not English frequently struggle to effectively express their thoughts and ideas in English (Lee, 2020; Tsai, 2019). The process can be time-consuming and demotivating for students. Besides semantics, these students may also struggle with a range of challenges when writing in English, including grammar, vocabulary, tense, and syntax (Eng, et al., 2020; Pan et al., 2016). These issues can impact the clarity and effectiveness of their writing, potentially leading to misunderstandings or low academic achievement, even unintentional plagiarism (Divan et al., 2015). Although efforts are made by universities to support students in writing academic assignments (e.g., language courses, writing tutorials), research suggests that they continue to struggle with academic writing (Leyland, 2020). In contrast to relying on traditional teaching and learning methods, research has observed an increase in the use of digital technologies by students to aid in their writing (Strobl et al., 2019; Schcolnik, 2018). However, there is a lack of understanding about how students actually use these tools in practice.

## 2.2. AI-powered Writing Assistants

Recent years have witnessed an increasing number of AI-powered technologies for teaching and instructing students in writing in higher education, including Automated Writing Evaluation (AWE), Automated Essay Scoring (AES), and Intelligent Tutoring System (ITS) (Cox, 2021; Nazari, et al., 2021; Godwin-Jones, 202). The use of writing tools is determined not only by need. The willingness and ability to use technology in the writing process is heavily dependent on a student's digital readiness. According to Hong and Kim (2018), students' digital readiness refers to their technological expertise, skills, knowledge, goals, expectations, and attitudes. It encompasses students' technology, ICT, and digital literacy, which allows them to use digital aids in formal environments, and academic writing. Students who are more digitally ready can be presumed to be using digital tools for academic writing.

Research has shown that AI-powered writing assistants can assist English language learning (Chong, 2019; Gayed et al., 2022; Fitria, et al., 2021), reduce cognitive barriers (Gayed, et al., 2022; Nazari, et al., 2021) and enhance the quality of writing for non-native speakers (Cheng, 2017; Hidayat et al., 2022; Nazari, et al., 2021; Nobles & Paganucci, 2015). Strobl et al. (2019) conducted a systematic review of the use of digital technology for academic writing. According to these authors, digital writing tools tend to focus on the

revising and editing process (e.g. grammar and spelling checks), and fewer studies tend to explore how these tools support the development of writing strategies or self-monitored improvement of the writing process. Other issues associated with AI-powered writing assistants include errors in the rewrite suggestions (Gayed, et al., 2022), concerns that overreliance on them may reduce skills and the risk that they might be used to breach academic integrity (Balida & Encarnacion, 2020; O'Neill & Russell, 2019).

## 2.3. Wordtune, an AI-powered writing assistant

Wordtune is an AI-powered writing assistant that provides rewrite options on writers' original phrases or sentences by altering the sentence structure or replacing words with synonyms (Zhao, 2022). It employs machine learning technologies such as natural language processing to generate naturalistic text. Users can access this application online via a web browser extension or a web-based editor. Wordtune provides a wide range of features for rewriting. The free version has a basic rewrite function. The premium version offers rewrites in different tones (casual or formal) and text length suggestions (to shorten or extend the text). While the rewrites can correct grammar mistakes the focus is on alternative ways to express ideas, rather than grammar checking, like Grammarly. It can also translate and rewrite text from other languages into English.

Figure 1. An example of Wordtune in Use.



According to Zhao (2022), Wordtune could afford English as a Foreign Language learners with language learning opportunities. She argues that English learners could strengthen their English writing skills by noticing the dissonance between their original writing and the more effective rewrite options provided by Wordtune. By selecting the best rewrite option or rejecting

irrelevant options, learners would be able to enhance their English writing skills through self-directed learning. However, like other AI-powered digital tools, Wordtune also has limitations, including unexplained error messages and inaccuracy of rewrites. Educators might also have concerns about overreliance on these digital tools and even the potential for them to be used for unfair means. As this is a relevant new AI-powered writing assistance launched in 2020, more empirical studies are needed to explore the value of Wordtune for EFL users for academic writing purposes. In particular, there has been no research conducted on exactly how Wordtune is used among international students in higher education.

### 3. Material and methods

The present study adopted a qualitative approach to explore the experiences of Chinese international students in UK universities. A total of 30 participants (20 male and 10 female) were recruited for this study through a snowball sampling strategy. Most were undertaking an undergraduate (UG) course (n=18), while the remaining participants were on one-year postgraduate taught (PGT) courses (Table 1). They were recruited on the basis of them being in the process of submitting dissertations at the time of the study. Participants were given free access to a premium Wordtune account for two months and then the interviews were conducted at the end of this trial period.

Participants were provided the option to choose between being interviewed in either Mandarin Chinese or English. Notably, all participants opted to be interviewed in their native language. Consequently, the interviews were conducted in Mandarin Chinese, subsequently translated into English by a member of the research team. The translated version was reviewed by a proofreader for accuracy, and an additional team member further validated the accuracy of the translation. Each interview lasted approximately 30 minutes. The data was analysed using the Thematic Analysis approach (Braun and Clarke, 2006). Informed consent was collected prior to the interviews. Ethics approval was obtained from the University of Sheffield Research Committee.

### 4. Results

The findings of the study will be summarised under four headings, responding to the project objectives. Firstly, we present what participants said about the challenges they face in writing. The second section examines their pre-existing use of digital tools when

writing. Thirdly, how their use of digital tools related to their existing self-evaluated English language competence is considered. The fourth section directly examines how participants used and evaluated Wordtune.

#### 4.1. Challenges faced by Chinese international students in academic writing

Students said that they were not very aware of academic writing style as it had not been taught to them in their previous studies or for English language tests needed to study abroad. Participants identified four main inter-related challenges in writing English. The first was articulating their ideas in the English language. Many students said that they found it hard to express their thoughts in English due to a lack of relevant professional or academic vocabulary. This resulted in them losing confidence when writing and could create a mental block.

“The challenge is more about English vocabulary, the lack of sentence-making ability, and the vocabulary is relatively poor.” (Participant 1, Male, PGT, English Beginner)

A second major challenge was fine-tuning a text they had written in correct academic English, using appropriate academic sentence constructions and vocabulary.

“First of all, I don’t know whether my thoughts are correctly conveyed in academic writing. I can’t fully guarantee that what I want to express is the same as what I actually expressed in my academic writing.” (Participant 24, Male, PGT, Intermediate English)

A third issue appeared to be the specific terminology of the discipline they were studying, which again had to be mastered:

“The main challenge is that I think it is professionalism because each course has some professional terms of its own, as well as its academic terms, and these academic terms are not the same as your daily speaking or normal expressions.” (Participant 30, Female, PGT, English Beginner)

The fourth barrier was tone of voice and trying to express what they wanted to say in an acceptable way.

“Because I am not a native English speaker, I say that the spelling of many words may be

inaccurate, and the sentence pattern, especially in academic writing, is not formal enough, and the writing style may not be British enough and not localized enough.” (Participant 1, Male, PGT, English Beginner)

“I hope that I can express myself more formally and can express some of my feelings better. Then, because I am not a native English speaker after all, I am afraid that the expression on the email will cause some misunderstanding and time-wasting in communication.” (Participant 14, Female, PGT, English Beginner)

Participants said that sometimes they could not distinguish between formal and informal vocabulary or sentence structures, resulting in using colloquialisms and not being able to express their emotions accurately.

Operating together these four barriers constituted a significant obstacle to progress in their studies.

#### 4.2. Commonly used digital tools by Chinese international students

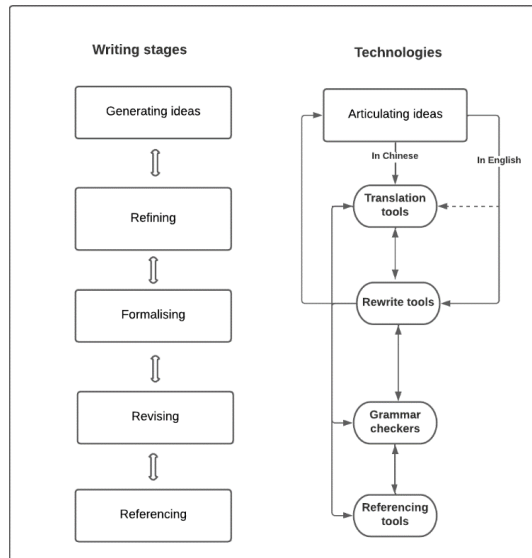
The Chinese international students participating in the study had a high level of digital readiness and so employed a broad range of tools to help them with the challenges they faced in writing (Table 2). To overcome the English language barriers identified in the previous section, participants reported that they used translation tools (e.g., Google Translate, DeepL, Chinese translation tools named ‘Youdao’ (NetEase), etc.) and other forms of writing tools such as rewrite tools (e.g., Wordtune and Quillbot), grammar checkers (e.g., Grammarly) referencing tools (e.g., Zotero, Mendeley). Translation tools appear to have been the most valued and widely used type of tool. This finding aligns with the research conducted by Kučić and Seljan (2014), who propose that language learners tend to prefer translation tools like Google Translate.

Table 1 Tools mentioned by participants

Types of tools	Functions	Technologies
Translation tools:	Provide translations of phrases and	Google Translate, NetEase, Eudic dictionaries,

	sentences into English	DeepL, Translate, (Wordtune)
Rewrite tools	Provide options for rewording English text (phrases or sentences), such as replacing words with more suitable synonyms or adjusting tenses, and sentence structures (e.g., formal style)	Wordtune, Quillbot
Grammar checkers	Identify and correct grammatical errors in written text	Grammarly
Referencing tools	Create citations and generate references in their written work	Zotero, Mendeley

Figure 2 The use of technologies within the writing process



It appeared that there are five stages of the writing process for Chinese international students which we have summarized at a high level in Figure 2. The first stage involves generating ideas and putting them into English text. Depending on their level of English proficiency, international students may produce Chinese text first and then translate it into English. During this process, translation tools are often used to help with the conversion of thoughts into English. The interview data suggested that students use a wide range of translation tools for this purpose and the same student might use more than one. In contrast, students with higher English proficiency may write their ideas in English directly, only occasionally using a translation tool for some words or phrases that they find difficult to express in English.

The second stage is refining the English text that has been produced. During this stage, rewrite tools such as Wordtune or Quillbot are used to find synonyms or better phrasing. These tools provide suggested substitutions for sentences or words, which can help to refine the expression of an idea. The third part of the process involves formalising the text in an academic writing style. During this stage, rewrite tools are often used again, but mostly using the "formal" feature, which changes sentence structures or vocabulary into a more formal expression. The next stage is revising the text to make it grammatically correct. During this stage, grammar checkers such as Grammarly may be used to identify and correct grammatical errors. The final stage is referencing, chiefly creating a well formatted reference list. At this stage, referencing tools such as Zotero and Mendeley are used.

"I usually use some tools, such as Google Translate, to translate my thoughts directly, and then use some simple auxiliary tools such as Grammarly to help me correct some wrong vocabularies, grammar, etc., formatting and so on, I've also used tools that can automatically insert references for me, and I think it's quite convenient." (Participant 13, Male, UG, English beginner).

"I use Microsoft Word to write English papers, and then use some online dictionaries, such as NetEase and Eudic dictionaries, there will be a help to rewrite them, and then check whether there are any wrong sentences." (Participant 19, Male, PGT, English Beginner).

Writing, especially of long texts such as essays, is a complex, iterative process so participants might go back and forward with the same or different tools during the

process of writing, So this description (and figure 2) is not intended to imply a simple linear process. This finding accords with the research conducted by Argüello Guzmán (2012) who identify a non-linear digital migration in the way university students read and write, characterized by the electrification and digitization of the mind during these processes. The types of tools identified as most frequently used for each stage can also be used in other stages, and the same is true for the specific AI-powered writing assistants associated with each stage. The following quote is particularly interesting for the sense of the concerted use of multiple technologies in an iterative way:

"In fact, my method is mainly to write Chinese first, then use Google Translate, and then paraphrase the Google translation, and directly use a software called quillbot to paraphrase it." (Participant 11, UG, Beginner)

The use of other AI-powered writing assistants such as Wordtune and Grammarly had a number of mentions among the participants. The primary reason for using these tools were for adjusting sentence structures and correcting grammatical mistakes. Participants believed that although translation software could help them articulate their thoughts better, rewrite software was needed to help them to restructure their writing to an academic style.

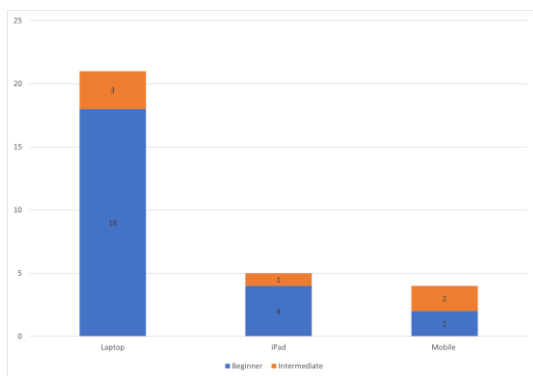
"Well, how do you say it? One is translation software. I think the most commonly used are Translate and DeepL. There are two translation software, some sentence rewriting, and then more professional software. For example, Wordtune and Grammarly are more professional grammar and rewriting software. I think these can help me do academic writing." (Participant 23, Male, PGT, English Beginner)

Thus all participants in the research had previous experience of using various digital tools, including translation tools, rewrite assistants, grammar checkers and referencing software, though they were not recruited on the basis of a particular interest in technology. Several were already users of Wordtune or tools with some similar functionality. The evidence suggests that international students possess a high level of digital readiness in using a range of digital tools for their academic studies.

### 4.3. Reliance on digital tools affected by the level of English proficiency and educational degrees

The students who participated had different levels of self-identified English language proficiency. Participants were asked about their perceived language level and the types of devices that they use Wordtune when writing academic essays. Participants self-reported that most of them were English beginners (n=24), and that they used laptops to access Wordtune for academic writing (Figure 3).

Figure 3: Perceived English-level and use of digital devices



It was apparent that students with intermediate proficiency in the English language were less reliant on any sort of tool, and mostly used them for proofreading or searching for synonyms. In contrast, students with a beginner proficiency level in English used different digital tools throughout their writing processes.

“If it is for me because my level is relatively poor, the proportion will be relatively large. If you use some tools, for the writing of a paper, the efficiency will be much higher.” (Participant 10, Male, UG, English Beginner)

Indeed, most of the UG students mentioned that their dependence on digital tools was very high. They believed that digital tools would provide them with a well written draft which they could not achieve without the help of such tools. In contrast, the dependence of PGT students with an intermediate proficiency level in English was much less and the tools were used in a strategic way at certain points of the writing process:

“Probably 50% [of the writing process had incorporated digital tools], these techniques are more needed in the early stage of literature search and later stage of article revision.”

(Participant 15, Male, PGT, English Intermediate)

### 4.4. The use of Wordtune by participants

Students were asked about their user experiences of Wordtune during the free 2-month trial they were given as part of the project. The most popular feature among all participants was the function of Wordtune to make their writing more formal. For example, Participant 10 most commonly used Wordtune to try and find a more academic style and reduce repetition of certain words.

“The most commonly used are some synonyms, and the conversion of sentence patterns is to convert some expressions that may not be so academic into more academic expressions, and some are too frequent, and then some synonyms are needed to replace them will use it.” (Participant 10, Male, UG, English Beginner)

Participant 28 used the formal and expand functions most often:

“I use this formal function most often, as well as this expand function. This formal function can help me change some informal vocabulary into a more formal format, and I think this extension function is very useful and can help me expand some ideas.” (Participant 28, Male, UG, English Beginner)

“Wordtune at this time to help me rewrite or expand into academic sentences.” (Participant 15, Male, PGT, English Intermediate)

Wordtune provides a list of rewrite functions for users to choose from. Participants were asked to describe how they decided which rewrite options to use for their writing. Participants reported that they would make a conscious decision by going through all the options provided by Wordtune. PGT students with intermediate English proficiency were most likely to benefit from the language learning opportunities by choosing from the rewrite options as they could distinguish between good options and bad ones and through this process of weighing them up, learning was promoted.

“Very good, generally read it, and then choose a more suitable one.” (Participant 9, Female, PGT, Intermediate).

In contrast, UG students with beginner English proficiency skills could not differentiate very well

between the options offered and so had limited opportunity to learn from the process. They would prefer the options to be reduced or automatically applied so that the tool was simple to use.

“Because it will provide a lot of rewriting options every time, it is very tiring to choose. It is recommended to give a little less directly. It can be simplified appropriately. I just need some opinions.” (Participant 20, Male, UG, English Beginner)

Consistent with this PGT students with ‘intermediate’ English proficiency skills tended to use Wordtune only at the final stage of writing, e.g., for correcting vocabulary or proofreading, as well as using the formal feature to rewrite sentences into a more formal style. On the other hand, UG students with ‘beginner’ English proficiency skills accessed multiple functions of the tool throughout their writing processes, including translation, basic rewrite, changing tone (e.g., casual, formal), and text expansion. etc. Specifically, the interview data suggested that participants with a lower level of English proficiency tended to use Wordtune to find synonyms for vocabulary and phrases. They also liked to use the ‘expand’ function to help them generate writing ideas. Some students reported that they would write in Chinese and use Wordtune to translate it to English and then use the expand function to make it more formal or ‘academic’. This is consistent with the previous finding that participants would use translation tools in combination with other tools. Since Wordtune also has a translation feature, some students would simply use Wordtune for direct translation and rewrite.

Interestingly, in addition to writing academic essays, participants reported that they also used Wordtune for improving communications with academic tutors by email. According to participants, Wordtune provided them with a sense of confidence that they communicated ideas and questions to their supervisors in a clearer and more polite manner. By using Wordtune, they felt they could convey their respect to their supervisors, which would otherwise be difficult.

“For example, if you want to send an email to your supervisor, it will rewrite it for you. Change the phrases and vocabulary to something respectful or something that fits your status, the ones that are often used should be more formal, and then expand on some sentences.” (Participant 7, female, UG, English Beginner)

There was agreement among participants that Wordtune was useful. They explained that Wordtune could help with all the language barriers that they had identified: including translating thought into English, as well as improving academic writing. Some also said it helped them to learn academic vocabulary and create error-free sentences through successive rewriting. Thus it helped them to improve their writing fluency.

“The main advantage is that the fluency and correctness of writing have improved a lot...It reduces my mistakes and errors.” (Participant 2, female, PGT, English Beginner)

#### 4.5 Concerns of using Wordtune

There were perceived to be some pitfalls to using Wordtune. Most of the participants were satisfied with the features of Wordtune, but they made several suggestions about how it could be made more usable. One issue about Wordtune participants reported was that it can only be accessed online. Occasionally, Wordtune does not work due to technical or internet connection issues. Therefore, many students have to use it along with other online word processors, such as google docs. Therefore, Wordtune has a heavy reliance on other online word processors.

“I have used Google Docs, Microsoft, and Chrome with Wordtune.” (Participant 13, Male, UG, English Beginner)

Another issue raised by participants was that there was a lack of a database of academic writing text. Although Wordtune offers a rewrite feature to change text to a more formal style, it still did not raise the text to an academic standard. Participants reported that there is a lack of academic vocabulary, phrases or sentence structures available. Participants recommended that Wordtune could either include more academic sources in their database or create a separate version for educational users, including academics and students.

“I hope that it can more accurately identify various academic vocabulary...” (participant 11, male, UG, Beginner)

They were also looking for support in using the language of their discipline.

“The translation is better, and some English may be added academically...I hope that its professional vocabulary library can be larger.”

(Participant 10, Male, UG Year-1, English Beginner)

## 5. Discussion and implications

The study explored the use of digital tools to assist in writing among international students and was based on interviews with 30 Chinese international students studying in the UK. It captured common challenges they faced in academic writing and the general experiences of using digital tools to assist in the process. The study focused on one particular AI-powered writing assistant, Wordtune, to explore user behaviour and experiences. Most studies of AI in education concentrate on institutionally sponsored AI technologies. But it may be that AI use is user driven. In this context it is critical to see how users adopt such technologies in the wild. This paper makes a contribution to developing this perspective.

Students reported that they were unaware of the academic writing style and format before coming to UK universities. Consistent with the previous literature, participants mentioned that the writing instruction they received in the previous institutions and language schools for IELTS in China did not apply to the academic environment of higher education in the UK (Guo, 2018; Leki, 2017). The students also observed that the types of writing required in higher educational settings differ significantly from those required in schools (Gilakjani, 2016). Several issues were identified regarding the language barriers that international students face in academic writing. As has been observed by previous studies (Guo, 2018; Leki, 2017) these overseas students found it difficult adjusting to the new writing style that is expected of them. In particular, they have trouble with converting thoughts into English, with academic vocabulary and sentence structures, and the formal writing style that is expected in academic writing.

To combat these barriers, all participants showed a high level of digital readiness (Hong & Kim). Most of the participants had previous experiences with various digital tools for academic writing purposes, such as Deep L, NetEase, and Google Translate, and Grammarly. In particular, participants frequently used a combination of digital tools, such as translation software and AI-powered writing assistants. The data showed that education level and English proficiency have an impact on the user behaviour of these digital tools. Students with a higher command of English proficiency or higher educational degree were less reliant on digital tools and were more likely to be selective in their use of digital tools according to various stages of their writing.

Typically, they would use translation software for difficult expressions from China to English, use text-processing tools for effective paragraphing and rewriting, and grammar checkers to correct errors. Referencing managers were also mentioned by these participants. In contrast, those who rated themselves as beginners in English or those who had just started university would heavily rely on digital tools throughout their writing and were less selective in their use of these tools.

As regards the specific user experience of Wordtune, participants expressed positive attitudes towards the tool both in academic writing and their communication with academic supervisors. It was evidenced that participants were more confident in the clarity of their writing and communication after using Wordtune. The function of rewriting in a formal style, which most closely resembles academic writing, was the most popular feature among all participants. They also valued this feature because it helped them convey their politeness and respect to academic staff in email communications, which would otherwise be difficult for them to show through writing.

In terms of user behaviour, participants with higher education levels or English proficiency tended to have a more intentional use of Wordtune. They were likely to use Wordtune after drafting a paragraph or at the final stage of the writing, e.g., to find academic synonyms for words or phrases, and apply formal sentence structures. In addition, they benefited from the language learning opportunities by noticing the differences in the rewrite options provided by Wordtune and choosing the best option that represented their idea. This confirms the findings of earlier studies which suggest that AI-powered writing assistants can assist in English language development (Fitria, et al., 2021; Zhao, 2022). In contrast, most participants with lower education levels and English proficiency used all Wordtune's translation, text expansion, and formal style functions throughout their writing process. They were less likely to notice errors in the rewrite options from Wordtune and would prefer less rewrite options or even automatic application of the rewrites. A pattern of learning from the tool was less evident.

There were some issues raised by participants using Wordtune. For example, these types of AI-powered writing assistants tend to rely heavily on continuous internet access and online word-processing software, such as Microsoft, Google docs, etc. In addition, although the formal feature somewhat resembles an academic writing style, it cannot fully satisfy academic writing needs. More academic vocabulary phrases and



sentence structures are needed to expand the current database to train the machine learning process of AI-powered writing assistants.

This study has revealed some of the ways that Chinese international students use digital tools in the writing process at a particular point in time. However, there are certain limitations within this study. Our study centers on a singular group of international students. Our understanding could be expanded by examining the behaviour of other groups of non-native English-speaking international students and by using observational or diarying methods to capture in greater detail how the use of digital tools fits into the writing process. It would be fascinating to examine logs for such tools in depth. Ideally this could be mapped to students English language performance.

Furthermore, participants were requested to self-report their English proficiency, which might not be the most precise reflection of their skills. Utilising more "objective" criteria, such as recent IELTS scores, could have provided additional insight. Additionally, we acknowledge the potential emergence of further limitations due to the diverse educational backgrounds and academic disciplines of the participants. While those chosen for this study were all engaged in dissertation writing, sharing a commonality in their writing tasks, their levels of academic writing skills and expertise may vary. Consequently, future investigations could concentrate on specific disciplines or education levels to enable a more comprehensive exploration of Wordtune's use by students. Lastly, as a qualitative study, we recognize some inherent constraints encompassing a relatively limited sample size. Subsequent research could employ a mixed-methods approach, combining qualitative interviews with quantitative surveys to enhance the depth of analysis. Moreover, future research could undertake a comparative analysis comparing Wordtune with other AI-powered writing tools, thereby extend the scope of the results.

Given that we were asking students about their own practices of writing, we did not think it was useful to ask directly about the potential of Wordtune and other tools to be used for unfair means. This was unlikely to yield anything but a defensive response. The descriptions of what students do portray them tackling a complex task with all the tools at their disposal. Observation would be a better approach to evaluating the risk here. As the technologies further develop, e.g., with the arrival of tools such as OpenAI's ChatGPT, capable of generating plausible text from a short instruction, so we can expect student behaviour to further evolve. It is important to

understand much better how students fold digital tools into their writing practices and how this impacts learning. This understanding can be the basis for providing better support to students in evaluating and using digital tools, allowing them to use the tools effectively and ethically. Laying out clear guidelines on what is permitted and what is not would be helpful to students.

## 6. Acknowledgements

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