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Zhao, X., Sbaffi, L. orcid.org/0000-0003-4920-893X and Cox, A. (2025) The digitisation of writing in higher education: exploring the use of Wordtune as an AI writing assistant. Electronics, 14 (6). 1194. ISSN 2079-9292

https://doi.org/10.3390/electronics14061194

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electronics

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Article

The Digitisation of Writing in Higher Education: Exploring the Use of Wordtune as an AI Writing Assistant

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Abstract: Background: Accelerated by the advent of AI-powered writing assistants, writing, as a crucial aspect of higher education assessment and practice, has undergone rapid digitisation in recent decades. However, there is a paucity of empirical research on its use in the everyday practice of students and staff. This study explores the use of Wordtune, an AWCF tool, to determine its benefits and limits from a user perspective. Methods: The research was conducted through a large-scale survey of Wordtune users. Descriptive statistics were generated, exploratory and confirmatory factor analysis was performed, and open-ended questions were analysed using content analysis. Results: Wordtune users are typically confident English speakers and use it alongside other tools such as Grammarly and Google translate. Wordtune is perceived by users as offering low-order benefits in terms of rephrasing and writing more grammatically but also as having high-order benefits such as overcoming mental blocks and creating opportunities for language learning. Users acknowledged very few drawbacks to using Wordtune. Conclusions: Our paper concludes with pedagogic suggestions for educators to support the use of AI writing assistants for student language learning.

Keywords: AI-powered writing assistants; artificial intelligence; Wordtune; digital writing; higher education; writing skills

Academic Editors: Marco Carratù and Minna Rollins

Received: 30 January 2025
Revised: 7 March 2025
Accepted: 13 March 2025
Published: 18 March 2025

Citation: Zhao, X.; Sbaffi, L.; Cox, A. The Digitisation of Writing in Higher Education: Exploring the Use of Wordtune as an AI Writing Assistant. *Electronics* **2025**, *14*, 1194. https://doi.org/10.3390/electronics14061194

1. Introduction

Although writing has always been mediated by technology (e.g., the pen), the digitisation of writing constitutes a major shift in this fundamental process of expression and learning [1,2]. Through the introduction of word processors, then spelling, grammar, and style checking, and then connectivity, this digitisation process may have had profound effects on writing, although these changes are hard to identify as they are primarily mental rather than directly visible changes [3].

There has been an acceleration of this digitisation process in recent years with the growing number of AI-powered writing assistants available. Godwin-Jones differentiates four types of such tool [4]: automatic writing evaluation (AWE) tools, which provide feedback on completed work; automatic written corrective feedback (AWCF) tools, which offer synchronous feedback on spelling, grammar, and/or style as text is written—the class that Wordtune fits into; translation tools; and text generation or natural language generation tools, which write bodies of text from a short stimulus.

If the writing process consists of the stages of "prewriting, planning, drafting, revising, and editing" [1] (p. 38), AWCF operates mostly in the latter two [5]. Tools such as AWCF offer obvious advantages to the learner, such as immediate feedback 24/7 and the potential for consistent but also personalised suggestions [6]. These tools are often seen as a means of saving teacher time in providing low-level feedback.

However, the growing body of research on what determines learners' engagement with ACWF tools cognitively, behaviourally, and affectively is inconclusive. Users do not simply respond to the feedback offered in an adjustive way and can reject correct suggestions. Erroneous suggestions tend to undermine confidence in use as "engagement with feedback is complex and multi-faceted" [7] (p. 13). Some studies suggest that those with higher writing competence engage more effectively with the tools [8], while others emphasise the importance of trust in the digital tool as overriding language competence [7].

Current research is also inconclusive about whether such tools promote the learning of improved writing skills, as opposed to just providing a proofreading service or even creating dependence on the tool [7]. More advisory feedback could promote learning, depending on the user's orientation. But Ranalli suggests that learners often see the tools as useful for proofreading rather than learning [7].

Further, from a learning perspective, it has to be acknowledged that automated feedback is usually found to be less helpful than human feedback [6]. Studies have found that human feedback outperforms AWCF because of the limitations of the tools, like failing to fit the writing genre, or because students' own low language skills limit their ability to understand the feedback they receive [6]. Many researchers suggest that, while the spelling, grammar, and even style checks offered by AWCF could be important, they do not address other types of issues such as the structuring and ordering of ideas [4]. It seems that, pedagogically, the key to improving writing is to teach writing strategy rather than low-level grammar or spell-checking [9,10].

Despite the moral panic in the media around such tools as ChatGPT 3.5 [11], these are only just starting to change how writing is done [12]. It is important to recognise that many learners are already using multiple tools at different stages of the writing process, so that the uses of tools like Wordtune fit into a wider landscape of digital writing [8,13,14]. This panoply of tools to support the writing process has been little analysed, particularly from the perspective of how they are used in practice and in conjunction with each other. This paper seeks to understand how one such AWCF tool, Wordtune, is used in practice and to determine what its benefits and drawbacks are from a user perspective.

Wordtune

Wordtune is a form of AWCF, which unlike Grammarly is characterised not by a focus on grammar or spell-checking but on offering rewrite options on authors' original phrases or sentences by altering the sentence structure and/or replacing words with synonyms [15]. It can be accessed via a web browser extension or a web-based editor. The free version of Wordtune has a basic rewrite function. The premium (subscription) version offers rewrites in different tones (casual or formal) and also text length suggestions, shortening or extending the text. While the rewrites offered correct grammar mistakes, the focus is on alternative ways to express ideas, rather than grammar checking. It also translates phrases or sentences from other languages into English (Figure 1).

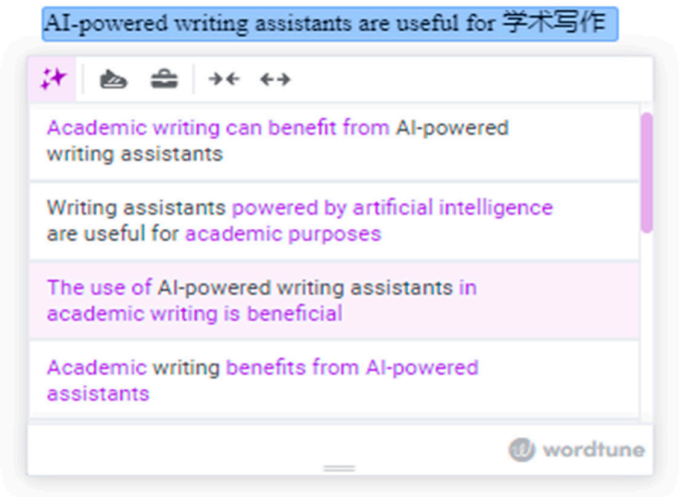

Figure 1. The Wordtune browser extension in use. Note: The highlighted text 'Academic English' was translated from Chinese into English using Wordtune in this example.

Zhao [8] and Rad et al. [16] suggest that English learners can strengthen their English writing skills by noticing the dissonance between their original writing and the more effective rewrite options provided by Wordtune. This suggests the possibility that lower-order benefits add up to high-order benefits. However, like other AI-powered digital tools, Wordtune also has limitations, including some unexplained error messages and mistakes it makes in rewriting sentences. This may lead to concerns about overreliance on these digital tools and even the potential for them to be used for unfair means [14].

In the context of the digitisation of writing, the current study set out to discover the following:

- Who uses Wordtune and how is it used in writing?
- What types of benefits is it seen to offer for writing?
- What issues does it have?

2. Materials and Methods

2.1. Process

We conducted a survey with Wordtune subscribers in higher education to gain insights into how people use the tool in their writing practices. The survey was composed of three main sections: (1) demographic aspects of the respondents, including whether English is their first language and proficiency in communicating in English; (2) writing practices and the use of Wordtune, mostly in the form of five-point Likert scale statements; and (3) additional information on the use and perceptions of Wordtune, also in the form of five-point Likert scale statements and additional open-ended questions. Survey invites were sent to university users, including both students and staff. The survey was sent via email to 9000 Wordtune subscribers, and 467 questionnaires were returned (response rate: 5%). After removing incomplete responses, 257 questionnaires were used for this study.

This study received ethical approval from the University of [Anon] (ID: 045359) in the United Kingdom. The survey was distributed to Wordtune subscribers worldwide. Participants were provided with informed consent prior to their participation in the study. All data collected were anonymised. Participants were informed of their right to withdraw from the study at any time without any negative consequences.

2.2. Data Analysis

For the purpose of data analysis, IBM SPSS Statistics 28 was used. Descriptive statistics were then generated. The means and standard deviations were calculated for each question. The next step was to perform independent-sample *t*-tests to compare mean scores for students with English as a first language or not and taught students vs. all other respondents, alongside analysing gender differences. Spearman's correlation coefficients, 'ρ', were also calculated between different groups, including length of time using Wordtune and uses and benefits of the software as well as English proficiency and uses of Wordtune. Chi square tests of independence were used to compare writing practices between premium and free version users of Wordtune.

Finally, exploratory and confirmatory factor analysis (EFA) was used to determine the smallest number of factors to best represent the interrelationships among the items in the survey and to identify loadings onto factors. Then, confirmatory factor analysis (CFA) was carried out to test the measurement model using IBM SPSS Amos 28 Graphics. In addition, qualitative content analysis was conducted on responses to open-ended questions. Quotes representing responses were included to provide further insights into the participants' views.

3. Results

3.1. Wordtune Users (RQ:1 Who Uses Wordtune?)

Two hundred and fifty-seven valid responses to the survey were used for this study. Respondents include taught students at both undergraduate (N = 76; 30%) and postgraduate level (N = 80; 31%) and PhD students (N = 53; 21%), with some academics (10%) and a few professional staff members (Table 1). Reflecting this wide user base, the age of the sample ranged from 18 to 71, with a mean of 32.2 (SD = 10.2) and modes of 23 and 30. The sample was roughly evenly split between males (N = 117; 46%) and females (N = 131; 51%), with a few preferring not to respond.

Table 1. Demographic characteristics of survey respondents.

		No.	**%**
Gender	Females	131	51.0
	Males	117	45.5
	Other	1	0.4
	Prefer not to say	8	3.1
Role	Undergraduate student	76	29.6
	Postgraduate student	80	31.1
	Research student	53	20.6
	University/college faculty or academic staff	28	10.9
	University/college admin staff	5	1.9
	University/college student support services	3	1.2
	Library services	1	0.4
	Other	11	4.3
English as 1st language	Yes	85	33.1
	No	172	66.9
English proficiency	No proficiency	2	0.8
	Elementary proficiency	3	1.2
	Limited working proficiency	27	10.5
	Professional working proficiency	72	28.0
	Full professional proficiency	64	24.9
	Native/bilingual proficiency	24	9.3

	N/A (English is my first language)	65	25.3
Age	18–24	68	26.5
	25–34	92	35.8
	35–44	68	26.5
	45–54	15	5.8
	55–64	10	3.9
	65 and over	1	0.4
	Prefer not to say	3	1.2

Two-thirds of users had a first language other than English, but a significant number of participants were native English speakers (N = 85; 33%), showing that the tool has applicability for all writers. Respondents tended to be relatively confident in their English writing skills. On a six-point scale, non-native English-speaking Wordtune users rated themselves as at the fourth highest level of competence—"Professional working proficiency (e.g., contribute to meetings, have conversations with colleagues, carry out most work functions requested of them)" (N = 72/192; 38%)—or at the fifth level—"Full professional proficiency (e.g., can have advanced discussions on a wide range of topics)" (N = 64/192; 33%). Thus, when we include native English speakers, Wordtune users seem to already have a high level of language proficiency. It appears that those with a high level of proficiency in the English language are more inclined to see a benefit in using digital writing assistants.

Wordtune users draw on multiple tools and types of support to write in addition to Wordtune, confirming the idea of the digitisation of writing (Figure 2). Translation tools appeared high up the list of other writing supports used, although not among native English speakers ($\varrho = -0.360$, $p < 0.001$). Voice/handwriting recognition software was not used much, especially among those with better English language levels ($\varrho = -0.131$, $p = 0.036$). But respondents also acknowledged using books and pen and paper to support the writing process.

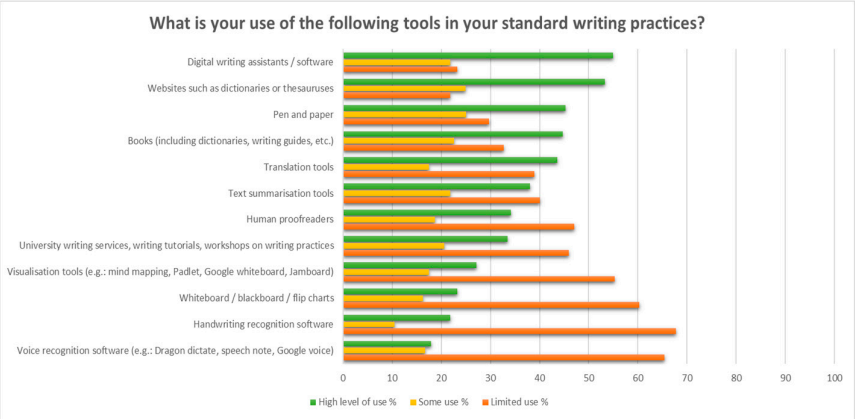

Figure 2. Use of tools in writing.

When asked in an open-ended question which other digital tools they used, 167 (66%) mentioned Grammarly and 72 (28%) mentioned Google Translate. Other tools mentioned included Quillbot, Essaybot, Deep-L, REF-N-Write, Pubsure, Aje, Wordhero, Creaitor.AI, Ginger, Bartelby, Chugzi, Wordtuner, Papersowl, Papago, Babylon, Paperwrite, Prowritingaid, and Hyperwrite. In contrast to the figures for Grammarly, there were very small numbers using each of these, but the response does fit with a sense of a burgeoning number of tools changing the nature of writing.

3.2. Using Wordtune (RQ1: How Is Wordtune Used in Writing?)

Respondents said they used Wordtune in a range of writing tasks, which differed slightly by role. Taught students said they used it for short and long assignments and for social media (e.g., blogs), including email. Academics and PhD students used it to support writing for publication and funding proposals. In general, participants primarily use Wordtune for study- or work-related purposes but also for some formal social media communications, including email. Respondents tended to use Wordtune "intensively when working on a particular type of work" (N = 128; 50%). But a few said they used it either "all the time" (N = 65; 25%) or "occasionally" (N = 52; 20%).

However, in general, respondents had not been using Wordtune very long. Indeed, nearly half had used it for less than three months, and only 6% had been using it for more than a year. This might be because the tool is relatively new, as it was launched in 2020. But the needs of the respondents must be taken into account when reflecting on how the tool was used: there was evidence that higher-order gains (e.g., to express what they are thinking, break through a mental block, and come up with new ideas) were more commonly found among those who had used Wordtune longer. Two-thirds of respondents were using the free version of Wordtune (N = 164, 64%). As noted in the literature review, this has significantly less functionality, e.g., in types of rewrites and the number of rewrites allowed per session. Among premium users, there was a clear emphasis on the use of the function to rewrite a sentence in a more formal tone (41.6%) which resembles an academic writing style. They also tended to use Wordtune for every aspect of their writing significantly more than the free version users (Chi square = 5.450; df = 1; $p = 0.020$).

The main uses that respondents acknowledged are set out in Figure 3. Writing more clearly and correcting grammar scored highly. The high scores for writing for an audience or expressing oneself in a polite way probably relate to selecting tone, which is central to Wordtune's functionality. However, such benefits seemed negatively correlated with the level of English confidence; in fact, the more fluent the users are in English, the less important these aspects appear to be (e.g., $\varrho = -0.274$, $p < 0.001$ for "It helps me express myself in a polite way"). Avoiding plagiarism was also acknowledged as an important use. Taught students emphasised this more than other users, as one might expect, but, interestingly, academic staff also mentioned this as a use too. Although Wordtune has a translation function, this did not seem to be used much, perhaps because there are other more specialised tools for translation. This suggests that users are quite discerning in how they apply Wordtune alongside other tools.

Those whose first language was not English seemed to use it slightly differently. For example, they agreed more strongly with the idea of using it to ensure politeness; in fact, 133 (77.3%) respondents whose first language was not English make high use of Wordtune for this purpose, as opposed to only 46 (54.1%) native English speakers (Chi square = 13.088; df = 1; $p < 0.001$).

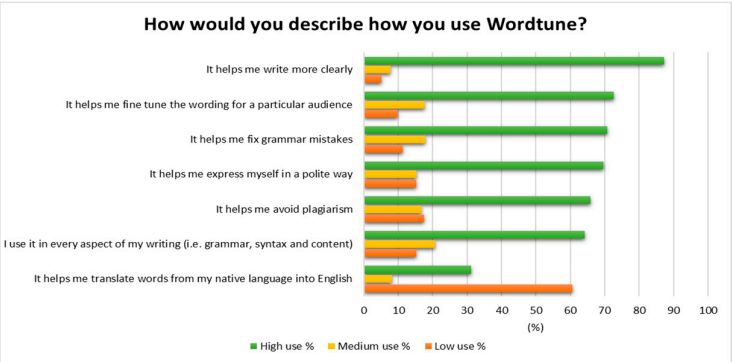

Figure 3. Use of Wordtune.

Some quotes from the open-text follow-up question illustrate the value of these uses in more detail:

> "Simplifying my complex sentences and making it more easily readable. Also, avoid plagiarism. Find synonyms and better/exact words to express my intention."
>
> "It makes the language richer and more varied"

3.3. The Benefits of Wordtune (RQ 2: What Types of Benefits Is It Seen to Offer for Writing?)

Figure 4 represents what respondents identified as the benefits of Wordtune. The response was positive with respect to all the benefits listed in the questionnaire. The most strongly supported benefits included obvious aspects given its functionality, such as finding synonyms, but also less obvious uses that leverage this, such as breaking a mental block or thinking of new ideas (Figure 4).

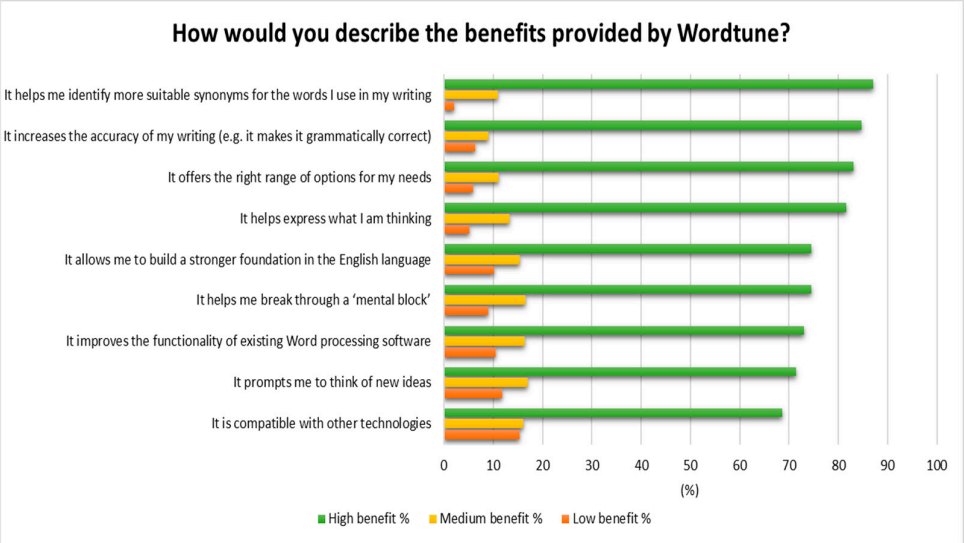

Figure 4. Benefits of Wordtune.

The impression of a wide range of benefits was reinforced by some of the open-text comments about why respondents would recommend its use to others. It was seen as easy to use:

> "Yes because it really helps when I have a mental block or I am not sure how to summarise or rewrite another author's ideas. It has been a huge benefit as I take graduate courses."

Respondents mentioned that Wordtune helps them write more clearly, fix grammar mistakes, and fine-tune wording for an audience, as well as to achieve higher-order gains such as to better express what they are thinking, break through a mental block, and come up with new ideas. It seems that, although the function of the tool is simply rewriting sentences, this benefit is perceived to be fundamental to the process of writing. We suggest that overcoming mental blocks happens because Wordtune's support in increasing confidence in grammar and spelling frees the writer to focus on trying to articulate ideas. As a complex iterative process, relieving effort at critical points can smooth the whole flow of writing. In fact, there appeared to be a statistically significant correlation between having used Wordtune for a longer time and agreement with the statements that it helped them "express what they are thinking" ($\varrho = 0.135$, $p = 0.031$) and "break through a mental block" ($\varrho = 0.156$, $p = 0.013$). This implies that deeper benefits arise from sustained use.

Further reinforcing this sense that Wordtune contributes in a profound way to writing performance, many respondents acknowledged that if they lost Wordtune, there would be a serious or very serious impact, causing them to write less clearly (N = 101; 43%), have reduced confidence (N = 139; 38.5%), and even have less motivation to write (29.8%). Importantly, when asked if they had improved their writing skills, 70% agreed. Another 20% of respondents also thought they had but were worried that they had become dependent on Wordtune. So, it appears that Wordtune is not simply a useful tool but also offers learning benefits.

Respondents also said that they tended to be selective about accepting suggestions from Wordtune. Rather than blindly making the changes the tool suggested, they either carefully chose the most appropriate option (40%) or adopted the most appropriate one with further edits (54%). This supports the idea of the thoughtful and discerning use of a writing tool by writers who were already rather proficient.

3.4. Issues with Wordtune (RQ3: What Issues Does Wordtune Have?)

Our survey identified issues with Wordtune, including inaccuracies, occasional malfunctions, corrections of irrelevant content, and failures when working with complex text. Specifically, advanced users tended to highlight the issue that "it doesn't work well with complex sentences (i.e., it changes the meaning)".

There were some interesting quotes associated with these problems that provide further insight into potential problems with use. Some comments were related to the interface or how one interacted with Wordtune:

> "Sometimes it gets on the way of writing when I don't need it"
>
> "The function I want the most is to combine 2 or more sentences into 1 or the other way around. But you do not offer this."
>
> "Not compatible with MS word software"

Some users complained that Wordtune only helped with low-level changes rather than high-level support with the following overall argument:

> "The capability of software to provide adequate answers in case of long sentences is limited. A sentence having around 15 words is best to find an alternative."

The same issue arose in responses to the survey question about areas for improvement. Here, dealing with blocks of text had 10 mentions.

> "To give suggestions to the whole paragraph instead of sentences. Also, to show statistics dashboard such as time spent and how many suggestions as well as number of words"

The last point suggests an interesting desire to have data on one's own use of Wordtune to support learning. Again, this points to a sophisticated, self-conscious use of the tool to support self-improvement rather than merely a time-saving device.

3.5. Wordtune Use Model Analysis

The picture emerging from the descriptive statistics and open-text qualitative content analysis is one of users who already have relatively good English skills and seek both low-level benefits (e.g., grammar correction) and high-order gains (breaking of mental blocks; new ideas and for learning). In order to confirm this pattern, we turned to analysing the data with Exploratory Factor Analysis (EFA).

EFA using principal component analysis (PCA) was undertaken to produce a model of factor structure and factor loadings for the 33 five-point Likert scale statements about the uses, benefits, and limitations of Wordtune included in the survey. Prior to conducting PCA, the suitability of the data for this test was considered. Both the Kaiser–Meyer–Olkin

(KMO) test and Bartlett's test of sphericity were undertaken to determine sampling adequacy. The KMO value was 0.904, which is greater than the recommended value of 0.6 [17]. Bartlett's test of sphericity was statistically significant at the $p < 0.001$ level [18]. After this, a scree plot and parallel analyses were used to identify the number of factors at work. This resulted in the determination of three factors and 21 items explaining 57% of the variance (factor 1 = 36%; factor 2 = 15%; factor 3 = 6%). Next, the factors were rotated using varimax with Kaiser normalisation to generate a component matrix. The matrix confirmed a clear structure with meaningful strong loadings for each of the three factors.

EFA was followed by CFA in order to evaluate the measurement model. The measurement model was tested and then re-specified to generate a "best-fit" model. Iterating this process led to the development of a refined measurement model with three factors and 12 items (Table 2). Item reliability (IR) ranged from 0.67 to 0.82, exceeding the acceptable value of 0.5 [19]. Composite reliability (CR) for these three factors ranged from 0.73 to 0.88, above the 0.60 benchmark [20]. Finally, the average variance extracted (AVE) ranged from 0.56 to 0.61, passing the threshold value of 0.5 [21], showing that these items were empirically distinct. Together, these indices showed that the model was reliable and could demonstrate both convergent and determinant validity.

Table 2. Results of confirmatory factor analysis.

Factor	Statement	IR	CR	AVE
1. 'High-level' use of Wordtune—strong agreement	It helps me identify more suitable synonyms for the words I use in my writing	0.68	0.883	0.602
	It helps me break through a 'mental block'	0.73		
	It offers the right range of options for my needs	0.76		
	It prompts me to think of new ideas	0.69		
	It helps express what I am thinking	0.75		
2. Use failures—strong disagreement	It fails to detect wrong use of words	0.78	0.862	0.611
	It finds problems that do not exist	0.76		
	It highlights the wrong parts of the writing I want to work on	0.67		
	It occasionally stops working	0.69		
3. 'Low-level' use of Wordtune—strong agreement	It helps me fix grammar mistakes	0.74	0.728	0.575
	I use it in every aspect of my writing (i.e., grammar, syntax and content)	0.82		
	It allows me to build a stronger foundation in the English language	0.67		

The fitness measures for the measurement model are shown in Table 3. These include the TLI (Tucker–Lewis index), GFI (goodness of fit index), NFI (normalised fit index), CFI (an incremental fit index of improved NFI), and RMSEA (root-mean-square error of approximation). As all of the fit measures fell into acceptable ranges, it was shown that the proposed model provides a suitable fit. This model explains 53% of the total variance in the usability of Wordtune.

Table 3. Confirmatory factor analysis: model fit statistics.

Fit index	Results	Recommended Value	Source
TLI	0.963	>0.95	[22]
CFI	0.972	>0.95	[23]
RMSEA	0.053	<0.06	[23]
NFI	0.937	>0.90	[22]
GFI	0.954	>0.80	[22]
Chi square/df	1.717	<3	[22]

The CFA model helped to confirm with precision the benefits of Wordtune as perceived by users, with two areas of agreement related to types of benefit and an area of disagreement with proposed use failures. We labelled factor 1 as "High-level use of Wordtune", which includes writing aspects such as helping to formulate new ideas or break through a mental block. This confirms the existence for users of significant high-order benefits to their perceived quality of the writing process.

Factor 2 was labelled "Use failures", and it focuses on the practical aspects of using Wordtune. Here, the proposed failures are actually perceived as not to be found. The items for this factor scored very low means (on a Likert scale from 1 = not an issue at all to 5 = serious issue), implying that respondents do not encounter potential functional drawbacks and, on the contrary, perceive the application as highly functional.

We then labelled factor 3 as "Low-level use of Wordtune". This refers to more expected benefits, such as fixing grammar errors and finding the correct spelling of words. This confirms the existence of low-order benefits for users for their perceived quality of writing.

4. Discussion

Given that there have been no previous research studies on the use of Wordtune, this paper increases our understanding of who uses this particular AWCF and how they use it, often in the context of other AI writing tools. Users of Wordtune are proficient in writing in English, whether as native English speakers or as competent second-language learners. Students are the main users, but academics and other staff use them too. Wordtune users employ it intensively in particular tasks (e.g., in the case of students' assignments and more public social media uses). They make strategic use of the tool by selecting between the options offered and rewriting suggested changes, just as they seem to use a range of other writing support tools alongside Wordtune for specific tasks. They see many benefits, with some being lower-order benefits directly relating to Wordtune's functionality, such as writing more clearly or more grammatically. Some other advantages are more indirect but higher-order benefits, such as overcoming mental blocks or thinking of new ideas. It seems that by offering support for basic writing tasks, more fundamental effects arise in the flow of ideas. Users also have a sense of learning from using Wordtune, and only a few feel they risk dependency. Consistent with this, they do anticipate that not being able to use Wordtune would have a serious or very serious impact on their writing. There are a few areas where Wordtune could be improved, such as helping more with larger blocks of text, in addition to concerns about the interface and the cost, but in general, users disagree with the suggested drawbacks of using it.

A burgeoning number of writing tools are becoming available to assist with writing [4]. Specialist tools such as Wordtune help writers improve their texts. Our study shows that the particular beneficiaries of this are those who are already competent but want to improve their skills. Wordtune is less a crutch to the weak writer to proofread their work and more a tool that gives those writers who are already competent support and added

confidence to write. Our work points to tools being used in a way beyond sheer proofreading and toward deeper benefits in writing and learning accrued by users with a high level of pre-existing language skills. This is consistent with the common finding that a low level of language skill has an impact on the benefit of using these tools, with those who apply them less reflectively having fewer long-term gains [6]. But it also reveals the way in which low-level gains release the writer from major obstacles such as a mental block by easing the whole process of writing.

Research suggests that the action of writing comprises lower- and higher-level processes [24]. At a conceptual level, the writing process should start with writers selecting the ideas they want to incorporate into their text and organising them into a plan that complies with the genre and communicative goal of their writing assignment [25]. If writers make use of writing tools, as in the case of this study, the main application of such tools is to stimulate them to find new or better strategies to express their ideas during the outlining and creating phases of writing [10].

Much of the previous literature has examined how students benefit from tools such as Grammarly but usually in the context of classroom-supported use and with an emphasis on L2 learners [6,26]. Our work points to the use of a wide range of tools in concert seemingly independently of the classroom context and used in a range of tasks. We suggest that the agenda of research should shift in the direction of examining the increasingly common use of multiple tools in concert in reality.

5. Conclusions

We are experiencing the digitisation of writing. As our study shows, many digital tools are in use even among confident writers. These should not be seen as merely helping to improve low-level problems such as phrasing, spelling, and grammar, as they also indirectly help in thinking and the whole process of writing. They are experienced as supporting learning. In contrast to the moral panic around ChatGPT, these tools seem to be used in very productive ways that assist in thinking and writing and promote learning.

This research has significant practical pedagogical implications. Educators need to recognise that students will inevitably use a variety of digital tools in writing and should accept that the primary support they can offer is guidance in making informed decisions about these tools. This is particularly crucial for students who are not highly digitally fluent or who have weaker English language skills. Building on concepts such as translation literacy [27] and digital literacies [28–30], educators should emphasise the importance of having a writing strategy and encourage students to prioritise it as a means of improving their writing, rather than focusing solely on correcting grammar and enhancing efficiency. Specifically, our findings suggest that educators should support students in making deliberate and informed choices about which digital tools to use, rather than simply defaulting to the most accessible option. Additionally, educators should help students develop an understanding of how different tools can be strategically selected and how to effectively employ feedback from tools for various writing tasks. Research indicates that users use a wide range of tools in practice, such as Grammarly, ChatGPT, and ProWritingAid [31], but many do not engage effectively with the feedback provided by these writing tools [9,32]. Moreover, it is essential for educators to raise students' awareness of how these tools are developed. This includes encouraging critical consideration of whether they were created through exploitative practices or in ways that may harm the environment, assessing potential biases in the training data, and questioning the privacy and confidentiality of text shared with these systems. Finally, educators should promote active reflection on students' experiences with these tools, including their emotional responses, and cultivate a mindset that encourages learning from these technologies wherever possible.

There are several limitations to this study that we would like to acknowledge. Firstly, as this is an exploratory study, we did not focus on a specific context or compare multiple contexts. Future research could collect data from participants within a specific country, at a certain academic level, or from a specific degree programme or conduct comparative studies across multiple contexts. Secondly, this study is based on a survey questionnaire; however, responses to open-text questions provided insightful comments from participants, which have been incorporated into the results. This highlights the need for a deeper exploration of users' perspectives. Future research could build on these findings by collecting interview and observational data to gain more comprehensive insights into user experiences. For example, future studies could explore how Wordtune is used in practice in the process of writing as well as how multiple tools are deployed across the writing process as a whole. In an environment of rapidly changing technologies, understanding how writers operate in the wild becomes increasingly important. Moreover, building on the findings of this study, future research can expand its scope by comparing similar AI writing assistants, such as Jasper, Quillbot, and the recently released GrammarlyGo. This would provide insights into their impact on students' learning in both the short term and the long term.

Author Contributions: Conceptualization, X.Z. and A.C. methodology, formal analysis, writing, X.Z., A.C. and L.S., review and editing, X.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: All anonymised data are available on the online dataset (https://osf.io/sgpyd/) (accessed on 7 January 2025).

Acknowledgments: The authors would like to express their sincere gratitude to all participants who contributed to this study. We would also like to acknowledge that, although this study focuses on AI writing tools, none were used in the writing process in this research. Moreover, this study was not funded by Wordtune, and all results are based on the analysis of the empirical data collected.

Conflicts of Interest: The authors declare no conflicts of interest.

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