Technology-Assisted EFL Academic Writing and Its Relation to Academic Writing Anxiety

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Abstract

Research practice is given top priority in universities worldwide. Scholars are pushed to write and publish articles in high-ranking journals with high citation indexes, mostly English-medium journals. English as a foreign language (EFL) scholars are anxious to publish articles in Anglophone journals and one of these obstacles is academic writing skills. Studies on academic writing paid more attention to the process and obstacles of EFL students of different ages. A few studies focus on strategies EFL scholars adopt, especially those related to technology. Hence, this paper bridged the gap by investigating the relationship between EFL scholars' academic writing strategies with the assistance of technology and their second language academic writing anxiety (SLAWA) in China. This study is a quantitative study with 140 Chinese scholars participating. Participants used technology to gain online databases most frequently. It also showed that technological strategies in the planning stage positively relate to SLAWA. In contrast, technological strategies in the problem-solving stage have no relation with SLAWA. In addition, participants' characteristics such as age and gender have no significance with SLAWA. The findings of this study suggest that more academic writing training related to technology is needed especially in the before-writing stage where scholars complain about SLAWA mostly.

Keywords: academic writing strategies, technology-assisted academic writing, english as a foreign language

1. Introduction

Research practice has aroused the attention of scholars all over the world in recent decades as the competitiveness among universities is increasingly fierce, especially those universities that hunt for success in international rankings (Shchemeleva, 2021). Universities' international rankings and reputations are directly associated with research quality and productivity. That means research is given top priority in universities worldwide and scholars are pushed to write and publish articles. Also, as Burgess et al. (2017) emphasize, scholars' rewards, promotions, and career opportunities have a close association with their publication. Not only the quantity of papers that scholars produce is underlined, but also the content and productivity of their work are evaluated by the number of citations they receive. In such a publish-or-perish culture, academics are stimulated to be research-active and research-productive. They are encouraged to write in high-ranking journals with high citation indexes, most of them are English-medium journals. (Mu, 2020).

For English as foreign language (EFL) scholars, publishing articles in Anglophone journals is challenging and one of these obstacles is academic writing skills. As Campbell (2019) suggests, academic writing in English is difficult for both native and non-native learners as it is a significant, complicated, and integrative task. It may be even tougher for EFL learners who need to overcome barriers from both linguistics and education (Hanauer, 2019). Existing literature demonstrates that EFL scholars suffer from the frustration of unrich vocabulary, reference organization, paraphrasing, coherent expression, and other difficulties in second language academic writing (SLAW) (Iqbal et al., 2021; McDowell & Liardét, 2019). With the fast development of technology, academic writing practices have mushroomed with the help of technological tools. As Iqbal et al. (2021) suggest, advanced technology has been prominent in academic writing in universities and research institutes as the technology may provide better research and learning

chances. Newer technologies provide functionality and further assistance to scholars, such as checking grammar and spelling, finding synonyms, generating indexes, etc. It is highlighted that integrating technology with academic writing may give users more chances and strategies to be more professional academic writers and meanwhile reduce the anxiety from academic writing (Bailey, 2019; Ferdousi, 2022).

In the recent decade, a growing number of studies concentrate on EFL learners' academic writing and their publishing experience (Bui et al., 2023; McDowell & Liardét, 2019). The main focuses of these studies are on the process, difficulties, and obstacles EFL learners experience, rather than the strategies they adopt for academic writing intending to publish in international journals (Mu, 2020). Also, existing research mainly explore the undergraduate or graduate students when researchers study technological support and strategies in academic writing, no matter native or non-native speakers (Bailey & Almusharraf, 2022). Only a few studies focus on research publishing practices (Bakla & Karakaş, 2022). In addition, scholars in Eastern countries such as China complain much stress and difficulties of academic writing for publishing but strategies to overcome these barriers are rarely explored (Mu, 2020). Thus, this study aims to investigate the relationship between EFL scholars' technological strategies for academic writing, demographics, and SLAWA. The research questions are as follows.

1. Which type of technology is adopted most frequently for academic writing?

2. How do technological strategies interact with second language academic writing anxiety?

3. How do gender and age interact with second language academic writing anxiety?

2. Literature Review

2.1 L2 Academic Writing

Academic writing is not the write-up process only, but a multi-step process where the write-up process is only one step. As Ferdousi (2022) highlights, the academic writing process is interwoven with reading, research, and writing. Much research demonstrates that EFL scholars complain about the process of academic writing which is tough and time-consuming. Besides gathering information about the topic, choosing a position, and supporting the position with ideas, opinions, and viewpoints of others (Winkler & Metherell, 2011), researchers also need to face the challenges of inappropriate citation format, inaccurate referencing, plagiarism and master the skills to communicate with peer viewers (Bakla & Karakaş, 2022). As Mu (2020) suggests, L2 academic writing for publishing in English is a spiral and circulating process, rather than a linear process. The appropriate use of strategies and technology can smooth the process. Furthermore, many EFL teachers feel a sense of inequality in academic writing, compared with native speakers. It is argued that native speakers have the advantages obtained by internalizing the language through "natural acquisition" (Hyland, 2016). However, Casanave (2018) argues that language is not the primary consideration for the journal to accept or reject the paper. The design of the research, paper organization, research resources, research writing experience, and social implication, rather than language errors may be given priority for reviewers and editors (Belcher, 2007; Hyland, 2016). This argument is supported by other researchers (e.g., Ferdousi, 2022; McDowell & Liardét, 2019). As Hyland (2016) emphasizes, the difficulties that EFL scholars face to get their work published are largely unrelated to the native and non-native distinction. What is more essential is for EFL scholars to improve their academic writing skills and research abilities, rather than focus exclusively on "disadvantage orthodoxy".

Researchers explored different strategies to improve L2 academic writing quality during the writing process. Different researchers may have different standards to classify different strategies (Mu, 2005). Some follow Oxford's (2016) taxonomy which classifies four groups of writing strategies including metacognitive strategies, affective strategies, cognitive strategies, and social-interactive strategies (Teng et al., 2021). However, some researchers such as Bailey (2019) argue that Oxford's taxonomy refers to language learning in general, not specifically to English writing only. Some scholars classify L2 academic writing strategies in chronological order (pre-, while-, and post-writing) from the pedagogical perspective. For instance, Fajrina et al. (2021) investigate the relationship between writing strategies and different English proficiency of 135 Indonesian EFL undergraduate students. Writing strategies were explored in Fajrina et al.'s study (2021) from the pedagogical perspective, namely prewriting, drafting, and revising. Questionnaires, vocabulary size tests, and manuscripts were adopted for data collection and the result demonstrated that writing strategies were used at a moderate level and there was no significant difference in choosing different writing strategies between students with high English proficiency and students with low English proficiency. The purpose of studying strategies is to learn these strategies to reduce L2 academic writing anxiety and difficulties. Chronological order is easy to distinguish the subcategories but it is hard to train the

strategies. As Bailey (2019) argues, the chronological ordering of strategies would be problematic because of the circular nature of L2 writing. The process of planning, decision-making, and evaluating may go through the whole process of writing, not exclusive to specific stages of writing (before, during, and after). It would bring challenges to implement strategy-training activities when the instructor has to deal with several writing-related issues at once such as requiring students to consider their planning or decision-making. Students therefore may have the risk of overburdening writing objectives and tasks. Thus, technological-supported strategies have not been classified to a specific stage of chronological order in this study.

2.2 Technological Tools with Academic Writing

The use of technology for academic writing is not a new phenomenon. Previous studies illustrate the benefits and potential drawbacks of using technological tools. There are many technological tools available that could smooth the process of academic writing. As Bakla and Karakaş (2022) suggest, technology tools may help researchers manage the duties of critically assessing sources, taking clear and thorough notes, and carefully identifying and using online resources and documenting sources reliably, especially to avoid plagiarism. For instance, some tools that could help the citation and reference management (e.g., Mendeley, Zetero, and EndNote), literature reviews, note organization, and storage, plagiarism (e.g., Turnitin), online translation (e.g., Google translation and Deepl), and tools to create audio and textual notes (e.g., Evernote and OneNote).

Research on ESL academic writing with technology has risen in recent decades. For instance, Park (2019) explored the usage of Grammarly, a grammar checker for Korean ESL high school learners. 40 writing samples were analyzed for grammar errors and it is shown that Grammarly could detect simple errors such as subject-verb agreements, prepositions, verb choices, etc., but as Park (2019) argues, limited types of grammatical errors were detected and the tool failed to explore all errors. Also, there would be some flawed grammar corrections for these errors. In 2020, Dennis designed a pre-test/ post-test quasi-experiment to explore online machine translation supporting pre-service ESL teachers' academic reading and writing in Korea. The result demonstrated that online machine translation could scaffold these graduate students' comprehension of difficult academic texts by improving L2 writing ability but not supporting overall L2 writing ability. In 2021, Nazari et al. investigated an artificial intelligence tool assisting academic writing for ESL postgraduate students in Iran. Through testing the result of equipped and non-equipped AI groups, it was demonstrated that students with AI assistance had a statistical improvement in scores and behaviour engagement. Nazari et al.'s (2021) study also suggests the efficient use of technology may promote academic writing outcomes through formative feedback and assessment.

2.3 Second Language Writing Anxiety

Second language writing anxiety (SLAWA) broadly refers to the set of attitudes, feelings, and actions that stop a person from finishing a writing task that they are capable of accomplishing (Al-Sawalha & Chow, 2012). As Zhang (2019) highlights, it is situation-specific anxiety that manifests only in certain circumstances. A growing number of scholars have realized the complex nature of SLAWA in recent decades and explored different factors related to SLAWA, such as self-efficacy, writing performance, gender, etc. Rasool et al. (2023) used mixed methods to investigate the level and nature of 76 EFL preservice teachers' writing anxiety (37 males, 39 females), considering the gender variable. It is identified that there is no difference between males and females in writing anxiety. Zhang (2019) used a qualitative case study to explore the SLAWA of colleague students related to the pedagogical use of online resources. Second-year English major EFL students were studied in her study (2019), and it was shown that online resources may help students reduce writing anxiety. Following Cheng's (2017) review, studies on SLAWA are increasing but there is still a shortage of research explored from multidimensional perspectives, especially SLAWA related to technology. The literature demonstrates that the main target of research on ESL academic writing with technology support is still students of different levels. Only a few studies concentrate on academic writing for publishing (Bakla & Karakaş, 2022). In line with the importance of academic writing practice from the perspective of strategies and technology, this study plans to enrich the literature to investigate the technological supports for academic writing for publishing and its relation to SLAWA.

3. Research Method

3.1 Participants

A total of 140 scholars (58 males, and 82 females) participated in this study (see Table 1). They were invited by emails or social networking sites. 47.1% have a doctorate, 43.6% have a master's degree and others have a bachelor's degree. 49 of these participants have less than 3 years of working experience, and 58 of them have from 3 to 10 years

of working experience. Most of them (60.7%) write papers for publishing less than once a year and only 12.1% write papers for publishing more than three times a year. These scholars are working in universities in China or are pursuing PhD in Malaysia.

Table 1. Demographic Information of Participants

		Frequency	Percentage
Gender	Male	58	41%
	Female	82	59%
Age	20-24	15	10.70%
	25-34	75	53.60%
	35-44	47	33.60%
	45-54	3	2.10%
Educational Background	Bachelor	13	9.30%
	Master	61	43.60%
	Doctor	66	47.10%
Working Experience	Between 1 and 3 years	49	35%
	Between 3 and 5 years	20	14.30%
	Between 5 and 10 years	38	27.10%
	Between 10 and 20 years	31	22.10%
	Above 20 years	2	1.40%
Your Current Position	PhD Student	84	60%
	Post-doctor	5	3.60%
	Lecturer	35	25%
	Associate Professor	2	1.40%
	Assistant Professor	5	3.60%
	Professor	3	2.10%
	Research Associate	6	4.30%
Frequency of Writing papers for Publishing	Less than once a year	85	60.70%
	Around 2 to 3 times a year	38	27.10%
	More than three times a year	17	12.10%

3.2 Instruments

Online questionnaires (Microsoft Forms) were used in this study to collect quantitative data. The questionnaires have 25 items, containing three parts, demographics, the scale of technology used for academic writing for publishing, and the scale of second language academic writing anxiety. In the demographic section, gender, age, educational background, working experience, and frequency of writing papers for publishing were explored. The scale of technology used for academic writing is a self-designed scale based on related literature (e.g., Bailey, 2019; Bailey & Almusharraf, 2022; Yu & Zhou, 2022). It explores different technological strategies in the planning stage (pre-writing) and problem-solving stage (while-writing and post-writing). The scale of SLAWA is partly adopted by Cheng (2004). Cheng's questionnaire targeted SLAWA and has already been tested by many researchers such as Bailey (2009), Mu (2020), Zhang (2019), etc. More items related to academic writing and publishing have been added (e.g., I am anxious about whether my academic writing could be published.). The quantitative data was randomly collected in order to get more participants to take part.

3.3 Data Analysis

SPSS (Version 26) was used to analyze data. First, data cleaning was conducted to remove outliers and normal distributions were observed. Kurtosis and skewness were checked, and all values of factors were within the range of -1.96 to 1.96, which means that the normality distribution of data is acceptable (George & Mallery, 2019). The Cronbach's Alpha of this data is 0.836. Then, SPSS was used to carry out exploratory factor analysis (EFA) to guarantee the reliability and validity of data. The Kaiser-Meyer-Olkin Measure (KMO) of this sample was 0.805 which is greater than the recommended value of 0.6 and the Bartlett's Test is significant, (P<0.05). Thus, this sample is suitable for factor analysis. Principal Component Analysis (PCA) checked the construct validity of the scales. As Stevens (2012) suggests, PCA is widely used to identify dimensionality and extract latent components. After running factor analysis, some items with factor loadings lower than 0.7 were removed (e.g., I use the software to help me design the related). Finally, an analysis resulted in items loading in their respective categories. Two factors are chosen, one is technological strategies in the Planning Stage, and another is technological strategies in the Problem-solving Stage (see Table 2).

Table 2. The Pattern Matrix of Strategies

	Component	
	1	2
I use software or online translators (e.g., Google translator, Deepl, Youdao, etc.) to translate English articles into my native language to help me understand.		0.864
I use the software (e.g., Mendeley, Endnote, Zotero, etc.) to conduct a literature review.		0.855
I use online database (e.g., Google Scholar, CNKI, Web of science) to collect related articles.		0.851
I use the software or website to check my spelling and grammar to proofread my academic writing.	0.886	
I use an online dictionary or dictionary app (e.g., Youdao, Thesuaurus, etc.) to assist my academic writing.	0.821	
I use citation generator or bibliography management software (e.g., Mybib, Zotero, Mendeley, etc.) to manage my citation and bibliographic data.	0.818	
I use anti-plagiarism software or website (e.g. Turnitin. CNKI Check, etc.) to check the originality of my work.	0.809	
I use the software or online website (e.g., Quillbot, StyleWriter,etc.) paraphrasing the word or sentences to proofread my academic writing.	0.748	
I use email or online chatting software to discuss my academic writing with reviewers.	0.725	

Note: Extraction Method: Principal Component Analysis; 2 Components Extracted.

3.4 Multiple Linear Regression

Multiple Linear Regression was used to explore the relationship between SLAWA, technological strategies in the Planning Stage, technological strategies used in the Problem-solving Stage, gender, and age. From Table 3, it is shown that the R-value (<0.9), R Square value (0-1), and P value (<0.05) all reach adequacy, so the regression is effective. To test for multicollinearity, the VIF value was observed as far less than the threshold of ten.

Table 3. The Model Summary

Model Summary[b]						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig.	Durbin-Watson
1	.660[a]	0.436	0.419	0.77094	.000[b]	1.81

a Predictors: (Constant), Gender, Planning, Age, Decision-making

b Dependent Variable: Second Language Academic Writing Anxiety

4. Result and Discussion

This study aims to investigate the relationship between EFL scholars' academic writing strategies with the assistance of technology and their second language academic writing anxiety in China. A total of 140 Chinese scholars participated in this quantitative study. Questionnaires were used for data collection while descriptive analysis and multiple linear regression were adopted for data analysis. Regarding technologies assisting academic writing (demonstrated in Table 4), 12 different types of technologies were explored. Participants use technology for online databases mostly (M=3.8, SD=1.384). Then, it was followed by the technology used for spelling and grammar checking (M=3.4, SD=1.268), using technology for literature review (M=3.39, SD=1.35), generating citation and managing bibliography (M=3.39, SD=1.267). using technology for online translation(M=3.35, SD=1.292), using the email or chatting software to discuss academic writing with reviewers (M=3.34, SD=1.162), using the chatting app or software to share writing (M=3.32, SD=1.189), doing anti-plagiarism (M=3.17, SD=1.292), designing the figures (M=3, SD=1.223), paraphrasing the words or sentences (M=2.95, SD=1.171), and using artificial intelligence to collect literature (M=2.9, SD=1.26). The least they use technology is to map the brainstorm (M=2.71, SD=1.172).

Regarding technologies used in different stages (demonstrated in Table 5), scholars use technologies in the planning stage more frequently (M=3.243, SD=0.945), compared with technology used in the decision-making stage (M=2.27, SD=0.677). Table 5 also illustrates the relationship between SLAWA and technological strategies in the planning stage, technological strategies in problem-solving and participants' characteristics including gender and age. It is demonstrated that SLAWA only has a relationship with technological strategies in the planning stage and has no association with technological strategies in the problem-solving and participants' characteristics.

Concerning Research Question One (i.e., Which type of technology is adopted most frequently for academic writing?), it is demonstrated that using technology for online databases (M=3.8, SD=1.384) is most frequently used (See Table 4). Most of the participants don't use technology to map the brainstorm (M=2.71, SD=1.172). Considering the classification of technology used for the planning stage and technology used for the problem-solving stage (see Table 5), scholars use technology in the planning stage more frequently. That is supported by Bailey's study (2019) where planning strategies were frequently used strategies.

Regarding Research Question Two (i.e., How do technological strategies interact with second academic writing anxiety?), Table 5 displays that only technological strategies in the planning stage has significance ($P<0.05$) with SLAWA and SLAWA has no relation with technological strategies in the problem-solving stage. That means only technology used in the planning stage has a positive relation to SLAWA. This finding is different from Bailey and Almusharraf's (2022) findings where SLAWA only has a relation to translation strategies and has no correlation with planning strategies and decision-making strategies. Important reasons that explain this difference are as follows. Firstly, the classification of strategies varies in different research. For instance, Item One from technological strategies in the planning stage (I use the software or online translator to translate English articles to my native language to help me understand.) could also be treated as a translation strategy. Item One has been reported as frequently used (M=3.35, SD=1.292). Second is the distinction of sampling. The participants of Bailey and Almusharraf's (2022) studies are university students while the participants of this study are scholars. The purpose of academic writing is different in the two samples, university students were to complete the task while scholars in this study were to get the paper published.

Regarding Research Question Three (How do gender and age interact with second language academic writing anxiety?), age, and gender have no significance with SLAWA (see Table 5). This study shows that SLAWA is unrelated to gender which further proves the result of Rasool et al.'s (2023) study where gender has no significant effect on preservice teachers' writing anxiety. Although some researchers such as Van DerKaay and Young (2012) argue that elder scholars may feel anxious about using technology for study or work, there was no correlation between age and SLAWA in this study. One reason is that participants in this study were still young with 53.6% of these participants between 24 and 34 years old while 33.6% were between 35 and 44 years old. These young people are 'digital natives' who are born with technology. Also, technology is embarked with our daily life and few people escape the influence of technology.

Table 4. Frequency of Using Different Technologies Assisting Academic Writing

	Mean	Std. Deviation
Technology to conduct a literature review	3.39	1.35
Technology to do online translation	3.35	1.292
Technology to map the brainstorm	2.71	1.172
Online database	3.8	1.384
Artificial Intelligence to collect literature	2.9	1.26
Citation generator or Bibliography management	3.39	1.267
Technology for spelling and grammar checking	3.4	1.268
Technology to paraphrase the words or sentences	2.95	1.171
Technology to design the figures	3	1.223
Anti-plagiarism technology	3.17	1.292
Using the chatting app or software to share my writing	3.32	1.189
Using the email or chatting software to discuss my academic writing with reviewers	3.34	1.162

Table 5. The Regression

Coefficients[a]										
Model		Mean	Std. Deviation	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
				B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.514	1.152	1.522	0.416		3.658	0.000		
	Planning	3.243	0.945	0.578	0.057	0.659	10.170	0.000	0.997	1.003
	Decision-making	2.270	0.677	0.033	0.070	0.031	0.470	0.639	0.985	1.015
	Age	1.590	0.494	-0.038	0.097	-0.025	-0.387	0.699	0.986	1.014
	Gender			-0.099	0.133	-0.048	-0.746	0.457	0.993	1.007
a Dependent Variable: ANXIETY										

5. Conclusion

This is a quantitative study exploring the relationship between EFL scholars' academic writing strategies with the assistance of technology and their SLAWA in China. Participants used technology to achieve online databases most frequently. It also showed that technological strategies used in the planning stage had a positive relation with SLAWA while technological strategies used in the decision-making stage have no significance. Also, demographic information such as age and gender have no relation with SLAWA. The study contributes to the existing literature by identifying the influence of technology on EFL scholars' academic writing and exploring the relationship between technological strategies and SLAWA. Meanwhile, it enriches the literature by studying the sample of scholars in China where the dominant sample is students. The finding of this study suggests that more academic writing training related to technology is needed especially in the before-writing stage where scholars complain about SLAWA mostly.

There were some limitations to this study. First, the sample size is not big, only involving 140 participants. The technology used for the planning stage category only contains three items. A more robust technology used for the planning stage category is needed to explore a bigger sample size in future studies. Second, the instruments of data collection and analysis are limited. Questionnaires and multiple linear regression were used. To enrich the data, future studies may use other instruments for data collection and analysis. For example, using observation to observe the whole process of the participant's academic writing (before, while, and after) and explore which technological

strategies are used and how scholars use these technological strategies. In addition, future studies could use qualitative data to get a different angle on the research topic.

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