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A PLS-SEM Analysis of Antecedents Influencing Polytechnic Students' Acceptance and Use of Artificial Intelligence (AI) Tools for Technical English

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Abstract

Technical English (TE) proficiency is crucial for the future careers of polytechnic students. While Artificial Intelligence (AI) tools offer significant potential to enhance language learning, their effectiveness relies on student acceptance and use. There is limited understanding of what drives polytechnic students to adopt these tools specifically for TE. This study aims to identify the key factors influencing polytechnic students' acceptance and use of AI tools in this context and employ a quantitative approach based on the Technology Acceptance Model (TAM) and Partial Least Squares Structural Equation Modelling (PLS-SEM) to analyse survey data collected from 100 Polytechnic Kota Bharu (PKB) students enrolled in TE courses. The research investigates core antecedents, primarily perceived usefulness (PU) and perceived ease of use (PEOU), and their impact on students' behavioural intention (BI) to use AI tools. The potential influence of external factors such as social influence and lecturer support are examined. The study found PEOU was identified as a critical antecedent, which significantly positively affected PU and BI. The study reaffirmed the significant predictive power of BI on AU, indicating that students' stated intentions reliably translate into their subsequent usage behaviour. This research will offer practical recommendations for educators seeking to integrate AI tools effectively into TE instruction. Theoretically, this study contributes to understanding technology adoption within the specific domain of technical and vocational language education, providing valuable insights for leveraging AI to improve essential communication skills for aspiring technical professionals.

Keywords: *Artificial Intelligence (AI) Tools; Technology Acceptance Model (TAM); PLS-SEM; Technical English; Polytechnic Students*

Introduction

In preparing polytechnic students for their future technical careers, strong communication skills are no longer just an advantage but essential (Ismail & Hassan, 2019; Ramamuruthy, Alias & DeWitt, 2021), particularly in Technical English (TE). The graduates must confidently read manuals (Krishnan et al., 2020; Nghia, Anh & Kien, 2023), write clear reports (Zainuddin et al.,2019; Scott et al., 2019), and communicate complex ideas effectively in English within their specific industries (Chan, 2021; Roshid & Kankaanranta, 2025). According to Renaldo (2024), the educational landscape has recently seen a dramatic shift with the rise of Artificial Intelligence (AI), bringing tools like sophisticated grammar checkers and chatbots into our students' learning routines. These technologies certainly hold promise, potentially offering personalised

practice, instant feedback, and more engaging ways to learn complex technical language (Darwish, 2025). However, a study by Zhai, Wibowo, and Li (2024) found valid concerns, including the risk of over-reliance hindering skill development, issues of unequal access, and the ethical considerations surrounding AI use in academic work. Despite the exciting potential of AI in language learning, simply having these tools available does not guarantee that they will be used effectively (Farooqi, Amanat, & Awan, 2024; Abdullah & Basheer, 2024), especially within the unique context of polytechnic education, where students often have an efficient focus. When using AI tools for a skill-based subject like TE, there is a lack of clear understanding of whether our students are embracing these technologies or, more importantly, why they might choose to use them (Kommineni et al., 2025). There's a noticeable gap in research focusing on the factors influencing AI adoption among polytechnic students within this crucial area, making it difficult for us educators to guide students or leverage these tools optimally.

This situation leads to fundamental research objectives:

i. To examine the factors that affect the acceptance and use of Artificial Intelligence (AI) tools for Technical English (TE) among polytechnic students.

ii. To investigate the relationship between Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Behavioural Intention (BI), and Actual Usage (AU) of Artificial Intelligence (AI) tools for Technical English (TE) among polytechnic students.

To assess the explanatory power of the Technology Acceptance Model (TAM) in the context of Artificial Intelligence (AI) tools for Technical English (TE) among polytechnic students, adoption using the Partial Least Square-Structural Equation Modelling (PLS-SEM) approach.

Literature Review

The integration of AI in English language instruction has gained significant attention in recent years, particularly in enhancing English for specific purposes (Huang et al., 2023; Loor et al., 2024; Kovalenko & Baranivska, 2024) such as Technical English (TE) for polytechnic students. Studies by Kong, Yang and Ho (2024), Kavitha and Joshith (2025), Sanchez-Prieto et al. (2020), and Otto et al. (2024) have explored the acceptance and pedagogical implications of AI tools, with a majority employing the Technology Acceptance Model (TAM) or the extended frameworks to evaluate factors influencing students' behavioural intention and actual use. Similarly, in a study by Pham and Wu (2023), they proposed a conceptual TAM-based framework examining learner attitudes toward AI chatbot use in English classrooms. Though empirical data were not collected, their work established theoretical relationships between PU, PEOU, attitude, and BI. Alike, Amanda and Hesty (2024) explored English for Foreign Language (EFL) learners' perceptions of

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ChatGPT using a qualitative approach. Their findings highlighted the tool's positive impact on vocabulary and grammar acquisition, although with noted limitations in pronunciation support.

Moreover, Wei, Zhao, and Ma (2025) offered a robust empirical foundation through a large-scale PLS-SEM analysis involving 351 Chinese EFL learners. Their study revealed that human likeness, social presence, and self-efficacy significantly influence motivation, predicting learning outcomes. Equally, Taufik and Fernandita (2025) investigated Indonesian EFL students' acceptance of ChatGPT for grammar learning, finding positive perceptions of PU and PEOU but noting concerns about over-reliance and academic integrity. Meanwhile, Yang (2024) conducted a mixed-methods study linking AI tool usage with increased motivation and achievement among EFL learners. Their research reinforced the potential of AI-mediated learning environments to foster autonomous and engaging learning experiences. Supporting that, Ansas et al. (2024) extended this discourse by evaluating vocational students' behavioural intention to use AI tools like Talk to GPT. Their findings emphasised improved fluency, pronunciation, and motivation, facilitated by the application's interactive feedback mechanisms.

Likewise, Harizah and Said (2024) addressed the intersection of cognitive styles and TAM, analysing how students' adaptive-innovative cognitive orientations influence their acceptance of ChatGPT and Kahoot. Although limited to a secondary school context, their quantitative study underscored the necessity of considering individual learner differences when implementing AI tools. Additionally, Wei (2023) conducted a controlled experimental study comparing AI-mediated instruction with traditional teaching. The AI group demonstrated significantly higher motivation, self-regulated learning, and English achievement, affirming the pedagogical merits of AI-enhanced language instruction.

Furthermore, Alharbi (2025) utilised an extended TAM framework incorporating perceived knowledge, engagement, and motivation to explain Saudi EFL learners' adoption of AI tools. Structural equation modelling confirmed the influence of these variables on PU and PEOU, ultimately predicting behavioural intention and usage. This large-scale study involving 472 university students offered generalizable insights while recognising the absence of faculty moderation effects. Supporting this, Salsabila and Widiastuty (2024) reinforced prior findings on AI's motivational benefits but highlighted limitations in accessibility due to freemium models of AI tools and the lack of integrated pronunciation features. Their qualitative insights supported the call for better curricular integration and technological enhancements.

Across those studies, several key themes emerge. Firstly, PU and PEOU consistently appear as primary determinants of AI acceptance. Validating TAM's applicability in various contexts is another thing to consider. Secondly, the BI is often driven by learners' motivation, confidence, and interaction with human-like AI features, as shown in Wei et al. (2025) and Alharbi (2025). Thirdly, structural models such as SEM or PLS-SEM are increasing, enabling more precise quantification of latent variables and their interrelationships. Despite these strengths, the reviewed literature reveals several limitations. Conceptual

studies lack empirical validation, as in Pham and Wu (2023), while qualitative designs, though rich in insight, offer limited generalizability. Sample sizes and contexts vary, ranging from secondary to university levels, affecting cross-study comparability. Additionally, concerns about academic misconduct and the underdevelopment of specific AI features like pronunciation support were recurrent.

The previous studies mentioned robustly support using TAM and extended models to analyse AI tool acceptance in English language learning. The SEM studies provide empirical clarity on the causal relationships among constructs like PU, PEOU, AU, and BI. These insights affirm the relevance and timeliness of a PLS-SEM analysis investigating Polytechnic students' acceptance and use of AI tools for TE, with strong theoretical and empirical backing.

Theoretical and Conceptual Frameworks and Hypotheses

This study is grounded in the Technology Acceptance Model (TAM) developed by Fred Davis (1989), which remains one of the most prominent theoretical frameworks for examining technology adoption. TAM posits that an individual's intention to adopt and use a particular technology is influenced by two fundamental cognitive beliefs Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). The TAM is applied to explore how polytechnic students accept and utilise AI tools such as grammar checkers, AI chatbots, paraphrasers, and summarisers for learning TE. The model assumes that when students perceive these AI tools as PEOU, they are more likely to find them PU. In turn, these beliefs are expected to shape their BI to use the tools in the future. Ultimately, this intention should lead to the tools' AU in their academic activities. Thus, TAM provides a structured and validated framework for evaluating technology acceptance in educational settings, particularly regarding students' engagement with AI-assisted learning platforms. The conceptual framework of this study is shown in Figure 1 below.

In adopting this model, the present study not only examines the direct relationships among PEOU, PU, BI, and AU but also supports the development of strategies to promote meaningful integration of AI tools in TE pedagogy for polytechnic students.

Based on the core constructs and interrelationships proposed by the Technology Acceptance Model (TAM), the following hypotheses are formulated for this study:

H1: Perceived Ease of Use (PEOU) of AI tools for Technical English (TE) positively influences the Perceived Usefulness (PU) of these tools.

H2: Perceived Ease of Use (PEOU) of AI tools for Technical English (TE) positively influences Behavioral Intention (BI) to use these tools.

H3: Perceived Usefulness (PU) of AI tools for Technical English (TE) positively influences Behavioral Intention (BI) to use these tools.

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H4: Behavioral Intention (BI) to use AI tools for Technical English (TE) positively influences the Actual Use (AU) of these tools.

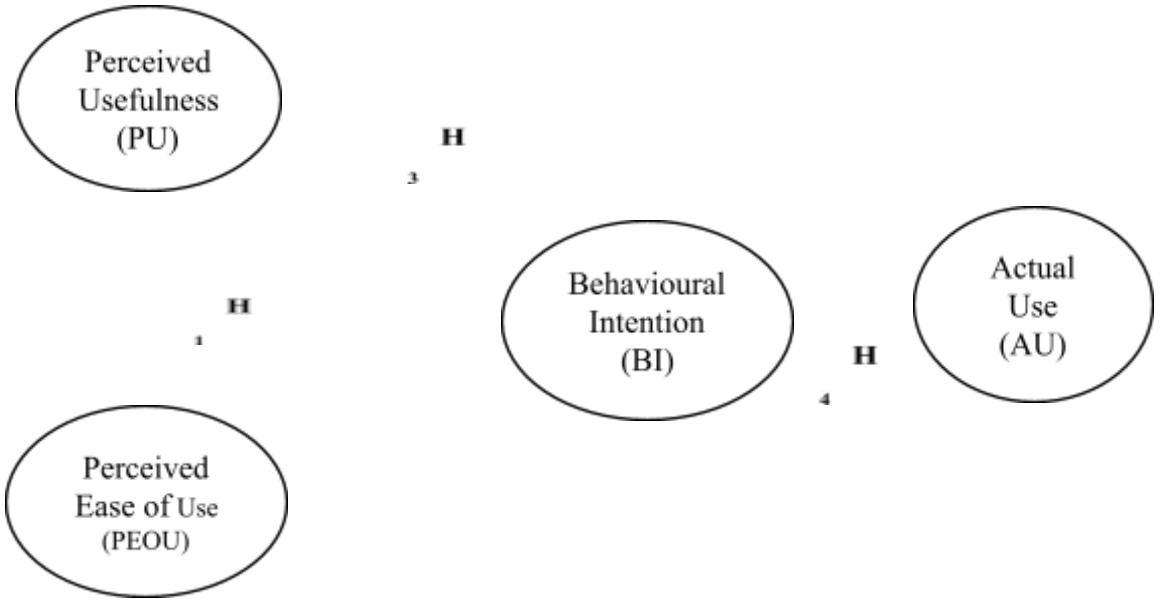

Figure 1: The Conceptual Framework of The Study based on TAM

Research Methodology

Context and subjects

The study was conducted at Politeknik Kota Bharu and targeted students in the TE subjects. This subject is a compulsory course designed for students in technical and engineering-related programmes. Politeknik Kota Bharu was selected as the research site due to the diverse student population across various engineering departments and its ongoing initiatives to incorporate digital and AI-assisted learning tools. The study used a non-probability sampling method, specifically purposive sampling, which was applied by selecting TE students with experience using AI tools. One hundred (100) students participated in the study, representing multiple academic programmes such as civil engineering, electrical engineering, and mechanical engineering. These students were chosen because they were actively engaged in learning activities requiring TE and were exposed to various AI tools during their coursework. The data was collected using an online Google Form questionnaire distributed to the students during the course session. Out of the targeted respondents, all 100 completed the questionnaire, resulting in a response rate of 100%. This high response rate reflects the students' interest and readiness to engage with emerging technologies, particularly in the context of AI-assisted language learning.

To ensure the adequacy of the sample size for this study, G-Power 3.1 was used to conduct an a priori power analysis for linear multiple regression, considering the minimum statistical power level of 0.80, an α =0.05, and a medium effect size ($f^2 = 0.15$) as suggested by Cohen (1988) (Gignac & Szodorai, 2016). Based on these parameters, the recommended minimum sample size for a model with four (4) predictors (PEOU to PU, PEOU, PU to BI, BI to AU) is approximately 85 respondents. Therefore, the sample size of 100 respondents in this study meets and slightly exceeds this requirement, ensuring sufficient power to detect meaningful effects within the tested model, which is supported by Hair et al. (2022), who suggested that for PLS-SEM, the minimum sample size should be determined by the 10-times rule, which recommends a minimum of ten times the maximum number of arrows pointing at any construct in the structural model. In this study, the most complex construct of BI has two (2) incoming paths (from PU and PEOU). Thus, the minimum required sample size would be $10 \times 2 = 20$. As such, the sample size of 100 far exceeds this threshold, meeting the accepted standards for PLS-SEM model estimation.

Survey instrument

The survey instrument for this study was adapted from the validated questionnaire developed by Saeed and Al-Emran (2018). The items were explicitly derived from Appendix A of the paper, which presents constructs aligned with TAM. The focus on the use of AI tools for TE learning among polytechnic students is applied to suit the context of this research, in which the original items were slightly modified to reflect the application of AI technologies, such as ChatGPT, Gemini, Quillbot, Grammarly, and Microsoft Co-Pilot, which represent language-related platforms. The questionnaire was divided into several key sections. The first part focused on gathering demographic information, including gender, department, programme of study, and familiarity with AI tools. This section provided context for understanding the profile of respondents. The second part measured the PU construct, examining students' beliefs about how AI tools help improve their performance, efficiency, and productivity in learning TE. There were seven (7) items under this construct. The third part assessed PEOU, which explored how easily students used AI tools for their academic tasks. This section included nine (9) items that captured students' perceptions of the simplicity, user-friendliness, and low effort required to operate the tools. The fourth part focused on BI, which gauged students' willingness and intention to continue using AI tools in the future. This construct was measured using three (3) items. Finally, the fifth part of the instrument measured AU, capturing how frequently students used AI tools in their TE learning. This section contains two (2) items. All responses in the instrument were collected using a five (5) point Likert scale ranging from strongly disagree to strongly agree. The instrument consisted of 20 construct-based items, ensuring comprehensive coverage of the students' acceptance and usage patterns of AI tools within the TAM framework.

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Data Analysis

Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed for the data analysis in this study. PLS-SEM is a powerful statistical method widely used for analysing complex relationships between latent variables, primarily when the research focuses on prediction and theory testing (Hair, Risher, Sarstedt & Ringle, 2019). This method was chosen due to the flexibility in handling small sample sizes, non-normal data, and the ability to model reflective and formative constructs (Ramayah, 2024; Memon et al., 2021), making it ideal for examining the relationships within the Technology Acceptance Model (TAM). The data were analysed using SmartPLS version 4.1.1.2 software, which allowed for the assessment of both the measurement model for reliability and validity and the structural model to test the relationships between constructs. In addition to PLS-SEM, descriptive statistics were calculated to summarise the responses across the different constructs, offering a clear understanding of how students perceive and use AI tools in their TE learning. The analysis also included tests for convergent validity using average variance extracted (AVE) and discriminant validity using the Fornell-Larcker criterion and Heterotrait-Monotrait ratio to ensure the robustness of the model (Ramayah, 2024; Heir et al., 2022). The combination of PLS-SEM for hypothesis testing and descriptive statistics for summarising participant responses provided a comprehensive approach to understanding the factors influencing the acceptance and use of AI tools for learning TE.

Result and Findings

Descriptive statistics

The sample predominantly comprises male students, representing 80% of the total (Table 1.0). In terms of the academic department, half of the respondents (52%) belong to the Electrical Engineering department, while the Mechanical Engineering and Civil Engineering departments account for 31% and 21%, respectively. The distribution across study programmes is diverse, with the highest concentrations found in the diploma in electrical engineering (30%), diploma in electrical & electronic engineering (22%), diploma in civil engineering (20%), and diploma in mechanical engineering (19%). Regarding AI tool usage for TE learning, ChatGPT, Gemini, and Microsoft Co-Pilot (35%) were the most frequently reported combinations, followed by ChatGPT alone (19%). ChatGPT appears in nearly all the reported combinations of tools used by the students.

Table 1: Demographic information

Items	Values	Frequency	Percentage
Gender	Male	81	80%
	Female	19	20%
Department	Civil engineering department	20	21%
	Electrical engineering department	50	52%

	Mechanical engineering department	30	31%
Study Programme	Diploma in civil engineering	19	20%
	Diploma in quantity surveying	2	2%
	Diploma in electronic engineering (communication)	3	3%
	Diploma in electrical & electronic engineering	21	22%
	Diploma in electrical engineering	28	30%
	Diploma in mechanical engineering	18	19%
	Diploma in mechanical engineering (automotive)	1	1%
	Diploma in mechanical engineering (agricultural)	8	8%
AI tools used in TE learning	ChatGPT, Gemini, Microsoft Co-Pilot	35	35%
	ChatGPT	19	19%
	ChatGPT, Microsoft Co-Pilot, Grammarly	14	14%
	ChatGPT, Gemini, Grammarly	9	9%
	ChatGPT, Gemini	6	6%
	ChatGPT, Gemini, Quillbot	5	5%
	ChatGPT, Grammarly, Quillbot	5	5%
	ChatGPT, Grammarly	2	2%
	ChatGPT, Gemini, Microsoft Co-Pilot, Grammarly	2	2%
	ChatGPT, Gemini, Microsoft Co-Pilot, Grammarly, Quillbot	1	1%
	ChatGPT, Microsoft Co-Pilot, Quillbot	1	1%
	Gemini, Microsoft Co-Pilot, Grammarly	1	1%

Measurement Model Assessment

The factor loading should be measured to assess the reliability of each item. The assessment of the measurement model indicates strong psychometric properties for all constructs, namely PU, PEOU, BI, and AU. Acceptable indicator reliability was established, as all item loadings exceeded the recommended threshold of 0.70, ranging from 0.709 (PEOU8) to 0.913 (AU1). Furthermore, the internal consistency reliability for each construct was confirmed, with Cronbach's Alpha (α) values surpassing 0.70 (PU=0.916, PEOU=0.925, BI=0.828, AU=0.795) and Composite Reliability values also exceeding the 0.70 benchmark (PU=0.933, PEOU=0.938, BI=0.897, AU=0.907). Convergent validity was supported as the Average Variance Extracted (AVE) for all constructs was above the minimum requirement of 0.50 (PU=0.666, PEOU=0.627, BI=0.744, AU=0.830). These results (Table 2) collectively demonstrate that the measurement model possesses adequate reliability and validity.

Table 2: Measurement Model result

Constructs	Items	Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Perceived Usefulness	PU1	0.823	0.916	0.933	0.666
	PU2	0.831			

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(PU)	PU3	0.771			
	PU4	0.800			
	PU5	0.827			
	PU6	0.794			
	PU7	0.862			
Perceived Ease of Use (PEOU)	PEOU1	0.815	0.925	0.938	0.627
	PEOU2	0.730			
	PEOU3	0.855			
	PEOU4	0.772			
	PEOU5	0.750			
	PEOU6	0.818			
	PEOU7	0.828			
	PEOU8	0.709			
	PEOU9	0.838			
Behavioural Intention to use (BI)	BI1	0.895	0.828	0.897	0.744
	BI2	0.824			
	BI3	0.868			
Actual Use (AU)	AU1	0.913	0.795	0.907	0.830
	AU2	0.909			

Discriminant validity was assessed using the Fornell-Larcker criterion, cross-loadings, and the Heterotrait-Monotrait ratio of correlations (HTMT). The HTMT results (Table 5), which are considered the most reliable criterion for assessing discriminant validity in PLS-SEM, indicated that all values were below the conservative threshold of 0.85 (ranging from 0.695 to 0.848), which strongly supports the constructs' distinctiveness (AU, BI, PEOU, PU). Examination of the cross-loadings (Table 4) further supported discriminant validity, as all indicators loaded more highly on their respective constructs than on any other construct. While the Fornell-Larcker criterion (Table 3) suggested potential concerns, particularly regarding the distinction between PEOU, PU, and BI due to high inter-construct correlations relative to the square roots of the AVEs, the robust evidence from the HTMT analysis confirms that discriminant validity is adequately established for this measurement model.

Table 3: Fornell Larcker Criterion Result

	AU	BI	PEOU	PU
AU	0.911			
BI	0.813	0.863		
PEOU	0.808	0.894	0.792	
PU	0.786	0.848	0.925	0.816

Table 4: Cross-Loading Result

	AU	BI	PEOU	PU
AU1	0.913	0.747	0.734	0.694
AU2	0.909	0.734	0.737	0.739
BI1	0.769	0.895	0.773	0.757
BI2	0.669	0.824	0.797	0.715
BI3	0.661	0.868	0.743	0.721
PU1	0.664	0.675	0.721	0.823
PU2	0.595	0.696	0.757	0.831
PU3	0.607	0.664	0.708	0.771
PU4	0.608	0.679	0.761	0.800
PU5	0.723	0.708	0.768	0.827
PU6	0.586	0.650	0.727	0.794
PU7	0.702	0.763	0.832	0.862
PEOU1	0.675	0.723	0.815	0.760
PEOU2	0.524	0.630	0.730	0.651
PEOU3	0.666	0.790	0.855	0.814
PEOU4	0.613	0.730	0.772	0.700
PEOU5	0.643	0.604	0.750	0.728
PEOU6	0.670	0.718	0.818	0.789
PEOU7	0.717	0.807	0.828	0.767
PEOU8	0.546	0.662	0.709	0.624
PEOU9	0.682	0.682	0.838	0.737

Table 5: Heterotrait Monotrait (HTMT) Result

	AU	BI	PEOU	PU
AU				
BI	0.797			
PEOU	0.707	0.825		
PU	0.695	0.782	0.848	

Structural Model Assessment

The model's explanatory power is evaluated by measuring the discrepancy amount in the dependent variables of the model. The structural model was assessed to test the hypothesised relationships between PEOU, PU, BI, and AU. The results of the hypothesis testing are presented in Table 6 and visualised in Figure 2. The analysis reveals that PEOU had a significant positive influence on PU (H_1: $\beta = 0.925$, $p = 0.000$) and a significant positive influence on BI (H_2: $\beta = 0.145$, $p = 0.000$). Furthermore, BI demonstrated a strong positive effect on AU (H_4: $\beta = 0.813$, $p = 0.000$). However, the hypothesised path from PU to BI (H3: $\beta = 0.145$, $p = 0.372$) was found to be non-significant ($p > 0.05$). Therefore, hypotheses H_1, H_2, and H_4 were

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supported, while H_3 was not supported in this study. Additionally, the model explained a substantial amount of variance in the endogenous constructs, specifically 85.5% of the variance in PU ($r^2 = 0.855$), 80.2% of the variance in BI ($r^2 = 0.802$), and 66.1% of the variance in AU ($r^2 = 0.661$).

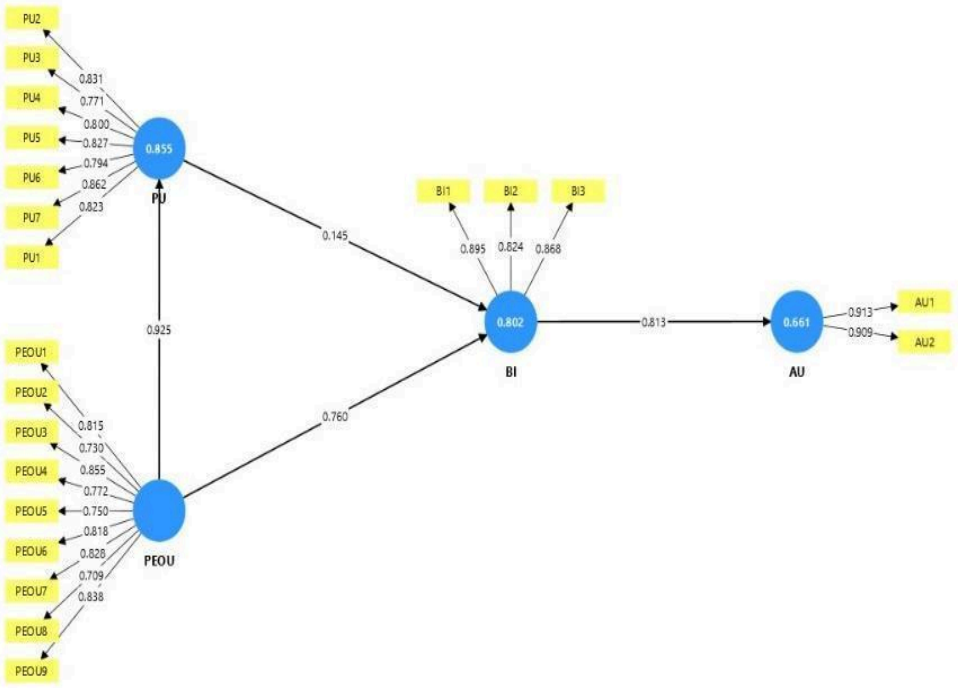

Figure 2: Path Analysis Result

Table 6: Hypotheses Testing Result

Hypothesis	Path	Path Coefficients	*P*- value	Remarks
H_1	PEOU → PU	0.925	0.000	Supported
H_2	PEOU →BI	0.760	0.000	Supported
H_3	PU→BI	0.145	0.372	Not Supported
H_4	BI→AU	0.813	0.000	Supported

Conclusion and Future Work

This study investigated the determinants influencing the acceptance and use of AI tools for TE among polytechnic students, employing the TAM as the guiding theoretical framework and following a rigorous assessment that confirmed the strong reliability and validity of the measurement model constructs, the hypothesised relationships (PEOU, PU, BI, and AU). The empirical results provide significant insights into the adoption process within this educational context. PEOU was identified as a critical antecedent, which significantly positively affected PU and BI, consistent with the previous study by Wiprayoga et al. (2023), Basuki et al. (2022), Chen and Aklikokou (2020) also, Wilson et al. (2021). This finding strongly

emphasises the necessity of user-friendliness and intuitive design for fostering positive perceptions and adoption intentions among polytechnic students. Furthermore, the study reaffirmed the significant predictive power of BI on AU, indicating that students' stated intentions reliably translate into their subsequent usage behaviour.

However, a particularly noteworthy finding was the non-significant relationship between PU and BI. Similar findings were exposed by Wang and Wang (2024), Lee et al. (2003), and Yousaf et al. (2024). Their studies stated that when the use of AI or technology is compulsory, perceived usefulness might become less relevant in forming intention compared to factors like ease of use or social pressure. This deviation from the classic TAM framework suggests that within the specific context of this study, perceptions of the technology's utility, while positively influenced by PEOU, did not directly motivate an intention to use it. This outcome may stem from various factors, such as the dominant influence of PEOU potentially overshadowing utility considerations in intention formation, or perhaps the benefits associated with usefulness are not fully recognised or leveraged to stimulate intention, possibly influenced by mandatory usage policies or specific instructional approaches. Consequently, while establishing the ease of use of technology is fundamental for acceptance among polytechnic students, PU alone may not drive BI in this setting. The model, however, demonstrated considerable explanatory power, accounting for substantial variance in PU (r^2 =0.855), BI (r^2 =0.876), and AU (r^2 =0.661).

From a practical standpoint, these results suggest that polytechnic educators and administrators should prioritise selecting and implementing technologies characterised by high usability. Moreover, support initiatives should extend beyond operational training to strategically emphasise how the technology's usefulness translates into tangible benefits within specific learning activities, potentially bridging the gap between perceived utility and usage intention; for technology developers serving the TVET sector, simplicity, and intuitive design remain paramount. Nevertheless, the study acknowledges limitations, including the cross-sectional nature, which precludes definitive causal claims over time, and the reliance on self-reported data. The findings' generalisability might also be constrained by the specific sample population drawn from a single polytechnic. Additionally, the model focused primarily on core TAM constructs, omitting other potentially influential variables.

Future Work

The findings and limitations of the current study pave the way for several promising directions for future research. Foremost among these is the need for further investigation into the non-significant relationship between perceived usefulness and behavioural intention observed in this context. Qualitative methodologies, such as in-depth interviews or focus group discussions with students, could yield rich insights into the underlying reasons for this disconnection. Concurrently, quantitative approaches could explore potential

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moderating variables, including the voluntariness of system use, the alignment between technology features and specific academic tasks (task-technology fit), individual differences in learning preferences, or specific course design elements that might condition the PU-BI relationship.

Future research endeavours should also develop more comprehensive models by integrating additional relevant constructs from established theories like the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Theory of Planned Behaviour (TPB). Exploring the potential roles of social influence, facilitating conditions, perceived behavioral control, or individual characteristics such as technology-related self-efficacy could offer a more holistic understanding of the factors driving technology acceptance and utilisation among polytechnic students.

Author contributions

Kamilah Zainuddin: Conceptualization, Methodology, Data Collection, Writing – Original Draft.
Khairul Azhar Mat Daud: Supervision, Validation, Formal Analysis, Writing – Review & Editing.
Noor Asmaa Hussein: Data Curation, Visualization, Writing – Review & Editing.

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Data availability statement

The author confirms that the data supporting the findings of this study is available within the article and/or its supplementary materials.

Conflicts of interest

The authors affirm that they have no competing interests or conflicts of interest to disclose.

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Pilot Study of Reading and Writing Anxiety Among Chinese EFL Majors by English Proficiency Level

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Abstract

This pilot study presents preliminary findings from a doctoral project investigating reading and writing anxiety among English as a Foreign Language (EFL) majors at a Chinese university. The primary aim was to assess the feasibility, reliability, and validity of two adapted instruments: the Chinese versions of the Foreign Language Reading Anxiety Inventory (Zoghi, 2012) and the Second Language Writing Anxiety Inventory (Cheng, 2004). These instruments respectively measure top-down, bottom-up, and classroom-related reading anxiety, as well as cognitive, somatic, and avoidance-related writing anxiety. A total of 30 undergraduate English majors were selected through purposive sampling, and subsequently grouped by English proficiency using their National College Entrance Examination (NCEE) scores. Statistical analyses, including Cronbach's alpha and exploratory factor analysis, indicated strong internal consistency and structural validity for both scales. Several low-performing items were revised or removed based on item-total correlation, expert and participant feedback. The findings confirm the instruments' suitability for large-scale deployment and provide insights into anxiety patterns among learners with different proficiency levels. Implications for instrument refinement and targeted pedagogical interventions are also discussed.

Keywords: *Reading Anxiety, Writing Anxiety, EFL learners, Instrument Validation, English Proficiency, Chinese university students*

Introduction

English language proficiency has become a key criterion for academic success in Chinese universities, particularly for English majors. However, despite rigorous preparation for the National College Entrance Examination (NCEE), many Chinese students enter university with insufficient skills for academic reading and writing in English. Hence, some universities in China have adopted a holistic teaching approach that integrates the previously separate English reading and writing courses into a cohesive programme for English majors. This integration, though pedagogically beneficial, may inadvertently heighten anxiety among EFL students—a growing concern (Elovskaya et al., 2019; Zhu, 2021). These skill gaps often lead to elevated levels of anxiety, especially in tasks requiring extended focus, complex processing, and exposure to unfamiliar vocabulary and cultural references.

Reading anxiety in EFL contexts commonly emerges from learners' difficulties with decoding texts, grasping main ideas, or navigating unfamiliar genres. Similarly, writing anxiety arises from concerns about

grammar accuracy, coherence, and fear of negative evaluation, all of which are exacerbated by academic expectations. While reading and writing anxiety have been widely studied as separate constructs, limited research has examined their combined presence or interaction within Chinese university settings.

Moreover, proficiency level is a potentially important moderator of language anxiety, yet its role remains under-explored. This pilot study was conducted to validate adapted Chinese versions of two established instruments: the Foreign Language Reading Anxiety Inventory (EFLRAI) (Zoghi, 2012) and the Second Language Writing Anxiety Inventory (SLWAI) (Cheng, 2004), for use among Chinese EFL undergraduates. The study also aimed to provide initial insights into the relationship between anxiety and language proficiency in preparation for a full-scale doctoral investigation.

Literature Review

This study draws on prior research into foreign language reading and writing anxiety, particularly within EFL contexts. The literature reveals that these anxieties are multidimensional and often shaped by linguistic proficiency, cognitive processing demands, and classroom experiences.

Foreign Language Reading Anxiety

Foreign Language Reading Anxiety (FLRA) refers to the discomfort learners experience when engaging with texts in a foreign language, commonly due to unfamiliar vocabulary, complex syntax, or culturally embedded content (Muhlis, 2017; Saito et al., 1999). FLRA is now understood as a multidimensional construct involving cognitive, emotional, and behavioural reactions (Capan & Karaca, 2013; Horwitz et al., 1986). High levels of FLRA have been associated with reduced comprehension, lower motivation, and increased task avoidance, especially among lower-proficiency learners (Brantmeier, 2005; Sellers, 2000).

To measure FLRA, the Foreign Language Reading Anxiety Scale (FLRAS) developed by Saito et al. (1999) remains a foundational tool. Zoghi (2012) extended this work by developing the English as a Foreign Language Reading Anxiety Inventory (EFLRAI), which incorporates dimensions more relevant to EFL learners, namely, top-down reading anxiety (difficulty extracting main ideas), bottom-up reading anxiety (word- and sentence-level processing), and classroom reading anxiety (anxiety triggered by reading aloud or teacher correction). These refinements have enhanced the contextual sensitivity of FLRA assessment tools (Guimba & Alico, 2015; Zoghi & Alivandivafa, 2014).

Foreign Language Writing Anxiety

Foreign Language Writing Anxiety (FLWA) refers to apprehension and avoidance behaviours linked to writing tasks in a second language, particularly when such tasks are associated with evaluation (Daly &

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Miller, 1975; Hassan, 2001). FLWA has been conceptualised as comprising cognitive anxiety (e.g., fear of negative evaluation), somatic anxiety (e.g., physiological symptoms), and avoidance behaviours (e.g., reluctance to write), all of which impact learners' academic performance (Cheng, 2004; Rezaei & Jafari, 2014).

Several instruments have been developed to assess FLWA. While the Writing Apprehension Test (Daly & Miller, 1975) and Writing Anxiety Questionnaire (McKain, 1991) contributed to early understanding, they were limited by issues of construct validity and unidimensionality. The Second Language Writing Anxiety Inventory (SLWAI), developed by Cheng (2004), addresses these gaps by measuring three distinct subtypes of anxiety. It has demonstrated high reliability across diverse EFL populations, with Cronbach's alpha values typically above 0.90 (Cheng, 2004; Kirmizi & Kirmizi, 2015; Zhang, 2011).

Although numerous studies have linked lower English proficiency with higher levels of FLWA and FLRA (Cheng, 2004; Sellers, 2000), few have examined these constructs in tandem within a single study or explored their relationship in the Chinese EFL university context. This gap underscores the need for validated, culturally adapted instruments that can reliably capture the nuances of reading and writing anxiety among this population.

Theoretical Frameworks of Reading and Writing Anxiety

This study is grounded in cognitive-affective theories of second language acquisition (SLA), which posit that emotional factors such as anxiety can significantly affect learners' processing of input and output in a second language. Notably, Tobias's (1979) three-stage model and Krashen's (1982) Affective Filter Hypothesis offer complementary perspectives on how anxiety interferes with learning.

Tobias (1979) argues that anxiety impairs attention, encoding, and retrieval, making it harder for learners to process reading and writing tasks. Similarly, Krashen (1982) suggests that a high affective filter, triggered by fear, embarrassment, or lack of confidence, blocks language input from reaching the learner's cognitive faculties. These frameworks help explain why anxious learners may struggle to comprehend texts or avoid writing altogether.

Horwitz et al. (1986) further conceptualise Foreign Language Anxiety (FLA) as a situation-specific construct linked to fear of negative evaluation and self-perceptions of inadequacy in the language classroom. When applied to reading and writing, this theory accounts for the behavioural manifestations of anxiety, such as reluctance to participate or procrastinate on writing tasks, which can hinder academic success.

Together, these theories justify the multidimensional structure of the instruments used in this study, which capture anxiety's cognitive, somatic, and behavioural components. They also support the rationale for exploring how proficiency levels mediate learners' affective responses to language tasks.

Methodology

This pilot study adopted a quantitative, cross-sectional design to assess the reliability, validity, and contextual appropriateness of two adapted anxiety measurement tools (the English as a Foreign Language Reading Anxiety Inventory (EFLRAI) and the Second Language Writing Anxiety Inventory (SLWAI) among Chinese EFL undergraduates. The instruments were translated into Mandarin and refined based on expert feedback and psychometric analysis.

Participants

A purposive sample of 44 third-year English majors was recruited from Hubei University of Automotive Technology (HUAT), a provincial university in China with curriculum features and learner demographics similar to the intended main research site (H University). After excluding incomplete or inconsistent responses, 30 valid cases were retained for analysis.

Participants ranged in age from 19 to 21 and had no prior study or travel experience in English-speaking countries. All had completed the National College Entrance Examination (NCEE), ensuring a comparable academic baseline. Gender distribution was skewed, with 26 females and 4 males, reflecting the broader demographic pattern among English majors in China.

To explore variations in anxiety by English proficiency, participants were divided into two groups based on their NCEE English scores. Students scoring equal to or above the sample mean (M = 111.2) were categorised as high proficiency, while those scoring at or below this threshold were categorised as low proficiency.

Instruments and Procedure

The pilot questionnaire consisted of four parts: (1) demographic background, (2) self-reported NCEE English scores, (3) the EFLRAI, and (4) the SLWAI. The EFLRAI (Zoghi, 2012) includes 27 items measuring three sub-constructs: Top-down Reading Anxiety (TRA), Bottom-up Reading Anxiety (BRA), and Classroom Reading Anxiety (CRA)(see Table 1). The SLWAI (Cheng, 2004) consists of 22 items assessing Cognitive Anxiety (CA), Somatic Anxiety (SA), and Avoidance Behaviour Anxiety (AA) (see Table 2).

Table 1: Sub-Constructs of the EFLRAI (27 Items)

Sub-construct	Item Numbers	Number of Items
Top-down Reading Anxiety (TRA)	Question 1-7	7
Bottom-up Reading Anxiety (BRA)	Question 8-21	14

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Classroom Reading Anxiety (CRA)	Question 22-27	6

Table 2: Sub-Constructs of the SLWAI (22 Items)

Sub-construct	Items (N=22)	Number of Items
Cognitive Anxiety (CA)	1, 3, 7, 9, 14, 17, 20, 21	8
Somatic Anxiety (SA)	2, 6, 8, 11, 13, 15, 19	7
Avoidance Behaviour Anxiety (AA)	4, 5, 10, 12, 16, 18, 22	7

The instruments underwent a rigorous translation and back-translation process, conducted by two bilingual language professionals. Expert reviewers in applied linguistics evaluated the Chinese versions for semantic, cultural, and conceptual equivalence. Necessary revisions were made to enhance clarity, contextual relevance, and item readability. The final versions were administered online using the Wenjuanxing platform. Participation was voluntary and anonymous. Ethical clearance and informed consent were obtained prior to data collection.

Data Analysis

Data were analysed using IBM SPSS Statistics Version 29. Descriptive statistics were computed to assess central tendencies and variability. Internal consistency of each subscale was evaluated using Cronbach's alpha, with 0.70 as the minimum acceptable threshold (George & Mallery, 2024). Corrected Item-Total Correlations (CITC) were also examined to identify problematic items; values below 0.30 were flagged for potential revision or deletion.

Construct validity was assessed through Exploratory Factor Analysis (EFA). The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity were used to determine sampling adequacy and factorability. Factor loadings were analysed to confirm alignment between items and theoretical sub-constructs. Items that exhibited low loadings or cross-loadings were revised or removed in consultation with experts.

Results

Reliability of the Research Instruments

The internal consistency of the Chinese versions of the EFLRAI and SLWAI was evaluated using Cronbach's alpha. Both instruments exceeded the conventional reliability threshold of $\alpha = 0.70$, indicating strong internal consistency and suitability for further use.

The EFLRAI (27 items) achieved a Cronbach's alpha of 0.902, suggesting excellent reliability. Similarly, the SLWAI (22 items) yielded a Cronbach's alpha of 0.882, reflecting good reliability. These

results support the internal coherence of the instruments and validate their use in the subsequent full-scale study.

Reliability Results of Reading Anxiety

Each EFLRAI subscale demonstrated acceptable to strong reliability. The Top-down Reading Anxiety (TRA) subscale recorded a Cronbach's alpha of 0.762; the Bottom-up Reading Anxiety (BRA) subscale reached 0.852; and the Classroom Reading Anxiety (CRA) subscale yielded 0.737. These values indicate that the subscales are sufficiently consistent for measuring their respective constructs among Chinese EFL learners. The results are presented in Table 3.

Table 3: Reliability of EFLRAI Subscales (Chinese Version)

Subscales	Number of Items	Cronbach's Alpha
Top-down Reading Anxiety (TRA)	7	0.762
Bottom-up Reading Anxiety (BRA)	14	0.852
Classroom Reading Anxiety (CRA)	6	0.737

To assess the internal consistency of the instruments, Corrected Item-Total Correlation (CITC) was examined as a key diagnostic indicator. CITC reflects the degree to which an item aligns with the overall construct it intends to measure (Pallant, 2020). Values above .30 are generally deemed acceptable (Field, 2018), while lower values may indicate poor item-fit and warrant revision or removal, particularly if their deletion improves Cronbach's alpha (DeVellis, 2016). Items TRA1 (r = .224), BRA21 (r = .254), and CRA26 (r = .176) fell below the recommended CITC threshold of .30, indicating weak item–scale alignment. Items BRA17 and CRA25 showed marginal values and were flagged for revision.

Based on psychometric evidence, expert input, and participant feedback, the three lowest-performing items (TRA1, BRA21, CRA26) were removed. BRA17 and CRA25 were revised to improve clarity and conceptual alignment. These adjustments strengthened the internal reliability of the refined scale (see Table 4).

Table 4: Item-Total Statistics of Reading Anxiety

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Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
TRA1	88.57	178.185	.224	.	.903
TRA2	88.67	172.506	.475	.	.898
TRA3	88.67	170.644	.533	.	.897
TRA4	88.33	170.782	.510	.	.898
TRA5	88.37	172.585	.467	.	.898
TRA6	88.37	170.999	.572	.	.897
TRA7	88.33	175.678	.335	.	.901
BRA8	88.87	164.947	.687	.	.894
BRA9	88.30	177.114	.320	.	.901
BRA10	88.37	173.137	.468	.	.899
BRA11	88.83	173.730	.353	.	.901
BRA12	88.80	171.200	.437	.	.899
BRA13	88.83	165.523	.617	.	.895
BRA14	88.97	165.344	.556	.	.897
BRA15	89.57	170.323	.473	.	.898
BRA16	88.47	171.499	.612	.	.896
BRA17	88.90	172.162	.436	.	.899
BRA18	89.77	172.392	.362	.	.901
BRA19	88.93	163.720	.741	.	.893
BRA20	89.33	166.644	.551	.	.897
BRA21	88.67	176.989	.254	.	.902
CRA22	89.57	164.323	.572	.	.896
CRA23	89.37	165.826	.611	.	.895
CRA24	89.27	169.789	.509	.	.898
CRA25	88.97	173.275	.393	.	.900
CRA26	90.33	180.989	.176	.	.903
CRA27	89.27	167.582	.555	.	.897

Reliability Results of Writing Anxiety

As indicated in Table 5, the SLWAI's three subscales also demonstrated satisfactory internal consistency. Cognitive Anxiety (CA) achieved a Cronbach's alpha of 0.822; Somatic Anxiety (SA), 0.813; and Avoidance Behaviour Anxiety (AA), 0.774. These results indicate that each subscale reliably measures its intended dimension of writing anxiety.

These findings align with previous studies. Cheng (2002; 2004) and Zhang (2011) confirmed the strong internal consistency of the SLWAI, with reported full-scale Cronbach's alpha values reaching as high

as 0.91. Similarly, Kirmizi (2015) also highlighted the high reliability of the SLWAI and its subscales. Thus, the Chinese version of the SLWAI was considered reliable and appropriate for the main study.

Table 5: Reliability of SLWAI Subscales (Chinese Version)

Subscales of SLWAI	Number of Items	Cronbach's Alpha
Cognitive Anxiety (CA)	8	0.822
Somatic Anxiety (SA)	7	0.813
Avoidance Behaviour Anxiety (AA)	7	0.774

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Table 6: Item-Total Statistics of Writing Anxiety

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
WACA1	67.17	120.420	.428	.777	.878
WASA2	66.83	120.144	.471	.869	.877
WACA3	66.93	115.306	.640	.902	.871
WAAA4	66.73	127.237	.129	.747	.885
WAAA5	67.10	118.162	.585	.906	.874
WASA6	67.57	117.357	.589	.754	.873
WACA7	67.40	120.248	.391	.855	.879
WASA8	67.70	118.562	.444	.789	.878
WACA9	66.93	114.064	.652	.905	.871
WAAA10	67.33	112.161	.751	.899	.867
WASA11	67.33	116.092	.588	.896	.873
WAAA12	66.77	116.668	.561	.792	.874
WASA13	67.03	117.689	.550	.868	.874
WACA14	67.43	116.116	.595	.852	.873
WASA15	67.97	120.930	.427	.812	.878
WAAA16	68.00	122.345	.423	.818	.878
WACA17	66.73	121.030	.413	.883	.878
WAAA18	66.77	125.495	.210	.827	.883
WASA19	67.93	119.237	.470	.769	.877
WACA20	67.17	122.006	.306	.887	.882
WACA21	67.13	113.706	.618	.796	.872
WAAA22	67.13	129.361	.007	.792	.888

CITC analysis revealed three items that failed to meet the 0.30 criterion (WAAA4, r = 0.129; WAAA18, r = 0.210; and WAAA22, r = 0.007) (see Table 6). Notably, removing WAAA22 increased the overall alpha from 0.882 to 0.888. Consequently, all three items were deleted, raising the SLWAI's final alpha to 0.896. These modifications enhanced both reliability and construct clarity.

Validity of the Research Instruments

Two forms of validity were assessed: face/content validity and construct validity. An expert in ESL and Applied Linguistics reviewed the instruments for clarity, cultural appropriateness, and conceptual alignment. Feedback led to minor revisions of several items to improve readability and contextual fit.

Construct validity was examined using Exploratory Factor Analysis (EFA). For the EFLRAI, all subscales met the required thresholds: KMO values exceeded 0.60 (TRA = 0.679, BRA = 0.618, CRA = 0.723), and Bartlett's Test of Sphericity was highly significant ($p < .001$ for all). The SLWAI also showed

strong construct validity, with KMO values above 0.60 (CA = 0.727, SA = 0.808, AA = 0.616) and significant Bartlett's Test results ($p < .001$). These results confirm that the revised instruments exhibit robust structural validity in the pilot context.

Construct Validity of EFLRAI

The Construct Validity results for the Chinese version of the EFLRAI are presented in Table 7.

Table 7: Construct Validity: KMO and Bartlett's Test for EFLRAI Subscales (Chinese Version)

Subscale of RA	KMO Value (KMO>0.6)	Bartlett's Test (p-value)
Top-down Reading Anxiety (TRA)	0.679	0.000
Bottom-up Reading Anxiety (BRA)	0.618	0.000
Classroom Reading Anxiety (CRA)	0.723	0.000

All three EFLRAI subscales demonstrated strong construct validity. The KMO values were 0.679 (TRA), 0.618 (BRA), and 0.723 (CRA), while Bartlett's tests were highly significant for all subscales ($p < .001$). These results confirm that each set of items measures a coherent latent construct and supports the multidimensional framework of reading anxiety.

Construct Validity of SLWAI

Table 8 presents the construct validity results for the Chinese version of the Second Language Writing Anxiety Inventory (SLWAI), which consists of three sub-constructs: Cognitive Anxiety (CA), Somatic Anxiety (SA), and Avoidance Behaviour Anxiety (AA). The Kaiser-Meyer-Olkin (KMO) values for all sub-constructs exceeded the minimum recommended threshold of 0.60, suggesting that the sampling was adequate for factor analysis. Specifically, the KMO values were 0.727 for CA, 0.808 for SA, and 0.616 for AA.

Furthermore, Bartlett's Test of Sphericity was statistically significant ($p < .001$) across all three sub-constructs, indicating that the correlation matrices were appropriate for factor analysis. These findings collectively support the construct validity of the SLWAI, confirming that each subscale effectively captures a distinct dimension of second language writing anxiety among Chinese EFL learners.

Table 8: Construct Validity: KMO and Bartlett's Test for SLWAI Subscales (Chinese Version)

Subscale	KMO Value (KMO>0.6)	Bartlett's Test (p-value)
Cognitive Anxiety (CA)	0.727	0.000
Somatic Anxiety (SA)	0.808	0.000
Avoidance Behaviour Anxiety (AA)	0.616	0.000

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Item Revision Based on Feedback

In response to reliability testing, expert review, and participant comments, several questionnaire items were revised or removed. Low-performing items with poor CITC values were deleted, while others were reworded to enhance grammatical accuracy, semantic clarity, or cultural appropriateness.

For example, EFLRAI Item 2 was revised for clarity ("It is worrying to me…" became "It worries me…"), and EFLRAI Item 5 was rephrased to correct a grammatical error. SLWAI Items 4, 18, and 22 were removed due to poor CITC and conceptual ambiguity.

All revised items were subsequently re-evaluated for internal consistency to ensure the instruments maintained psychometric robustness. These revisions represent a critical step in culturally adapting established instruments for use in the Chinese EFL context.

Table 9: Summary of Item Revisions Based on Pilot Feedback

Instrument Section	Item No.	Original Wording	Feedback Source	Type of Issue Identified	Action Taken
EFLRAI	1	I do not feel at ease when the title of the text is unfamiliar to me.	Reliability Test	Low corrected item-total correlations	deleted
EFLRAI	2	It is worrying to me when the ideas expressed in the text are culturally unclear.	Expert validation	Unclear expression	Revised to "It worries me when the ideas in the text are culturally unclear."
EFLRAI	5	When I cannot recognize minor ideas (details) of the text is worrying to me.	Expert validation	Grammatical inaccuracy	Revised to "I feel anxious when I cannot identify the smaller details in the text."
EFLRAI	21	I get confused when I encounter a certain grammar point that I understand but makes no sense to me.	Reliability Test	Low corrected item-total correlations	deleted
EFLRAI	26	It makes me uncomfortable when the instructor corrects my pronunciation or translation mistakes.	Reliability Test	Low corrected item-total correlations	deleted
SLWAI	4	I often choose to write down my thoughts in English.	Reliability Test	Low corrected item-total correlations	deleted
SLWAI	18	I usually seek every possible chance to write English	Reliability Test	Low corrected item-total correlations	deleted

		compositions outside of class.			
SLWAI	22	Whenever possible, I would use English to write compositions.	Reliability Test	Low corrected item-total correlations	deleted

Discussion

The findings from this pilot study confirm that the adapted Chinese versions of the EFLRAI and SLWAI are psychometrically sound tools for assessing reading and writing anxiety among Chinese EFL undergraduates. Both instruments demonstrated high internal consistency and acceptable construct validity, supporting their use in a larger-scale investigation.

The results highlight the importance of contextually adapting existing instruments. Several items that performed well in the original versions did not exhibit strong item-total correlations in the Chinese context, likely due to linguistic or cultural differences. This underscores the necessity of rigorous piloting and expert review during scale adaptation, particularly for cross-linguistic research.

The removal and revision of items with low CITC values led to improvements in reliability, with both instruments exceeding the conventional threshold for Cronbach's alpha after refinement. These findings align with previous validation studies (e.g., Cheng, 2004; Zoghi & Alivandivafa, 2014), which emphasize the multidimensionality of skill-specific language anxiety and the benefits of targeted measurement.

Preliminary trends observed in this pilot also provide pedagogical insights. Participants with lower English proficiency appeared to exhibit higher anxiety levels across both reading and writing tasks. While inferential statistics were not applied due to the small sample size, this trend is consistent with prior research linking lower proficiency to heightened anxiety (Cheng, 2004; Sellers, 2000). These findings suggest that language anxiety may be moderated by linguistic competence, with lower-proficiency learners being particularly vulnerable.

From an instructional perspective, the findings support the need for differentiated pedagogical interventions. Strategies such as anxiety-reducing reading scaffolds, guided writing support, and culturally responsive materials may be particularly beneficial for lower-proficiency learners. Additionally, awareness of the somatic, cognitive, and behavioural symptoms of writing anxiety can help instructors design more empathetic and supportive classroom environments.

Overall, the pilot study achieved its objective of evaluating the feasibility and psychometric robustness of the adapted instruments. The data offer valuable direction for refining both the measurement tools and the research procedures for the full-scale study.

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Conclusion and Implications

This pilot study provides evidence that the adapted versions of the English as a Foreign Language Reading Anxiety Inventory (EFLRAI) and the Second Language Writing Anxiety Inventory (SLWAI) are reliable and valid tools for use among Chinese undergraduate EFL learners. Both instruments showed strong internal consistency and acceptable construct validity following careful cultural and linguistic adaptation.

The process of item revision, informed by statistical diagnostics, expert review, and participant feedback, was essential to enhancing the instruments' contextual sensitivity and measurement accuracy. This underscores the importance of localised validation, especially when using established tools across different linguistic and educational settings.

The pilot also revealed preliminary patterns suggesting that learners with lower English proficiency may experience higher levels of reading and writing anxiety. While further investigation is needed to statistically confirm these trends, the findings highlight a potentially important interaction between proficiency and affective factors in language learning. This suggests the need for responsive pedagogical strategies tailored to learners' emotional and linguistic profiles.

For future research, the validated instruments will be employed in a full-scale study involving a larger and more diverse sample. Inferential statistical methods will be used to examine the relationships between anxiety dimensions, proficiency levels, and language performance. The study may also incorporate qualitative components to provide deeper insights into learners' lived experiences with language anxiety.

Ultimately, this research contributes to the growing literature on skill-specific language anxiety and offers practical tools for both researchers and educators seeking to better understand and support EFL learners in high-stakes academic environments.

Author contributions

Conceptualisation, methodology, formal analysis, and initial draft preparation by Hu Kangna; supervision, writing, review, and editing by Prof Dr Ain Nadzimah Abdullah and Dr Mohamad Ateff Md Yunos. All authors have reviewed and approved the manuscript for publication.

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author, [0364821@sd.taylors.edu.my]. The data are not publicly available due to [restrictions e.g. their containing

information that could compromise the privacy of research participants]. This study received an ethics review exemption from the university, referenced as HEC 2025/161.

Conflicts of interest

No potential conflict of interest was reported by the authors.

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Navigating Learner Autonomy in the Digital Age: Chinese College EFL Students' Behaviour and Challenges

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Abstract

The rapid advancement of information technology has significantly transformed college English education in China, particularly in promoting autonomous learning. This study explores the readiness and challenges of English as a Foreign Language (EFL) students in Fujian Province in practicing autonomous learning within a digital environment. The study aims to: (1) assess students' overall readiness for learner autonomy, and (2) examine their learning behaviours and challenges related to digital technology use. Data were collected through questionnaires distributed to 450 college students. The questionnaire comprised 23 items categorised into four areas: readiness for autonomous learning, goal setting, method-use, and self-evaluation. Findings indicate that students displayed a moderate level of readiness for autonomous learning. While they showed motivation and a basic understanding of learning strategies, their self-evaluation skills were notably weak. In terms of goal setting, students were somewhat prepared to revise their study plans, but struggled to effectively achieve long-term English learning goals. Regarding method-use, participants demonstrated readiness to adjust strategies using digital tools, yet still lacked consistency in applying them effectively. For self-evaluation, students showed a willingness to utilise available online resources, but did not actively seek out opportunities to learn English beyond the classroom setting. The findings highlight the need for targeted support and digital literacy training to enhance learner autonomy among college EFL students in China's digital age.

Keywords: *Learner autonomy, digital age, EFL students, Chinese college students, language learning strategies, self-directed learning*

Introduction

Research Background

With the development of global integration, English is becoming increasingly crucial, and English competence in a country has a major impact on the acquisition of current information and the effectiveness of international communication (Rintaningrum, 2023).

In the digital environment, the rapid development of information technology has greatly changed the traditional model in the field of education, and college English education is no exception (Timotheou et al., 2023). As an important learning method, autonomous learning has become increasingly important in college English learning in the digital age (Pratiwi & Waluyo, 2023). The digital age has made it easier than ever to obtain college English learning resources independently (Allcoat et al., 2021). Students can easily access a

large amount of English learning materials through the Internet, such as online courses, e-books, learning websites, etc., which greatly enriches the range of learning materials (Chen & Huang, 2021). In the digital environment, students can choose a learning method that suits them according to their learning style and interests to improve their language skills (Nguyen et al., 2022).

Generally, there is a strong emphasis on the importance of autonomous learning in EFL education (Indah et al., 2021). However, research on learner autonomy in the digital age remains limited. Therefore, this study aims to investigate this critical aspect of college students' learner autonomy in the digital era in China, where English is taught as a foreign language. To guide this investigation, the following research questions have been formulated:

a) What is the overall readiness of Chinese college students for autonomous English learning in the digital age?

b) What are the learning behaviours and challenges faced by Chinese college students in autonomous English learning in the digital age?

Objectives of the Study

The purpose of this study is to scrutinise the scenario of learner autonomy among college EFL students in Fujian Province, China. Hence, the following are the objectives of the study:

a) to investigate Chinese college EFL students' overall readiness for learner autonomy in the digital environment.

b) to examine learning behaviour and challenges in autonomous learning among college EFL students using digital technology.

Literature Review

Definitions of autonomous learning

Henry Holec in 1970s formally put forward the concept of autonomous learning. This concept was defined as the ability to be responsible for one's learning, namely, the ability to independently determine goals, contents, and processes (Raya & Vieira, 2020). After that introduction, however, the concept has been analysed in diverse ways.

Due to the different theoretical standpoints and research methods of researchers, there is no unified definition of self-directed or autonomous learning. Some scholars regard it as a kind of behaviour, while others regard it as a kind of ability. In sum, there are eight theories of autonomous learning: (1) Operativism: self-directed learning is a kind of responsive response based on external rewards or punishments (Nyuhuan, 2024); (2) Humanism: the development of an individual's self-system inevitably produces self-directed

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learning (Chamani et al., 2023); (3) Information Processing: information obtained by an individual is tested according to predefined criteria, and if it does not match perfectly, it has to be tested again, and so on until the information meets the criteria. (Li & Zhang, 2021); (4) Social cognitive school: autonomous learning is essentially the learner's regulation and control of the learning process (Mehdiyev, 2020); (5) Autonomous volitional school: students' autonomous learning is in fact a process of volitional control (Tsilmak et al., 2020); (6) Speech self-direction school: autonomous learning is a process in which an individual actively regulates his/her own learning by using his/her own internal speech (Mehdiyev, 2020); (7) Constructivist school: autonomous learning is a process in which learners regulate their learning according to their own needs (Dmitrenko et al., 2021); (8) Information processing school: Autonomous learning is a process in which learners actively adjust their learning strategies and efforts according to their own learning abilities and the requirements of the learning task (Marantika, 2021).

Despite the lack of consensus definition, scholars have put forth several theoretical stances that capture the complexity of autonomous learning. These viewpoints can be broadly divided into constructivist, behaviourist, and cognitive traditions. The operativist perspective, which is behaviourist in nature, sees autonomous learning as a conditioned reaction to outside stimuli like rewards and penalties. Cognitive theories, on the other hand, such as Speech Self-Direction, Autonomous Volitional, Social Cognitive, and Information Processing, place more emphasis on the internal processes that students employ to control their ideas, actions, and tactics. These approaches emphasise how learners can use internal dialogue and volitional control to plan, monitor, and modify their learning. In contrast, humanistic thought emphasises the importance of self-actualisation and personal development, arguing that autonomous learning develops organically as people gain independence and a sense of self. Constructivist theories, finally, portray autonomous learning as a dynamic, learner-centered process in which people actively create knowledge and modify their learning methods according to their requirements and objectives. In sum, these theories collectively provide a thorough explanation of autonomous learning as an inherent capacity and an interacting process influenced by environmental, cognitive, and motivational factors.

Challenges of learner autonomy in digital contexts

In the current digital environment, autonomous learning of English at university presents multiple challenges, both in terms of technology and learning itself. The following are the main challenges:

Information overload and resource screening difficulties

One is that online English learning resources, e.g., MOOCs, videos, and apps are flooded with resources, but the quality varies, making it difficult for students to identify materials suitable for their own level. There are too many online English resources, but learners don't know how to choose them", and most learners have

experienced learning inefficiency due to choosing the wrong materials (Huang et al., 2025). The other is that fragmented resources may lead to a lack of coherence in learning and make it difficult to form a complete language proficiency system. According to Liu et al. (2022). Although fragmented learning can improve short-term memory, only 17% of learners are able to transform it into actual language output ability.

Insufficient self-directed learning ability

Firstly, many students lack the ability to set goals, plan learning paths, and self-monitor, which makes it easy for them to fall into "ineffective learning". A survey by Wu et al. (2021) found that only 10% of college students were able to make a clear English learning plan, and more than 50% did not regularly review their learning results. In addition, without classroom supervision and peer pressure, students are easily distracted by social media and games, making learning less sustainable. In a report by Wang et al. (2022), 60% of students surveyed admitted to being "easily distracted when studying independently", with social media and gaming being the main triggers.

Technology dependence and digital divide

First, over-reliance on translation software and grammar checking tools weakens active thinking skills. Su et al. (2025) showed that 89% of students used grammar checking tools like Deepseek, but 43% of them showed a significant increase in writing errors after disabling the tool. Second, some students may not have equal access to quality resources due to equipment performance, network conditions or economic factors, exacerbating the learning gap. A survey by Abuali and Ahmed (2025) in universities in developing countries showed that 31% of students were unable to complete an online English course due to internet or device problems, with the percentage being higher in remote areas.

Psychological and behavioural problems

On one hand, facing the screen for a long time leads to distraction and learning burnout. According to Su et al. (2025) study, 67 percent of students experience "screen burnout" after prolonged online English learning, which manifests itself as a loss of concentration and efficiency. On the other hand, the lack of immediate support when encountering difficulties in independent learning may trigger language learning anxiety. A follow-up study by (Zhu, 2021) found that only 28 percent of students would actively seek help when they encountered problems in independent learning, while the rest chose to give up or procrastinate, leading to the accumulation of anxiety. In conclusion, even though digital environments have a great deal of potential for encouraging autonomous learning, these issues need to be resolved with focused support techniques, resource direction, and psychological scaffolding to genuinely help college students.

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Psychological Frameworks

The framework of the research will consist of humanistic psychology (HP), constructivist learning theory (CLT), and cognitive psychology (CP). The combination of the three is suitable for research on college English autonomous learning in a digital environment. HP explains how emotion works on learning autonomy (DeRobertis, 2021), while CLT explains how external factors, such as teachers, play a role in autonomous learning (Chuang, 2021). Cognitive psychology is highly significant and aligns well with the objectives of the study. By incorporating CP, researchers can delve deeper into students' learning strategies. The aforementioned theories have established a strong theoretical basis for learner autonomy, as illustrated in Figure 1 (Cheng, 2019).

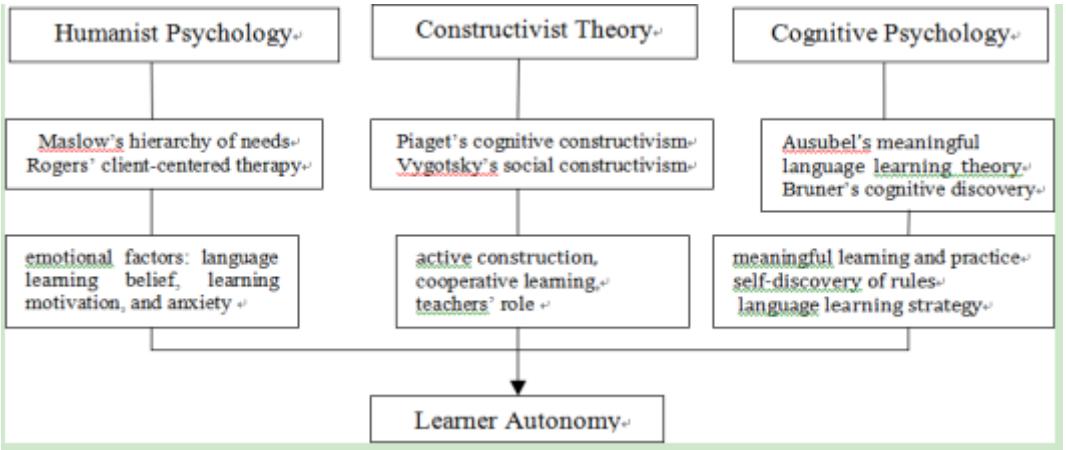

Figure 1: The Framework of the Study

Methodology

Research Design

The aim of the study is to investigate Chinese college EFL students' overall readiness for learner autonomy in the digital environment and examine learning behaviour and challenges in autonomous learning among college EFL students using digital technology. Hence, this kind of research needs rich data collection which should be quantitative design rather than qualitative research. Therefore, the researcher in this study will choose questionnaires as research instruments to collect rich and credible data according to the "fit for purpose" principle (Chigbu et al., 2021).

Instrument

The study uses an online questionnaire instrument composing of two parts. Part A aims to collect demographic information of subjects, including their gender and age etc. Part B includes 23 questions, which are divided into sections that check students' readiness for independent learning (3-6), set learning

goals (7-13), explore learning methods (14–19), and assess the process of learning English (20-25), all based on Cheng's (2019) study.

The Likert scale enables the subjects to clearly express their attitudes or opinions. At the same time, the subjects only need to choose the corresponding options according to their actual situation, which is convenient for researchers to conduct statistical analysis. By calculating indicators such as the mean and standard deviation, researchers can understand the overall attitude or opinion distribution of the subject group.

Table 1: Questionnaire Items

Variables	Section	Number of ranges	Number of items
Demographic	A	1 – 2	2
Readiness for independent learning	B	1 – 6	4
Goal setting		7 – 13	7
Method-use		14– 19	6
Self-evaluation		20 – 25	6

Respondents

The questionnaire survey adopts an anonymous survey form and takes 450 students from Fujian Forestry Vocational and Technical College, Northern Min Vocational and Technical College, and Wuyi College as the survey subjects. These students are sophomores and have one year of autonomous learning experience in college English. They can describe their autonomous learning of college English.

The participants come from different departments, majoring in art and media, computer science, banking and finance, business, electrical and electronics, accounting, and engineering. These majors are very popular among the three colleges, and many students choose these majors, so it is easy to find volunteers. None of them are native English speakers.

Table 2: Sample Size of Participants

College	No of students	Major
Fujian Forestry Vocational and Technical College	150	Art and media, Computer science, Banking and finance, Business, Electrical and electronics, Accounting, and Engineering
Northern Min Vocational and Technical College	150	Art and media, Computer science, Banking and finance, Business, Electrical and electronics, Accounting, and Engineering
Wuyi College	150	Art and media, Computer science, Banking and finance, Business, Electrical and electronics, Accounting, and Engineering

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Data Collection

This study will be carried out at three colleges in Fujian Province. The questionnaire will be distributed offline. The researcher will contact the college's English lecturer via cell phone and meet with them after school at each college. After discussing the objective of the study, the researcher will distribute and collect the questionnaire with the assistance of a college lecturer. 450 students will participate in the collection of quantitative data. They are all sophomores with previous independent learning experience. To guarantee that the distribution and collection of questionnaires are properly supervised, the entire process is carried out in the classroom for 20 minutes. The college lecturer is present throughout the process to ensure that data is collected efficiently and accurately.

Data Analysis

Questionnaire data will be entered into a computer data file. The Statistical Package for the Social Sciences (SPSS) will then be used to evaluate the data. The internal consistency reliability of the measurement scales was assessed using Cronbach's alpha coefficients as presented in Table X. All variables demonstrated acceptable to excellent levels of reliability. Specifically, Readiness for independent learning ($\alpha = 0.932$), Goal setting ($\alpha = 0.950$), and Method-use ($\alpha = 0.949$) showed excellent internal consistency, indicating a high degree of reliability in measuring their respective constructs. While Self-evaluation had an alpha of 0.758 which is considered acceptable. These results suggest that all scales used in the study are sufficiently reliable for further statistical analysis ($\alpha = 0.983$).

Table 3: Reliability Analysis (Cronbach's Alpha Values for Each Construct Measured)

Variables	Number of items	Cronbach Alpha
Readiness for independent learning	4	0.932
Goal setting	7	0.950
Method-use	6	0.949
Self-evaluation	6	0.758
All	23	0.983

Findings

This section summarises the findings of the pilot study that answer the research questions.

RQ1: What is the overall readiness of Chinese college students for autonomous English learning in the digital age?

In Table 4, it was found that college students were prepared for learner autonomy (M=3.68). The highest mean score among these three aspects was goal setting (M=3.79), followed by self-evaluation (M=3.64), and method-use (M=3.46). Based on the findings, college students were somewhat more prepared for learner autonomy than the medium level, while their capacity for method use was lacking.

Table 4: College Students' Readiness for Learner Autonomy

Dimension	No.	Mean	S.D.	Rank
Goal setting	450	3.79	.64	1
Method-use	450	3.46	.72	4
Self-evaluation	450	3.64	.69	3
Overall readiness in the digital age	450	3.68	.60	2

RQ2: What are the learning behaviours and challenges faced by Chinese college students in autonomous English learning in the digital age?

Chinese EFL students' learning behaviour and challenges in the digital age could be analysed from three perspectives, namely, goal-setting, method-use, and self-evaluation.

Setting up learning goals

In table 5, college students were well versed in the modification of study schedule as needed (M=3.81), followed by goal setting (M=3.79), and understanding course requirements (M=3.71). Based on the findings, college students were somewhat more prepared for modifying their study plans, while their capacity to achieve their English language goal was lacking (M=3.14).

Table 5: Setting up learning goals

Item	No.	Mean	S.D.	Rank
I am aware of the criteria for the course.	450	3.71	.72	3
I am aware of the need to study diligently under the course objectives.	450	3.67	.63	5
I can create an English language goal.	450	3.40	.74	6
I can achieve my English language goal.	450	3.14	.67	7
I can schedule time for studying English.	450	3.79	.61	2
I can adjust my study schedule to fit my circumstances.	450	3.66	.65	4
I modify my study schedule as needed.	450	3.81	.60	1

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Using the learning methods

Table 6 shows college students were well in the modification of learning strategies as needed (M=3.78), followed by employing writing techniques (M=3.61), and employing reading strategies (M=3.60). Based on the findings, college students were somewhat more ready to modify their learning methods, while their capacity to employ listening techniques was lacking (M=3.41).

Table 6: Using the learning methods

Item	No.	Mean	S.D.	Rank
I am aware of the general English language learning methodology.	450	3.53	.71	4
When I work on my listening abilities, I employ listening techniques.	450	3.41	.63	6
I work on my English speech using communicative techniques.	450	3.48	.71	5
When I read in English, I employ reading strategies.	450	3.60	.69	3
When I write in English, I employ writing techniques.	450	3.61	.65	2
I modify my English language learning strategies as necessary.	450	3.78	.77	1

Evaluating the process of English language learning

In table 7, college students were good at utilising all of the learning materials available (M=3.73), followed by applying the new information when practicing (M=3.68), and assessing learning results (M=3.60). Based on the findings, college students were somewhat more ready to utilise learning materials available, while their capacity to look for opportunities to study English out of class was lacking (M=3.15).

Table 7: Evaluating the process of English language learning

Item	No.	Mean	S.D.	Rank
I can assess my learning results.	450	3.60	.61	3
Outside of class, I look for opportunities to study English.	450	3.15	.69	6
I can utilize all the learning materials available to me.	450	3.73	.74	1
When I practice my English, I make an effort to apply the new information.	450	3.68	.66	2
Together with my classmates, I can learn.	450	3.57	.69	4
I take steps to rectify my blunders because I am aware of their causes.	450	3.53	.79	5

Discussion

This pilot study set out to investigate Chinese college EFL students' overall readiness for learner autonomy in the digital age and examine learning behaviours and challenges in autonomous learning from the perspective of goal-setting, method use, and self-evaluation. In the past, several academics have also studied college English autonomous learning (Cheng, 2019; Chuang, 2021; Zhu, 2021; Liu et al., 2025; Wu et al.,

2021; Su et al., 2025). Studies carried out in a digital setting were, nevertheless, comparatively uncommon. This study deliberately narrows its focus to participants exclusively in three colleges for sampling convenience. Besides, it will be conducted in Fujian province, which may not be representative of the entire country.

Conclusion

The findings from 450 participants revealed that Chinese college students exhibit a moderate level of readiness for autonomous English learning in the digital age. While they are relatively capable of modifying study plans and learning strategies, there is a notable gap in their ability to effectively achieve language learning goals, particularly in the areas of listening and out-of-class learning. Their strengths lie in understanding course requirements, using available learning resources, and employing certain language skills such as reading and writing. However, the challenges in goal setting, listening skill development, and seeking learning opportunities out of class indicate that students may require more targeted support and instructional guidance to enhance their autonomous learning in a digital environment.

Author contributions

This research paper resulted from the collaboration of three authors. Zhu Jiang composed the conceptualisation, literature review, and theoretical framework. Soo Kum Yoke and Wan Zumusni Mustapha conducted essential edits, performed final proofreading, and guaranteed compliance with academic standards. All writers reviewed and endorsed the final manuscript.

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Data availability statement

The author confirms that the data supporting the findings of this study are available within the article and/or its supplementary materials.

Conflicts of interest

The authors have no conflicts of interest to declare.

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In Other Words: Exploring Student Criticality Through Lexical Bundles

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Abstract

Lexical bundles play a crucial role in conveying evaluations, opinions, and attitudes in both spoken and written communication. These recurring multiword sequences are recognised as essential components of fluent and natural linguistic expression in academic texts. However, although lexical bundles are significant in expressing personal and professional evaluations, their use in the literature review genre remains relatively underexplored. This corpus-based study analyses a self-compiled learner corpus of literature review chapters from Applied Linguistics Master's theses using WordSmith Tools 6.0 (Scott, 2012). A total of 60 four-word lexical bundles were identified and categorised into epistemic and attitudinal functions. The findings reveal a strong reliance on impersonal epistemic bundles such as *"it can be said"* and *"due to the fact"*, indicating learners' tendency to hedge claims and express cautious evaluations. Among attitudinal bundles, those related to ability (e.g., *"to be able to"*, *"can be used to"*) were the most frequent, suggesting an emphasis on potential and capacity rather than assertive critique. Bundles signalling importance and obligation were also common, while those expressing evaluation or contrast appeared less frequently—except *"on the other hand"*, which had the highest overall frequency and distribution. These findings suggest that student writers employ lexical bundles to project a measured and often tentative stance, reflecting a developing sense of criticality. The study offers pedagogical insights for academic writing instruction, particularly in fostering more confident and balanced expressions of evaluation in literature review writing.

Keywords: *expressions of criticality, lexical bundles, literature review, student writers*

Introduction

Academic writing plays a vital role in postgraduate education. Thesis writing, particularly, requires students not only to communicate knowledge effectively but also to demonstrate the ability to critically engage with existing research. Among the various sections of a thesis, the literature review has been considered as one of the most important sections. It allows writers to position their research within the broader academic conversation (Fernandez, 2019; Hart, 1998; Rowle & Slack, 2004) by synthesising prior studies, identifying gaps, and justifying the relevance of their own research or investigations. However, literature review writing often poses a significant challenge for student writers, who may struggle to go beyond summarising existing work to offering evaluative and analytical commentary (Akindele, 2008; Osman, 2012; Shahzavar & Kourepaz, 2020).

A key aspect of producing an effective literature review is the expression of criticality (Bruce, 2014); without it, the review may lack depth and fail to contribute meaningfully to academic discourse. Criticality can be seen as the writer's ability to assess the strengths, limitations, and implications of existing studies, while articulating their own stance (Bruce, 2014, Tarmizi & Aziz Hussin, 2021). As Bruce (2014) and Kwan (2006) observe, criticality is central to literature review writing, enabling writers to question, interpret, and evaluate the literature as they construct a foundation for their own work. Criticality is typically realised through specific linguistic choices, including hedging, attitude markers, boosters, and self-mentions. These strategies not only signal a writer's level of certainty, evaluation, and positioning in relation to cited sources, but also convey personal evaluations and degrees of commitment to the claims being made (Gray & Biber, 2012; Hyland, 2005; Lancaster, 2016).

Despite its importance, expressing criticality in literature review writing poses significant challenges, especially for student writers (Shahzavar & Kourepaz, 2020). Challenges such as limited command of academic language, unfamiliarity with evaluative conventions, and difficulty in articulating a personal stance (Akindele, 2008; Fernandez, 2019; Osman, 2012) often result in literature reviews that are more descriptive than analytical. These limitations hinder students' ability to establish the significance of their research and position their work within the scholarly landscape. Moreover, while numerous studies have addressed rhetorical structures and moves in literature reviews (e.g. Chen & Li, 2019; Gil-Salom & Soler-Monreal, 2014; Kwan, 2006; Kwan et al., 2012; Rabie & Boraei, 2021), less attention has been given to how criticality is expressed at the phrasal level, particularly through recurrent word combinations known as multi-word expressions or lexical bundles.

Lexical bundles can be defined as sequences of words identified through a corpus-driven approach using specified frequency and distribution criteria (Chen & Baker, 2010). Writers who are able to comprehend and produce texts using lexical bundles appropriately are more likely to be perceived as fluent users of the language (Wright, 2019). Furthermore, the use of lexical bundles has been shown to play an important role in constructing academic discourse. Beyond their cohesive function, many lexical bundles convey epistemic and authorial attitude, both of which are essential for demonstrating critical engagement (Hyland, 2008; Wright, 2019). For example, expressions like "*it should be noted that*" or "*this may suggest that*" help writers express caution, judgment, and interpretation. However, little is known about how student writers use these bundles in literature review sections to express criticality when reviewing existing studies.

This study investigates how four-word lexical bundles are used by student writers to show criticality in the literature review chapters of Applied Linguistics Master's theses. By examining how these bundles signal evaluative and interpretive stance, the study aims to provide insights into the ways student writers construct criticality and to contribute to improved guidance for effective literature review writing. Particularly, this study intends to answer the following research questions:

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1. What are the most frequently used four-word lexical bundles by student writers in the literature review sections of Applied Linguistics Master's theses?
2. What functions do these four-word lexical bundles serve in expressing criticality in the literature review sections of Applied Linguistics Master's theses?

Literature Review

Academic writing in higher education requires students to demonstrate not only mastery of disciplinary knowledge but also the ability to engage critically with existing scholarship (Fernandez, 2019). In this context, the literature review plays a central role in positioning a study within its academic field, identifying research gaps, and justifying the need for further investigation (Winchester & Salji, 2016). Effective literature review writing often involves the expression of criticality, which may be described as the writer's ability to articulate their position, evaluation, or attitude toward the literature under review (Boote & Beile, 2005; Fernandez, 2019; Hart, 1998; Hei & David, 2015). This includes both the expression of personal sentiments, attitudes, and evaluations and the degree of certainty, doubt, precision, or limitation they convey regarding the information presented.

Expression of criticality has been examined from multiple perspectives, particularly through analyses of linguistic and rhetorical strategies. Studies such as Hyland (2005) and Lancaster (2016) have explored how features like hedging, boosting, attitude markers, self-mentions, and disclaim markers contribute to the construction of a critical stance in academic writing. This involved linguistic devices like modal verbs (e.g., *can, could,* may), adjectives (e.g., *important, essential, crucial*), nouns (e.g., *issue, problem*), and pronouns (e.g., *I, we, our*) to name a few. Since criticality is realised through linguistic choices, it can also be examined through phraseology, as specific combinations of words contribute to the expression of evaluative and interpretive stance, as demonstrated in several prominent studies (see for examples Biber et al.; 2004, Hyland, 2008; Zhang et al., 2021). Although rhetorical moves and evaluation strategies in literature reviews have received considerable attention, less focus has been placed on how criticality is realised through lexical bundles.

Lexical Bundles in Academic Writing

Lexical bundles, also referred to as n-grams, fixed expressions, or formulaic language, are sequences of words that occur frequently and predictably in specific discourse contexts (Biber et al., 2004; Chen & Baker, 2010). These bundles are typically identified using automated, frequency-driven approaches. Their effective use is widely believed to enhance the fluency and coherence of academic writing. Writers who understand and use lexical bundles appropriately are often perceived as more proficient and fluent users of academic English (Wright, 2019). Moreover, the frequent and contextually appropriate use of lexical bundles signals a

writer's command of academic language, reflecting not only linguistic proficiency but also familiarity with disciplinary norms and register-specific conventions (Cortes, 2006; Hyland, 2012).

Beyond their formulaic structure, lexical bundles play a crucial role in fulfilling pragmatic and rhetorical functions in academic discourse. As Hyland (2008) highlights, these bundles are not merely frequent word combinations; they contribute significantly to the organisation of information, the signalling of logical and rhetorical relationships, and the management of reader expectations. More importantly, lexical bundles help writers conform to the communicative norms of specific academic genres. In the context of literature reviews, they are particularly valuable for supporting key rhetorical moves such as establishing research gaps, clarifying results and methods, supporting interpretations, reporting data, and contextualising findings (Wright, 2019). These functions highlight the strategic role of lexical bundles in shaping critical academic discourse, making them especially relevant to the expression of criticality, where precision, stance, and coherence are essential.

Lexical Bundles and Criticality

Research has shown that lexical bundles play distinct functional roles in academic texts, contributing not only to fluency and textual flow but also to the expression of evaluative and interpretive stance. Among the most influential models, Biber et al. (2004) proposed a widely adopted taxonomy that categorises lexical bundles into referential, discourse-organising, and stance bundles. Of particular relevance to criticality are stance bundles, which are further divided into epistemic and attitudinal types. Epistemic bundles comment on the knowledge status of information (e.g., *it can be argued that*), while attitudinal bundles reflect the writer's stance, judgment, or degree of certainty regarding a proposition (e.g., *it is important to, must be considered*).

Building on Biber et al.'s framework, Hyland (2008) introduced an alternative classification based on rhetorical orientation which include research-oriented, text-oriented, and participant-oriented bundles. Especially notable are participant-oriented bundles, which express writer stance and foster reader engagement, helping writers manage the dialogic relationship between themselves and their audience. These bundles play a vital role in constructing a persuasive and critical voice in academic writing.

Subsequent researchers have expanded and refined these frameworks to capture more refined evaluative meanings. For instance, Muslu (2014, 2018) added evaluation as a subcategory to account for writer judgment, while Joharry (2021) introduced importance and emotivity bundles to capture expressions of significance and affect. These refinements underscore the potential of lexical bundles to signal criticality through expressions of obligation, certainty, contrast, and value judgment.

Together, these frameworks provide a robust foundation for analysing how writers, especially student writers, use lexical bundles to express critical engagement in academic discourse. Table 1 below presents a

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summary of established functional classifications of lexical bundles, which serve as the analytical foundation for the present study's examination of criticality in learner literature review texts.

Table 1: Summary of Functional Classifications of Lexical Bundles in Existing Frameworks

Biber et al. (2004)	Hyland (2008)	Muslu (2014, 2018)	Joharry (2021)
Referential Bundles ● Imprecision bundles ● Bundles specifying attributes ● Time/place/text-deixis bundles **Discourse Organizing Bundles** ● Topic introduction bundles ● Topic elaboration/ clarification bundles ● Identification/focus bundles **Stance Bundles** ● Epistemic lexical bundles - Personal - Impersonal ● Attitudinal lexical bundles - Desire - Intention - Obligation - Ability	**Research Oriented Bundles** ● Location ● Procedure ● Quantification ● Description ● Topic **Text Oriented Bundles** ● Transition signals ● Inferential signals ● Causative signals ● Structuring signals ● Framing signals ● Relationship signals ● Objective signals **Participant Oriented Bundles** ● Stance features ● Engagement features	**Discourse Organizer** **Referential Expressions** **Stance Bundles** ● Epistemic stance bundles - Personal (certain, uncertain) - Impersonal (certain, uncertain) ● Attitudinal stance bundles - Desire - Obligation - Ability - Evaluation	**Referential Bundles** ● Identification/focus bundles ● Bundles specifying attributes of following nouns/entities Time/place/text-deixis bundles ● Bundles specifying attributes of preceding nouns/entities ● Time/place/text-deixis bundles ● Imprecision bundles ● Other referential bundles **Discourse Organizing Bundles** ● Topic introduction bundles ● Topic elaboration/ clarification bundles ● Inferential bundles **Stance Bundles** ● Epistemic stance bundles ● Attitudinal/ modality stance bundles - Desire - Obligation - Ability - Importance - Emotivity

To reflect the complexity of critical stance, the present study adopts Biber et al.'s (2004) framework, incorporating relevant subcategories including contrastive bundles to allow a more comprehensive analysis of how lexical bundles contribute to the expression of criticality in academic writing. It also incorporated elements of evaluative and importance from Muslu (2018) and Joharry (2021). The adapted model in analysing lexical bundles is presented in the following table:

Table 2: Categories of Lexical Bundles as Expressions of Criticality Taxonomy

Criticality Bundles Criticality bundles are lexical bundles that reflect the writer's position, careful evaluation, and attitude toward a subject or proposition.	
Epistemic Comments on the knowledge status of the information in the following proposition	**Attitudinal** Expresses attitudes (self or other) towards the actions or events
Personal: Personal epistemic stance bundles are multi-word expressions that explicitly convey the writer's thoughts, beliefs, or feelings as personal viewpoints. Examples: *I think that, in my opinion, as we know*	**Desire**: Desire bundles are multi-word expressions that articulate the writer's personal wishes, preferences, or aspirations regarding actions, events, or outcomes. Examples: *I wish that, I want to, we want to*
Impersonal: Impersonal epistemic stance bundles are multi-word expressions that avoid directly attributing statements to the speaker. Examples: *the fact that, are more likely to*	**Obligation**: Obligation bundles are multi-word expressions used to convey obligations, duties, or directives. Examples: *we have to, you need to*
	Ability: Ability bundles are multi-word expressions that indicate the capability or potential of an individual or group to perform a specific action or task. Examples: *with the help of, us the opportunity to, you can use*
	Importance: Importance bundles are multi-word expressions that convey a sense of significance regarding the information presented. Examples: *important part of our*
	Evaluation – Evaluative bundles are multi-word expressions that convey the writer's assessment, opinion, or judgment on a particular subject or topic. Examples: *is the best way, the advantages of*

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	Contrastive – Contrastive bundles are multi-word expressions that indicate counter-expectancy and highlight contrasts between different elements, often incorporating conjunctions such as '*but*,' '*however*,' and '*nevertheless*'. Examples: *on the other hand, but at the same time*

Gaps in Research on Learner Use of Lexical Bundles for Criticality

While extensive work has been done on lexical bundles and stance expression in academic writing, most studies have focused on expert texts (e.g., Bruce, 2014; Hyland, 2008; Walkova, 2019; Wright, 2019), rhetorical structures (e.g., Gil-Salom & Soler-Monreal, 2014; Kwan, 2006; Rabie & Boraie, 2021), or broad categories of stance (e.g., Biber et al., 2004; Byrd & Coxhead, 2010; Chen & Baker, 2010; Hyland, 2012; Zhang et al., 2021). Comparatively little attention has been paid to how four-word lexical bundles function specifically to express criticality in learner corpora, particularly within the literature review sections of Master's theses.

Moreover, many prior investigations have prioritised textual or rhetorical models (e.g., the CARS model) without incorporating corpus-based approaches that can uncover phraseological patterns across a broader dataset (e.g., Gil-Salom & Soler-Monreal, 2014; Kwan, 2006). Even when learner writing is examined, the focus tends to be on structural or referential functions of bundles (Biber et al., 2004; Chen & Baker, 2010; Hyland, 2012), rather than their specific role in conveying evaluative stance or interpretive judgment.

Nonetheless, a number of studies have begun to explore how students use lexical bundles to convey stance. For instance, Kim and Kessler (2022) found that high-scoring Chinese EFL learners demonstrated greater variety and strategic use of stance bundles in response to academic prompts, suggesting heightened awareness of discourse conventions. Muslu (2018) similarly observed cross-cultural differences in the use of epistemic and attitudinal bundles among Turkish and Japanese EFL learners. In the Malaysian context, Joharry (2021) found that learners often used stance bundles repetitively and tied closely to content, with limited evaluative depth. Whereas Zhang et al. (2021) reported that Chinese Master's students tended to use bundles marked by strong certainty and first-person stance, suggesting a risk of over-assertiveness and limited hedging.

Collectively, these findings point to both the developmental nature and contextual variability of lexical bundle use in learner writing. They highlight key pedagogical concerns, such as learners' limited awareness of collocational norms, over-reliance on rigid formulaic expressions, and difficulties in hedging or modulating claims (Joharry, 2021; Lee & Chen, 2009). These issues can impair clarity, fluency, and the

expression of a critical stance—particularly in literature review writing, where evaluative and interpretive functions are essential.

Despite growing recognition of these challenges, focused research on how student writers use lexical bundles to construct criticality remains limited. This is particularly notable given the central role of the literature review in demonstrating evaluative engagement. To address this gap, the present study adopts a corpus-based approach to investigate the frequency and functions of four-word lexical bundles in a self-compiled learner corpus of literature review chapters from Applied Linguistics Master's theses. By classifying these bundles according to their epistemic and attitudinal functions, the study aims to provide insights into how student writers express criticality in academic discourse. The next section outlines the methodology adopted for corpus compilation and analysis.

Methodology

This study adopts a corpus-based approach to investigate how four-word lexical bundles function as expressions of criticality in literature review chapters written by student writers. The learner corpus, known as the Malaysian Literature Review Corpus (MLRC), was self-compiled to suit the specific objectives of the study. It consists of 90 literature review texts from Applied Linguistics Master's theses authored by Malaysian postgraduate students across three public universities: Universiti Teknologi MARA (UiTM), Universiti Kebangsaan Malaysia (UKM), and Universiti Putra Malaysia (UPM). Table 3 summarises the details about the corpus:

Table 3: Corpus Used for the Study

Malaysian Literature Review Corpus (MLRC)	Number of Texts	Number of Words
Universiti Teknologi MARA	30	260,660
Universiti Kebangsaan Malaysia	30	181,078
Universiti Putra Malaysia	30	254,756
Total Number of Text / Words	**90**	**696,494**

The theses were selected using purposive sampling based on the following criteria: the text must be authored by a Malaysian student, focused on language or applied linguistics, accessible in hard or soft copy form, and written between January 2010 and December 2020. All texts were processed to remove non-linguistic elements such as tables, figures, and equations to ensure consistency and facilitate accurate textual analysis. The final corpus comprises 696,494 words (UiTM: 260,660; UKM: 181,078; UPM: 254,756).

Given the absence of an existing corpus that represents this specific genre and demographic, a self-compiled corpus was necessary. This allowed for stricter control over corpus design and ensured

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alignment with the study's focus on how student writers in a local academic context express criticality. As noted by Granger (2008), a well-constructed smaller corpus—if tailored to specific research questions—can yield valuable insights despite its size. Similar corpus sizes have been used in prior studies such as Zhang et al. (2021) and Chen and Baker (2010), supporting the appropriateness of this approach.

To identify lexical bundles, the corpus was analysed using WordSmith Tools 6.0 (Scott, 2012), a software suite designed for analysing large bodies of text through tools such as *WordList*, *KeyWords*, and *Concord*. The *WordList* tool was used to generate an index of four-word lexical bundles based on set frequency parameters. The software allows users to define parameters for how many words each bundle should contain and how often they must appear. In line with Cortes (2004) and Chen and Baker (2010), this study focused exclusively on four-word lexical bundles, as this length has been shown to be frequent and functionally significant in academic writing.

A cut-off frequency was applied due to the relatively small size of the learner corpus. Following Chen and Baker's (2010) recommendation, a lexical bundle had to occur at least five times and appear in a minimum of five different texts to be retained. This threshold helps eliminate idiosyncratic usage from individual writers and ensures broader relevance within the learner population. Additionally, the tool was configured to stop counting bundles at sentence boundaries, as bundles spanning across two sentences often lack coherence (Scott, 2015).

The identified four-word bundles were then categorised based on their functions using the developed taxonomy (See: Table 2). The analysis focused on epistemic and attitudinal bundles, which were further divided into subcategories as outlined in the earlier section. Personal epistemic bundles included first-person expressions such as *"I think that"*, while impersonal epistemic bundles featured phrases like *"it is possible that"*. Within the attitudinal category, desire bundles expressed the writer's personal wishes, preferences, or aspirations regarding actions, events, or outcomes, as in *"I wish that"*, whereas obligation bundles conveyed duties, directives, or necessity, such as *"you need to"*. Other attitudinal subcategories included ability bundles, which indicate the capability or potential of an individual or group to perform a specific action (e.g., *"you can use"*), and importance bundles, which highlight the significance of the information presented (e.g., *"important part of our"*). Additionally, evaluative bundles conveyed the writer's assessment, opinion, or judgment on a particular subject or topic (e.g., *"is the best way"*), while contrastive bundles signalled counter-expectancy or contrast between elements, often using conjunctions such as *"but"*, *"however"*, or *"nevertheless"*, as seen in *"but at the same time"*.

Following the initial categorisation of four-word lexical bundles into epistemic and attitudinal functions, a more detailed qualitative analysis was carried out to investigate how these bundles functioned as expressions of criticality. Using the Concord function in WordSmith Tools 6.0, concordance lines were generated for each lexical bundle to examine the immediate textual context in which they occurred. This

enabled close reading and functional interpretation of how the bundles were employed by student writers to articulate degrees of certainty, evaluate cited literature, or signal a personal or impersonal stance.

While the taxonomy provided the structural basis for classification, the operationalisation of criticality involved examining how each lexical bundle functioned within its specific syntactic and discourse context. Bundles were only considered to express criticality if they contributed to evaluation, interpretation, stance-taking, or contrast in relation to cited literature or conceptual claims. For instance, *"it is important to"* was only coded under *importance* when it functioned as an evaluative marker, and not when it was used to explain grammatical constructions or appeared as part of illustrative examples that did not fulfil a clearly evaluative role. This interpretive layer ensured that functional categorisation was context-sensitive and aligned with the study's working definition of criticality. The analytical process was guided by functional definitions and examples from Biber et al. (2004), Muslu (2014, 2018), and Joharry (2021), particularly in identifying bundles related to importance, evaluation, and contrastiveness—key elements associated with critical academic engagement.

To ensure accuracy and consistency in classification, a two-stage inter-rater reliability procedure was employed. In the first stage, the taxonomy developed for identifying lexical bundles as expressions of criticality was reviewed by a senior English language lecturer with over fifteen years of experience in academic writing instruction. This expert examined the categories to ensure they were mutually exclusive and exhaustive, validating their definitions and accompanying examples. Following this validation, the finalised taxonomy was used to train a second independent rater. In the second stage, 70 items representing various lexical bundles from both expert and student texts were independently coded by the researcher and the second rater. To assess the level of agreement, Cohen's Kappa statistic was calculated. The results showed a Kappa value 0.782 for the lexical bundle subcategories, indicating substantial agreement. These results confirm a high level of consistency and reliability in the classification process, supporting the validity of the qualitative analysis.

Findings and Discussion

The findings of this study are presented based on the Categories of Lexical Bundles as Expressions of Criticality taxonomy, as outlined in Table 2. Epistemic bundles and attitudinal bundles found MLRC were normalised per million words to ensure consistent interpretation across texts of varying lengths within the learner corpus and to facilitate clearer reporting of lexical bundle usage. This approach also supports potential future comparisons with other corpora and aligns with standard practice in corpus-based research (Biber et al., 2004; Hyland, 2008; Chen & Baker, 2010). Table 4 shows the frequency, normalised frequency and distribution across corpus for epistemic four – word lexical bundles found in MLRC:

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Table 4: Frequency, Normalised Frequency and Distribution Across Corpus for Epistemic Four – Word Lexical Bundles Found in MLRC

	Lexical Bundles	Freq.	Range	Norm'd Freq	Prop (%)
Personal (0)	-				
Impersonal (12)	due to the fact	47	20	67.48	22.22
	are more likely to	38	17	54.56	18.89
	it can be said	26	17	37.33	18.89
	can be said that	24	16	34.46	17.78
	can be seen as	25	14	35.89	15.56
	it is believed that	19	14	27.28	15.56
	the fact that the	18	14	25.84	15.56
	can be considered as	15	14	21.54	15.56
	it is possible to	12	10	17.23	11.11
	more likely to be	12	9	17.23	10.00
	could be said that	11	6	15.79	6.67
	it could be said	11	6	15.79	6.67

The analysis of epistemic four-word lexical bundles revealed a total of 12 impersonal bundles, with no personal epistemic bundles identified in the learner corpus. This suggests that student writers overwhelmingly favoured impersonal expressions when articulating knowledge claims or evaluations. High-frequency bundles such as *"due to the fact"*, *"it can be said"*, and *"it is believed that"* exemplify this trend. These expressions reflect a cautious and detached stance, often associated with hedging or minimising personal involvement in claims. Such bundles were typically used by student writers to interpret or explain existing knowledge, express possibility or capability, present claims, and synthesise key findings, concepts, or patterns in the literature review chapters. The following excerpts illustrate how these linguistic devices and lexical bundles were employed in context.

> From the explanation given, it seems that *it is possible to* learn a language informally and at the same time, the students can enhance on the English skills as well.
>
> MLRC_UKM29

> Furthermore, teachers need to encourage speaking and using the language because it would motivate them to study autonomously and at the same time they would consider different ideas of spoken communication after they read more upon it (López, 2011). *It is believed that* by giving some freedom to the students in learning process, it would help them to be more critical in whatever they do such as they could use the same strategies they have learn and apply it in different situations that they think suitable.
>
> MLRC_UiTM29

> Another study by Leung (2006) investigated the syntactic elements observed in the print advertisements in Hong Kong and Sweden. Based on the results, code-mixing was the most dominant type and noun phrase was the most code-mixed item. The globalizing of the English language is obvious and reflected in print advertisements. *It **can** be said* that English is the most favorable foreign language used in the print media not only in Malaysia, but also in Hong Kong and Sweden.
>
> MLRC_UPM18

By mitigating the certainty of their assertions, student writers make their claims less definitive and, consequently, more acceptable within academic discourse. This finding supports the observations of Gray and Biber (2017) and Wright (2019), who emphasise the function of hedged expressions in framing tentative, non-categorical claims in scholarly texts—a strategy often realised through impersonal lexical bundles. Similarly, Hyland (1998) underscores the centrality of hedging in academic argumentation, highlighting its role in conveying appropriate levels of caution and accuracy in the presentation of knowledge.

The observed preference for impersonal epistemic constructions among student writers may reflect their efforts to conform to disciplinary norms that prioritise objectivity and restraint. Through the use of such bundles, learners hedge their claims, express possibility rather than certainty, and avoid overt self-reference—strategies that suggest an emerging awareness of academic stance-taking. However, the absence of personal epistemic markers (e.g., *"I believe that"*, *"we suggest that"*) may also indicate a degree of hesitancy or underdeveloped confidence in adopting a more explicit authorial voice. Overall, the reliance on impersonal epistemic bundles reveals a cautious and indirect rhetorical style, characteristic of novice academic writers who are still developing their critical voice.

In Table 5, the frequency, normalised frequency and distribution across corpus for attitudinal four – word lexical bundles found in MLRC are summarised:

Table 5: Frequency, Normalised Frequency and Distribution Across Corpus for Attitudinal Four – Word Lexical Bundles Found in MLRC

	Lexical Bundles	Freq.	Range	Norm'd Freq	Prop (%)
Desire (0)	-			0.00	
Obligation (5)	there is a need	22	14	31.59	15.56
	that need to be	19	14	27.28	15.56
	should be taken into	13	10	18.66	11.11
	should be able to	11	8	15.79	8.89
	it needs to be	10	6	14.36	6.67
Ability (23)	to be able to	51	28	73.22	31.11
	can be used to	46	29	66.05	32.22

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	can be seen that	32	16	45.94	17.78
	will be able to	30	17	43.07	18.89
	can be defined as	27	15	38.77	16.67
	that can be used	26	17	37.33	18.89
	have the ability to	22	14	31.59	15.56
	can be seen in	22	12	31.59	13.33
	would be able to	21	13	30.15	14.44
	students are able to	20	10	28.72	11.11
	can be used in	19	15	27.28	16.67
	can be found in	17	12	24.41	13.33
	learners are able to	17	9	24.41	10.00
	it can also be	16	12	22.97	13.33
	they are able to	15	14	21.54	15.56
	can be viewed as	15	11	21.54	12.22
	that can be found	14	9	20.10	10.00
	must be able to	13	7	18.66	7.78
	can also be used	12	11	17.23	12.22
	can be used as	12	11	17.23	12.22
	has the ability to	12	8	17.23	8.89
	can be referred to	11	10	15.79	11.11
	students will be able	10	5	14.36	5.56
Importance (13)	it is important to	68	41	97.63	45.56
	it is important for	28	23	40.20	25.56
	there is a significant	18	12	25.84	13.33
	it is essential to	16	14	22.97	15.56
	a significant role in	14	12	20.10	13.33
	an integral part of	13	12	18.66	13.33
	is very important for	12	11	17.23	12.22
	significant difference in the	12	7	17.23	7.78
	one of the important	11	9	15.79	10.00
	play a significant role	11	8	15.79	8.89
	is important to understand	10	7	14.36	7.78
	is very important in	10	8	14.36	8.89
	it is very important	10	9	14.36	10.00
Evaluation (5)	it is clear that	23	15	33.02	16.67
	it is difficult to	16	15	22.97	16.67
	a positive impact on	10	9	14.36	10.00
	have positive attitudes towards	10	5	14.36	5.56
	is similar to the	10	10	14.36	11.11
Contrastive (2)	on the other hand	209	57	300.07	75.56
	as compared to the	17	13	24.41	14.44

The analysis of attitudinal four-word lexical bundles yielded a total of 48 distinct bundles, which were further categorised into obligation, ability, importance, evaluation, and contrastive functions. Among

these, ability bundles emerged as the most frequent subcategory, with 23 unique instances. High-frequency examples such as *"to be able to"* and *"can be used to"* indicate that student writers frequently relied on expressions of possibility or potential when reviewing existing literature. This finding contrasts with the research of Jalali (2013), who found that *Ability* bundles were the least used in both the expert and student corpora of graduate-level theses and dissertations in the field of applied linguistics.

This pattern suggests a tendency to highlight what could be done or achieved, rather than to make assertive evaluative judgments, a possible reflection of learners' cautious stance or developing confidence in academic argumentation. These ability bundles were typically employed to interpret or explain existing knowledge, suggest possibilities, present claims, and synthesise key findings, concepts, or patterns within the literature review sections. The following excerpts illustrate how these linguistic devices and lexical bundles were used by student writers to construct meaning and express a developing sense of criticality.

> The attention of using mobile applications for learning focused on learning vocabulary and drill on the quiz (Joseph & tither 2009). Drilling helps the students to remember the way to use the language correctly and the learners *would be able to* avoid making the same mistakes during the time of learning. The students' achievement of learning a language using mobile devices differs from each other based on the understanding about the language.
>
> MLRC_UKM29

> They also concluded that the reading component can be a salient predictor of students' success at the tertiary level in the first and sixth semesters due to the Malaysian education system which focuses more on reading. Presumably, students who are competent in reading *would be able to* read better at the tertiary level and thus would manage to score well in their CGPA.
>
> MLRC_UPM30

Obligation bundles, such as *"there is a need"* and *"that need to be"*, appeared frequently in the corpus, indicating a moderate use of directive or necessity-based expressions. These bundles reflect student writers' attempts to convey urgency or justify the need for specific actions, often in the context of proposing further research. In literature review writing, obligation bundles help emphasise shared understanding between writers and readers, thereby enhancing the persuasiveness and acceptability of the writers' arguments. Student writers commonly employed these expressions when evaluating and synthesising existing literature, reinforcing the claims of previous authors, or promoting particular viewpoints. The use of obligation bundles in this way enables learners to highlight the strengths and weaknesses of previous studies, identify research gaps, and establish the relevance or necessity of their own investigations - key features in expressing criticality in literature review writing.

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> Briefly, these studies only focus on Philip's marginalised identity, which is the portrayal of his identity at the beginning of the story and during the Japanese occupation. The changes in Philip's cultural practices and identity after fifty years the Japanese occupation ends have not been thoroughly investigated by scholars. Hence, *there is a need* for this study to address this issue.
>
> MLRC_UPM19

> In this study, they selected eleven internal medical faculty members to view seventeen recorded presentations independently. Results showed that the contents in OCP should be presented in three styles only which are economy, fluency and precision in language. This shows that *there is a need to* use proper language in OCP as it can make communication more effective between teachers and students.
>
> MLRC_UPM20

Importance bundles, such as *"it is important to"* and *"a significant role in"*, were used to highlight the perceived value or relevance of specific concepts, findings, or perspectives. Their presence indicates an awareness of the need to emphasise evaluative meaning, although such expressions were often employed in relatively formulaic ways. A closer analysis of these bundles suggests that student writers use them to strengthen their evaluations in literature review texts by signalling the significance of particular ideas or arguments. Rather than conveying personal attitudes or emotions, these bundles help emphasise the importance of certain reviewed points, thereby contributing to the development of a critical stance. This strategic use of lexical bundles that convey significance plays a key role in shaping the evaluative dimension of student writing.

> After thorough reviews, it can be summarized that *it is important to* know the definition of the term "vocabulary" and to understand its importance to L2 learning. Without the proper acquisition of vocabulary, L2 learners will have difficulties in learning English and unable to practice it in other language competencies such as speaking, writing, reading and listening. Furthermore, it is also important for the learners to understand the importance of vocabulary in second language acquisition.
>
> MLRC_UKM15

> In visual images, the position, size, and composition of the contents of the image play *a significant role in* the meaning making (Liu., J, 2013). Kress and Van Leeuwen (2006) claimed that image and other visual modes can represent objects and their relations in a world outside the representational system, so there are many ideational choices available for visual sign-making in visual communication.
>
> MLRC_UKM8

Evaluation bundles, such as *"it is clear that"* and *"a positive impact on"*, were less frequently used in the corpus, yet they represent more direct attempts by student writers to engage critically with the literature. These bundles allow writers to articulate judgments, signal approval or critique, and draw attention to the implications or outcomes of previous studies. Their presence, albeit limited, suggests that while learners are beginning to adopt a more evaluative stance, they may still be hesitant to fully assert their own interpretations or challenge existing claims. The relatively infrequent use of evaluation bundles may reflect a developing confidence in academic judgment, as students appear more comfortable summarising findings than interrogating them. Nevertheless, when employed, these bundles contribute meaningfully to the expression of criticality by enabling students to identify strengths and weaknesses, expose gaps, and underscore the complexity of the issues discussed in the reviewed literature - a pattern also observed by Azar and Hashim (2019) in their analysis of review genre.

> Looking at the research on apologies in the Malaysian context, *it is clear that* there is a significant lack of research studies on apologies using politeness and naturally occurring data. The lack of focus on apologies using politeness as well as naturally occurring data has prompted the researcher to examine apologies using this type of data with reference to pragmatic politeness strategies practiced.
>
> MLRC_UiTM11

> Although there are many types of needs analysis highlighted by Songhori (2008) in his Jigsaw puzzle, this study will only be focusing on three types of needs analysis; Target Situation Analysis, Present Situation Analysis and Learning Needs Analysis or Strategy Analysis. These types keep the learner in view, for example, what the learner needs to do, what skills they need to have, and how they perceive their own abilities. They are close to the stance taken by this study, which puts the learner at the centre. Whereas types such as genre analysis and discourse analysis focus on the language and structure of the product. However, *it is difficult to* put a clear boundary between types of needs analysis, as there are often overlaps and they are complementary to each other.
>
> MLRC_UPM28

Finally, contrastive bundles, particularly *"on the other hand"* and *"as compared to the"*, played a significant role in helping student writers balance perspectives and introduce alternative viewpoints which are essential features of effective literature review writing. Among these, *"on the other hand"* was the most frequently occurring bundle in the entire corpus, both in raw and normalised frequency, underscoring its importance in learners' attempts to signal contrast and engage with differing perspectives. This finding is in line with previous research by Cortes (2004), Hyland (2008), Byrd and Coxhead (2010), Wright (2019), and Zhang et al. (2021), who identified this bundle as a frequent and significant expression in academic texts.

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However, the use of contrastive bundles in the corpus often reflected straightforward comparisons, with student writers frequently summarising opposing ideas rather than offering in-depth critical evaluations.

> This is the act of switching to a new topic agenda in an attempt to distract the participants away from the confrontational frame. This may have even less face-threatening acts than compromising as both sides' faces are maintained. *On the other hand*, it could completely backfire as Gunther (2007) explains that frame breaks are only successful for a short while.
>
> MLRC_UPM15

> The findings of the study showed that first, in the 60 minutes of speech from both groups of speakers, the native speakers of English used lexical hedges more than the ELF-speaker group. Native speakers used approximately 4.44 lexical hedges per minute whereas ELF-speakers used 3.85 lexical hedges per minute. This shows that Native speakers used more negative politeness strategy *as compared to the* ELF speakers through the use of lexical hedges.
>
> MLRC_UiTM12

In literature review writing, contrastive bundles serve important rhetorical purposes: they allow writers to highlight contradictions or tensions in the literature, evaluate unexpected findings or conflicting evidence, and draw attention to opposing viewpoints. Moreover, these bundles can be strategically used to discuss the strengths and limitations of prior research, identify gaps in the literature, and ultimately justify the rationale for the current study. While their frequent use suggests an awareness of the need to contrast sources, the findings indicate that student writers may still be developing the ability to fully exploit these bundles for deeper critical engagement. Additionally, a high frequency of such bundles may indicate an overreliance on familiar expressions.

Overall, the quantitative data show that student writers employed a range of attitudinal bundles, but with a strong emphasis on potential (ability), importance, and contrast. While this pattern reflects an emerging capacity to engage evaluatively, the limited use of more assertive evaluative bundles suggests that learners may still be developing confidence in articulating stronger critical judgments.

Conclusion

The findings of this study highlight several key patterns in how student writers use four-word lexical bundles to express criticality in literature review writing. The dominance of impersonal epistemic bundles suggests a cautious stance and a clear preference for hedging, reflecting learners' tendency to distance themselves from claims and avoid strong personal assertions. Similarly, the high frequency of ability

bundles indicates that student writers often frame their arguments in terms of potential or capability, rather than making assertive or definitive evaluative statements.

The use of importance and obligation bundles further demonstrates an emerging evaluative stance in learners' writing, although this is often employed in a relatively limited and formulaic manner. Notably, the absence of desire bundles may reflect a reluctance or lack of confidence in expressing strong personal preferences, possibly due to learners' perceptions of what constitutes appropriate academic tone. Conversely, the frequent use of contrastive bundles, particularly *"on the other hand"*, suggests that student writers are beginning to develop a more balanced and dialogic approach to positioning sources and viewpoints, which is an important aspect of criticality.

These findings offer insights into the developmental nature of stance expression in student academic writing. While the MLRC provides valuable insights into Malaysian postgraduate writing practices, it is limited in scope to the field of Applied Linguistics. As such, the findings may not generalise across disciplines or cultural-linguistic contexts. Future research could incorporate cross-cultural corpora or examine novice and expert writing across subject areas to explore how expressions of criticality vary by genre, proficiency level, or academic convention.

This study also offers three key pedagogical implications for academic writing instruction. First, it highlights the importance of explicitly teaching lexical bundles and associated strategies for expressing criticality in literature reviews. Understanding the distinctions between expert and student usage can help instructors target common challenges, particularly in evaluating, synthesising, and positioning sources. Second, the taxonomy developed in this study can inform curriculum design. The identified strategies and linguistic devices may be integrated into research writing modules and adapted into instructional materials that guide students toward more expert-like evaluative practices. Third, the study supports the use of corpus-based approaches in writing instruction. By exposing students to authentic examples of how lexical bundles function in context, educators can raise learners' awareness of evaluative language and stance. Incorporating corpus-informed activities encourages more reflective and critical academic writing.

Overall, the taxonomy and findings provide practical tools for instructors and curriculum developers seeking to enhance students' critical engagement with literature and improve the overall quality of literature review writing.

Author contributions

The content Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing - Original Draft, Project Administration, M.L.M.T.

Validation, Writing - Review & Editing, A.H.A.A.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, M.L.M.T., upon reasonable request.

Conflicts of interest

The authors declare they have no competing interests.

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Piloting a Questionnaire on Affective Factors Influencing Willingness to Communicate in English Among Chinese Undergraduates at a Malaysian University

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Abstract

This paper reports on a pilot study evaluating the clarity, reliability, and feasibility of a questionnaire designed to assess affective factors impacting Chinese undergraduates' Willingness to Communicate (WTC) in English at a Malaysian university. The research sought to understand their relationship with WTC by focusing on self-perceived communication competence (SPCC), communication apprehension (CA), motivation, and attitudes toward English. The questionnaire comprised five constructs covering relevant constructs. First, it seeks to assess the internal consistency, clarity, and contextual suitability of a 5-part questionnaire. Second, it provides preliminary insights into the affective profile of Chinese undergraduates in Malaysia as it relates to English communication. A sample of 45 Chinese undergraduates participated in this study. Results showed acceptable reliability (Cronbach's alpha > .70) and highlighted the questionnaire's suitability for the target population. Participant feedback improved item clarity and cultural relevance. This paper underscores the importance of piloting to validate instruments, especially in diverse educational settings, and shares lessons learned in instrument design and cultural adaptation.

Keywords: *Willingness to Communicate (WTC), self-perceived communication competence (SPCC), communication apprehension, motivation, attitude toward English, Chinese undergraduates, reliability*

Introduction

Background

In the context of international education, English functions not only as a medium of instruction but also as a critical tool for academic engagement, intercultural communication, and social integration (Roshid et al., 2024). As a global lingua franca, English proficiency is increasingly regarded as an essential competency for students pursuing higher education abroad (Roshid et al., 2024). For Chinese undergraduates, mastery of English is viewed as a pathway to global competitiveness, yet their willingness to actively communicate in English remains a persistent challenge, particularly in host countries where English is a second rather than native language (Liu & Huang, 2020; Zhai & Razali, 2022a). Malaysia provides a unique context for investigating these dynamics. As a multilingual nation where English is widely used in higher education, Malaysia attracts a growing number of international students from China, who are drawn by its cultural

proximity, affordability, and academic reputation (Wang & Yang, 2017; Zakaria & Ibrahim, 2022). However, the shift from a teacher-centered, grammar-focused Chinese classroom to Malaysia's interactive, discussion-driven pedagogy poses psychological and cultural adjustments for Chinese students (Ahmad & Yusof, 2017). This transition often manifests in reticence during classroom activities, reluctance to initiate conversation, and limited participation in informal English interactions, issues that are closely tied to underlying affective variables (Peng & Woodrow, 2010; Zhai & Razali, 2022).

Previous studies have emphasised the importance of affective constructs in predicting WTC (Lee & Chen Hsieh, 2019; Wang et al., 2025), but there remains a lack of research that examines these factors collectively within the Chinese undergraduate population in Malaysia. Moreover, existing measurement tools, though well-established, often require cultural adaptation and validation when applied to new contexts (Cruchinho et al., 2024; Idemudia et al., 2025). Therefore, it is imperative to ensure that instruments designed to measure constructs such as SPCC, CA, motivation, and attitude toward English are both reliable and contextually appropriate.

Objectives and Research Questions

This pilot study serves two primary purposes. First, it seeks to assess the internal consistency, clarity, and contextual suitability of a 5-part questionnaire. Second, it provides preliminary insights into the affective profile of Chinese undergraduates in Malaysia as it relates to English communication. The primary research questions guiding this investigation are:

RQ1: To what extent is the questionnaire clear, reliable, and culturally appropriate for Chinese undergraduates studying in Malaysia?

RQ2: What are the levels of self-perceived communication competence (SPCC), communication apprehension (CA), motivation, and attitude toward English among Chinese undergraduates in relation to their willingness to communicate in English?

Literature Review

Context of English Communication Among Chinese Undergraduates in Malaysian Universities

In recent years, Malaysia has become an increasingly popular destination for Chinese undergraduates pursuing higher education (Zakaria & Ibrahim, 2022). English serves as a vital medium of instruction in Malaysian universities, playing a crucial role in academic engagement, intercultural communication, and social integration (Fang & Sah, 2023). However, Chinese undergraduates often face challenges in adapting to the interactive and discussion-driven teaching methods in Malaysian universities, which differ significantly from the teacher-centered, grammar-focused approach in China (Zhai & Razali, 2022b). This

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transition can lead to issues such as reticence during classroom activities, reluctance to initiate conversations, and limited participation in informal English interactions (Zhai & Razali, 2022b). These behaviors are closely tied to affective factors that influence their willingness to communicate in English.

Theoretical Frameworks and Constructs

Willingness to Communicate (WTC)

The concept of Willingness to Communicate (WTC) has gained considerable attention in the field of second language acquisition (SLA) as a key predictor of learners' actual use of the target language (Kirkpatrick et al., 2024). MacIntyre et al. (1998) define WTC as "a readiness to enter into discourse at a particular time with a specific person or persons, using a L2." Unlike linguistic competence or general motivation, WTC focuses on a learner's situational readiness to communicate, which may vary moment to moment depending on psychological, interpersonal, and contextual factors (Peng, 2025; Zarrinabadi et al., 2019).

The heuristic model proposed by MacIntyre and colleagues outlines a six-layered structure (shown Figure 1), with stable traits such as personality and motivation at the base, and more immediate, situational variables like state anxiety and desire to communicate at the top (MacIntyre et al., 1998; MacIntyre & Wang, 2021). This model positions WTC as the final step before actual speech, highlighting the complexity of language use beyond grammar and vocabulary. The model has since been adapted in various contexts but remains underexplored among Chinese learners studying in English as a Medium of Instruction (EMI) environments, particularly in Southeast Asia. Research by Research by Subekti (2020) and Muftah (2023) has shown that factors like self-perceived communication competence and communication anxiety significantly influence WTC in different educational settings.

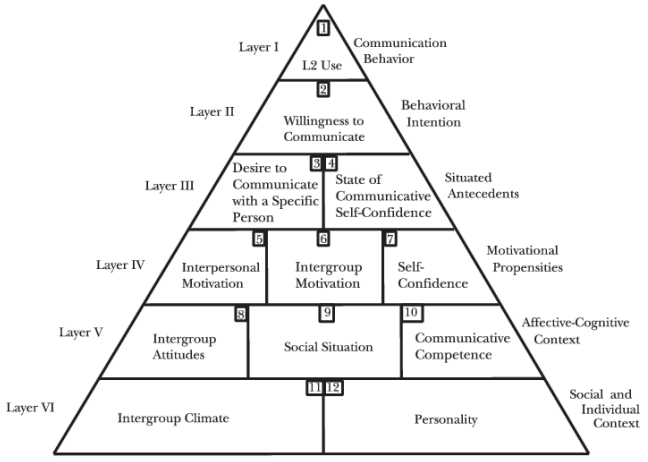

Figure 1: MacIntyre et al.'s (1998) heuristic model of variables influencing WTC

Complementing the heuristic model, the study applied Bandura's (2001) Social Cognitive Theory (SCT) as an explanatory lens for understanding how learners develop communicative confidence. SCT posits that self-efficacy—defined as an individual's belief in their capability to perform specific tasks—is a key determinant of behavior. In the context of language learning, self-efficacy influences learners' willingness to engage in communicative activities. Self-efficacy is shaped through enactive mastery experiences, vicarious experiences (e.g., observing peer modeling), and social feedback. Learners with high self-efficacy are more likely to take risks, persist in communication, and resist anxiety. Graham (2022) demonstrates that students who benefit from mastery experiences and affirming social feedback exhibit enhanced willingness to communicate. Bandura (2001) also emphasises the role of human agency in shaping behavior, highlighting the interplay between personal, behavioral, and environmental factors in the development of self-efficacy.

These theoretical frameworks together provide a comprehensive lens for examining the affective predictors of WTC among Chinese undergraduates in Malaysian EMI settings. The heuristic model offers a structured approach to understanding the multiple layers of influence on WTC (MacIntyre & Wang, 2021), while SCT provides insights into the psychological mechanisms underlying learners' communicative confidence and behavior (Graham, 2022). Combining these frameworks allows for a nuanced exploration of how factors such as self-perceived communication competence, communication apprehension, motivation, and attitudes toward English interact to shape Chinese students' willingness to communicate in English in a Malaysian university context.

Self-Perceived Communication Competence (SPCC)

SPCC refers to a learner's self-assessed ability to communicate effectively in a second language. MacIntyre and Charos (1996) emphasise that SPCC is often a more accurate predictor of communication behavior than objective proficiency. In Chinese educational contexts, where language instruction tends to focus on reading and writing skills for examination purposes, students may develop strong receptive skills but still report low SPCC, especially in speaking (Xing & Bolden, 2019).

Nadeem et al. (2023) found a significant positive correlation between SPCC and WTC, suggesting that learners with higher self-confidence in their communicative ability are more willing to initiate conversations. This is particularly relevant for Chinese students in Malaysia, who must adjust to an educational system that places a high premium on spoken interaction and collaborative learning tasks. Since the focus of this paper is to examine the reliability of the used questionnaire, hence SPCC was operationalised through 15 items adapted from MacIntyre and Charos (1996), covering public speaking, meetings, and dyadic interactions.

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Communication Apprehension (CA)

Communication Apprehension (CA), as defined by McCroskey (1970), is the fear or anxiety associated with real or anticipated communication. It is one of the most frequently cited affective barriers to WTC. Learners with high levels of CA are often reluctant to participate in oral activities, regardless of their language ability. In Alrabai's 2022 study, students with high communication apprehension (CA) exhibited significantly lower willingness to communicate (WTC) and were less likely to engage in peer-based speaking tasks. Yu and Wong's 2025 research indicated that Chinese students, influenced by Confucian educational values emphasising modesty and error avoidance, are highly susceptible to CA in unfamiliar and interactive classroom settings. Pragash et al.'s 2020 study further confirmed that CA is a strong negative predictor of classroom participation and peer communication in ESL and EMI environments. In the current study, CA was measured through 25 items adapted from the PRCA-24 scale, covering group communication, formal meetings, dyadic interactions, and public speaking.

Motivation and Attitudes toward English

Motivation plays a central role in SLA, especially in determining the learner's persistence, effort, and communicative behavior. Dörnyei's (2009) L2 Motivational Self System differentiates between integrative motivation (desire to connect with the target culture) and instrumental motivation (goal-oriented drive, such as passing exams and improving employability). Both forms of motivation have been positively associated with WTC (Yashima, 2002; Ebn-Abbasi et al., 2022).

Attitude toward English, though closely related to motivation, is treated as a distinct construct influencing learners' emotional and behavioral orientation toward the language. Learners who perceive English as a valuable and empowering tool are more inclined to use it spontaneously and persistently. Zhao et al., (2024) observed that positive attitudes not only foster WTC but also reduce anxiety and enhance communicative persistence, particularly in intercultural group interactions.

Motivation was operationalised through 26 items adapted from Dörnyei's (2009) L2 Motivational Self System, covering ideal L2 self, ought-to L2 self, and instrumentality. Attitude toward English, though closely related to motivation, is treated as a distinct construct influencing learners' emotional and behavioral orientation toward the language. Attitude toward English was operationalised through 14 items adapted from previous studies, covering attitudes toward learning English and attitudes toward the L2 community.

Research Gap in the Malaysian EMI Context

While WTC and its affective factors have been widely studied in EFL contexts, there remains a notable gap in research focusing on Chinese students studying in Malaysian EMI institutions. Malaysia presents a unique

multilingual and multicultural context, where Chinese undergraduates are immersed in English-dominant academic practices while navigating diverse peer interactions.

Zhai and Razali (2022a) reported that many Chinese students in Malaysia experience difficulty adapting to communicative teaching methods, leading to reduced WTC despite sufficient language knowledge. Likewise, Zakaria and Ibrahim (2022) observed that classroom participation and peer engagement are significantly lower among Chinese international students than local peers, often due to affective barriers rather than linguistic deficiencies. Therefore, validating a culturally responsive instrument to measure affective predictors of WTC in this population is both timely and necessary.

Methodology

Research Design

This study adopted a quantitative, instrument-validation pilot design. The primary objective was to test the reliability and clarity of a questionnaire developed to measure affective factors influencing Chinese undergraduates' Willingness to Communicate (WTC) in English. A pilot study is a standard methodological step in large-scale research involving self-report instruments, as it allows for the identification of linguistic, structural, or cultural inconsistencies in survey items (Sundram & Romli, 2023). This pilot study aims to assess the internal consistency, clarity, and contextual suitability of a 5-part questionnaire. The design was deemed appropriate given the need to adapt previously validated constructs to a new cultural and educational context, namely Chinese students studying in a Malaysian EMI environment.

Instrument

The study utilised an online survey instrument comprising five validated scales: the Willingness to Communicate in English Scale, Self-Perceived Communication Competence Scale, Personal Report of Communication Apprehension (PRCA-24), Motivation Scale, and Attitude Toward the English Language Scale. Table 1 presents the total number of items for each variable. All items were presented on a 5-point Likert scale ranging from 1 to 5.

Table 1: The total numbers of each variable item

Section	Subconstruct	Number of Items	Total Items
Section 1	Student Background Information	4	4
Section 2	**Willingness to Communicate in English**		
	Public Speaking	4	**20**
	Meetings	4	
	Group Discussion	4	
	One-on-One Conversations	4	

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	Online Communication	4	
Section 3	**Affective Factors**		**80**
Section 3.1	Self-Perceived Communication Competence		
	Public Speaking	3	15
	Large Meetings	3	
	Small Groups	3	
	Dyad (One-on-One)	3	
	Online Communication	3	
Section 3.2	Communication Apprehension		
	Group	6	25
	Formal Meeting	6	
	Dyadic	6	
	Public	7	
Section 3.3	Motivation		
	Ideal L2 Self	5	26
	Ought-to L2 Self	8	
	Instrumentality (Promotion)	8	
	Instrumentality (Prevention)	5	
Section 3.4	Attitudes Toward English		
	Attitudes to Learning English	6	14
	Attitudes to L2 Community	8	

Participants

The study recruited 51 Chinese undergraduates from Malaysian private universities, selected for their demographic similarity to the target population. This allowed for a preliminary assessment of the survey's validity and reliability.

Table 2: Sample Size Cleaning Process

Stage	Sample Size	Criteria
Initial Collection	51	Automatically recorded via Google Forms
Exclusion of First-Semester Students	6	Screening criteria: "Current enrolled semester" ≥ 2
Valid Sample	45	Retained for pilot test analysis

Data Collection Procedure

The data for this study were collected through an online questionnaire administered via Google Forms. The following is a detailed account of the data collection process:

Participants Recruitment: Participants were recruited from two private universities (Sunway University and INTI International University). Invitations to participate in the study were sent out via email, with a total of 51 Chinese undergraduates invited. The invitation email included a brief introduction to the study's purpose and a link to the online questionnaire

Consent and Information: Prior to accessing the survey, participants were provided with an information sheet outlining the study's objectives, the voluntary nature of their participation, and their right to withdraw at any time. An electronic consent form was also presented, and only those who clicked "Agree" could proceed to the survey. Those who selected "Disagree" were redirected to a termination page with a message of thanks, and their status was recorded as "declined."

Survey Administration: The online survey was designed to take approximately 15 minutes to complete. Participants were assured of the confidentiality of their responses, and the survey was programmed to validate real-time responses through Google Forms' "required question" feature, minimising missing data.

Data Validation: Throughout the data collection period, the researchers monitored the incoming responses to ensure data quality. The stringent recruitment criteria prolonged the data collection timeline due to the limited pool of eligible Chinese undergraduates in private universities. To address potential careless or random answering, the main study will incorporate real-time validation algorithms and attention-check questions.

Completion and Follow-up: Upon completion of the survey, participants were thanked for their time and contribution to the study. No incentives were offered for participation, as the focus was on obtaining genuine and unbiased responses from the participants.

This comprehensive procedure ensured that the data collected was both valid and reliable, providing a solid foundation for the subsequent analysis and interpretation of the findings.

Data Analysis Procedure

The collected data were coded and analyzed using SPSS version 27. Internal consistency reliability was assessed for each construct using Cronbach's alpha. Following the guideline of Nunnally and Bernstein (1994), an alpha value of 0.70 or higher was considered acceptable. The results indicated good to excellent internal consistency across the subscales, with Cronbach's alpha values ranging from 0.76 to 0.97. Specifically, the Willingness to Communicate scale achieved a Cronbach's alpha of 0.96, the Affective Factors composite scale achieved 0.91, SPCC achieved 0.95, Communication Apprehension achieved 0.76, Motivation achieved 0.96, and Attitudes Toward English achieved 0.97. These results suggest that the questionnaire demonstrated strong reliability across all subscales, with most showing good to excellent internal consistency and only Communication Apprehension having an acceptable level of reliability (see Table 3).

Table 3: Pilot Test Cronbach's alpha

Scale/Subscale	Number of Items	Cronbach's α	Interpretation

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Willingness to communicate	20	.96	Excellent
Affective Factors	80	.91	Excellent
SPCC	15	.95	Excellent
Communication Apprehension	25	.76	Acceptable
Motivation	26	.96	Excellent
Attitudes Toward English	14	.97	Excellent

Findings

This section presents the results of the pilot study in direct response to the research questions:

RQ1: To what extent is the questionnaire clear, reliable, and culturally appropriate for Chinese undergraduates studying in Malaysia?

The pilot study confirmed the questionnaire's internal consistency (all $\alpha > .90$), and participant feedback supported its cultural clarity. This addresses RQ2: To what extent is the questionnaire clear, reliable, and culturally appropriate for Chinese undergraduates studying in Malaysia? The results indicate that the questionnaire is clear, reliable, and culturally appropriate for the target population.

Inferential analysis was not conducted as this was an instrument validation study. Cronbach's alpha values above 0.90 indicate strong reliability and support the quality of the instrument for future analysis.

RQ2: What are the levels of self-perceived communication competence (SPCC), communication apprehension (CA), motivation, and attitude toward English among Chinese undergraduates in relation to their willingness to communicate in English?

The questionnaire employed different Likert scales for different constructs, defined as shown in Table 4.

Table 4: Measurement Scales Used in This Study

Variable	Scale	Anchors
Willingness to Communicate (WTC)	5-point Likert scale	1 = Never 2 = Rarely 3 = Undecided 4 = Often 5 = Always
Self-Perceived Communication Competence (SPCC)	5-point Likert scale	1 = Completely Incompetent 2 = Below Average 3 = Average 4 = Above Average 5 = Completely Competent
Communication Apprehension (CA)	5-point Likert scale	1 = Strongly agree 2 = Agree

		3 = Undecided 4 = Disagree 5 = Strongly Disagree
Motivation	5-point Likert scale	1 = Strongly Disagree 2 = Disagree 3 = Undecided 4 = Agree 5 = Strongly Agree
Attitudes toward English	5-point Likert scale	1 = Strongly Disagree 2 = Disagree 3 = Undecided 4 = Agree 5 = Strongly Agree

Descriptive statistics were computed to evaluate the levels of each affective construct and WTC among participants, based on the defined Likert scales (as shown in Table 55).

Table 5: Descriptive Statistics of Affective Constructs and WTC

Variables	Number of Items	Mean	SD
Willingness to communicate	20	3.66	.97
Affective Factors	**80**	**3.50**	**1.20**
SPCC	15	3.73	.89
Communication Apprehension	25	3.07	1.22
Motivation	26	3.51	1.31
Attitudes Toward English	14	3.70	1.37

Willingness to Communicate: Participants showed a moderate to high willingness to communicate (M = 3.66, SD = 0.97), indicating that, on average, they are somewhat willing to engage in English communication. The moderate standard deviation suggests variability in willingness among participants.

Affective Factors: The overall score for affective factors (M = 3.50, SD = 1.20) suggests a moderate to high level of influence from these factors. This indicates that emotions, attitudes, and motivations related to communication play a significant role in participants' willingness to communicate.

Self-Perceived Communication Competence (SPCC): Participants reported a relatively high level of self-perceived communication competence (M = 3.73, SD = 0.89). This indicates that most participants feel moderately to highly competent in their ability to communicate in English, which is a positive sign for their willingness to engage in communication.

Communication Apprehension: A moderate level of communication apprehension was reported (M = 3.07, SD = 1.22). This suggests that some participants experience anxiety or fear regarding communication, which may impact their willingness to communicate in certain situations.

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Motivation: Motivation levels were moderate to high (M = 3.51, SD = 1.31). This indicates that participants have a relatively strong drive to engage in English communication, though there is still room for enhancing their motivational levels.

Attitudes Toward English: Participants held generally positive attitudes toward English (M = 3.70, SD = 1.37). The relatively large standard deviation shows a wide range of attitudes, with some participants having more positive attitudes and others having more negative ones.

In summary, participants showed a moderate to high willingness to communicate (M = 3.66, SD = 0.97), indicating that, on average, they are somewhat willing to engage in English communication. The overall score for affective factors (M = 3.50, SD = 1.20) suggests a moderate to high level of influence from these factors. Participants reported a relatively high level of self-perceived communication competence (M = 3.73, SD = 0.89). A moderate level of communication apprehension was reported (M = 3.07, SD = 1.22). Motivation levels were moderate to high (M = 3.51, SD = 1.31). Participants held generally positive attitudes toward English (M = 3.70, SD = 1.37). The relatively large standard deviation for some variables indicates a wide range of responses, with some participants scoring higher and others lower on certain constructs.

Inferential analysis was not conducted as this was an instrument validation study. Cronbach's alpha values above 0.90 indicate strong reliability and support the quality of the instrument for future analysis.

The findings reveal that Chinese undergraduates in Malaysian universities generally exhibit a moderate to high willingness to communicate in English. The overall score for affective factors suggests a moderate to high level of influence from these factors. Participants reported a relatively high level of self-perceived communication competence and generally positive attitudes toward English. However, a moderate level of communication apprehension was reported, and motivation levels were moderate to high. These findings are consistent with the theoretical frameworks and constructs discussed in the literature review, highlighting the importance of considering the interplay of these factors in the main study.

Implications for the Main Study

The pilot test confirmed the reliability and practicality of the research instruments. The strong internal consistency of all subscales and the acceptable distributional properties support the use of these instruments in the main study. However, the pilot sample size (N = 45) was relatively small, which may limit the generalisability of the findings. The main study will address this limitation by using a larger sample size to meet the statistical power requirements for PLS-SEM. Additionally, the main study will incorporate attention-check items and real-time validation mechanisms to enhance data integrity.

The pilot study also provided preliminary insights into the levels of the affective factors among the participants. The results indicated that participants generally exhibited a moderate to high willingness to

communicate in English. The overall score for affective factors suggests a moderate to high level of influence from these factors. Participants reported a relatively high level of self-perceived communication competence and generally positive attitudes toward English. However, a moderate level of communication apprehension was reported, and motivation levels were moderate to high. These findings highlight the importance of considering the interplay of these factors in the main study.

In summary, the pilot study laid a solid foundation for the main research by validating the instruments and providing initial insights into the affective factors related to WTC among Chinese undergraduates in Malaysia. The main study will build on these findings, using a larger and more representative sample to explore the relationships between these factors and WTC in greater depth.

Conclusion

This pilot study set out to evaluate the reliability, clarity, and contextual relevance of a questionnaire designed to assess affective factors influencing Willingness to Communicate (WTC) in English among Chinese undergraduate students at a Malaysian university. The study focused on four key constructs: Self-Perceived Communication Competence (SPCC), Communication Apprehension (CA), motivation, and attitude toward English, all of which are widely recognised as affective factors of L2 communication behavior.

The findings from 45 participants demonstrated that the adapted instrument has satisfactory internal consistency across all subscales, with Cronbach's alpha values exceeding the recommended threshold of 0.70. This indicates that the questionnaire is a reliable tool for measuring the intended constructs. Descriptive data further revealed that students reported generally high levels of SPCC and motivation, positive attitudes toward English, and moderate levels of CA. These trends were consistent with theoretical expectations and prior empirical findings, indicating the potential relevance of these constructs in shaping WTC among international learners in EMI environments.

In summary, the pilot study has successfully met its objectives and established a foundation for the main research. The validated instrument is now ready for broader administration, where inferential analysis can be conducted to examine the relationships between affective factors and WTC. The main study will use a larger sample size to meet the statistical power requirements for PLS-SEM and will incorporate attention-check items and real-time validation mechanisms to enhance data integrity.

Author contributions

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Study conception and design: All authors; Data collection: Lyu Yunhe.; Analysis and interpretation of results: Lyu Yunhe; Writing - draft preparation: Lyu Yunhe; Writing – Reviewing and editing: All authors reviewed the results and approved the final version of the manuscript.

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Data availability statement

The data supporting this study's findings are available on request from the corresponding author.

Conflicts of interest

The authors have no conflicts of interest to declare.

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Device Preference and Its Influence on Online Reading Strategies and Reading Struggles: A Quantitative Study Among Malaysian Undergraduates

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Abstract

This quantitative study investigates how Malaysian undergraduates' preference for physical versus online reading materials relates to their online reading struggles and use of reading strategies. Using survey data from 200 students, the study examined group differences in reported reading struggles and in the use of global, problem-solving, and support strategies. Findings showed that students preferring print materials experienced significantly greater online reading challenges (moderate effect size) and relied more on support strategies, whereas students preferring digital texts more frequently used problem-solving strategies. Correlation analyses indicated that reading struggles were associated with different strategic responses depending on preference group, although differences in correlation strength were not statistically significant. These results suggest that reading preferences shape not only perceived difficulties but also the ways students adapt during online academic reading. The study highlights the need for tailored instructional support, especially within Malaysian ESL contexts, and recommends further mixed-methods research to deepen understanding of students' online reading behaviours.

Keywords: *Online reading struggles, Reading strategies, Material preference, Malaysian undergraduates, Digital literacy, ESL learners*

Introduction

Background of Study

The integration of digital technologies has profoundly reshaped academic reading practices in higher education, particularly in the post-pandemic era. Malaysian undergraduates now rely heavily on digital resources such as e-books, journal articles, and online databases for their academic work (Rahmat et al., 2022). While these digital materials offer clear benefits such as greater accessibility and immediacy, there remain concerns about students' ability to fully comprehend online texts, especially when compared to traditional print formats (Mangen, Walgermo, & Brønnick, 2013; Delgado et al., 2018).

Research suggests that reading printed texts typically involves linear, sequential processing, which fosters deeper cognitive engagement, stronger comprehension, and better recall (Mangen et al., 2013; Delgado et al., 2018). By contrast, online reading often follows a non-linear and fragmented pattern, shaped by features such as hyperlinks, scrolling, and multimedia elements. These features can disrupt sustained attention, increase cognitive load, and ultimately reduce comprehension (Coiro, 2011; Sandberg, 2011). This distinction has important implications for students who need to navigate dense academic texts that demand critical analysis and synthesis.

Despite widespread digitalisation in Malaysian universities, many students still prefer printed materials, citing advantages like reduced eye strain, better concentration, and a clearer grasp of complex content (Wong, 2018; Rahmat et al., 2022). This tension between institutional moves toward digitalisation and students' continuing preference for print raises important questions, particularly for ESL learners, who also face added challenges related to language and vocabulary (Singh et al., 2023).

To make sense of online texts, students draw on a variety of reading strategies. According to Amer et al. (2010), these strategies fall into three categories:

- **Global strategies**, such as setting reading goals, previewing content, and summarising key ideas;
- **Problem-solving strategies**, including rereading, slowing down, or visualising material;
- **Support strategies**, like using dictionaries, translating terms, or taking notes.

Previous research has found that students who are more comfortable with digital materials often rely more heavily on global and problem-solving strategies, which require metacognitive awareness and active adaptation (Amer et al., 2010; Sandberg, 2011). Conversely, those who prefer print may lean more on support strategies, often as a way to compensate for difficulties they face when reading digitally (Rahmat et al., 2022).

Challenges unique to online reading—such as frequent distractions from hyperlinks, screen fatigue, and cognitive overload from non-linear navigation—can make comprehension even harder (Hooper & Herath, 2014; Coiro, 2011). These issues may be amplified for ESL learners, who also contend with complex academic language and less familiarity with digital texts (Singh et al., 2023; Rahmat et al., 2022).

Students' preference for physical versus digital materials seems to shape not only how much they struggle with online reading but also the strategies they choose (Amer et al., 2010). Yet, relatively few studies have systematically investigated whether reading preference moderates these relationships, especially within the Malaysian ESL context.

While prior research has examined reading struggles and strategy use separately, limited work has looked at how preference interacts with these factors in a single framework, particularly among Malaysian ESL undergraduates. Specifically, there is little evidence on whether preference is linked to higher reported struggles, distinctive patterns of strategy use, and whether these associations differ by preference group.

To address this gap, the present study explores:

1. Whether preference for physical versus online materials is associated with differences in online reading struggles;
2. How preference relates to the use of global, problem-solving, and support reading strategies;
3. Whether the relationship between reading struggles and strategy use differs across preference groups.

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Problem Statement

The widespread development of online reading in higher education can bring merits and challenges to student learning. With online materials being perhaps more flexible and more available, students continue to report problems with maintaining attention, carrying on with non-linear text and reading closely (Sandberg, 2011; Coiro, 2011). These difficulties were exacerbated by the naturally distracting features of digital media, which offer readers notifications, hyperlinks, and the temptations of multitasking (Hooper & Herath, 2014). Thus, while online reading is essential for academic success, it is also a significant source of cognitive exhaustion for many students.

In addition to the technological challenges of reading online, student preference for format also affects reading experiences to a great extent. According to studies such as Mangen et al. (2013) and Wong (2018), many students prefer printed reading materials because it is easier to concentrate, to comprehend, and to avoid eyestrain. This preference for print-learning materials could become a handicap when students need to engage with academic content on the Web. Students that rely on print may have a harder time developing the necessary flexibility to follow the disjointed and changing format of an online text, an experience that can cause them to be less able to understand and more frustrated.

Furthermore, the methods that students use while reading online are essential factors for achieving success. Amer et al. (2010) emphasise that strategic reading involving planning, problem-solving, and external support mechanisms can significantly mitigate comprehension difficulties. However, the use and effectiveness of these strategies may differ based on students' comfort with digital reading. Those more comfortable with online materials may naturally apply problem-solving and global strategies, whereas print-preferring students may rely more heavily on support strategies, such as translation or extensive note-taking (Rahmat et al., 2022).

Despite the critical role of reading strategies, much of the existing research has focused broadly on reading difficulties without systematically investigating whether students' material preferences moderate these experiences (Abdul Rahim et al., 2023). Particularly in the Malaysian context, where digital adoption is high but traditional reading habits remain strong (Mustafa, 2018), there is a need to explore how preference influences digital reading struggles and strategic behaviours. Furthermore, Malaysian students often engage with academic texts in a second language (English), adding layer of complexity to online reading comprehension (Singh et al., 2023).

Without a clear understanding of how reading preferences interact with online reading struggles and strategy use, educators risk developing one-size-fits-all interventions that fail to address the diverse needs of learners. Tailored strategies that account for individual preferences could lead to better academic outcomes, higher engagement, and reduced reading anxiety. Hence, this study seeks to investigate the relationship

between Malaysian undergraduates' reading material preferences, their online reading struggles, and their use of reading strategies.

Research Objectives

This study seeks to explore the relationship between undergraduate students' reading material preferences (physical vs. online) and their experiences of online academic reading. Specifically, the objectives of this research are:

1. To determine whether there is a significant difference in online reading struggles between students who prefer physical reading materials and those who prefer online materials.
2. To examine how reading material preference influences the use of global, problem-solving, and support reading strategies during online academic reading.
3. To investigate the relationship between online reading struggles and the use of reading strategies (global, problem-solving, and support) among students with different reading material preferences.

Research Questions

In alignment with the objectives, the study addresses the following research questions:

1. Is there a significant difference in the level of online reading struggles between students who prefer physical reading materials and those who prefer online materials?
2. How does reading material preference affect students' use of:
    a) Global reading strategies,
    b) Problem-solving reading strategies
    c) Support reading strategies during online academic reading?
3. What is the relationship between online reading struggles and the use of reading strategies (global, problem-solving, and support) within each preference group (physical vs. online)?

Literature Review

Device Preference and Its Impact on Reading Comprehension

The preference for physical versus digital reading materials has been the subject of numerous studies. Research has shown that students who prefer physical reading materials tend to report better comprehension, particularly when dealing with academic texts that require deep understanding (Mangen, Walgermo, & Brønnick, 2013). This preference is thought to be due to the linear and sustained nature of print reading, which allows for better cognitive engagement and retention (Delgado et al., 2018).

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A meta-analysis conducted by Delgado et al. (2018) revealed that reading on paper is linked to improved comprehension, particularly for activities that demand extensive cognitive processing. Conversely, digital reading may present greater difficulties because of distractions and the disjointed nature of online materials (Sandberg, 2011). Coiro (2011) indicates that the hyperlinked and multimedia-filled characteristics of online texts hinder concentration, resulting in reduced understanding. This indicates that the devices chosen by students could greatly affect their engagement with and comprehension of academic content.

Nonetheless, digital reading offers benefits like accessibility and convenience. Research conducted by Rahmat et al. (2022) indicates that Malaysian university students are progressively employing digital formats for their academic work, emphasising the transition to digital media in higher education. Although digital reading presents cognitive difficulties, its ease of use is leading to increased adoption.

Online Reading Strategies

Effective reading techniques are essential for tackling the difficulties of digital reading. Amer et al. (2010) recognised three primary types of strategies that learners employ when interacting with online texts: global strategies, problem-solving strategies, and support strategies. Global strategies encompass establishing reading objectives and preparing before reading, while problem-solving techniques include revisiting challenging passages, and support methods involve utilising external resources like dictionaries or note-taking tools.

Employing global and problem-solving strategies is especially vital in online reading, as non-linear and multimedia-heavy material can interfere with understanding. Sandberg (2011) highlights that establishing precise reading goals and actively interacting with material can improve understanding, while techniques for problem-solving, like reviewing challenging parts, can assist students in overcoming reading challenges. Learners who feel more at ease with digital texts generally use these strategies more efficiently than those who favour printed resources (Amer et al., 2010).

Conversely, students are in favour of physical texts might depend more on support techniques, like thorough note-taking or utilising translation resources. Such strategies are frequently used when learners encounter challenges with navigation or understanding in digital settings (Rahmat et al., 2022). Reading strategy is important to counterbalance the challenges of reading on screen. Amer et al. (2010) identified three main categories of strategies used by learners during online reading: global strategies, problem-solving strategies and support strategies. Reading strategies are considered to incorporate global (e.g., setting a purpose and planning reading before reading), problem-solving (e.g., rereading difficult passages), and support strategies (e.g., using dictionaries or taking notes) (RAND Reading Study Group, 2002).

On the one hand, physical text support according to students could rely more on strategies such as very detailed notes, or working with dictionaries. These strategies are often employed when students have trouble navigating or comprehending digital environments (Rahmat et al., 2022).

Reading Struggles in Digital Environment

Challenges in reading within online learning contexts are thoroughly recorded, as numerous students face obstacles resulting from the disjointed and non-sequential characteristics of digital materials. Sandberg (2011) contends that online reading is frequently interrupted by distractions like hyperlinks, multimedia components, and notifications, which complicate students' ability to stay focused. Moreover, learners might struggle to connect thoroughly with content presented in digital formats because of cognitive overload (Coiro, 2011).

These challenges are intensified for ESL (English as a Second Language) learners, who may already struggle with understanding the language and its vocabulary. Rahmat et al. (2022) discovered that Malaysian undergraduates, especially ESL students, face greater challenges with online texts compared to printed materials, reporting difficulties in comprehending intricate academic vocabulary and adhering to the organisation of digital content.

In addition, digital gadgets may cause cognitive stress. Frequent use of digital screens has been demonstrated to cause eye strain, which may subsequently decrease reading effectiveness (Hooper & Herath, 2014). These elements add to the increasing worry regarding how device choice affects students' online reading experiences and their capability to tackle reading difficulties.

The Role of Device Preference in Strategy Use

It is also claimed that the choice of reading device heavily influences the reading strategy when students are reading academic texts online. Those who prefer paper and pencil are prone to use support strategies such as using dictionaries and taking extensive notes whereas digital-based material users are prone to using global and problem-solving strategies (Amer et al., 2010). Comfort with digital reading formats affects how successfully students deal with online texts and apply reading strategies.

Amer et al. (2010) argue that familiarity with digital text materials makes it easier for students to utilise a variety of reading strategies (e.g., previewing, goal setting, re-reading) more readily in response to the demands of online reading. However, students who are less accustomed to learning with digital materials might struggle to organise their interaction with the material in an organised manner and may resort to more passive strategies, like translation or searching for definitions (Rahmat et al., 2022).

Considering the importance of reading strategies for improving the reading experience online, interventions in education can take into account the device preference of the students and provide reading

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strategies tailored to the device. For physical readers, such support could include training in specific strategies, whereas for online readers, interventions could concentrate on digital literacy skills.

In summary, while prior research has identified the importance of reading strategies and recognised the impact of students' preference for physical versus digital materials, few studies have systematically examined whether this preference moderates the relationship between online reading struggles and strategy use, particularly in the Malaysian ESL undergraduate context. Addressing this gap, the present study investigates whether reading preference is associated with differences in perceived online reading struggles, patterns of strategy use, and the strength of correlations between struggles and strategies. This focus aims to provide a more nuanced understanding of digital reading behaviours and inform targeted instructional interventions.

Conceptual Framework

This study is grounded in a conceptual framework that positions reading material preference whether a student prefers physical texts or online materials as a key factor influencing two interrelated outcomes in online academic reading: (1) the experience of reading struggles, and (2) the use of reading strategies. Adapted from the models developed by Amer, Al Barwani, and Ibrahim (2010), and expanded by Rahmat et al. (2022), the model incorporates constructs central to digital reading performance in undergraduate students.

Reading material preference is hypothesised to shape how students engage with online texts. Students who prefer reading physical materials may struggle more than others when required to switch to digital reading spaces, which are frequently non-linear navigable, involve multimedia aspects and are associated with screen-based fatigue (Mangen, Walgermo, & Brønnick, 2013; Delgado et al., 2018). This bias should also affect the intensity of reading difficulties such as comprehension, attention and cognitive overload.

Simultaneously, the framework suggests that reading material preference affects students\' use of online reading strategies. Following Amer et al. (2010) classification, these are grouped into three main categories:

- Global Strategies: setting reading purposes, previewing text, and summarising.
- Problem-Solving Strategies: adjusting reading rate, rereading difficult sections, and visualising.
- Support Strategies: using dictionaries, translating, and note-taking.

The framework additionally includes a two-way connection between difficulties in reading and the utilisation of strategies. On one side, utilising effective reading strategies can assist students in tackling obstacles in online reading; conversely, students facing more significant challenges might be encouraged to

depend more on compensatory strategies, especially support strategies (Abdul Rahim et al., 2023; Singh et al., 2023). This lively engagement showcases the flexible quality of scholarly reading in online settings.

This framework directs the exploration of how preferences for reading materials influence students' digital reading behaviours. It lays the groundwork for investigating if variations in challenges and strategy application are significantly linked to students' favoured reading medium and if these two results mutually enhance each other within the framework of online academic reading.

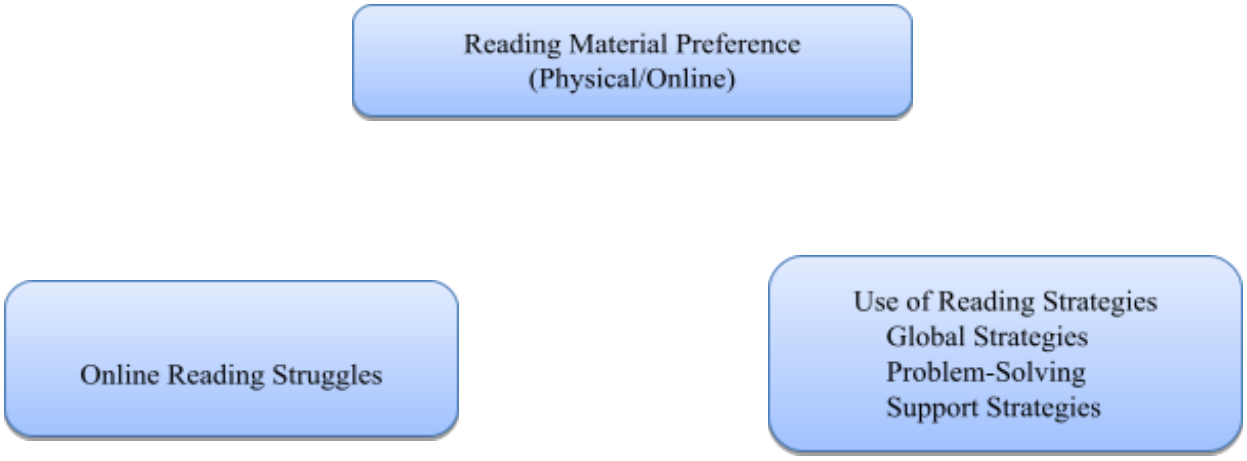

Figure 1: Conceptual Framework of the Study

Methodology

Research Design and Participants

This study adopted a quantitative cross-sectional survey design to examine the relationship between Malaysian undergraduates' reading material preferences (physical vs. online), their online reading struggles, and their use of reading strategies. The target undergraduate population the university was approximately 15,000 students at the time of data collection. A total of 200 students from multiple faculties and year levels participated in the study, yielding a response rate of roughly 1.3%.

Participants were selected through convenience sampling, as this allowed efficient recruitment across faculties and programmes within the limited timeframe. While this sampling method constrains generalisability, it is a common approach in exploratory research investigating student perceptions and behaviours.

Instrument Development and Validity

The self-administered questionnaire consisted of four sections:

i) Demographic information (gender, faculty, year of study, self-rated English proficiency)

ii) Reading material preference (physical vs. online)

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iii) Online reading struggles (10 items)

iv) Reading strategies (33 items), subdivided into:

Global strategies (7 items)

Problem-solving strategies (6 items)

Support strategies (8 items)

Items were adapted from established instruments by Amer et al. (2010) and Abdul Rahim et al. (2023) to ensure content relevance for Malaysian ESL undergraduates. Content validity was evaluated by an expert panel review involving two specialists in applied linguistics and educational measurement, who assessed item clarity, cultural appropriateness, and alignment with constructs.

A pilot test with 15 undergraduates was conducted to assess clarity and internal consistency. Results yielded a Cronbach's alpha of .87 and a Kaiser–Meyer–Olkin (KMO) value of .78, indicating satisfactory internal reliability and sampling adequacy. Minor wording adjustments were made based on pilot feedback.

Procedure

The final questionnaire was distributed online via Google Forms. Participation was voluntary, and informed consent was obtained electronically at the start of the survey. Participants were clearly informed about the study's aims, their right to withdraw at any point without penalty, and the anonymous and confidential handling of their responses. The survey required approximately 12–15 minutes to complete.

Data Analysis

Quantitative data were analysed using SPSS Version 26, with AMOS 26 employed for the confirmatory factor analysis. Before running any inferential tests, the dataset was carefully checked for missing values and assessed for normality using the Shapiro–Wilk test, alongside review of skewness and kurtosis values. To determine whether the data were suitable for factor analysis, the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity were conducted. When normality assumptions were not met, appropriate non-parametric alternatives such as the Mann–Whitney U test were applied to ensure robust results.

Descriptive statistics, including means, standard deviations, and frequencies, were calculated to summarise participants' demographic characteristics and questionnaire responses. To explore group differences based on reading material preference, independent-samples t-tests were conducted (or Mann–Whitney U tests where necessary). Relationships between online reading struggles and the use of reading strategies were analysed using Pearson correlation coefficients, and differences in correlation strength between preference groups were examined through Fisher's r-to-z transformation. Consistent with APA (7th edition) guidelines, all inferential tests included effect sizes (such as Cohen's d and correlation coefficients r) and 95% confidence intervals to convey the magnitude and precision of the findings.

Findings

Preliminary Analyses

Before inferential testing, data were screened for missing values and normality. The Shapiro–Wilk test and inspection of skewness and kurtosis indicated that most variables were approximately normally distributed, except for support strategy scores, which showed mild positive skew (W=0.94, p=0.002; skewness=1.15). Therefore, non-parametric tests (Mann–Whitney U) were used where normality was violated.

Internal consistency reliability was assessed separately for each subscale. Cronbach's alpha and McDonald's omega coefficients indicated good internal consistency:

Table 1: Internal consistency reliability of each subscale

Subscale	Number of items	A	Ω
Online reading struggles	10	.85	.86
Global strategies	7	.82	.83
Problem-solving strategies	6	.80	.81
Support strategies	8	.83	.84

As shown in Table 1, all four subscales demonstrated good internal consistency reliability. Cronbach's alpha values ranged from .80 for problem-solving strategies to .85 for online reading struggles, while McDonald's omega coefficients were similarly strong, ranging from .81 to .86. All of these values exceed the commonly recommended threshold of .70, suggesting that each subscale reliably captures its intended construct.

In terms of construct validity, the Kaiser–Meyer–Olkin (KMO) measure was .82 and Bartlett's test of sphericity was significant ($p < .001$), confirming that the data were suitable for factor analysis. Exploratory factor analysis identified a three-factor solution consistent with the theoretical framework, explaining 61.4% of the total variance. Subsequent confirmatory factor analysis indicated acceptable model fit ($\chi^2/df = 2.05$, CFI = .934, TLI = .916, RMSEA = .069, SRMR = .057). Furthermore, average variance extracted (AVE) values exceeded .50 for all constructs, supporting convergent validity, and discriminant validity was confirmed as the square root of AVE values was greater than the inter-construct correlations.

Participant Demographic Profile

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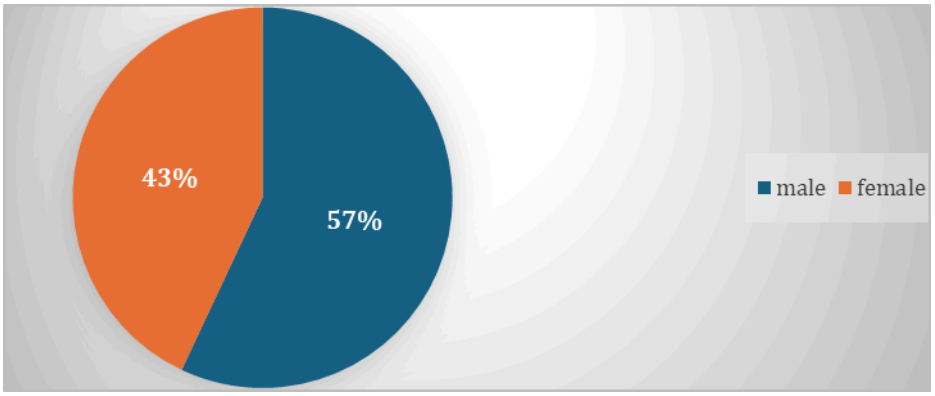

Figure 2: Percentage for Gender

Figure 2 shows the gender distribution of the sample, where 57% (n=114) were male (represented by the blue section) and 43% (n=86) were female (represented by the red section). The chart visually emphasises that male students slightly outnumber female students in the sample, with a difference of 14 percentage points.

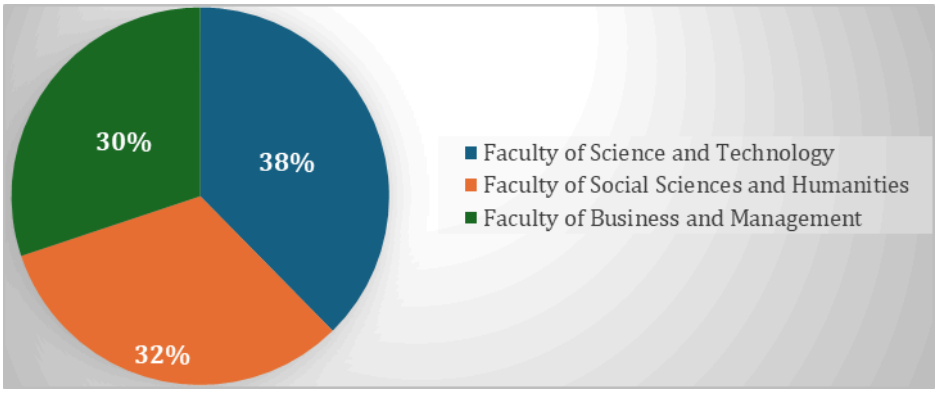

Figure 3: Percentage for Cluster

Figure 3 shows the distribution of participants across three faculties: the Faculty of Science and Technology (38%, n=76), the Faculty of Social Sciences and Humanities (32%, n=64), and the Faculty of Business and Management (30%, n=60). The Faculty of Science and Technology had the largest representation in the sample, followed by the Faculty of Social Sciences and Humanities, while the Faculty of Business and Management had the smallest share.

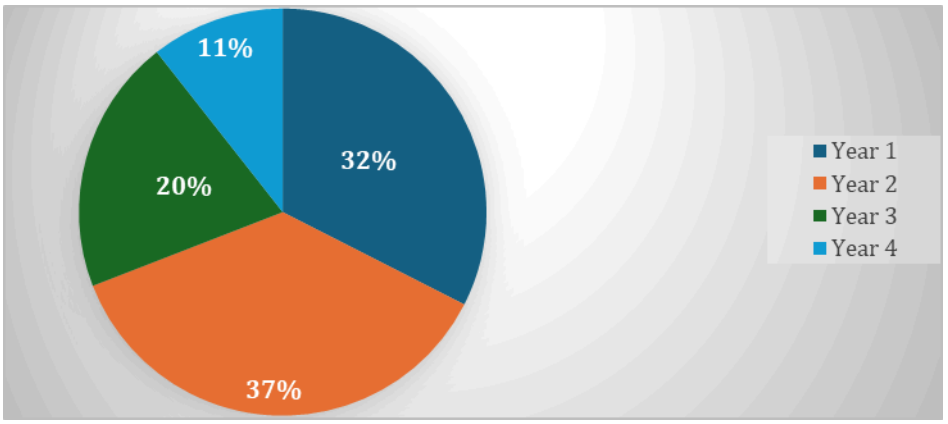

Figure 4: Percentage for Year of Study

Figure 4 shows the distribution of participants across four academic years: Year 2 had the largest share with 37% (n=74), followed by Year 1 with 32% (n=64), Year 3 with 20% (n=40), and Year 4 with the smallest proportion at 11% (n=22).

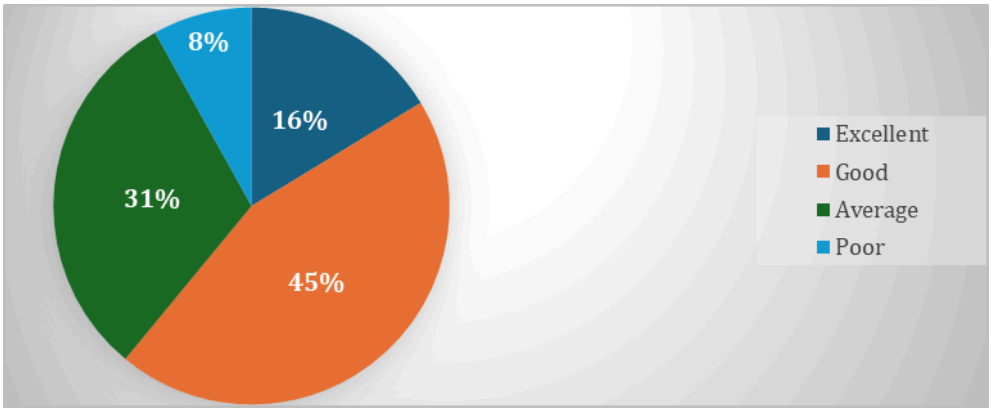

Figure 5: Percentage for Self-Rating Reading Proficiency

Figure 5 illustrates the distribution of participants' self-rated performance: 45% (n=90) rated it as *Good*, 31% (n=62) as *Average*, 16% (n=32) as *Excellent*, and 8% (n=16) as *Poor*. This indicates that the majority of respondents rated their performance positively, with the largest proportion selecting the *Good* category.

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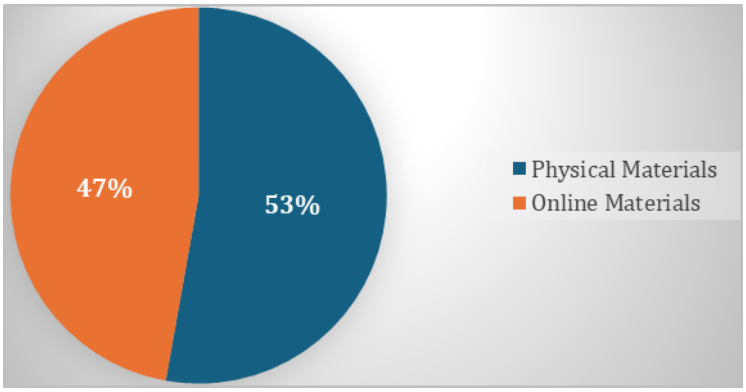

Figure 6: Percentage for Reading preference

Figure 6 shows the distribution of participants' preferences for reading materials: 53% (n=106) preferred *Online materials*, while 47% (n=94) preferred *Physical materials*. This indicates a slight preference for online materials in the sample, although the difference between the two categories is relatively small.

Descriptive Statistics of Online Reading Struggles

Figure 7 presents the results of survey questions related to the challenges faced during online reading, displaying both the mean scores and standard deviations for each statement. The "I experience eye strain when reading online materials" statement ranks highest with a mean of 4.0, followed closely by "I prefer shorter texts when reading online due to mental fatigue" at 3.88. Other notable statements include "I find it difficult to concentrate when reading on a screen" (mean of 3.85), and "I get easily distracted when reading online texts" (mean of 3.98). In contrast, statements such as "I find it hard to understand complex academic texts online" (mean of 3.55) and "I get confused navigating hyperlinks and digital pages" (mean of 3.45) received lower mean scores. The standard deviations across all statements remain consistent, indicating that participants' responses did not vary widely, with most agreeing on the presence of online reading challenges such as eye strain, distractions, and mental fatigue.

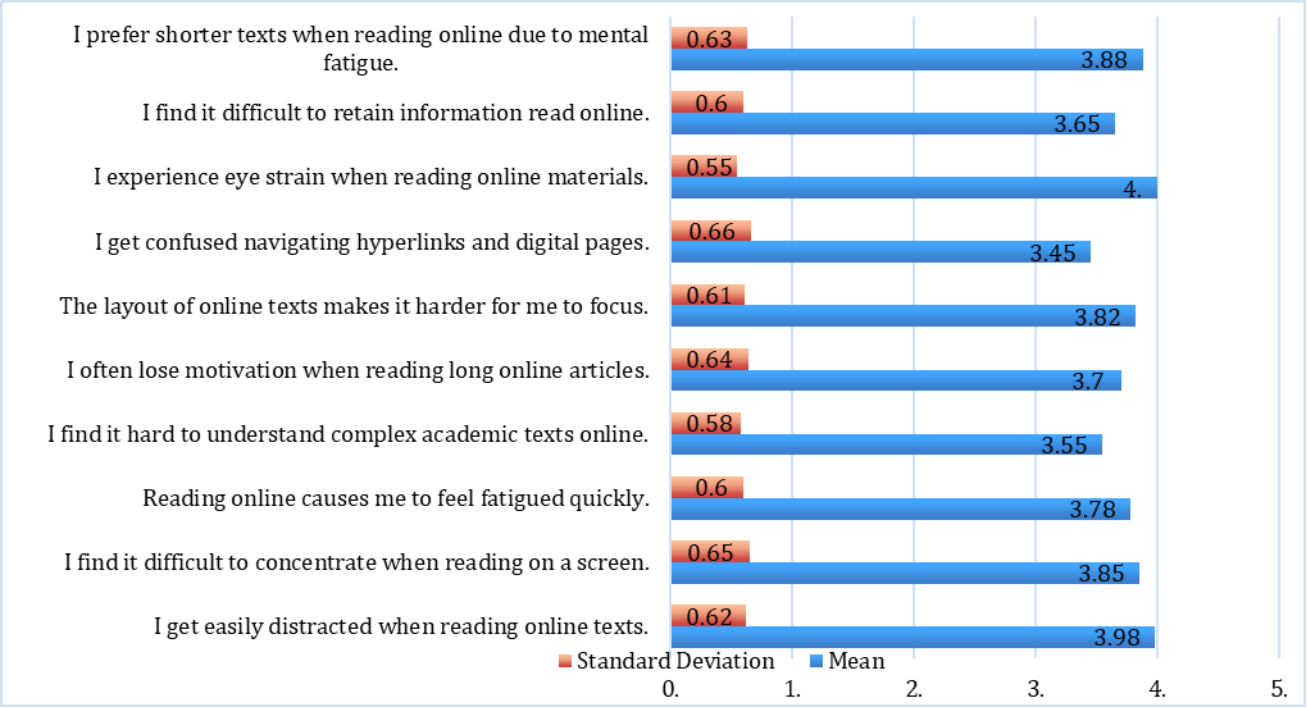

Figure 7: Online Reading Struggles

Global Reading Strategies

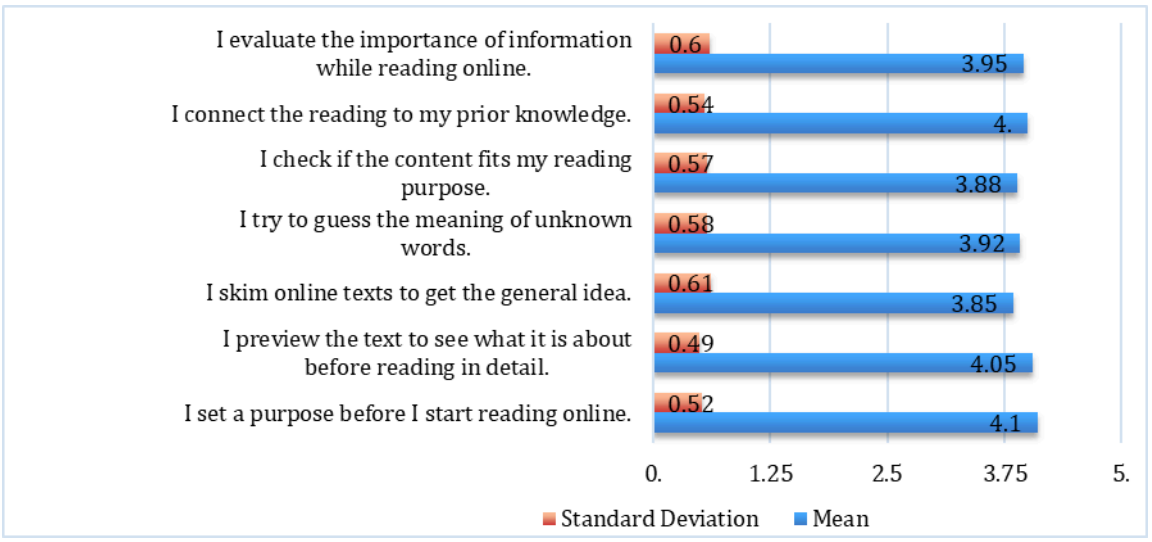

Figure 8: Global Reading Strategies

Figure 8 displays survey results on strategies used by participants when reading online, with the corresponding mean scores and standard deviations. The highest mean score (4.1) was for "I set a purpose before I start reading online", followed closely by "I preview the text to see what it is about before reading in detail" at 4.05. The mean score for "I connect the reading to my prior knowledge" was 4.0, indicating

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strong agreement with the use of this strategy. The lowest mean score (3.85) was for "I skim online texts to get the general idea", suggesting that while participants utilise this strategy, it is less common than the others. The standard deviations for all statements are relatively small, indicating consistency in responses among participants, with minimal variation in how the strategies are applied.

Descriptive Statistics for Problem-Solving Strategies

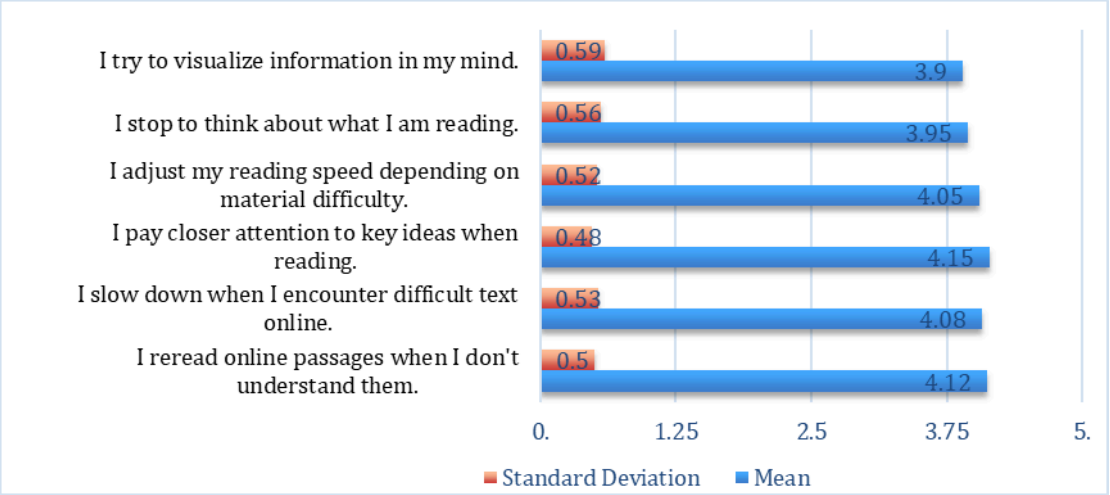

Figure 9: Problem-solving strategies

Figure 9 presents survey results on the use of reading strategies for comprehension and retention while reading online, showing the mean scores and standard deviations. The highest mean score (4.15) was for "I pay closer attention to key ideas when reading", followed closely by "I reread online passages when I don't understand them" (4.12). "I slow down when I encounter difficult text online" received a mean score of 4.08, indicating that participants generally engage in slowing down when faced with challenges. The lowest mean score (3.9) was for "I try to visualize information in my mind", suggesting this strategy is used less frequently compared to others. The standard deviations for all questions are relatively small, indicating that responses were consistent across participants.

Descriptive Statistics for Support Strategies

Figure 10 presents the results of survey items measuring the use of various support reading strategies during online academic reading, including their mean scores and standard deviations. Among these strategies, “I use a dictionary when I encounter unfamiliar words” had the highest mean score of 4.0, indicating that participants frequently rely on this approach to support comprehension. This was closely followed by “I search for additional information online to better understand the topic,” which had a mean score of 3.95, and

"I copy and save important excerpts from online texts," with a mean of 3.92. By contrast, the statement "I discuss the reading material with others to clarify my understanding" received the lowest mean score of 3.55, suggesting that participants engage in this collaborative strategy less often than the others. Overall, the relatively small standard deviations across all items indicate that students' responses were consistent, reflecting similar patterns in the use of these support strategies.

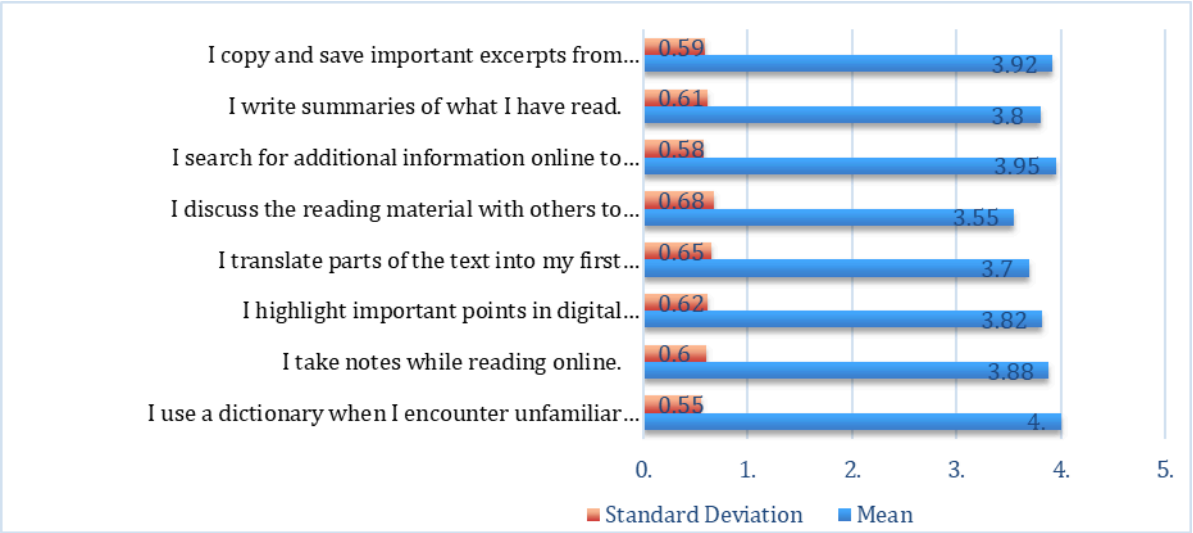

Figure 10: Support strategies

RQ1: Group Differences in Online Reading Struggles

Research Question 1 examined whether students who prefer physical reading materials experience higher online reading struggles compared to those who prefer online materials. An independent-samples t-test was conducted comparing the total struggles scores between the two groups. Students who preferred physical materials (n=106) reported significantly higher online reading struggles (M=3.90, SD=0.45) than those who preferred online materials (n=94; M=3.60, SD=0.50); $t(198)=4.25$, $p<.001$.

This result corresponds to a moderate effect size (Cohen's d=0.62, 95% CI [0.33, 0.90]), suggesting that preference for print is associated with greater perceived struggles when reading online.

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Table 2: Means and Standard Deviations of Online Reading Struggles by Preference Group

Preference Group	N	Mean	SD
Physical materials	106	3.90	0.45
Online materials	94	3.60	0.50

**. t(198)=4.25, p<.001, Cohen's d=0.62, 95% CI [0.33, 0.90]

As shown in Table 2, students who preferred physical reading materials reported higher mean scores for online reading struggles (M=3.90, SD=0.45) compared to those who preferred online materials (M=3.60, SD=0.50). This difference was statistically significant and reflected a moderate effect size (Cohen's d=0.62), suggesting that students who favour printed materials perceive more difficulty when engaging with online academic texts. This moderate effect size (Cohen's d=0.62) suggests the difference is not only statistically significant but also practically meaningful, indicating that students who favour printed materials may face noticeably greater difficulties when reading online texts.

RQ2: Preference and Use of Reading Strategies

Research Question 2 explored whether students' reading material preference (physical vs. online) is associated with differences in their use of three types of online reading strategies: global strategies, problem-solving strategies, and support strategies. Prior to analysis, normality tests showed that scores for global and problem-solving strategies were approximately normally distributed, whereas support strategy scores displayed mild positive skew (Shapiro–Wilk W=0.94, p=0.002). Accordingly, independent-samples t-tests were used to compare global and problem-solving strategies, while a Mann–Whitney U test was applied for support strategies.

Results indicated no significant difference in the use of global strategies between students who preferred physical materials (M=4.05, SD=0.40, n=106) and those who preferred online materials (M=4.10, SD=0.42, n=94); t(198)=0.88, p=0.38, Cohen's d=0.13, 95% CI [-0.16, 0.42]. Similarly, no significant difference was found for problem-solving strategies (physical: M=3.85, SD=0.48; online: M=3.90, SD=0.47); t(198)=0.75, p=0.45, d=0.11. However, students who preferred physical materials reported significantly higher use of support strategies (Mdn=4.00) than those preferring online materials (Mdn=3.85); U=3,012, p=0.018, r=0.20, reflecting a small effect size.

As shown in Table 3, while there were no significant differences in the use of global or problem-solving strategies between preference groups, students who preferred physical materials reported significantly higher use of support strategies. This suggests that print-preferring students may compensate for perceived challenges in online reading by relying more on external aids such as note-taking, dictionaries, or translation tools. Although the statistical effect was small (r=0.20), this finding may have practical

significance: it suggests that print-preferring students consciously or unconsciously compensate for digital reading challenges by relying more on external aids such as note-taking or translation.

Table 3: Comparisons of reading strategy use by preference group

Strategy Type	Preference Group	N	Mean	SD	Test Statistic	p	Effect size (95% CI)
Global strategies	Physical	106	4.05	0.40	t(198)=0.88	.38	d=0.13 [-0.16, 0.42]
	Online	94	4.10	0.42			
Problem-solving strategies	Physical	106	3.85	0.48	t(198)=0.75	.45	d=0.11
	Online	94	3.90	0.47			
Support strategies	Physical	106	4.00	0.44	U=3,012	.018	r=0.20
	Online	94	3.85	0.50			

Note. Mann–Whitney U test used for support strategies due to non-normality; Cohen's d reported for t-tests; r reported for Mann–Whitney U.

Correlation Between Online Reading Struggles and Strategy Use

To address Research Question 3, Pearson correlation coefficients were computed separately for students who preferred physical materials (n=106) and those who preferred online materials (n=94) to examine the relationship between online reading struggles and the use of three types of reading strategies: global strategies, problem-solving strategies, and support strategies.

Table 4: Correlations between online reading struggles and reading strategies by preference group

Strategy Type	Preference Group	N	R	p
Support Strategies	Physical	106	0.32	.01
	Online	94	0.24	.07 (ns)
Problem-Solving Strategies	Physical	106	0.21	.07 (ns)
	Online	94	0.31	.01
Global Strategies	Physical	106	0.15	.12 (ns)
	Online	94	0.18	.09 (ns)

Note. Fisher's r-to-z tests comparing correlation strengths between preference groups: support strategies z=0.73, p=0.46; problem-solving strategies z=0.84, p=0.40; global strategies z=0.22, p=0.82. ns=not significant.

As shown in Table 4, among students who preferred physical reading materials, a weak but statistically significant positive correlation was found between online reading struggles and the use of support strategies (r=0.32, p<.05). This suggests that students who experienced greater difficulties when

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reading online tended to rely more on external aids, such as dictionaries, note-taking, or translation. In contrast, no significant correlations were observed between struggles and global strategies (r=0.15, ns) or problem-solving strategies (r=0.21, ns) within this group.

Among students who preferred online materials, a significant weak positive correlation was found between online reading struggles and the use of problem-solving strategies (r=0.31, p<.05), suggesting that these students were more likely to adapt their reading behaviours (e.g., rereading, adjusting pace) when facing difficulties. No significant correlations were observed between struggles and global strategies (r=0.18, ns) or support strategies (r=0.24, ns) within this group.

To test whether the strength of these correlations differed significantly between preference groups, Fisher's r-to-z transformations were conducted. Results indicated that none of the differences in correlation strength were statistically significant:

- Support strategies: z=0.73, p=0.46
- Problem-solving strategies: z=0.84, p=0.40
- Global strategies: z=0.22, p=0.82

While the correlations are weak, their practical importance lies in highlighting different adaptive behaviours: print-preferring students tend to increase support strategy use when struggling, whereas online-preferring students lean more on problem-solving strategies.

Discussion

This study set out to explore how Malaysian undergraduates' preferences for physical versus online reading materials relate to their online reading struggles and the reading strategies they use. By addressing three specific research questions, it aimed to shed light on how these preferences shape reading behaviour and outcomes in an increasingly digital academic environment.

Regarding RQ1, the findings revealed that students who preferred physical reading materials reported significantly higher levels of online reading struggles compared to those who preferred digital materials (M=3.90 vs. M=3.60; t(198)=4.25, p<.001), with a moderate effect size (Cohen's d=0.62). This supports prior research suggesting that students accustomed to print formats often experience greater cognitive load, fatigue, and distractions when reading on screens (Delgado et al., 2018; Mangen et al., 2018). These struggles may stem from the hypertextual, non-linear nature of online texts, which can disrupt concentration, especially for learners more comfortable with sequential print reading (Coiro, 2011; Sandberg, 2011).

For RQ2, the study examined whether material preference affects the use of reading strategies. Results showed no significant differences in the use of global (t(198)=0.88, p=0.38, d=0.13) or

problem-solving strategies (t(198)=0.75, p=0.45, d=0.11). However, students preferring physical materials reported significantly greater use of support strategies (U=3,012, p=0.018, r=0.20), such as dictionary use and note-taking. Although the effect size was small (r=0.20), this still suggests a meaningful practical difference in how print-preferring students compensate for digital reading challenges. This suggests that these students compensate for online reading difficulties by relying on external aids strategies often seen as reactive rather than proactive (Rahmat et al., 2022). Meanwhile, students more comfortable with online materials tended to use metacognitive, problem-solving strategies, consistent with the idea that digital familiarity encourages more active self-regulation (Amer et al., 2010).

In RQ3, the study explored how reading struggles correlate with strategy use within each preference group. Among print-preferring students, struggles were positively correlated with increased use of support strategies (r=0.32, p=0.01), indicating reliance on external help when difficulties arise. For students preferring online materials, struggles were significantly correlated with greater use of problem-solving strategies (r=0.31, p=0.01), suggesting an adaptive, internal response to reading challenges. Fisher's r-to-z tests, however, showed that these differences in correlation strength between groups were not statistically significant. Taken together, these patterns align with earlier research and suggest that students don't all respond to reading difficulties in the same way; their preferred reading medium shapes how they adapt when challenges arise.

From a pedagogical perspective, these findings highlight the need to tailor reading support to different learner profiles, especially within the Malaysian ESL context. Many undergraduates study academic content in a second language, which may intensify cognitive load during online reading. Educators could help print-preferring students develop proactive strategies (e.g., setting goals, previewing content) while supporting ESL learners with tools like bilingual glossaries or digital annotation training. Recognising that preference influences not just what strategies students use, but also how they respond to reading difficulties, is critical for designing inclusive interventions.

In summary, this study underscores that students' reading material preferences significantly shape their online reading challenges and strategic responses. Recognising these differences is essential for fostering effective academic reading in a digital age, particularly in multilingual, ESL contexts like Malaysian higher education.

Limitations and Recommendations

This study has several limitations that should be acknowledged. First, it relied on a convenience sample drawn from a single Malaysian university, which may limit the generalisability of the findings to other higher education institutions or contexts. Second, the cross-sectional design captures students' reading

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struggles and strategy use at only one point in time, making it impossible to conclude causality or how these patterns might evolve. Third, all data were based on self-report measures, which are subject to social desirability bias and may not fully reflect students' actual reading behaviours.

In light of these limitations, educators and curriculum developers should be cautious in applying these findings universally. It is recommended that institutions consider gathering similar data across multiple faculties and universities to verify whether the observed patterns hold in diverse contexts. Incorporating objective measures such as reading analytics, eye-tracking data, or log file analysis could provide a richer understanding of how students engage with digital texts. Future research could also adopt mixed-methods designs that combine surveys with interviews or think-aloud protocols to capture richer, contextualised insights into reading processes. Additionally, integrating explicit instruction on digital reading strategies, especially problem-solving and global strategies, could support students who prefer print materials and may be less comfortable navigating online texts. Finally, recognising the added complexity for Malaysian ESL learners, educators might consider bilingual support tools, targeted vocabulary instruction, and structured training in digital reading platforms to foster more equitable academic reading outcomes.

By acknowledging these limitations and applying targeted recommendations, higher education institutions can better support students' transition to digital reading environments while respecting diverse reading preferences and language backgrounds.

Conclusion

This study examined how Malaysian undergraduates' preference for physical versus online reading materials relates to their online reading struggles and use of reading strategies. Using a quantitative survey approach, the findings revealed that students who preferred print materials experienced greater challenges when reading online than those who favoured digital texts. The strategies students employed also differed by preference: print-preferring students relied more on support strategies, while students comfortable with online materials more frequently used global and problem-solving strategies. Correlation analyses further indicated that students' responses to reading difficulties varied between preference groups, highlighting the influential role of preference in shaping strategic reading behaviour.

These findings contribute to the growing body of research on digital academic literacy by demonstrating that online reading challenges are not solely the result of skill deficits. Instead, they are also influenced by factors such as familiarity, comfort, and cognitive expectations associated with students' preferred reading formats. By acknowledging these factors, educators and curriculum designers can better support students' transition to digital reading, creating learning environments that respect different preferences and foster academic success.

Author contributions

The author solely conceptualised the research, developed the instrument, conducted data collection and analysis, and was responsible for writing and revising the manuscript.

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Data availability statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of interest

The author declares no conflict of interest related to this study.

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