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AI Literacy and English Writing Anxiety in an ESP Context: A Mixed-Methods Study from Vietnam

Ho Dinh Phuong Khanh[1]✉, Nguyen Phu Quynh Nhu[2]

[1] khanhhdp@ueh.edu.vn

[2] nhunpq@ueh.edu.vn

[1,2] University of Economics Ho Chi Minh City (UEH)
279 Nguyen Tri Phuong street, Dien Hong ward,
Ho Chi Minh City,
(Vietnam)

✉ Corresponding author

ABSTRACT: *This study explores how artificial intelligence (AI) literacy relates to English writing anxiety among university students in an English for Specific Purposes (ESP) setting in Vietnam. Using an explanatory sequential mixed-methods design, the study integrates survey data from 441 ESP students with semi-structured interviews to examine both the quantitative association and students' situated accounts of AI-supported writing. The quantitative results indicated a weak, statistically non-significant association between AI literacy and writing anxiety ($r = -.062$, $p = .195$). This result provides no evidence of a statistically significant linear association in this sample. Interview accounts suggested context-dependent differences in how students used AI and managed writing-related stress; these possible processes were not tested as mediators. Students described benefits (e.g., efficiency and linguistic support) alongside concerns (e.g., over-reliance and ethical issues). Building on these accounts, the study proposes a preliminary five-stage "Clarify-Draft-Refine-Verify-Reflect" conceptual framework for AI-supported writing. The framework is offered as a proposition for future instructional research and warrants further empirical validation. The study provides context-specific insights into AI-supported ESP writing while distinguishing bivariate association from participants' contextual accounts.*

KEYWORDS: **AI literacy, English writing anxiety, English for specific purposes, mixed methods, self-regulated learning, AI-supported writing.**

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1. Introduction

English writing anxiety remains a persistent challenge for learners in foreign language contexts, especially among students in English for Specific Purposes (ESP) programs who must produce academic or professional texts in English despite having limited language proficiency. This form of anxiety can negatively affect writing performance, self-efficacy, and overall engagement, often manifesting as cognitive worry, somatic tension, and avoidance behaviors (Cheng, 2004).

At the same time, the rapid uptake of artificial intelligence (AI) tools such as Grammarly and ChatGPT is reshaping writing in higher education. These tools can provide automated feedback, language refinement, and support for idea development. Their use, however, also raises pedagogical and psychological concerns, including over-reliance, reduced autonomy, uncertainty about authorship, and academic-integrity risks. Evidence that AI support either alleviates or intensifies anxiety remains mixed, suggesting that its effects depend on the learner, task, and manner of use.

One factor that may help explain this variability is AI literacy. As a multidimensional construct encompassing operational knowledge, critical evaluation, and ethical awareness (Ng et al., 2021; Carolus et al., 2023), AI literacy may be associated with how learners select, prompt, evaluate, and regulate AI support during writing. Yet research has focused more often on performance and adoption than on affective outcomes such as writing anxiety. This gap is particularly relevant in ESP contexts and in rapidly digitizing systems such as Vietnam, where non-English-major students increasingly

encounter AI tools without necessarily receiving systematic guidance in their use.

To address this gap, the study used an explanatory sequential mixed-methods design to examine the statistical association between AI literacy and English writing anxiety and then explore how selected students interpreted AI's role in their writing and anxiety-management practices. The study was guided by the following research questions:

1. What is the relationship between AI literacy and English writing anxiety among ESP students in Vietnam?
2. How do ESP students perceive the role of AI tools in their English writing processes?
3. How do students with different levels of AI literacy describe their strategies for managing English writing anxiety?

The study is informed by Zimmerman's (2002) Self-Regulated Learning (SRL) theory, which conceptualizes learning through forethought, performance, and self-reflection. Within this interpretive lens, AI literacy is treated as a potential personal resource for selecting and monitoring AI support, while writing anxiety is an affective experience that may interact with these processes. Because SRL was not directly measured, the framework is used to interpret, not statistically test, the mechanisms suggested by participants' accounts.

The study contributes in three ways. First, it provides evidence from non-English-major ESP students in Vietnam, an underrepresented population in research on AI-supported writing. Second, it distinguishes a bivariate association between AI literacy and anxiety from students' context-dependent accounts of AI use, thereby avoiding the assumption that greater literacy automatically reduces anxiety. Third, it develops a preliminary, theoretically informed instructional framework that can guide future pedagogical design and empirical testing.

2. Literature review

2.1. Foreign language writing anxiety

In the field of language education, foreign language writing anxiety (FLWA) has received sustained scholarly attention because of its significant impact on learners' performance and engagement. FLWA is commonly understood as a negative emotional state experienced when individuals are required to write in a foreign language, often characterized by cognitive worry, somatic tension, and avoidance behavior (Cheng, 2002; Cheng, 2004). As a multidimensional construct, FLWA encompasses both psychological and contextual factors, making it a complex phenomenon that extends beyond individual ability.

Research attributes FLWA to interacting learner, task, instructional, and contextual conditions. Learner-related sources include low confidence, fear of negative evaluation, and difficulty generating or expressing ideas (Cheng, 2002; Liu & Ni, 2015). Task demands, time pressure, feedback practices, and limited planning support may intensify these concerns, whereas process-oriented guidance and opportunities to revise can make writing more manageable (Ferris & Hedgcock, 2023; Hyland, 2019). Studies in exam-oriented EFL settings further show that concern with accuracy and evaluation can reinforce avoidance and apprehension (Jebreil et al., 2015; Salikin, 2019). These strands collectively indicate that writing anxiety is not reducible to language proficiency or a single learner characteristic.

FLWA is associated with cognitive interference, somatic tension, avoidance, and weaker engagement with composing and revision (Cheng, 2004; Rasool et al., 2023). Its consequences nevertheless vary with task conditions and the strategies available to learners. This variability is important for AI-supported writing: an AI tool may reduce immediate linguistic or planning demands for one learner, yet create uncertainty about accuracy, authorship, or evaluation for another. The relevant question is therefore not simply whether AI reduces anxiety, but under which conditions learners experience its support as manageable and trustworthy.

2.2. AI literacy

As AI becomes embedded in academic and professional activity, AI literacy has emerged as a multidimensional competence rather

than a narrow ability to operate a tool. Major frameworks include understanding AI, applying it appropriately, evaluating outputs and limitations, and recognizing ethical and social consequences (Long & Magerko, 2020; Ng et al., 2021; Carolus et al., 2023; Shiri, 2024). This broader conception is especially relevant to writing, where technically fluent use does not necessarily entail accurate evaluation, responsible attribution, or preservation of authorial agency.

Recent measurement work similarly treats AI literacy as a set of related but distinguishable competencies, including use and application, conceptual understanding, detection or evaluation of AI-generated content, and ethical awareness (Carolus et al., 2023; Yuan et al., 2024). Domain-specific work in L2 writing extends this position by emphasizing decisions about prompting, verification, attribution, and appropriate integration into composing (Xu et al., 2025). Together, these perspectives locate AI literacy at the intersection of technical competence, critical judgment, and responsible action.

Emerging evidence links AI literacy and self-regulatory capacities with more purposeful use of generative AI and with writing-related outcomes (Shi et al., 2025). These associations do not establish that AI literacy itself produces better performance or well-being; learners with greater experience, confidence, or proficiency may also report higher literacy. Nevertheless, the literature consistently suggests that critical evaluation and strategic control distinguish learning-oriented use from simple dependence on generated text.

The affective implications are less clear. Greater knowledge may increase perceived control, but it may also heighten awareness of hallucination, bias, detection, and integrity risks. Conversely, limited literacy may produce either uncertainty or uncritical trust. AI literacy could therefore relate to writing anxiety in competing directions, and a small or null overall correlation may conceal substantially different patterns of use. This unresolved possibility motivates the mixed-methods design of the present study..

2.3. AI in academic writing: Benefits, challenges, and the role of anxietyy

Research on AI-supported writing identifies benefits in grammar and vocabulary support, feedback availability, idea development, and revision efficiency (Alharbi, 2023; Warschauer et al., 2023; Duncanson, 2024). Such affordances may reduce immediate cognitive and linguistic demands, especially for L2 writers, and can support iterative revision when learners compare suggestions with their intended meaning. Yet the same affordances can encourage superficial acceptance when output is treated as authoritative rather than evaluated.

Concerns center on inaccurate output, weakened cognitive engagement, over-reliance, loss of voice, and uncertainty about acceptable authorship (Selwyn, 2017; Cotton et al., 2023; Wohlfarth et al., 2023; Zhai et al., 2024). These concerns are also affective: immediate, non-judgmental feedback may reassure learners, whereas fear of detection, inability to verify output, or dependence on AI may generate additional anxiety. Accordingly, frequency of use is not equivalent to informed or self-regulated use.

Empirical findings reflect this tension. Wang (2024) reported lower writing anxiety and improved writing outcomes for learners receiving AI-generated corrective feedback relative to comparison conditions. By contrast, Yu (2024) found that more frequent AI-assisted writing was associated with greater writing anxiety. The studies examined different constructs and designs- an instructional feedback condition in one case and self-reported frequency in the other- so their results are not directly contradictory. Rather, they suggest that the emotional consequences of AI depend on the type, purpose, and quality of engagement.

Taken together, prior research provides a rationale for examining AI literacy and writing anxiety without presuming a direct negative relationship. AI literacy may matter because it informs how learners plan AI use, judge output, and maintain control, but writing anxiety also reflects proficiency, evaluation conditions, task difficulty, and self-beliefs. The present study therefore tests only their bivariate association and uses interviews to explore plausible processes; it does not test mediation or causality.

2.4. Theoretical framework

Zimmerman's (2002) SRL theory provides an interpretive framework for these processes. The forethought phase concerns goals, task analysis, and motivational beliefs; the performance phase involves strategy use, monitoring, and control; and self-reflection involves evaluation and adaptation. In AI-supported writing, these phases can include deciding whether AI is appropriate, specifying the kind of support required, monitoring the fit and accuracy of output, and reflecting on what was learned rather than merely what was produced.

Writing anxiety can enter this cycle as both a condition and a consequence. Apprehension may disrupt planning and monitoring, while effective strategies may increase perceived control (Cheng, 2004). AI literacy is therefore conceptualized as a possible resource for self-regulated engagement with AI, not as an anxiety-reduction mechanism in itself. A learner may be technically capable yet anxious about authorship, or less technically capable yet reassured by AI's availability.

This integration yields two analytically distinct expectations. At the variable level, AI literacy may show an overall association with writing anxiety. At the process level, students may describe different ways of using and evaluating AI that alter their sense of control during particular tasks. The quantitative strand addresses the first expectation, while the qualitative strand explores the second.

The SRL lens also informs the preliminary Clarify-Draft-Refine-Verify-Reflect framework presented later. The framework is a conceptual synthesis of theory and participants' reported practices. It was not implemented or evaluated in this study and should therefore be understood as a proposition for future instructional research.

3. Methodology

This study employed an explanatory sequential mixed-methods design (Creswell & Creswell, 2018). Survey data were analyzed first to estimate the bivariate association between AI literacy and writing anxiety. Ten participants were then purposively selected from the survey sample for interviews designed to elaborate how students with contrasting survey profiles described AI use and managed writing-related anxiety. The two strands were analyzed separately and integrated during interpretation.

3.1. Participants

The target population for this study consisted of undergraduate students enrolled in English for Specific Purposes (ESP) courses at the University of Economics Ho Chi Minh City (UEH), Vietnam. The population included approximately 1,200-1,500 students across 13 business-related disciplines (e.g., Accounting, Finance, International Business, Marketing) during the 2024-2025 academic year.

A convenience sample was recruited through participating ESP classes. The final survey sample comprised 441 students (126 males and 315 females), aged 18-24. Although this number exceeded the 306 cases indicated by Krejcie and Morgan's (1970) table for a population of approximately 1,500, that calculation does not make a non-probability sample representative. The sample provided a substantial number of observations for the planned correlational analysis, but generalization beyond the participating courses remains limited.

All participants completed two self-report instruments: an 18-item version of the Meta AI Literacy Scale (MAILS; Carolus et al., 2023) and the Second Language Writing Anxiety Inventory (SLWAI; Cheng, 2004). Notably, no pre-screening item was used to exclude students with limited or no prior experience with AI tools. This decision was made to capture the full range of AI exposure typical of real ESP classrooms and to treat AI literacy as a continuous construct rather than a binary condition (Ng et al., 2021; Carolus et al., 2023). The sample's mean AI-literacy score was 6.63 (SD = 1.92).

For the qualitative phase, 10 participants were selected through purposive sampling from the larger survey sample. This sampling strategy was adopted to include information-rich cases and variation across survey profiles. Participants were selected based on the following criteria:

- AI literacy levels (5 high scorers and 5 low scorers),

• Writing anxiety levels (high, moderate, and low),

• Demographic diversity (including approximately 70% female representation and students from at least 8 different disciplines),

• Willingness to participate and the depth of responses provided in the survey.

The upper- and lower-end labels were used descriptively within the observed sample rather than as validated proficiency bands. The purposive sample was intended to provide explanatory depth for Research Questions 2 and 3 rather than numerical representation. Interviews began after the survey analysis. No substantially new codes or dimensions relevant to the research questions appeared after the eighth interview; two additional interviews were completed to examine whether this pattern held across contrasting profiles. All 10 interviews were retained. Participants described prior exposure to tools such as ChatGPT, Grammarly, and Poe.

3.2. Instruments

3.2.1. The Meta AI literacy scale

AI literacy was measured using the Meta AI Literacy Scale developed by Carolus et al. (2023). This instrument is grounded in established frameworks of competencies (Bloom et al., 1956) and AI literacy (Ng et al., 2021), and adopts a modular structure that allows different components to be used independently.

The study used an 18-item subset of MAILS drawn from the four AI-literacy facets most directly relevant to students' use and evaluation of AI systems: Use and Application (6 items), Understanding (6 items), Detection of AI-generated Content (3 items), and Ethical Awareness (3 items). The additional MAILS modules concerning AI creation and broader psychological competencies were not administered. The overall score was calculated as the mean of the 18 administered items. This subset was treated as a study-specific operationalization, and the study did not undertake a separate construct-validation study for the adapted version.

Participants rated their responses on an 11-point Likert scale ranging from 0 ("never or only very rarely") to 10 ("very often").

Previous studies have reported acceptable to excellent internal consistency for the Meta AI Literacy Scale (Carolus et al., 2023). In the present study, reliability analysis demonstrated excellent internal consistency for the overall AI Literacy scale (α = .972). The four dimensions also exhibited strong reliability, with Cronbach's alpha coefficients of .964 for Use and Application of AI, .936 for Understanding of AI, .900 for Detection of AI-generated Content, and .917 for Ethical Awareness. These results indicate that the instrument was highly reliable for measuring AI literacy among Vietnamese ESP students.

3.2.2. The second language writing anxiety inventory

English writing anxiety was measured using the Second Language Writing Anxiety Inventory (SLWAI) developed by Cheng (2004). This widely used instrument consists of 22 items measuring three dimensions of writing anxiety: Cognitive anxiety, Somatic anxiety, and Avoidance behavior.

Participants responded using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

The SLWAI has demonstrated strong psychometric properties in previous research (Cheng, 2004). In the present sample, internal consistency was good for the total scale (α = .876) and Cognitive Anxiety (α = .890), acceptable for Somatic Anxiety (α = .759), and marginal for Avoidance Behavior (α = .660). Because the study's principal analysis used the total SLWAI score, the lower reliability of the Avoidance subscale did not affect the reported correlation directly. Nevertheless, any subscale-level interpretation should be made cautiously

Table 1. Internal consistency of the research instruments

Scale/Subscale	Number of Items	Cronbach's α
AI Literacy (overall)	18	.972
Use and Application of AI	6	.964
Understanding of AI	6	.936

Scale/Subscale	Number of Items	Cronbach's α
Detection of AI-generated Content	3	.900
Ethical Awareness	3	.917
SLWAI (overall)	22	.876
Cognitive Anxiety	7	.890
Somatic Anxiety	7	.759
Avoidance Behavior	8	.660

3.2.3. Semi-structured interviews

To complement the quantitative data, semi-structured interviews were conducted to explore students' experiences with AI tools in their writing processes, their emotional responses, and the strategies they employed to manage writing anxiety.

The interview protocol comprised 10 open-ended questions informed by the literature and the survey results. Questions addressed patterns of AI use, perceived benefits and limitations, emotional responses to AI-supported writing, strategies for managing writing anxiety, and views on curriculum support.

The interview protocol was pilot-tested with two experts and five students to ensure clarity, relevance, and appropriateness. Based on their feedback, minor revisions were made before the main data collection.

All interviews were conducted in Vietnamese, lasted approximately 30-45 minutes, and were audio-recorded with consent. Recordings were transcribed verbatim. Coding was conducted with reference to the Vietnamese transcripts, and quotations selected for publication were translated into English and checked against the source wording to preserve meaning.

3.3. Data analysis

3.3.1. Quantitative analysis

Quantitative data were analyzed in SPSS Statistics 29. Means and standard deviations were calculated for the composite AI-literacy and writing-anxiety scores.

Cronbach's alpha was calculated for both total scales and their dimensions. As shown in Table 1, reliability was strong for the two total scores, although the SLWAI Avoidance Behavior subscale showed marginal internal consistency.

The relationship specified in Research Question 1 was examined using a two-tailed Pearson product-moment correlation with $\alpha = .05$. Pearson's r was interpreted as the effect-size estimate, and a 95% confidence interval was calculated using Fisher's z transformation. No regression analysis was conducted or reported.

3.3.2. Qualitative analysis

Qualitative data from the interviews were analyzed thematically through a systematic and iterative process consisting of the following steps:

1. Familiarization with the data: The researchers read the transcripts multiple times to gain an overall understanding of the content and identify initial patterns.

2. Identification of relevant segments: Segments of text related to the research objectives were identified and extracted.

3. Coding: Meaningful units of text were labeled with codes representing key ideas and concepts.

4. Category development: Codes were grouped into broader categories, and overlapping or redundant codes were refined or removed.

5. Theme generation: Categories were organized into higher-level themes that captured the central patterns in the data.

Both researchers first coded the transcripts independently and then compared code labels, boundaries, and interpretations. Disagreements were discussed until a shared coding decision was reached, and the codebook was revised iteratively. The purpose of this comparison was analytical consistency rather than calculation of a chance-corrected agreement coefficient. Saturation was monitored through a running code-and-theme matrix: after Interview 8, subsequent data elaborated existing categories but did not add a substantively new category relevant to the research questions. Interviews 9

and 10 were used to test this assessment. An audit trail retained coding decisions, theme revisions, and analytical memos.

3.3.2. Integration of data

Integration occurred after the separate analyses through a question-by-question comparison of the correlation result and qualitative themes. The researchers examined whether the interview accounts converged with, diverged from, or qualified the survey-level pattern.

The qualitative strand was not used to override the non-significant correlation. Instead, it was used to identify context-dependent practices that a single bivariate coefficient could not represent. Table 4 summarizes the themes used in this mixed-methods interpretation.

3.4. Ethical considerations

Several measures were taken to ensure the ethical conduct of the study and to protect participants' rights and well-being. Before data collection, the research proposal underwent institutional ethical review and approval, and all procedures followed the approved protocol. Participants were provided with an informed consent form outlining the purpose of the study, the voluntary nature of participation, and their right to withdraw at any time without penalty.

Anonymity and confidentiality were strictly maintained. Survey responses were anonymized using identification codes, and interview transcripts were de-identified to remove any personally identifiable information. Given the potentially sensitive nature of writing anxiety, participants were informed that they could skip any questions they found uncomfortable.

All data were stored securely and will be retained for a period of five years before being destroyed. The researchers also maintained reflexivity throughout the study, particularly with regard to assumptions about students' familiarity with AI technologies. Reflexive notes were kept to critically examine potential biases in data collection and interpretation.

3.5. Limitations

Several limitations constrain interpretation. The single-institution convenience sample and cross-sectional self-report design limit representativeness and causal inference. The adapted 18-item MAILS subset was not subjected to a separate construct-validation study in this population, and the present report does not document a translation or back-translation, expert-review, or pilot procedure specific to the subset; its scores should therefore be interpreted as a study-specific operationalization. The study also did not directly measure writing proficiency, self-efficacy, self-regulated learning, actual AI-use behavior, or writing performance. The 10 interviews provided explanatory depth but not population estimates, and the upper- and lower-end AI-literacy labels were descriptive within-sample selections rather than validated categories. Future research should use multi-site and longitudinal designs, document AI exposure and task conditions, validate translated or adapted instruments, and directly measure candidate explanatory variables.

4. Results

4.1. Relationship between AI literacy and writing anxiety (RQ1)

Participants had a mean AI-literacy score of 6.63 (SD = 1.92) on the 0-10 response scale and a mean writing-anxiety score of 3.44 (SD = 0.54) on the 1-5 scale (Table 2). AI literacy and writing anxiety showed a negligible negative correlation, $r(439) = -.062$, $p = .195$, 95% CI [−.154, .032] (Table 3). The interval includes zero and only small effects in either direction. Thus, the data provide no evidence of a practically meaningful linear association between the two composite scores in this sample.

Table 2. Descriptive statistics for the study variables

Variable	Mean	SD
AI Literacy	6.63	1.92
Writing Anxiety	3.44	0.54

Table 3. Correlation between AI literacy and writing anxiety

Variable	r	p	95% CI for r
AI Literacy - Writing Anxiety	-.062	.195	[−.154, .032]

The correlation addresses only the overall linear association between the two measured constructs. The interview findings below examine how students described AI use and anxiety in particular writing situations.

4.2. Students' perceptions of AI in writing processes (RQ2)

The qualitative findings reveal that students perceive AI as a supportive yet limited partner in their writing processes. Rather than replacing their own efforts, AI is typically integrated into a hybrid human-AI workflow in which students maintain control over content while using AI for support. A common pattern involved drafting independently and then using AI for revision and refinement. As one participant explained, "I draft it myself first, then ask AI to proofread, check for errors and suggest better or more suitable wording" (S3). Similarly, another student noted that "normally I use AI to revise the coherence of my sentences. The ideas, I usually generate myself" (S2). These accounts indicate that students tend to position AI as a tool for enhancement rather than substitution.

At the same time, variation in usage depth was evident. Some students limited AI use to surface-level editing, while others engaged in more complex interactions, such as analyzing and restructuring content. For instance, one student described a more iterative approach: "I usually copy a whole paragraph into AI and ask it to analyze… then I note down the key points and rewrite" (S5). Such practices reflect an augmentation-oriented model of AI use (Popenici & Kerr, 2017), where learners actively integrate AI into their writing processes in ways that align with their goals and capabilities. This variation suggests that AI use may be related not only to access but also to students' strategic awareness and level of competence.

Students' engagement with AI was closely linked to their confidence in using it effectively, although this confidence was often accompanied by a strong awareness of its limitations. For example, one participant noted that "it only meets my needs when I give the right prompts… I haven't fully leveraged it yet" (S3), highlighting the importance of prompting skills. Even students who reported relatively high levels of trust expressed caution, as illustrated by the comment "AI sometimes makes mistakes or hallucinates, and I might miss them" (S7). Others reported lower levels of trust, with one student stating that "I trust AI's grammar around 50-60%, but… I still need to adjust" (S6). These responses illustrate critical evaluation and recognition of AI limitations in some participants, reflecting an emerging form of critical AI literacy (Floridi & Chiriatti, 2020).

In terms of perceived benefits, students consistently highlighted improvements in writing quality, efficiency, and emotional reassurance. AI was viewed as particularly useful for enhancing vocabulary and grammatical accuracy, as reflected in the comment "AI helps me write sentences with more academic vocabulary and tighter structure" (S4). Efficiency was also a key advantage, especially under time pressure, with one student noting that "AI summarizes the key points more quickly instead of me translating the whole text" (S5). In addition, some participants described AI as providing psychological support and reducing immediate stress during writing tasks. As one participant explained, "less anxious, because it helps me a lot… like a teacher reviewing my essay" (S2). These findings align with prior research emphasizing the role of AI in providing immediate, individualized feedback and scaffolding learning (Alharbi, 2023; Duncanson, 2024).

Despite these advantages, participants also expressed concerns about over-reliance and its potential impact on learning. Participants warned that excessive dependence on AI could hinder the development of writing skills and creativity. For example, one student observed that "if students depend too much on AI… their writing will decline. They won't learn vocabulary or try to think of new ideas" (S1), while another noted that "if you depend too much, you lose creativity…

the essay isn't really yours anymore" (S4). These concerns were closely linked to issues of academic integrity and authorship, as reflected in the statement "AI should support, not replace our brains" (S6). Notably, some students described actively regulating their use of AI to maintain autonomy, with one participant explaining that "I'll limit asking AI to write… use it to outline and give examples, then I'll write on my own" (S8). Such responses indicate that students are not only aware of the risks associated with AI but are also developing strategies to manage them.

Students also identified several technical limitations of AI tools, including mechanical language, lack of coherence, and difficulty interpreting user intent. For instance, one student commented that "its writing feels too machine-like… not human enough" (S1), while another observed that "the wording is mechanical… looks obviously AI-generated" (S8). Difficulties with prompting were also noted, with one participant stating that "sometimes AI doesn't understand my ideas… I have to repeat myself many times" (S4). These challenges highlight the need for human oversight and suggest that effective AI use requires not only access but also skill and experience.

With regard to curriculum integration, participants generally expressed support for incorporating AI literacy into formal instruction. As one participant stated, "I think AI should be part of English courses" (S1), while another emphasized that "every field requires AI… it's essential to learn it" (S5). Students highlighted the importance of learning not only technical skills but also ethical considerations, as reflected in the comment "if I know AI's functions, limitations, and ethical issues, I can use it better" (S1). However, some students viewed AI skills as easily self-acquired, with one participant noting that "I don't think it's necessary… AI skills are easy to find online" (S2). This variation suggests that while AI literacy is widely recognized as important, its integration into curricula should be carefully designed to meet diverse learner needs.

4.3. AI literacy and coping strategies for writing anxiety (RQ3)

The qualitative findings provide further insight into how selected participants described managing writing anxiety in relation to AI use. Some participants described feeling less anxious when AI provided immediate support and feedback. For example, one participant stated that "I feel less anxious because I balance its use positively" (S1), while another noted that "less anxious, because it helps me a lot…" (S2). However, this experience was not uniform across contexts. Some participants described AI as helpful mainly in time-constrained situations, as reflected in the comment "if I have to write quickly, AI makes me less anxious. But for long essays, I feel anxious" (S6). Participants also described anxiety in relation to academic integrity and AI-detection tools, with one participant admitting that "with academic AI-check tools… I also feel worried" (S4).

The upper- and lower-end selections were not treated as validated groups, but the accounts included contrasts in how confidently and strategically participants described using AI. One participant described more strategic use, as illustrated by the comment "it only meets my needs when I give the right prompts…" (S3). Other participants expressed uncertainty and limited trust in AI outputs, with one stating that "about 50%, because my English is weak…" (S5), and another noting that "I worry my prompts won't fully convey my ideas" (S8). These accounts suggest a possible relationship between AI literacy and how students engage with AI, but they do not show that AI literacy directly reduces anxiety or determines emotional experience.

Importantly, students' coping strategies extended beyond AI use and included a range of self-regulation techniques. For example, one participant described using emotional regulation strategies, stating that "I take deep breaths to calm down… then slowly develop content" (S7), while another emphasized goal-setting and gradual improvement: "I identify my weaknesses, set goals, and work gradually to improve" (S6). AI was integrated into these broader strategies as one of several tools supporting the writing process. As one student explained, "if I understand

Table 4. Summary of qualitative themes

Theme	Key subthemes	Interpretive summary	Illustrative quotation
Human-led, strategic use	Independent drafting; selective revision; iterative prompting	Students generally retained ownership of ideas and used AI mainly to improve language, organization, or efficiency.	"I draft it myself first, then ask AI to proofread…" (S3)
Benefits accompanied by limits	Language support; time saving; emotional reassurance; output errors	AI could reduce immediate task pressure, but students did not regard its output as consistently reliable.	"AI sometimes makes mistakes or hallucinates…" (S7)
Agency, authorship, and ethical concern	Over-reliance; creativity; academic integrity; AI detection	Students associated responsible use with limiting substitution and maintaining authorship.	"AI should support, not replace our brains" (S6)
Context-dependent anxiety management	Time pressure; prompt confidence; trust calibration; non-AI coping	AI support was described as helpful in some situations, whereas uncertainty, long tasks, and detection concerns could sustain or create anxiety.	"If I have to write quickly, AI makes me less anxious" (S6)
Need for structured AI-literacy instruction	Prompting; verification; ethical use; differentiated support	Most participants favoured explicit guidance, although views differed on whether these skills required formal instruction.	"If I know AI's functions, limitations, and ethical issues, I can use it better" (S1)

what the examiner wants… I can present my ideas better" (S2). These findings align with Self-Regulated Learning theory (Zimmerman, 2002), highlighting the active role of learners in managing both cognitive and emotional aspects of writing.

5. Discussions

5.1. A negligible bivariate association

The survey result provides no evidence that students who reported greater AI literacy were generally less anxious about English writing. The effect was negligible and its confidence interval included zero. This finding should not be interpreted as proof that AI literacy is irrelevant or that the constructs are equivalent across literacy levels; rather, it shows that a direct linear association was not detectable with these measures and this sample. It also clarifies why findings from AI-feedback interventions cannot be transferred automatically to AI literacy. Wang (2024) examined an instructional feedback condition, whereas Yu (2024) examined frequency of AI-assisted writing. Neither variable is identical to the multidimensional literacy score used here.

5.2. AI literacy as a conditional resource

The interviews suggest why the near-zero correlation can coexist with meaningful differences in practice. Participants described prompt formulation, selective acceptance, output verification, and limits on AI-generated text as ways of maintaining control. These patterns are compatible with SRL processes of planning, monitoring, and reflection (Zimmerman, 2002), but they do not demonstrate that self-regulation mediates the association between AI literacy and anxiety. A more defensible interpretation is that AI literacy may function as a conditional resource whose relevance varies across tasks, proficiency levels, institutional rules, and learners' confidence in evaluating AI output.

5.3. Pedagogical implications and a preliminary instructional framework

Table 5. Preliminary clarify-draft-refine-verify-reflect framework

Stage	Related SRL function	Student action	Instructor support	Potential relevance to anxiety
Clarify	Forethought	Identify purpose, audience, task criteria, and permitted AI use.	Model task analysis and establish transparent AI-use boundaries.	May reduce uncertainty about expectations.
Draft	Forethought/ performance	Develop an initial outline or draft before substantial AI assistance.	Use low-stakes planning and drafting activities.	May protect ownership and limit dependence.
Refine	Performance	Use focused prompts for selected language, organization, or idea-development needs.	Teach prompt specificity and comparison of alternatives.	May provide bounded support during difficult stages.
Verify	Performance/ self-monitoring	Check accuracy, sources, disciplinary fit, voice, and academic integrity.	Provide verification checklists and model error detection.	May support calibrated trust rather than uncritical reassurance.
Reflect	Self-reflection	Record decisions, evaluate learning, and plan future independent performance.	Use brief revision logs or reflective notes.	May strengthen perceived control and strategy awareness.

For ESP instructors, the findings support instruction that treats AI literacy as more than tool operation. Students can be taught to define the communicative purpose and disciplinary audience of a task, draft an initial position before requesting AI assistance, formulate bounded prompts, compare AI suggestions with course criteria, verify factual and linguistic accuracy, and document which suggestions were accepted, modified, or rejected. Such activities preserve disciplinary learning and authorship while making the verification process visible. Because students differed in confidence and prior experience, instruction should also include low-stakes practice and alternatives for learners who choose limited AI use.

The five-stage Clarify-Draft-Refine-Verify-Reflect framework translates these principles into a teachable sequence. It is a conceptual proposition derived from SRL theory and the interview patterns; the present study did not test its effectiveness. Accordingly, the framework is offered as a basis for instructional design and future validation rather than as an evidence-based intervention.

6. Conclusions and recommendations

Using an explanatory sequential mixed-methods design, this study found a negligible, statistically non-significant correlation between AI literacy and English writing anxiety among 441 Vietnamese ESP students. Interviews with 10 purposively selected participants nevertheless showed substantial variation in how students used AI, evaluated its output, protected authorship, and incorporated it into broader coping strategies. The strands are complementary only in this limited sense: the interviews illuminate situational processes that were not represented by the bivariate correlation; they do not convert the non-significant result into evidence of an indirect effect.

The study's main contribution is therefore conceptual and contextual. It distinguishes AI

literacy from AI exposure and identifies strategic judgment, calibrated trust, and learner control as promising processes for future study. These interpretations are consistent with SRL theory, but self-regulation, proficiency, and self-efficacy were not measured and no mediation analysis was conducted. Claims about mechanisms must consequently remain provisional.

The findings also support a pedagogical focus on process rather than unrestricted tool use. The proposed Clarify-Draft-Refine-Verify-Reflect sequence offers one way to structure that focus, but it requires classroom implementation and outcome evaluation before it can be described as effective. Future studies could compare the framework with usual instruction and examine changes in writing anxiety, writing quality, revision decisions, and independent performance.

Several limitations constrain interpretation. The single-institution convenience sample, cross-sectional self-report design, and small purposive interview sample limit generalizability and causal inference. The adapted 18-item MAILS subset was not separately validated in this population, and the present report does not document a translation or back-translation, expert-review, or pilot procedure specific to the subset. The study also did not directly measure writing proficiency, self-efficacy, self-regulated learning, actual AI-use behavior, or writing performance. The upper- and lower-end AI-literacy labels were descriptive within-sample selections rather than validated proficiency categories, and the marginal reliability of the SLWAI Avoidance subscale warrants caution. Future studies should use multi-site and longitudinal designs, document AI exposure and task conditions, validate translated or adapted instruments, and directly measure candidate explanatory variables.

Overall, AI literacy should not be presented as a simple remedy for writing anxiety. Its educational value lies in helping learners make informed, ethical, and purposeful decisions while preserving responsibility for the text. That proposition is more modest than a direct anxiety-reduction claim, but it provides a clearer basis for ESP instruction and future research.

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