Students' perceptions of generative AI in EFL writing: Strategies, self-efficacy, satisfaction and behavioural intention

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This study examined students' perceptions and attitudes towards generative artificial intelligence (AI) tools in language learning, particularly in English as a Foreign Language (EFL) writing. Employing a cross-sectional design, data were collected from 399 Saudi university EFL students to assess self-reported associations between AI chatbots and writing-related attitudes. The findings indicate that these chatbots were associated with increased self-efficacy, satisfaction and behavioural intention among participants. Participants reported high levels of satisfaction and self-efficacy, moderate levels of AI writing strategies (operationalised usefulness) and strong intention to reuse. The structural equation model results showed that AI writing strategies were significantly associated with satisfaction (β = .784), self-efficacy (β = .525) and behavioural intention (β = .353), where satisfaction and self-efficacy served as mediators of the strategies–intention relationship. These findings highlight the potential of AI to support confidence, develop attitudes and possibly grow skills for second language writing, particularly with younger people who are familiar with technology. Because outcomes were cross-sectional and self-reported, these estimates represent associations that should not be viewed as causal effects. The findings indicate the promise of AI to cultivate students' confidence and positive attitudes towards second language writing, especially when working with younger university learners with a high level of digital exposure.

Implications for practice or policy:

- Universities should integrate approved generative AI into writing centres and language labs with short disclosures and reflective rationales.
- Departments should design assessments and modules on permitted, ethical and non-coercive AI uses such as brainstorming, vocabulary and revisions.
- Low-stakes AI-assisted practice should be encouraged, while high-stakes assessments remain under instructor control.
- Institutions should publish course-level AI policies outlining permitted and forbidden uses, disclosure requirements, privacy considerations and integrity standards.

Keywords: generative artificial intelligence, language learning, English as a Foreign Language, self-efficacy, behavioural intention, satisfaction, AI writing strategies

Introduction

The growth of artificial intelligence (AI) has rapidly changed the nature of day-to-day life, particularly with regard to virtual assistants available on smartphones and highly capable language models. Generative AI tools (e.g., chatbots) can produce human-quality output. As generative AI develops, we need to critically reflect on these tools, their limitations and educational implications. Although the development of

generative systems rests on a foundation of natural language processing research (Wen & Wang, 2023), studies have investigated educators' perspectives (Polak et al., 2022). However, there is limited research regarding English as a foreign language (EFL) students' experiences and their needs in using AI for writing. Strzelecki (2023) noted that the research into learners' perceptions and behavioural intention towards AI is limited. This study examined how EFL learners use generative chatbots for writing purposes, specifically looking at their satisfaction, self-efficacy and behavioural intention for future use of generative AI tools. The following research questions (RQs) guided this study, focusing on students' perceptions and attitudes (not objective performance):

- RQ1: How do students evaluate their use of generative AI tools (e.g., chatbots) in second language writing, and what are the relationships between student characteristics, AI-assisted writing practices, satisfaction, self-efficacy and behavioural intentions?
- RQ 2: What are the direct effects among AI writing strategies, satisfaction, self-efficacy and behavioural intentions related to the use of generative AI tools (e.g., chatbots) for second-language (L2) writing?
- RQ 3: What are the mediating effects of satisfaction with using generative AI tools (e.g., chatbots) and self-efficacy with using generative AI tools (e.g., chatbots) in L2 writing on the relationship between AI writing strategies and behavioural intention for L2 writing?

Building on the technology acceptance model (TAM; Davis, 1989), we conceptualised AI writing as our operationalisation of perceived usefulness; we treated perceived ease of use as self-efficacy; attitude is satisfaction towards AI-assisted writing; and behavioural intention is the intention to use generative AI for writing. We do not model perceived usefulness as a separate construct.

Literature review

Theoretical framework

Empirical studies using TAM are valuable for understanding technology use in terms of perceived ease of use and perceived usefulness (Davis, 1989; King & He, 2006; Lederer et al., 2000), but the original model can be too general when applied to generative AI in L2 writing. In addition to TAM, the task-technology fit (TTF) construct helps to explain how learners evaluate AI tools based on tangible affordances for writing strategies (e.g., vocabulary growth, feedback evaluation, idea generation) rather than usefulness alone (Goodhue & Thompson, 1995; Mustafa & Garcia, 2021).

In this study, we explicitly operationalised perceived usefulness as AI writing strategies (e.g., planning prompts, iterative revision, error checking) that instantiate utility at the task level. Our framework, therefore, reclaims perceived usefulness for producing AI-based writing strategies to understand how AI tool affordances align with specific writing tasks. When writing, students evaluate and adopt AI features based on task fit, providing a framework for measuring adoption variables (Granić & Marangunić, 2019). Although TAM emphasises perceived usefulness and ease of use as primary determinants of behavioural intention, it does not fully capture the psychological mechanisms that shape learners' confidence in adopting new technologies. To address this gap, social cognitive theory (SCT) highlights self-efficacy, the belief in one's capacity to perform specific tasks successfully, as a central determinant of behaviour (Bandura, 1997). Within this framework, self-efficacy not only influences individuals' choices and effort investment but also their persistence when facing challenges.

Extending this to technology adoption, research consistently demonstrates that learners with higher self-efficacy are more likely to engage with and sustain the use of digital tools (Kelly et al., 2022; Sun & Mei, 2022). Such research shows that self-efficacy, trust and anxiety shape learners' attitudes, involving both cognitive and affective dimensions beyond ease and usefulness (Sun & Mei, 2022). The unpredictable and sometimes hallucinated AI output demands that students critically assess outputs (Dahri et al., 2024). A critical review of AI in higher education highlights both benefits (e.g., personalised feedback, engagement)

and drawbacks (e.g., overreliance, shallow learning, integrity issues) (Abdaljaleel et al., 2024; Bibi & Atta, 2024; Yu et al., 2024).

We contrast evidence that frames AI as helpful with work highlighting its limitations, such as overreliance, shallow learning and ethical risks (Abdaljaleel et al., 2024; Bibi & Atta, 2024; Yu et al., 2024). Accordingly, we adopted a critical stance that contrasts supportive findings with documented risks and treats effects as context-dependent rather than universal. Although many studies remain descriptive, we synthesised them by specifying when AI supports greater autonomy and when its use should involve prescriptive guidance (Goodhue & Thompson, 1995), structured reflection (Kelly et al., 2022) and ethical training (Mabrouk et al., 2022).

In this study, our modified TAM places AI-assisted writing strategies at the centre, with self-efficacy and satisfaction as use mediators (Kelly et al., 2022; Liu & Ma, 2024), situated within a TTF framework. We reframed perceived usefulness as enacted strategies (e.g., planning prompts, iterative revision, error checking), thus aligning TAM with TTF in generative environments, making strategies the immediate antecedent to satisfaction and self-efficacy while allowing for the pathway to intention.

L2 writing and generative AI tools

L2 writing is rapidly growing due to the global rise of English and increasing demand for written texts (C. T. K. Nguyen, 2019; Silva & Matsuda, 2012). Recent research has highlighted pedagogical models and best practices in AI use during writing instruction (Tseng & Warschauer, 2023). Generative AI tools (e.g., chatbots) are used for diverse writing tasks like idea generation, editing and translating (AlAfnan et al., 2023; Buholayka et al., 2023); in our framework, these task-oriented uses constitute AI writing strategies (our operationalisation of perceived usefulness).

Studies have shown AI-assisted writing helps learners monitor performance via analytics and receive tailored feedback (Imran & Almusharraf, 2023; Zadorozhnyy & Lai, 2023), creating engagement opportunities and reinforcing operationalised usefulness through strategy enactment. Learners have reported improved writing and valued immediate feedback (Bibi & Atta, 2024; Lee & Park, 2023). Research on collaborative AI use has noted benefits for self-directed learning, critical thinking and creativity, especially when tasks are ethically framed (Kim et al., 2023). However, critical engagement remains a boundary condition: students must be trained to identify bias, evaluate AI feedback and avoid surface-level improvements (AlAfnan et al., 2023; Dahri et al., 2024). AlAfnan et al. emphasised output inconsistencies and biases, recognising the need for training in evaluating AI responses (Mabrouk et al., 2022; Sun & Mei, 2022).

This mixed evidence highlights boundary conditions, including assignment design, scaffolding and policy clarity, under which strategies translate into positive attitudes and intentions. In practice, educators must structure AI use to avoid overreliance, such as requiring learners to rationalise revisions using AI feedback or combining it with peer or instructor input (Kelly et al., 2022). Instructors can design scaffolded activities alternating between AI use, manual revision and analysis (Imran & Almusharraf, 2023; Safitri & Fithriani, 2024). Curriculum designers might include AI literacy (e.g., bias detection) in writing courses (Mabrouk et al., 2022).

Self-efficacy and L2 writing with generative AI tools

Generative AI tools (e.g., chatbots) enhance L2 writing self-efficacy and perceived ease of use in TAM, offering contextualised feedback that contributes to students' writing confidence (Sousa et al., 2023). Empirical studies have linked AI use in L2 writing directly to increased self-efficacy. For example, Song and Song (2023) found that students instructed on ChatGPT left class with greater self-efficacy and motivation. T. T. H. Nguyen (2023) reported improved lexical use and increased confidence among EFL students. Bibi and Atta (2024) found that 80% of students believe ChatGPT improved their writing and self-efficacy. Wang (2024) showed that AI-supported translation feedback reduces student anxiety and boosted self-efficacy. Similarly, Amin (2023) found that generative AI reduces perceived writing barriers, making

writing feel less daunting. These outcomes are conceptually related to, but distinct from, concerns about whether such benefits endure over time. At the same time, evidence is mixed regarding the durability of these gains and their impact on learner autonomy, particularly when feedback is accepted uncritically. In this regard, self-efficacy development appears to depend on how learners approach AI. Overreliance on AI feedback and uncritical acceptance may hinder autonomous skill development (Dahri et al., 2024). Learners must evaluate AI-generated output critically and decide when to accept or amend it (Sun & Mei, 2022). Thus, gains in self-efficacy depend on reflective AI use, in contrast to peer or teacher feedback (Kelly et al., 2022).

Satisfaction with generative AI tools in EFL

Satisfaction is a key attitudinal predictor in TAM, linked to continued use and positive attitudes towards technology (Davis, 1989; Venkatesh & Davis, 2000). ChatGPT has gained significant satisfaction among EFL students in L2 writing due to its affordances and time-saving benefits (Bibi & Atta, 2024). Recent studies have shown that EFL students are highly satisfied with generative AI tools due to time efficiency, personalised feedback and increased engagement (Bibi & Atta, 2024; Imran & Almusharraf, 2023). EFL educators, however, have emphasised the need for professional development to understand AI tool limitations (T. T. H. Nguyen, 2023).

Chatbot-supported writing activities offer authentic language practice, instant feedback and proficiency gains, especially for beginners (Abd Rahim et al., 2023; Dai et al., 2023; Guirao et al., 2015; Monika & Suganthan, 2024). Students have reported vocabulary improvement, greater enjoyment and broad support for AI use (Monika & Suganthan, 2024; Nugroho et al., 2023). However, satisfaction must be weighed against concerns such as increased risk of plagiarism and shallow learning when students adopt AI feedback uncritically (Ali, 2023). Although TAM often treats efficacy as an antecedent of satisfaction, some evidence suggests affective satisfaction can reinforce efficacy via perceived success and reduced anxiety (Teng, 2024).

Behavioural intention to use generative AI tools (e.g., chatbots)

Perceived usefulness, self-efficacy, ease of use, habit and attitudes shape behavioural intention to use AI tools (Kelly et al., 2022; Liu & Ma, 2024). TAM research has extended these constructs to language tasks, showing learners engage more if they view AI as a helpful resource (Liu & Ma, 2024). Habitual use predicts intention, but attitudes and satisfaction explain more variance (Chen et al., 2021; Strzelecki, 2023).

Learners often perceive AI as useful after successful outcomes, reinforcing future use (Kelly et al., 2022). Yet habitual use can cause overreliance, often driven by convenience rather than pedagogical value, reducing critical engagement (Dahri et al., 2024). Novelty-based motivation also fades without a meaningful purpose, especially as digital literacy grows (Yu et al., 2024). Thus, intention reflects perceived value but can also mask unreflective use, highlighting the need to interpret associations cautiously.

Demographic factors and L2 proficiency

Research on demographics and proficiency in adopting AI tools has shown mixed results. Yilmaz et al. (2023) found overall positive perceptions of ChatGPT among university students, with males reporting higher self-efficacy and no grade-level differences. Males also rated themselves as more confident in AI knowledge (Yeh et al., 2021) and viewed AI suggestions as more valuable, while females rated AI-generated information as less useful (Araujo et al., 2020). In contrast, some findings suggest that females and visual learners perform better in writing tasks, and females showed higher syntactic accuracy at advanced proficiency levels (Sabarun et al., 2021). Taken together, these findings suggest that demographic influences are complex and may interact with learner proficiency and instructional context. Satisfaction is influenced by feedback accuracy, cultural alignment and responsiveness, especially in Saudi contexts (Goar et al., 2023; Silvestre et al., 2023; Soomro, 2018). Male self-efficacy may reflect greater exposure to technology, while female attitudes may stem from more complex expectations (Araujo et al., 2020; Yeh et al., 2021). Older learners often report lower satisfaction, likely due to limited digital exposure

rather than age itself (Abdaljaleel et al., 2024), and adopt AI tools more slowly due to unfamiliarity or different instructional needs.

Demographics and proficiency influence perceived ease of use and usefulness, shaped by prior experience with technology and task demands. Learners with higher digital literacy find AI tools easier to use (Venkatesh & Davis, 2000), while task fit shapes perceived usefulness (Goodhue & Thompson, 1995). These differences reflect familiarity and support needs, not innate traits.

Research model and hypotheses

Taken together, the reviewed literature provides a foundation for the proposed research model. Drawing on TAM, TTF and SCT, we outline eight hypotheses aligning with the RQs that specify the direct and mediating relationships among AI writing strategies, satisfaction, self-efficacy and behavioural intention. These eight hypotheses (H1–H8) guide the empirical analysis presented in the following sections.

TTF theory suggests that alignment between task and tool increases user satisfaction (Goodhue & Thompson, 1995). In the context of L2 writing, studies have confirmed that students report high satisfaction with ChatGPT when it supports writing processes such as drafting and feedback (Bibi & Atta, 2024; Imran & Almusharraf, 2023). Based on this evidence, we hypothesised that AI writing strategies will positively influence satisfaction with generative AI tools in L2 writing (H1).

Bandura's (1997) self-efficacy theory highlights mastery experiences as key to building confidence. Empirical findings have shown that ChatGPT use enhances learners' writing confidence and reduces anxiety, further supporting the connection between enacted strategies and perceived capability (Song & Song, 2023; Wang, 2024). Accordingly, we hypothesised that AI writing strategies will positively influence self-efficacy in L2 writing (H2).

The TAM posits that perceived usefulness is a primary driver of behavioural intention (Davis, 1989). In language learning, strategy use, such as error checking and revision, has been shown to predict learners' willingness to adopt AI tools (Kelly et al., 2022; Liu & Ma, 2024). Thus, we hypothesised that AI writing strategies will positively influence behavioural intention to use generative AI tools in L2 writing (H3).
Satisfaction with feedback and perceived success have also been shown to foster greater confidence in writing ability (Lee & Park, 2023; Venkatesh & Davis, 2000). We therefore hypothesised that satisfaction with generative AI tools will positively influence self-efficacy in L2 writing (H4).

In addition, TAM extensions emphasise satisfaction as an antecedent of continued use (Thong et al., 2006), and studies have confirmed that EFL students who are satisfied with ChatGPT are more likely to reuse it (Bibi & Atta, 2024). This leads to our fifth hypothesis: satisfaction with generative AI tools will positively influence behavioural intention (H5).

SCT positions self-efficacy as a key predictor of behaviour (Bandura, 1997). Similarly, research on technology adoption has found that learners with greater self-efficacy are more likely to sustain use of digital tools (Kelly et al., 2022; Sun & Mei, 2022). Thus, we hypothesised that self-efficacy with generative AI tools will positively influence behavioural intention in L2 writing (H6).

The following pertains to the indirect paths of interest. According to TAM, satisfaction functions as an attitudinal predictor of continued technology use (Davis, 1989). Recent research has further demonstrated that satisfaction with generative AI mediates the relationship between task strategies and behavioural intention in EFL contexts (Abdaljaleel et al., 2024; Yu et al., 2024). Thus, we hypothesised that satisfaction with generative AI tools will mediate the relationship between AI writing strategies and behavioural intention to use these tools for L2 writing (H7).

In addition to satisfaction, self-efficacy serves as another pathway linking strategy enactment to sustained use. Learners who effectively apply AI-assisted writing strategies build confidence in their ability to use these tools, which in turn increases their intention to reuse them (Song & Song, 2023; Sun & Mei, 2022).

Accordingly, we hypothesised that self-efficacy will mediate the relationship between AI writing strategies and behavioural intention to use generative AI tools for L2 writing (H8). Figure 1 illustrates the proposed research model, showing the hypothesised paths and their directional relationships.

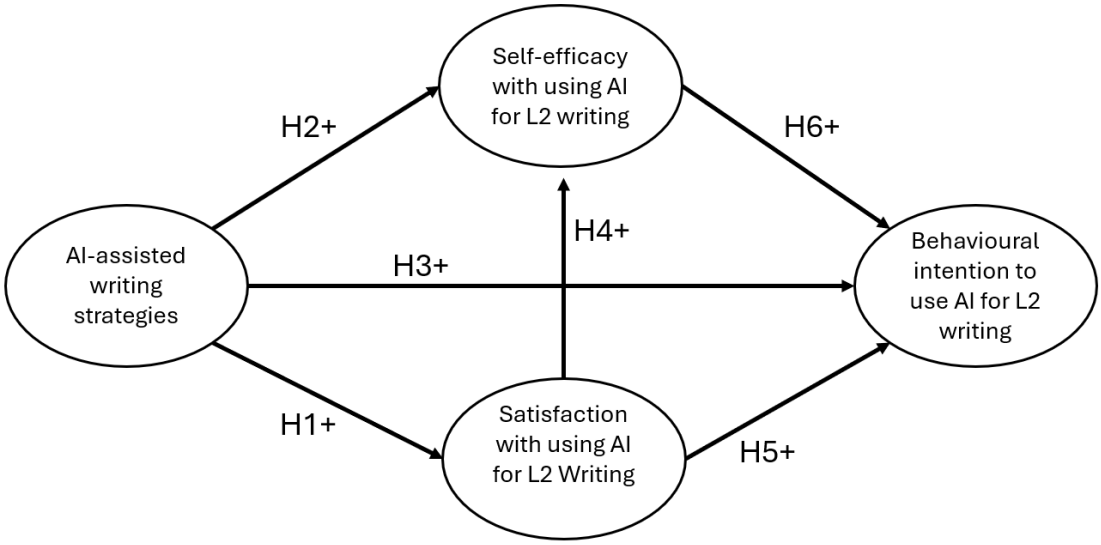

Figure 1. Conceptual model
Note. Mediation hypotheses (H7 and H8) are examined via indirect effects in the SEM and are not depicted with separate arrows.

Methods

This descriptive cross-sectional study, conducted at a university in Saudi Arabia, investigated the use of generative AI tools (e.g., chatbots) for L2 writing. It examined satisfaction (attitude), self-efficacy (perceived ease of use) and behavioural intentions to continue using generative AI tools. A cross-sectional design is an approach for assessing perceptions and attitudes at a single time point, and AI writing strategies (operationalisation of perceived usefulness). A cross-sectional design at a single time point does not permit causal inference or conclusions about effectiveness. The study context is tertiary EFL writing instruction (university courses), which has implications for later practice and policies.

Participants

A total of 399 participants took part in the study: 350 (87.7%) female and 49 (12.3%) male. The majority were in the age group of 18–24; however, there were 54 participants aged 25–29 and 18 participants who were older than 30 (mean age = 22.9, *SD* = 3.76). Students' grade point averages ranged from 2.14 to 5.00 (*M* = 4.26, *SD* = 0.53; see Table 1), and their self-rated English proficiency was 7.37 out of 10 (*SD* = 1.75). The sample majors included Engineering, Business, Health Sciences, Linguistics and Media. Participants were 291 first-year, 27 second-year and 81 third-year students (see Table 1). Although there were more females than males in the sample, this reflects EFL gender distribution in local tertiary demographics; for example, female enrolment was approximately 78% in 2022 (Al-Khresheh, 2024). We note this demographic imbalance as a limitation for generalisability.

Table 1
Participant background (n = 399)

	M	*SD*
Age	22.9	3.75
Grade level		
Freshman	291	
Sophomore	27	
Junior	81	
Self-rated L2 proficiency	7.37	1.76
Female	350	
Male	49	

Questionnaire

We administered a questionnaire comprising two sections: demographics (age, academic scores, English proficiency, gender and major) and Likert-scale items (1 = *strongly disagree*, 5 = *strongly agree*) measuring self-efficacy, behavioural intention and satisfaction aligned with EFL instruction contexts. Self-efficacy items were adapted from Bong and Skaalvik's (2003) academic self-efficacy scale, grounded in Bandura's (1997) SCT. For example, "I am confident with my ability to participate in [this subject]" was modified to "I am confident that I am learning how to write in English while using generative AI tools (e.g., chatbots)". This retained the core focus on perceived capability in a task-specific AI context (Bailey & Rakushin-Lee, 2021).

Satisfaction was measured using adapted items from Cai et al. (2024), such as "I am satisfied with using generative AI tools (e.g., chatbots) to enhance language learning". This captured participants' overall evaluation of generative AI in EFL writing.

Behavioural intention items were drawn from TAM (Davis, 1989) and were informed by prior validated tools in e-learning (Tarhini et al., 2017) and language technology (Almusharraf & Bailey, 2025). Sample items included "I intend to use generative AI (e.g., chatbots) to enhance my English writing experience" and "I am likely to recommend generative AI (e.g., chatbots) to others for writing improvement".

AI writing strategies, which we operationalised as perceived usefulness, were measured through task-specific items based on L2 writing strategy literature (Maarof & Murat, 2013). These spanned the pre-writing (e.g., idea generation, vocabulary), while-writing (e.g., clarifying ideas) and post-writing (e.g., feedback) stages. One item also measured AI-generated test simulations (see Table 2). Items indexed enacted, procedural uses of AI (rather than general attitudes), such as error checking, revision cycles using AI and strategy-based self-evaluation. We do not model perceived usefulness as a separate construct; all references to usefulness in this study fundamentally refer to the enactment of strategy.

To establish content validity across all scales, item development followed established scale construction guidelines, including the use of clear, non-leading language and alignment with well-defined constructs (DeVellis, 2016), as well as construct representation principles. Further, a panel of three researchers in education, language technology and writing reviewed all items, whether adapted or newly developed, for clarity, theoretical alignment and contextual relevance to EFL learners using generative AI tools in tertiary contexts.

Questionnaire administration

The study adhered to ethical research standards. Participation was voluntary and anonymous, and students could withdraw at any time or decline the use of their data. Informed consent was obtained electronically via online forms, and students were informed that the questionnaire aimed to support research on pedagogical practices involving generative AI tools.

Data analysis

SPSS version 28 was used for descriptive statistics and exploratory factor analysis, while AMOS version 27 was used for structural equation modelling (SEM). For RQ1, we computed means and standard deviations for all individual items and total scales. For RQ2, we calculated bivariate associations among variables using Pearson correlations. For RQ3, we tested mediation within the SEM framework.

Data cleaning

The data-cleaning process identified and removed nine outliers using linear regression, Mahalanobis, and Cook's distance measures. Latent factor indicators followed normal univariate distributions, with kurtosis and skewness within the acceptable range of -1.0 to +1.0 (George, 2011). Sampling adequacy was confirmed by a high Kaiser–Meyer–Olkin value (0.953) and significant Bartlett's test of sphericity ($\chi^2(253) = 5731.377$, $p < 0.001$), indicating interrelated variables. Commonality values exceeded the 0.50 benchmark (Kline, 2023). These results confirmed the data's suitability for SEM. Because the survey was administered through Google Forms with all items set as required, no cases with missing data were submitted, and therefore neither pairwise nor listwise deletion was necessary.

Results

The study found that students felt very satisfied using AI tools ($M = 4.01$, $SD = 0.84$), especially appreciating the features of explanations, translation and content support (see Table 2). Self-efficacy was high ($M = 3.77$, $SD = 1.05$); students reported high confidence in being able to use AI effectively to express complex ideas and improve their English writing (this suggests confidence in the ability to use the tools, not frequency of usage). AI writing strategies were moderate ($M = 3.54$, $SD = 0.97$); however, simulating writing tests scored low ($M = 3.23$, $SD = 1.38$), suggesting there is a potential area for practice. Students also reported a moderately high behavioural intention to continue using AI tools overall ($M = 3.62$, $SD = 0.89$), with many students expressing a desire to continue using these tools and recommending them to others (see Table 2).

Table 2
Mean score results of the study's variables

	Self-efficacy with using generative AI tools (e.g., chatbots) in L2 writing	*M*	*SD*
1	Interacting with generative AI tools (e.g., chatbots) increases my confidence in understanding and expressing complex ideas in my English writing.	3.81	1.14
2	Generative AI tools (e.g., chatbots) enhance my confidence in my written communications.	3.76	1.21
3	I am confident that I am learning how to write in English while using generative AI tools (e.g., chatbots).	3.75	1.19
4	Using generative AI tools (e.g., chatbots) boosts my confidence in my English writing skills.	3.74	1.20
	Total	**3.77**	**1.05**
	AI-assisted L2 writing strategies		
5	I learn new English words and phrases using generative AI (e.g., chatbots) when writing in English.	3.80	1.19
6	I seek feedback on my English writing from generative AI (e.g., chatbots) tools (e.g., chatbots).	3.60	1.25
7	My English writing has changed after receiving feedback from generative AI (e.g., chatbots).	3.58	1.25
8	I compare my English writing with examples generated by generative AI (e.g., chatbots).	3.54	1.29
9	I ask generative AI (e.g., chatbots) to clarify English grammar rules and concepts when writing in English.	3.48	1.27

10	I use generative AI (e.g., chatbots) to simulate English tests and quizzes when learning writing.	3.23	1.38
	Total	**3.54**	**0.97**
	Satisfaction		
11	I am satisfied with the functions and education services available in generative AI (e.g., chatbots) (i.e., providing explanations, translating, answering questions, and assessing language proficiency).	4.16	1.02
12	I am satisfied with using generative AI (e.g., chatbots) as a tool to enhance language learning.	3.97	1.10
13	I am satisfied with the learning resources available in generative AI (e.g., chatbots) (e.g., articles, books, research papers, audio recordings, videos, presentations, etc.).	3.96	1.11
14	I am satisfied with the organisation and presentation format of the content in generative AI (e.g., chatbots).	3.94	1.06
	Total	**4.01**	**0.84**
	Behavioural intention to use generative AI (e.g., chatbots) in L2 Writing		
15	I am likely to recommend generative AI (e.g., chatbots) to others for writing improvement.	3.88	1.17
16	I intend to explore various features and functionalities of generative AI (e.g., chatbots) to enhance my English language writing.	3.81	1.17
17	I believe that interacting with generative AI (e.g., chatbots) will help me overcome language barriers and improve my English writing.	3.81	1.14
18	I am confident that using generative AI (e.g., chatbots) will positively impact my English writing abilities.	3.79	1.11
19	I intend to use generative AI (e.g., chatbots) as an autonomous learning tool to enhance my English language skills.	3.65	1.15
20	I am motivated to continue using generative AI (e.g., chatbots) for English writing improvement.	3.64	1.10
21	I intend to use generative AI (e.g., chatbots) to enhance my English writing experience.	3.50	1.07
22	I am determined to set specific goals for my English language writing using generative AI (e.g., chatbots).	3.29	1.18
23	I am committed to incorporating generative AI (e.g., chatbots) as a regular part of my English language writing routine.	3.16	1.21
	Total	**3.62**	**0.89**

The study found that females reported significantly higher satisfaction, self-efficacy and behavioural intention towards using generative AI in L2 writing compared to males. Younger students reported higher satisfaction; however, age was not significantly related to self-efficacy or behavioural intention. Table 3 presents strong positive correlations ($r > .50$, $p < .01$) between self-efficacy, satisfaction, behavioural intention and AI writing strategies, which are approximately latent constructs consistent with the hypothesised model.

Table 3
Correlations and mean scores for the study's variables

		1	2	3	4	5	6	7	8
1	Gender								
2	Age	-.224**							
3	University level	-.064	-.128*						
4	Self-rated proficiency	-.082	-.017	-.069					
5	Self-efficacy	.102*	-.058	.032	-.135**				
6	Behavioural intention	.127*	-.007	-.025	-.117*	.691**			
7	AI writing strategies	.056	.018	-.030	-.117*	.681**	.680**		
8	Satisfaction	.137**	-.121*	-.051	-.114*	.616**	.589**	.585**	
	M	1.877	22.925	1.474	7.371	3.766	3.615	3.539	4.010
	SD	0.329	3.751	0.811	1.756	1.048	0.894	0.974	0.839

Note. Self-efficacy = self-efficacy with using generative AI tools in L2 writing; Satisfaction = satisfaction with using generative AI tools; Behavioural intention = behavioural intention to use generative AI tools for L2 writing. Self-rated English proficiency was measured on a 1–10 scale (1 = *true beginner*, 10 = *expert*).
*$p < .01$. **$p < .001$.

Validation of the theoretical model

The theoretical model (Figure 1) was evaluated using SEM. Reliability and validity were also established; the Cronbach's alpha and composite reliability (CR) values all passed the conventional threshold of .70, and all average variance extracted (AVE) scores were above .50 (see Table 4). Satisfaction's AVE was marginal (.47) but acceptable given its CR (.78) and theoretical coverage; items were retained for content representation.

Table 4
Factor loadings, AVE and CR scores

	1	2	3	4	*CR*	*AVE*
Behavioural intention 1	0.83				0.92	0.56
Behavioural intention 2	0.77					
Behavioural intention 3	0.77					
Behavioural intention 4	0.77					
Behavioural intention 5	0.76					
Behavioural intention 6	0.73					
Behavioural intention 7	0.72					
Behavioural intention 8	0.70					
Behavioural intention 9	0.70					
AI writing strategies 1		0.86			0.86	0.51
AI writing strategies 2		0.79				
AI writing strategies 3		0.69				
AI writing strategies 4		0.68				
AI writing strategies 5		0.65				
AI writing strategies 6		0.58				
Self-efficacy 1			0.89		0.91	0.71
Self-efficacy 2			0.88			
Self-efficacy 3			0.79			
Self-efficacy 4			0.81			
Satisfaction 1				0.79	0.78	0.47
Satisfaction 2				0.69		
Satisfaction 3				0.67		
Satisfaction 4				0.58		

Note. Self-efficacy = self-efficacy with using generative AI tools (e.g., chatbots) in L2 writing; Satisfaction = satisfaction with using generative AI; Behavioural intention = behavioural intention to use generative AI for L2 writing.

Confirmatory factor analysis

Confirmatory factor analysis indicated the model was a good fit: χ^2/df = 2.54, comparative fit index = 0.953, Tucker-Lewis index = 0.947, root-mean-square error of approximation = 0.054, PCLOSE = 0.137. All hypothesised paths were confirmed in the results (see Table 5 and Figure 2). The strongest direct relationship was between AI writing strategies and satisfaction (β = .784, p < .001); strategies also had a strong effect on self-efficacy (β = .525) and a moderate effect on behavioural intention (β = .353). The outcomes regarding satisfaction and self-efficacy also contributed to predicting behavioural intention.

Table 5
Direct and indirect effects of the study's model

	Predictor	Outcome	β	*B*	*SE*	*CR*	*p*	Support
	Direct paths							
H1	AI writing strategies	Satisfaction	.784	.730	.080	9.78	**	Pass
H2	AI writing strategies	Self-efficacy	.525	.471	.085	6.22	**	Pass
H3	AI writing strategies	Behavioural intention	.353	.327	.081	4.35	**	Pass
H4	Satisfaction	Self-efficacy	.420	.404	.075	5.60	**	Pass
H5	Satisfaction	Behavioural intention	.300	.298	.076	3.92	**	Pass
H6	Self-efficacy	Behavioural intention	.260	.269	.071	3.68	.003*	Pass
	Indirect paths				β	*B*	*p*	
H7	AI writing strategies	X Satisfaction	X Behavioural intention		.24	.22	**	Pass
H8	AI writing strategies	X Self-efficacy	X Behavioural intention		.14	.13	.003*	Pass

Note. Self-efficacy = self-efficacy with using generative AI tools in L2 writing; Satisfaction = satisfaction with using generative AI tools; Behavioural intention = behavioural intentions to use generative AI tools for L2 writing.
*p < .01. **p < .001.

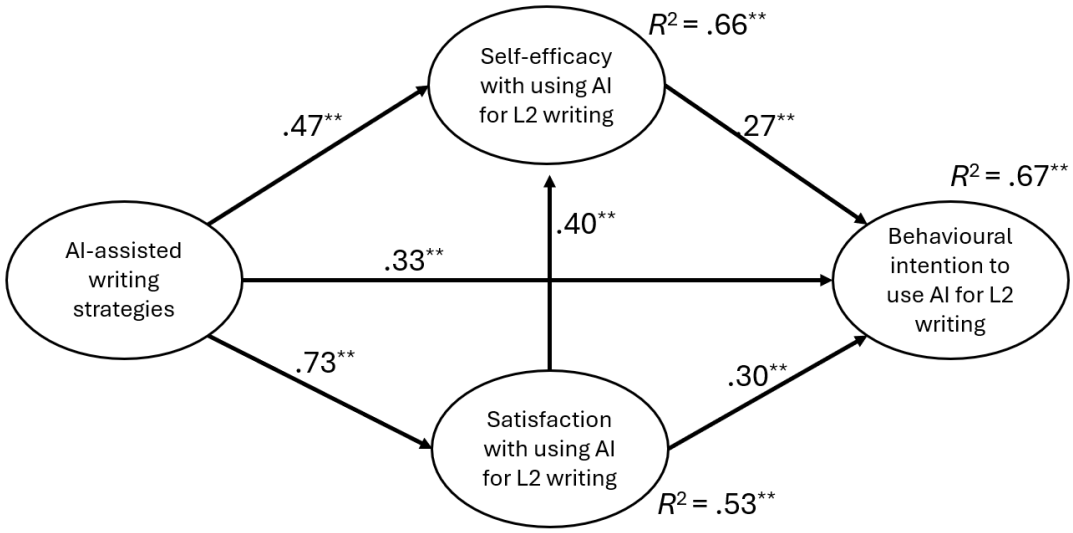

Figure 2. Tested model

Discussion

This study employed a modified TAM to investigate the role of generative AI tools (i.e., chatbots) in language learning, particularly in L2 writing. The theoretical framework examined AI-assisted L2 writing strategies, satisfaction, self-efficacy and behavioural intention as they pertain to how generative AI tools help support L2 writing learning. In tertiary writing contexts (e.g., English for Academic Purposes and English for Specific Purposes courses), these constructs are conceptualised as intersections with course design choices such as process-based assessment, AI-use policy at an institution and teaching professional development that add different shapes to how strategies are represented as satisfaction, self-efficacy and intention.

RQ1: Levels and relationships among variables

Participants reported that AI tools like ChatGPT positively affected EFL students' self-efficacy and perceived usefulness in supporting writing and confidence in writing. According to SCT (Bandura, 1997), self-efficacy is a central determinant of behaviour. As participants reported increased confidence in their writing when using AI tools, this reflects the role of mastery experiences and technological affordances in enhancing perceived capability, key sources of self-efficacy in SCT. The variety and proficiency level of AI-assisted strategies provided learners with scaffolded opportunities to experience success, thereby reinforcing their belief in their ability to manage complex writing tasks. In turn, this heightened self-efficacy supports greater willingness to adopt and sustain the use of generative AI tools for language learning, consistent with research demonstrating the predictive power of self-efficacy on behavioural intention (Kelly et al., 2022).

Instructors can boost self-efficacy through scaffolded activities, starting with guided AI use in groups comparing AI and peer feedback, then progressing to individual evaluation skills to prevent uncritical acceptance of AI suggestions. Curriculum designers should incorporate AI literacy in writing courses, including checklists or reflective prompts such as "Why is AI suggesting this? Does it align with my intent?". At the university level, we encourage process-oriented assessment with brief documentation of AI use (what was used and why), and targeted teaching professional development in writing feedback with AI and prompt design that supports local landscape policy.

AI-assisted L2 writing strategies

Students used generative AI tools for various strategies, including vocabulary learning, feedback and simulated test practice, consistent with Dai et al. (2023), who highlighted AI's authenticity and usefulness in feedback. However, low satisfaction with AI-generated quizzes and exam simulations reveals a gap; better design and assessment-focused AI features could improve effectiveness. Theoretically, treating perceived usefulness as a strategy expands TAM to generative AI, as it allows for utility to be located in enacted interactional practices, not only before beliefs are formed prior to use. This warrants a shift from a linear order of usefulness being evaluated before use to a use-evaluation loop that is pertinent in L2 writing (due to the accuracy and genre idiosyncrasies as well as the hallucination risk). It also supports why we observe strategies preceding satisfaction, self-efficacy, and intention, and can elucidate boundary conditions (task type, scaffolding, policy). In tertiary genres (literature reviews, reports, lab write-ups), strategy enactment is particularly salient because outputs must be critically engaged and modified to discipline conventions rather than accepted verbatim.

As a recommendation, educators might pilot formative quizzes where AI provides distractor analysis or explanations for incorrect choices, while maintaining high-stakes assessments under instructor control to prevent overreliance. Curriculum developers should set clear policies: "AI use is allowed for low-stakes practice, but assessment must adhere to academic integrity standards with explicit guidelines on AI's role". Programmes may provide tools with campus licensing or approval to provide universal access, while curbing variability based on features generated by paywalls.

Gender, age and L2 proficiency differences

Significant differences emerged in satisfaction, self-efficacy and behavioural intention by gender, age and proficiency. Female students scored higher on all three, contrasting with findings favouring males' self-efficacy in AI use (Araujo et al., 2020; Yeh et al., 2021). Younger students reported greater satisfaction, consistent with evidence that younger users adopt AI more readily (Thormundson, 2023).

Lower proficiency learners showed higher satisfaction, self-efficacy and behavioural intention, aligning with Kasneci et al. (2023), who found generative AI especially beneficial for learners with greater needs. We did not test mechanisms for these differences; therefore, implications remain tentative and likely mediated by course design and policy in tertiary contexts.

These differences call for tailored interventions: instructors could offer advanced or older learners targeted training on higher-level AI uses (e.g., genre conventions), while curriculum designers could scaffold tasks by proficiency, providing basic support for beginners and critical engagement for advanced students. Policymakers should fund professional development addressing diverse profiles, avoiding one-size-fits-all solutions. Policymakers should also align teaching and professional development with these profiles (e.g., genre-based prompting workshops) and be clear about the policy so support is not one-size-fits-all.

RQ2: Direct relationships

Figure 2 illustrates results for the SEM examining the direct relationships among AI-assisted writing strategies, self-efficacy, satisfaction and intention to use AI tools for L2 writing. Students' use of AI strategies (e.g., vocabulary development, idea clarification and feedback interpretation) significantly increased both self-efficacy and satisfaction, mirroring findings by Song and Song (2023) and T. T. H. Nguyen (2023), who reported that ChatGPT-enhanced instruction improved learners' confidence, motivation and lexical development. Since we collected cross-sectional self-reported data, we regard the coefficients as associations rather than indications of a causal effect.

The strongest observed effect was from AI writing strategies to satisfaction (β = .73), underscoring satisfaction as a major driver of continued use, consistent with extended TAM frameworks (Thong et al., 2006) and Chen et al. (2022). Notably, satisfaction predicted behavioural intention more strongly than self-efficacy, suggesting that emotional and experiential responses (e.g., enjoyment, perceived ease) may be more influential than confidence alone, an insight supported by Bibi and Atta (2024).

The results show that AI writing strategies strongly predict satisfaction (β = .78) and self-efficacy (β = .53), and also have a direct effect on behavioural intention (β = .35). Satisfaction further predicted both self-efficacy (β = .42) and behavioural intention (β = .30), while self-efficacy also contributed to behavioural intention (β = .26). These findings affirm the relevance of task-specific strategies, affective satisfaction and user confidence in predicting adoption (Kelly et al., 2022; Liu & Ma, 2024). We note, however, that directionality among attitudinal constructs in cross-sectional SEM is model dependent; longitudinal or experimental designs are needed to establish causal ordering. For tertiary programmes, we recommend brief reflection prompts and AI-use logs embedded in coursework to capture both affective responses and strategy development, with disclosure rules ensuring alignment with institutional policy.

RQ3: Indirect relationships

RQ3 examined two indirect relationships in the model: (a) satisfaction mediating between AI-assisted writing strategies and behavioural intention and (b) self-efficacy as a mediator. For the first pathway, satisfaction partially mediated the relationship (β = .22). Although the effect size was small, it was statistically significant, indicating that learners' satisfaction influences their intention to continue using AI tools for L2 writing. This supports TAM, which posits satisfaction as an attitudinal predictor of technology adoption (Davis, 1989). Recent studies by Abdaljaleel et al. (2024) and Yu et al. (2024) have also highlighted satisfaction as a key predictor of ongoing use of generative AI for language learning.

The second indirect relationship demonstrated a smaller effect size (β = .13), suggesting that self-efficacy is again acting as a partial mediator between AI strategies and behavioural intention. This is understood as learners who are confident in their ability to use AI for writing will be more willing to utilise the tools in their future learning practices. This is consistent with the findings of Sun and Mei (2022), who have described the mediating role of self-efficacy in predicting behavioural intention through knowledge acquisition during contrasting AI-supported versus traditional language instruction in the context of L2 learning. The indirect effects demonstrated that satisfaction and self-efficacy function as key mediators between AI-assisted strategies and intended long-term adoption in postsecondary learning contexts. The findings show that satisfaction and self-efficacy feed each other, which indicates that postsecondary learners are motivated to sustain the use of generative AI tools based on cognitive (self-efficacy) and affective (satisfaction) factors.

To build both mastery and satisfaction, instructors should scaffold students' use of AI tools through sequenced interventions. Beginning with low-stakes tasks where AI-generated feedback supports basic writing practice promotes early competence without penalising error. Progressively, students should engage in higher-stakes activities that require comparing AI feedback to instructor or peer feedback, fostering reflection and metacognitive awareness. Alternating between skills-focused tasks (e.g., grammar correction) and more engaging tasks (e.g., AI brainstorming followed by human-led editing) may also sustain motivation while reinforcing critical judgement. Institutions could run pilots of course-embedded evaluations that solicit self-efficacy and satisfaction data to inform programme-level development while emphasising to students that emotional investment is also reliant on observable growth in skills.

The findings support generative AI as a pedagogical tool for L2 writing strategies, particularly through personalised, real-time feedback. This feedback promotes awareness of writing weaknesses and self-regulated learning and autonomy (Dahri et al., 2024). However, increased satisfaction and confidence must be tempered with critical training. AI models frequently generate fluent but inaccurate or biased suggestions. Instructors must emphasise critical validation of AI output. Curriculum designers should explicitly integrate training on AI bias, typical error patterns and the risks of overreliance.

Cultural and educational context

The Saudi EFL context is characterised by highly conventionalised academic writing and an unstable guideline for AI use. This context may influence learners' comfort and intentions for the reuse of generative AI and induce circumspection when generalising these associations to other contexts. In the structure of higher education in Saudi Arabia, where EFL writing is typically taught in traditional, formal and assessment-driven ways, generative AI tools (including ChatGPT) can provide different methods of vocabulary support, feedback and interactive practice that are individualised. Saudi students, particularly younger learners, tend to have high levels of digital exposure, which likely explains their reported satisfaction and engagement with generative language learning opportunities. Saudi female learners are known for their enthusiasm for digital learning and self-directed study (Mabrouk et al., 2022), which may assist their growth in this area. These cultural and educational factors help situate the changes in writing strategies and the use of writing tools that we observed. To ground applicability in the tertiary context, we present three institutional levers: (a) assessment practices (process-oriented rubrics with AI-use disclosure), (b) institutional policy clarity (uses permitted, format for disclosure, integrity alignment) and (c) educative materials for the teacher (AI-use feedback, prompt design, checking for error and bias). These institutional levers likely informed our observed associations and should be explicit in course and programme design. We note that our research has limited generalisability because it is based on a two-site sample of predominantly female learners; we would welcome replication across institutions that have different policies and access models as well.

Limitations

The study's focus on L2 writing only restricts the extent to which findings can be generalised to learning other language skills (e.g., speaking, listening and reading) and to non-tertiary contexts. Future research

should examine how generative AI supports a broader range of skills across varied instructional settings. Self-reporting, while useful, may have introduced potential recall and social desirability bias. Future studies could employ behavioural or performance-based measures alongside self-reporting to provide corroborative evidence.

The sample, being undergraduates from a single Saudi university, predominantly female (87.7%; 12.3% male), may limit the generalisability. These features may systematically shape perceived usefulness, satisfaction, self-efficacy and intention (e.g., local pedagogy, peer norms and institutional AI policies), so estimates should be interpreted as context bound. Additionally, this study focused almost exclusively on the benefits of generative AI without systematically reviewing potential negatives (e.g., overreliance, wrong information, ethical concerns); future studies should also consider these issues to assist researchers, educators and students in the more responsible pedagogical use.

Conclusion

This study found that Saudi EFL students generally accepted AI tools for writing and reported high satisfaction and self-efficacy, moderate use of AI writing strategies, and lower use of test simulations. The SEM results show positive associations in which AI-supported strategies were linked to satisfaction and self-efficacy, which in turn are associated with greater behavioural intention.

The pattern of the findings supports a teacher-guided, strategy-based integration in tertiary contexts: implementation of process-oriented assessment with AI disclosure, reflection on why AI suggestions were accepted or rejected and teacher professional development with emphasis on feedback-with-AI, prompt design and bias and error checking. Programmes should provide clarity in policy (acceptable use, disclosure format, integrity alignment) and equitable access to approved tools.

Data availability

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

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Author contributions

Asma Almusharraf: Conceptualisation, Data curation, Project administration, Supervision, Fund acquisition, Visualisation, Writing – original draft, review and editing; **Daniel Bailey:** Conceptualisation, Formal analysis, Methodology, Validation, Visualisation, Writing – original draft, review and editing; **Norah Almusharraf and Turkiah Alotaibi:** Conceptualisation, Writing – original draft, review and editing.

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