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The Role of Automated Writing Assessment: University Students' Views on Writing Performance and Self-Regulation

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Abstract

This study investigates how artificial intelligence (AI) supports students' self-regulated writing (SRW) practices in academic contexts, particularly in thesis writing. Adopting a qualitative case study design, the research involved six final-year students in an English Language Education program, selected through purposive sampling to represent varying levels of AI reliance. Data were collected through Likert-scale questionnaires and semi-structured interviews, then analyzed using descriptive statistics and thematic analysis. The findings indicate that students predominantly use AI tools for text-processing tasks such as grammar correction, paraphrasing, and translation, which contribute to improved writing accuracy, efficiency, and confidence. However, AI is less consistently utilized for higher-order processes, including idea development and progress monitoring, reflecting varied levels of metacognitive engagement. The results also reveal that students strongly prefer combining AI-generated feedback with input from teachers and peers, particularly for conceptual and substantive revisions. While AI enhances motivation and supports certain aspects of self-regulation, concerns about over-reliance and reduced critical engagement persist. These findings suggest that AI functions most effectively as a complementary tool within a broader pedagogical framework rather than as a substitute for human interaction. The study highlights the importance of integrating AI literacy and metacognitive training into academic writing instruction to ensure that students can use AI tools critically and strategically.

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INTRODUCTION

Writing in a foreign language remains one of the most cognitively demanding academic activities, particularly for university students who are required to produce structured, coherent, and argument-driven texts in a language they have not fully mastered (Berger & Hartgerink, 2022; Ke & Zhou, 2025; Najafov et al., 2025). This challenge becomes even more pronounced in thesis writing, where students are expected not only to demonstrate linguistic accuracy but also to regulate their own learning processes, manage complex ideas, and sustain motivation over an extended period. Writing in this context is not merely a linguistic task, but a multidimensional process that involves cognitive control, metacognitive awareness, emotional regulation, and social interaction (Hillman & MacDonald, 2025; Kokutse, 2022; Tavsanli, 2025). Empirical studies have consistently shown that students often struggle with maintaining grammatical accuracy, organizing arguments, and expressing ideas clearly, which ultimately affects both their confidence and the overall quality of their writing (K. Chen et al., 2021; Gebremariam, 2024; Qin & Groombridge, 2023). These challenges highlight the need for effective support systems that can assist students not only in correcting errors but also in developing sustainable writing strategies.

Within this context, self-regulated writing has emerged as a critical framework for understanding how students actively plan, monitor, and evaluate their writing processes (Inan-Karagul & Seker, 2021; Shen & Bai, 2024; Zhu & Sun, 2025). Self-regulated writing emphasizes

learners' ability to take control of their own cognitive, metacognitive, and motivational processes in order to achieve specific writing goals (Han, 2024; Ramirez-Arellano, 2024; Teng, 2021). Research indicates that students who successfully apply self-regulated writing strategies tend to demonstrate higher writing performance, stronger self-efficacy, and greater adaptability in handling complex writing tasks (Han, 2024; Shen & Bai, 2024; Zhu & Sun, 2025). At the same time, recent developments in artificial intelligence have begun to reshape how these strategies are enacted in practice. AI-powered tools such as Grammarly, QuillBot, and ChatGPT offer immediate feedback, automated corrections, and assistance in idea generation, which can potentially support various dimensions of self-regulated writing. Several studies suggest that AI can enhance writing efficiency and provide valuable support in early drafting and revision stages (Mahdi et al., 2025; Mekheimer, 2025). However, emerging evidence also indicates that students tend to rely heavily on AI for surface-level tasks, such as grammar correction and paraphrasing, rather than engaging in deeper cognitive processes.

A growing body of literature has examined the pedagogical role of AI in writing instruction, particularly through the lens of Automated Writing Evaluation systems. These studies consistently highlight the strengths of AI in providing fast, consistent, and structured feedback on linguistic accuracy and mechanical aspects of writing (Prillaman, 2023; Qin & Groombridge, 2023; Wang & Hu, 2022). At the same time, critical limitations remain evident. AI-generated feedback often lacks contextual sensitivity, rhetorical awareness, and the ability to address higher-order concerns such as argumentation and conceptual clarity. Moreover, concerns have been raised regarding over-reliance on AI, which may reduce students' critical engagement and limit the development of independent writing skills (Abuzar et al., 2025; Nahas, 2024; O'Brien, 2025). While some studies argue that AI-generated feedback can improve writing quality, others emphasize the continued importance of human feedback in supporting deeper learning processes (Kashiha, 2025; Özeren & Özeren, 2025; Zhang & Zhang, 2023). This tension reflects an unresolved question in the literature regarding the extent to which AI can genuinely support self-regulated writing beyond surface-level assistance.

Despite increasing attention to AI-assisted writing, there remains a limited understanding of how students actually integrate AI into their self-regulated writing practices, particularly in real academic contexts such as thesis writing. Existing studies often focus on the effectiveness of AI tools in improving writing outcomes, but relatively few examine how students perceive, adapt, and regulate their use of AI across different dimensions of writing. This gap is particularly significant in EFL contexts, where students face additional linguistic and cognitive challenges. Furthermore, previous research rarely differentiates students based on their level of AI usage, which may obscure important variations in how AI is experienced and utilized. Addressing this gap requires a more nuanced, qualitative approach that captures students' lived experiences and strategic decision-making processes when interacting with AI tools.

Based on these considerations, this study aims to explore students' perceptions of using artificial intelligence to support self-regulated writing, with a particular focus on how AI is integrated into cognitive, metacognitive, social, and motivational dimensions of writing. By examining students with different levels of AI reliance, this study seeks to uncover patterns of use, perceived benefits, and potential limitations in a more contextualized and comparative manner. The study does not assume that AI functions uniformly across all learners; instead, it investigates how individual differences shape the role of AI in writing practices. Through this approach, the study intends to contribute to a more grounded understanding of AI as a co-regulatory tool that interacts with, rather than replaces, human feedback and learner agency.

Ultimately, this study positions AI not simply as a technological tool, but as part of a broader learning ecosystem in which students continuously negotiate between automation, reflection, and interaction. Understanding this dynamic is essential for designing pedagogical approaches that do not merely introduce AI into writing instruction, but integrate it in a way that supports meaningful learning, critical thinking, and sustained academic development.

RESEARCH METHOD

This study adopted a qualitative case study design to examine how students perceive and utilize artificial intelligence (AI) in supporting self-regulated writing (SRW). The case study approach was considered appropriate as it allows for a contextualized exploration of students' writing practices within a real academic setting, particularly during the thesis-writing phase, which demands a high level of self-regulation (Gretschel et al., 2023; Naeem & Thomas, 2025; Star et al., 2025). Rather than isolating variables, this design enabled the researcher to capture the interplay between students' strategic behavior, their reliance on AI tools, and their evolving writing processes. A qualitative approach was therefore essential to uncover not only what students do when using AI, but also how and why they integrate these tools into their writing practices, especially in relation to planning, monitoring, and revising their work (Byrne, 2025; Hughes et al., 2025; Truman, 2023).

The participants were final-year students from the English Language Education Study Program, selected through purposive sampling based on their experience with both SRW strategies and AI-assisted writing tools. Data were collected through questionnaires and semi-structured interviews. The questionnaire functioned as a preliminary mapping tool to categorize students according to their level of AI reliance, while the interviews provided deeper insights into their experiences, strategies, and concerns. Six participants were selected to represent three levels of AI use: low, moderate, and high. This categorization was particularly important, as it allowed for a more nuanced comparison of how different levels of engagement with AI shape students' writing behaviors. The researcher acted as the primary instrument in the data collection process, facilitating interaction and ensuring that participants' responses were interpreted within their contextual meaning (H. Chen et al., 2025; Smith et al., 2022; Summers et al., 2024). To enhance the credibility of the findings, data triangulation and member checking were employed (Al-Eisawi, 2022; Kullman & Chudyk, 2025; Stockless & Brière, 2024).

Data analysis combined descriptive statistical interpretation of questionnaire results and thematic analysis of interview data. The questionnaire utilized a 6-point Likert scale, including an "I don't know" option, to capture variations in familiarity and experience with AI tools. Mean scores were calculated to identify general patterns of AI use across different dimensions of self-regulated writing. Meanwhile, interview data were transcribed and analyzed thematically following the procedures of data reduction, coding, categorization, and interpretation (Naeem et al., 2024; Polat, 2025; Udayanga, 2025). Key themes that emerged included grammar and spelling correction, paraphrasing, translation, idea generation, and self-regulated writing behaviors. This integrated analytical approach allowed the study to connect numerical trends with in-depth qualitative insights, thereby providing a more comprehensive understanding of how AI functions within students' writing processes.

RESULT AND DISCUSSION

Result

The findings indicated that the majority of students (95%) viewed the AAI tool as very useful in supporting self-regulated writing strategies, with their rankings falling between the "High" and "Very High" categories. This reflects a generally positive perception of AI's role in improving academic writing performance. However, a small minority (5%) reported "Low" levels of use, indicating the need for further investigation to understand the factors contributing to their limited engagement with AI. To gain a more comprehensive understanding of AI's contribution to self-regulated writing, the following sections will analyze the findings across four key dimensions: cognitive, metacognitive, social behavioral, and motivational regulation. This multidimensional analysis identifies key areas where AI provides the most significant benefits, while also highlighting aspects where students' perceptions tend to vary.

Cognitive Dimension

The cognitive dimension is concerned with how much AI tools improve text processing and memory for course-related content. According to the investigation, students were generally in agreement about AI's contribution to the technical parts of writing. Lower levels of agreement were recorded for indicators related to understanding substance. Only 62.5% of students stated that AI helped maintain topic clarity in their writing, and even fewer—only 40%—considered AI useful in assisting them to recall previously learned academic material. These results highlight a notable disparity: although AI is believed to be beneficial for enhancing mechanical or surface-level writing abilities, some students still view it as having a limited impact on long-term academic recall and deeper conceptual comprehension. This pattern is further supported by the distribution of responses.

Table 1. Students' Agreement Levels on AI-Assisted Text Processing and Course Memory

No.	Questionnaire Items	IHNI	SDA	DA	N	A	SA	Total
	TEXT PROCESSING							
1	When writing, I use AI to check my grammar mistakes.	0%	2.5%	7.5%	7.5%	47.5%	35%	100%
2	When writing, I use AI to check spelling and punctuation errors.	0%	2.5%	10%	25%	40%	22.5%	100%
3	When writing, I use AI to check the cohesiveness and logical structure of my sentences and paragraphs.	0%	2.5%	10%	30%	47.5%	10%	100%
4	When writing, I use AI to improve my word choice.	0%	0%	7.5%	12.5%	57.5%	22.5%	100%
5	When writing, I use AI to check whether the topic and the content have been clearly expressed.	5%	0%	15%	17.5%	42.5%	20%	100%
	COURSE MEMORY							
6	I use AI to provide materials from previous writing courses.	2.5%	2.5%	12.5%	42.5%	35%	5%	100%

Table 1 shows that students predominantly reported using AI for text-processing tasks such as checking grammar, spelling, and punctuation, as well as improving word choice, all of which received high levels of agreement. This indicates that AI plays an important role in supporting students' control of language mechanics and improving writing accuracy. However, lower levels of agreement were found in items related to maintaining topic clarity and recalling materials from previous courses, suggesting that AI is less frequently used or considered less effective for deeper cognitive processes. Overall, these findings suggest that AI is mainly perceived as a supportive tool for surface-level writing improvement rather than for facilitating long-term academic memory and conceptual understanding.

Metacognitive Dimension

This dimension assesses explicitly the contribution of artificial intelligence (AI) in supporting the idea planning process and monitoring targeted progress in writing. Data shows that while AI has been utilized moderately to help students generate ideas (47.5%) and retrieve relevant information (62.5%), students' perceptions of AI's effectiveness in presenting their writing progress tend to vary, with only 60% agreeing. This finding highlights the role of AI in enabling users to evaluate their writing development. While some students find AI helpful in initiating thought processes and accessing previous material, there is still uncertainty about its role as a reliable monitoring tool in the ongoing writing process. The distribution of students' responses in the metacognitive dimension is presented in **Table 2**.

Table 2 shows that students demonstrate moderate engagement with AI in supporting idea planning and goal-oriented monitoring during the writing process. In the idea planning

dimension, a considerable proportion of students reported using AI to generate ideas and search for relevant information, with higher agreement observed in information retrieval compared to idea generation. This indicates that AI is more frequently utilized as a resource for accessing supporting content than as a tool for initiating original ideas. In terms of goal-oriented monitoring, students reported a relatively moderate level of agreement in using AI to track their writing progress and achieve their goals. However, the distribution of responses suggests some variability in how students perceive the effectiveness of AI for this purpose.

Table 2. Students' Use of AI in Idea Planning and Goal-Oriented Monitoring

No.	Questionnaire Items	IHNI	SDA	DA	N	A	SA	Total
	IDEA PLANNING							
1	Before writing, I use AI to generate ideas.	0%	7.5%	22.5%	22.5%	40%	7.5%	100%
2	Before writing, I use AI to search for relevant information to support my topic.	0%	2.5%	17.5%	17.5%	45%	17.5%	100%
	GOAL-ORIENTED MONITORING							
3	I use AI to monitor my writing progress and ensure I achieve my goals.	0%	2.5%	12.5%	25%	47.5%	12.5%	100%

Social Behavior Dimension

This dimension examines students' engagement in receiving feedback and participating in collaborative, peer-based learning. Most students expressed a positive attitude toward AI-generated feedback (67.5%) and reported using it to improve their writing (75%). The highest level of agreement (97.5%) was observed in students' preference for combining AI support with teacher and peer feedback. Additionally, peer discussion after using AI-based tools was widely reported (77.5%), suggesting that AI is most effective when positioned as a complement rather than a substitute for collaborative, human-centered learning processes. The distribution of students' responses in this dimension is presented in **Table 3**.

Table 3. Students' Use of AI in Feedback Handling and Peer Learning

No.	Questionnaire Items	IHNI	SDA	DA	N	A	SA	Total
	FEEDBACK HANDLING							
1	I am open to AI feedback on my writing for an in-depth analysis of my writing style.	2.5%	2.5%	2.5%	25%	52.5%	15%	100%
2	I try to improve my English writing based on AI feedback.	0%	0%	7.5%	17.5%	55%	20%	100%
3	I try to improve my English writing not only based on AI, but also based on my teacher's and peer's feedback.	0%	0%	0%	2.5%	45%	52.5%	100%
	PEER LEARNING							
4	I discuss with my peers after using AI to have more ideas to write.	2.5%	0%	2.5%	17.5%	42.5%	35%	100%

Table 3 shows that students demonstrate strong engagement in integrating AI feedback with social and collaborative learning practices. High levels of agreement indicate that students are receptive to AI-generated feedback and actively use it to improve their writing. Notably, the strongest agreement is found in combining AI feedback with input from teachers and peers, highlighting students' preference for a blended feedback approach. Furthermore, the substantial proportion of students engaging in peer discussion after using AI tools suggests that AI serves as a catalyst for collaborative learning rather than an isolated tool. Overall, these findings indicate that AI is most effective when embedded within interactive and socially mediated learning environments, where human feedback and peer interaction remain essential components of the writing development process.

Motivational Regulation

This dimension covers motivational self-talk, interest enhancement, and emotional control in the context of AI-assisted writing. The data indicate that students generally show positive motivational engagement when using AI, particularly in terms of commitment to improving their writing competence and increased confidence when presenting their work. However, the role of AI in enhancing students' interest, especially in selecting engaging topics, appears to be comparatively moderate. The distribution of students' responses in this dimension is presented in **Table 4**.

Table 4. Students' Motivational Regulation in AI-Assisted Writing

No.	Questionnaire Items	IHNI	SDA	DA	N	A	SA	Total
	MOTIVATIONAL SELF-TALK							
1	I am committed to using AI applications as part of my strategy to improve my writing competence.	0%	0%	7.5%	17.5%	57.5%	17.5%	100%
	INTEREST ENHANCEMENT							
2	I choose interesting topics with the help of AI.	0%	0%	17.5%	32.5%	35%	15%	100%
	EMOTIONAL CONTROL							
3	I feel confident in presenting my writing, especially when supported by AI tools.	0%	0%	7.5%	32.5%	42.5%	17.5%	100%

Table 4 shows that AI contributes positively to students' motivational regulation, particularly in fostering commitment and confidence in writing. A high level of agreement in motivational self-talk indicates that students are willing to integrate AI as part of their strategy to improve writing competence. Similarly, responses in the emotional control category suggest that AI support enhances students' confidence when presenting their work. In contrast, lower levels of agreement in interest enhancement indicate that AI plays a more limited role in helping students select engaging topics, suggesting that personal preference or intrinsic interest may still dominate this aspect. Overall, these findings imply that AI functions as a supportive tool for strengthening motivation and emotional readiness, although its influence on sustaining interest in topic selection remains comparatively moderate.

Interview Results

The interview findings reveal that students' perspectives on the use of artificial intelligence (AI) to enhance self-regulated learning (SRL) strategies in writing vary considerably. The results were thematically organized based on the primary functions of AI tools, including grammar and spelling correction, paraphrasing, translation, and idea generation. In addition, the findings highlight students' preferences and the ways in which they adaptively utilize AI to optimize their SRL strategies and support their overall writing development. These variations reflect differences in students' digital literacy and strategic awareness, as well as the growing role of AI as both a co-regulatory tool and a cognitive aid in writing. Overall, the results suggest that while AI effectively supports mechanical accuracy and writing fluency, its full potential is realized only when it is integrated into a purposeful, reflective, and strategy-driven learning process.

Grammar and Spelling Correction

Students widely recognized the benefits of AI tools such as Grammarly in improving grammar and spelling. Many participants emphasized that these tools increased their confidence in writing, as they help ensure grammatical accuracy and reduce anxiety related to language errors. Several students reported relying on AI to support their limitations in grammatical knowledge and writing structure. As illustrated in the following excerpts:

> "My grammar is quite weak, and I have difficulty composing and adjusting formulas and word patterns. So, I need Grammarly to correct grammatical errors in my thesis."
> "Grammarly helps me check my grammar and reduces my workload because I haven't fully

> mastered grammar yet." "In my experience, Grammarly has been quite effective so far, and one of the reasons I prefer it is its ease of use. I remember downloading it and connecting it to Word easily."

Despite these positive perceptions, some students expressed concerns regarding potential over-reliance on AI tools for grammar checking. They noted that such tools may lack deeper contextual understanding and do not always provide comprehensive explanations. As a result, several participants indicated a preference for human feedback, which they perceived as more nuanced, contextualized, and pedagogically valuable for supporting long-term writing development.

Paraphrasing

QuillBot has become a widely used paraphrasing tool among students due to its ability to reconstruct sentences while preserving their core meaning. Its use is perceived as beneficial for expanding vocabulary and improving syntactic variation in writing. Many participants reported that the tool facilitates quicker access to alternative word choices and expressions, thereby reducing the effort required for manual paraphrasing. As reflected in the following excerpts:

> "QuillBot makes it easy to find synonyms and new vocabulary without having to search for them individually, which makes my work much easier." "Sometimes I use QuillBot to check word patterns."

However, several participants also highlighted limitations in the accuracy of AI-generated paraphrases. In some cases, the output was reported to deviate from the original meaning, requiring users to manually revise the text to maintain semantic accuracy and intended meaning. As one participant noted:

> "In some situations, QuillBot's paraphrased results have changed the structure and meaning so far from my original intent that they require readjustment to maintain the accuracy of the message."

These findings suggest that while paraphrasing tools can support lexical development and structural variation, they still require critical evaluation and user control to ensure the preservation of meaning in academic writing.

Translation

DeepL is widely used among students as a primary translation tool, with many participants perceiving its output quality as superior to other platforms, particularly for academic writing. Students highlighted its accuracy and its ability to produce more natural and contextually appropriate translations. As reflected in the following excerpts:

> "I use DeepL as an alternative for translation and sometimes also to check my English writing." "DeepL is more accurate and better suited for academic writing."

Despite these strengths, several participants noted that the tool is not without limitations. In particular, issues related to contextual accuracy and grammatical consistency were reported. Some students found that the system occasionally misinterprets tense usage or fails to fully capture the intended meaning within specific contexts, requiring manual revision to ensure accuracy. As one participant explained:

> "For example, we want to use past tense, but AI changes it to present tense, so we have to fix it manually." "We want to translate in a specific context, but AI translates it differently from what we want."

These findings indicate that while AI-based translation tools offer substantial support in improving linguistic accuracy and efficiency, they still require active user monitoring and

adjustment to ensure alignment with intended meaning and academic conventions.

Artificial Intelligence–Assisted Writing and Self-Regulated Writing (SRW)

The interview findings indicate that students' use of artificial intelligence (AI) in writing is closely influenced by their individual writing habits and levels of self-regulation. Some students reported integrating AI tools consistently into their daily writing routines as part of an ongoing composition process, while others used them more selectively depending on specific needs. As illustrated in the following excerpts:

> "I use AI very often, every day, because I work on my thesis every day."
> "I rarely use Grammarly; I only use translation tools."
> "As for AI like ChatGPT, I rarely use it, almost never."

Several participants also reported using AI tools, particularly Grammarly, to monitor their writing progress. The feedback and scoring features were perceived as useful indicators of improvement, allowing students to track reductions in errors over time and evaluate their writing development. As one participant explained:

> "I trust Grammarly to assess my writing in detail because it not only provides instant feedback but also consistently follows word patterns." "The AI helps me identify errors, and when I reduce my errors, I know my writing is improving."

However, not all students expressed confidence in AI-assisted writing. Some participants remained skeptical about the reliability of AI tools and preferred to rely on their own linguistic competence. Concerns were also raised about overdependence on AI and its potential impact on students' understanding and ability to explain their own writing. As reflected in the following statements:

> "I don't have much faith in the app. I already trust my own grammar-checking abilities." "I'm worried I won't understand my own writing if I rely too much on AI." "I'm not confident using AI because I'm afraid if someone asks me a question, I won't be able to explain it."

Overall, these findings suggest that AI functions as a flexible tool within self-regulated writing practices, with its effectiveness depending on how strategically it is used. While some students leverage AI as a tool for continuous monitoring and improvement, others approach it with caution, highlighting the importance of balancing technological support with the development of independent writing competence.

Discussion

The findings of this study reveal a nuanced spectrum of student attitudes toward the use of artificial intelligence (AI) in self-regulated writing (SRW), shaped primarily by differences in familiarity, frequency of use, and individual learning strategies. Students who engaged intensively with AI tools tended to perceive them as highly supportive, particularly in enhancing writing accuracy, efficiency, and confidence. In contrast, less frequent users expressed reservations about the reliability of AI-generated outputs and the potential for overdependence. Across all groups, AI was predominantly used for text-processing functions such as grammar correction, paraphrasing, and idea generation, confirming its strong role in supporting lower-order and procedural aspects of writing. However, students consistently indicated that AI could not fully substitute for human feedback, especially in addressing higher-order concerns such as argument development, coherence, and contextual appropriateness. This suggests that while AI contributes meaningfully to the cognitive and metacognitive dimensions of writing, its integration into SRW remains partial and contingent on users' strategic awareness and critical engagement.

These findings both align with and extend existing literature on AI-assisted writing and self-regulated learning. Consistent with prior studies, AI tools were found to be effective in

improving linguistic accuracy and supporting surface-level revision processes (Abuzar et al., 2025; O'Brien, 2025; Prillaman, 2023). Similarly, the role of AI in facilitating idea generation during the pre-writing stage supports the work of (Zhang & Zhang, 2023). However, this study challenges claims that AI-generated feedback alone is sufficient to enhance overall writing quality (Gretschel et al., 2023; Naeem & Thomas, 2025; Star et al., 2025). Instead, students demonstrated a clear preference for combining AI input with human feedback, particularly for deeper conceptual revisions. This finding reinforces Intan Palullu & Bahri (2023) framework of self-regulated learning, which emphasizes the importance of metacognitive monitoring and interpretive engagement in the learning process. Furthermore, concerns about over-reliance (Naeem et al., 2024), highlighting a critical tension between technological assistance and learner autonomy that remains underexplored in current literature. To synthesize these findings, this study proposes a conceptual model of AI-supported self-regulated writing, as illustrated in **Figure 1**.

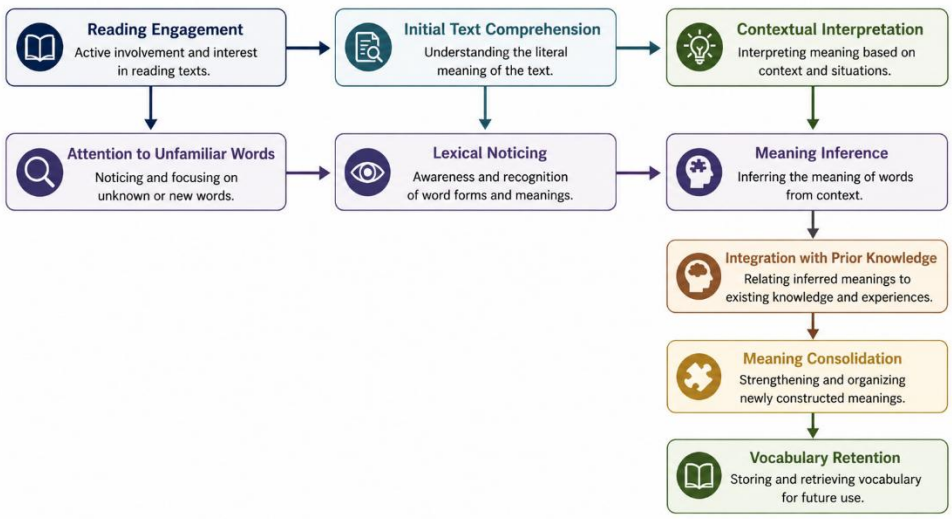

Figure 1. Conceptual Model of AI-Supported Self-Regulated Writing (SRW) (Author Synthesis)

The model highlights the role of AI as a supportive tool across multiple SRW dimensions, while emphasizing the continued importance of human feedback in regulating and refining students' writing development.

This study contributes to the growing body of research on AI in education by positioning AI not merely as a writing aid, but as a co-regulatory agent within the SRW framework. It advances current understanding by demonstrating how students selectively integrate AI into different phases of the writing process, ranging from idea generation to error correction and progress monitoring. More importantly, it highlights the emergence of a hybrid feedback ecosystem in which AI-generated input and human feedback operate in a complementary manner. This extends the work of Berger (2022)by providing empirical evidence of how such hybrid interactions function at the student level. From a pedagogical perspective, the findings underscore the need to move beyond tool adoption toward strategic integration, where students are guided to critically evaluate and regulate their use of AI. This has important implications for curriculum design, particularly in fostering AI literacy and metacognitive awareness as integral components of academic writing instruction.

This study underscores the evolving role of AI as a supportive yet limited agent in self-regulated writing. While AI demonstrates strong capabilities in enhancing technical accuracy, fluency, and initial idea development, it remains insufficient as a standalone tool for comprehensive writing improvement. Its effectiveness is maximized when integrated within a structured learning environment that emphasizes reflection, critical engagement, and interaction with human feedback

sources. These findings suggest that future research should focus on developing AI systems that incorporate adaptive feedback mechanisms and metacognitive scaffolding to better support higher-order writing skills. Additionally, educational institutions should prioritize the integration of AI literacy into writing curricula to ensure that students develop not only technical proficiency but also the critical capacity to evaluate and utilize AI responsibly. Addressing issues of accessibility and equitable access to advanced AI tools will also be essential in fostering inclusive and sustainable AI-supported learning environments.

CONCLUSION

This study set out to examine how artificial intelligence (AI) mediates students' self-regulated writing practices, particularly in terms of usage patterns, perceived effectiveness, and its role alongside human feedback. The findings indicate that while students generally value AI for improving technical aspects of writing such as grammar, paraphrasing, and translation, they remain reliant on teachers and peers for deeper, conceptual revision and validation. This dual reliance reflects not only the current limitations of AI in addressing higher-order writing concerns but also the enduring importance of socially mediated learning processes. At the same time, variations in AI use reveal differences in students' self-regulation, confidence, and digital literacy, with more strategic users benefiting from AI as a supportive tool, while others remain cautious or underutilize its potential. These patterns suggest that AI, in its current form, functions most effectively as a complementary resource rather than a replacement for human interaction. The broader implication is that educational practices must move beyond mere tool adoption toward cultivating critical and reflective AI use, ensuring that students develop both technical proficiency and intellectual independence. Integrating AI literacy into writing instruction, supported by guided pedagogical frameworks and equitable access to advanced tools, offers a pathway toward a more balanced and sustainable learning ecosystem in which technology enhances, rather than diminishes, the development of academic writing competence.

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