

Exploring the Influence of Generative AI on Self-Regulated Learning: A Mixed-Methods Study in the EFL Context

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ABSTRACT

Given the transformative impact of Generative AI (GenAI) on education, this study investigates its specific influence on the distinct phases of students' Self-Regulated Learning (SRL) within an English as a Foreign Language (EFL) context. Despite its ubiquity, a gap exists in understanding how students practically use GenAI to self-regulate their learning and what adaptive strategies they employ. This study utilized a mixed-methods approach to explore this phenomenon. Participants were 100 undergraduate EFL students in an Indonesian university with at least three months of experience using ChatGPT. Data were collected through an adapted SRL questionnaire, semi-structured interviews, and Focus Group Discussions (FGDs). Quantitative data were analyzed using Pearson correlation and ANOVA, while qualitative data underwent thematic analysis. The findings revealed a significant positive correlation between GenAI use and overall SRL ($r = .55$), although its influence was strongest on the forethought (planning) phase and markedly weaker on the self-reflection phase. Qualitatively, students devised adaptive strategies such as dynamic scaffolding and learner-driven fading to foster independence. However, these were often counteracted by hindering factors, primarily cognitive offloading, the illusion of competence, and a widespread deficit in critical digital literacy. Theoretically, this study contributes by articulating how GenAI reshapes core learning processes, proposing necessary extensions to established frameworks of self-regulation and sociocultural learning. The pedagogical implications are profound, demanding a curricular shift towards foundational critical digital literacy and a fundamental redesign of assessment to prioritize process over product.

Keywords: Adaptive Strategies, EFL Learning, Generative AI, Self-Regulated Learning

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INTRODUCTION

The emergence of Generative Artificial Intelligence (GenAI) marks a transformative technological shift. This development has significantly altered the landscape of student learning, especially within the context of English as a Foreign Language (EFL) instruction. For instance, these tools can function as tireless conversational partners for speaking practice or generate customized reading materials tailored to individual proficiency levels (Tu, 2020; Yang et al., 2022). While GenAI affords personalized, interactive, and adaptive learning experiences, its implementation concurrently raises salient concerns regarding student over-reliance, academic integrity issues such as plagiarism, and a potential erosion of learner autonomy (Perkins, 2023; Roe et al., 2023; Yusuf et al., 2024). Central to these concerns is the potential

impact of these tools on students' capacity for Self-Regulated Learning (SRL), a crucial component of academic autonomy (Chiu, 2024; Nückles et al., 2020).

SRL is considered a vital competency, equipping students to actively formulate objectives, monitor their progress, and evaluate their learning outcomes. Within the increasingly digitalized landscape of higher education, proficiency in SRL not only enhances academic achievement but also cultivates the dispositions necessary for lifelong learning (Chou & Zou, 2020; Lai, 2024). Students who possess strong SRL skills tend to exhibit greater autonomy, reflectivity, and resilience when navigating complex learning challenges, including those mediated by AI-based technologies. However, the advent of GenAI introduces a new paradox to the cultivation of SRL. On one hand, these tools can serve as valuable scaffolds, assisting students in planning their learning pathways, gauging their comprehension, and receiving instantaneous feedback (Chiu, 2024; Hastomo et al., 2025; Waziana et al., 2024). On the other hand, unstructured utilization of GenAI risks undermining learner agency and fostering a fallacious sense of mastery (Jin et al., 2023; Lee & Low, 2024).

To deconstruct this contradiction, it is crucial to situate the influence of GenAI within the established theoretical framework of SRL. The theoretical framework of SRL is structured around three core phases. These progress from forethought for planning and goal-setting, to performance involving strategy implementation and self-monitoring, and conclude with self-reflection to evaluate learning outcomes (Lai, 2024; Sherafati & Mahmoudi Largani, 2023; Zimmerman, 2002). Within the context of GenAI integration, each of these phases is being reshaped, as the technology can function in a dual capacity: both as a facilitator of learning and as a mechanism for offloading cognitive responsibility (Combrinck & Loubser, 2025; Molenaar, 2022; Ulla et al., 2023). It is imperative to understand how students navigate their engagement with GenAI across these distinct SRL phases.

A growing body of research suggests that integrating GenAI can bolster students' capacity for SRL. These tools support this development by enabling personalized goal-setting, offering instantaneous feedback, and generating adaptive learning pathways (Chang et al., 2023; Hsiao & Chang, 2023). As a popular GenAI tool, ChatGPT has been utilized to assist students in structuring arguments, comprehending complex linguistic concepts, and honing their English writing and speaking abilities (Cardon et al., 2023; Ng et al., 2024; Werdiningsih et al., 2024; Wulyani et al., 2024). Nevertheless, the uptake and utility of these tools are not uniform across the student population. Usage strategies are heavily contingent upon a range of individual differences, including personality traits, motivational orientations, and diverse cultural and linguistic backgrounds (Kim et al., 2021; Weng et al., 2024). For instance, personality traits such as openness to experience, extraversion, and agreeableness are positively correlated with successful self-regulation when using GenAI support (Guan et al., 2024; Li & Kim, 2024). Conversely, students exhibiting higher levels of neuroticism tend to struggle with managing their learning processes autonomously, even with the availability of tools like ChatGPT.

Scholarship on the connection of GenAI and SRL reveals that its impact is highly contingent on both student characteristics and pedagogical design. Research indicates divergent usage patterns, with high-achieving students leveraging AI for self-reflection while their lower-achieving peers often seek direct answers, bypassing deeper cognitive processing (Lai, 2024). Consequently, without structured pedagogical scaffolds like reverse prompting, AI integration risks diminishing students' self-regulatory capacities (Chang et al., 2023). On a broader level, systematic reviews critique the field for being insufficiently grounded in pedagogical theory and for largely overlooking the adaptive strategies students employ (Darnell & Gopalkrishnan, 2023; Kadri & Widiawati, 2020). This oversight is particularly notable for EFL learners, who face unique cultural and motivational barriers, such as teacher dependency, when using these tools (Nguyen et al., 2024; O'Toole & Horvát, 2024). Eventually, this interaction with GenAI is also shown to impact learners' fundamental psychological needs for autonomy, competence, and relatedness (Wu & Wang, 2025; Young & Shishido, 2023).

In light of the preceding discussion, there is a compelling imperative to critically examine the implications of GenAI integration for students' SRL. This is particularly salient within the

EFL context, which places a premium on learner autonomy and engagement. Accordingly, the present study seeks to address the following primary research questions:

1. How does the integration of GenAI influence the distinct phases of students' SRL within an EFL context?
2. What adaptive strategies do EFL learners devise to leverage GenAI for enhancing their learning autonomy?
3. What factors impede the seamless integration of GenAI into students' SRL processes within the EFL context?

Through an investigation of these questions, this study aimed to offer theoretical, practical, and pedagogical contributions grounded in the reflective and context-sensitive utilization of technology in education.

METHOD

Research Design

This study employs a mixed-methods approach to explore the influence of Generative AI tools, specifically ChatGPT, on students' SLR within the context of EFL learning. This approach was chosen to integrate the statistical pattern-finding strengths of numerical data with the rich narrative depth of qualitative inquiry (Creswell, 2012). This integration enables an understanding of the underlying mechanisms, strategies, and challenges not discernible through quantitative analysis alone.

Participants

The study's participants were comprised of 100 undergraduate students from STMIK Kalirejo, Lampung. They were selected based on their active use of ChatGPT for a minimum of three months for English language practice, such as for grammatical exercises or conversational simulations. Participant selection was conducted in two stages: first, purposive sampling was used to ensure that the criterion of GenAI usage experience was met. This was followed by stratified sampling based on language proficiency levels, as measured by the TOEFL ITP test. Proficiency levels were categorized as low (score <450), intermediate (450–500), and high (>500), with 35, 40, and 25 participants in each stratum, respectively. From this pool, 15 participants (five from each stratum) were randomly selected for the qualitative phase to ensure a diverse representation of experiences.

Instruments

The research instruments consisted of an SRL questionnaire, semi-structured interviews, and Focus Group Discussions (FGDs). Quantitative data, addressing the first research question, were collected using an adapted questionnaire that integrated the SRL questionnaire by Salehi and Jafari (2015) with 10 supplementary items related to GenAI use. This instrument was selected for its established validity and reliability in measuring SRL dimensions such as goal-setting, self-motivation, and self-evaluation. The adaptation involved adding items such as "How often do you use ChatGPT to revise grammatical errors?" measured on a 5-point Likert scale (1 = Never, 5 = Very Often). Prior to distribution, the questionnaire was validated by two experts in English language learning to ensure the relevance of the items to the EFL and GenAI context. A reliability test using Cronbach's alpha was conducted on a pilot group of 30 respondents and demonstrated adequate internal consistency ($\alpha = 0.85$).

Qualitative data, addressing the second and third research questions, were obtained through semi-structured interviews and FGDs. The semi-structured interview guide was adapted from the instrument developed by Chang et al. (2023), featuring open-ended questions such as "How does ChatGPT help you plan your autonomous learning goals?" or "What is the biggest challenge when using AI to evaluate your learning progress?". FGDs were conducted in three sessions (one per proficiency stratum) to discuss collaborative strategies and challenges in GenAI use, such as difficulties in designing effective prompts or over-reliance on instant corrections.

Data Analysis

To analyze the quantitative data for the first research question, the researcher utilized SPSS version 28, following three main stages. First, descriptive statistics (mean, standard

deviation) were calculated to map the frequency of GenAI use and the distribution of SRL scores. Second, a Pearson correlation analysis was employed to examine the relationship between the intensity of ChatGPT use and SRL indicators such as goal-setting ability or time management. Third, a one-way ANOVA was applied to compare the differences in SRL scores across the language proficiency strata, with Tukey's post-hoc test used to identify which groups differed significantly. For example, if a significant difference were found between high- and low-proficiency students, further analysis would explore whether this relates to how they leverage AI for complex versus basic tasks.

Meanwhile, qualitative data were analyzed using the thematic analysis framework proposed by Braun et al. (2015), facilitated by NVivo 12 software. This process included: (1) initial coding to identify concepts such as "AI use for vocabulary scaffolding" or "frustration with AI output inaccuracies"; (2) theme development, which involved generating broader themes like "GenAI as a metacognitive reflection tool" or "dependency vs. autonomy"; and (3) triangulation with quantitative findings to validate and enrich the results. For instance, if the correlation analysis indicated a positive relationship between ChatGPT use and increased SRL scores, thematic analysis might reveal that this was driven by the AI's ability to provide motivating, instantaneous feedback. Conversely, if the ANOVA showed significant inter-strata differences, the interviews could explain that high-proficiency students were more critical in evaluating AI outputs compared to their low-proficiency peers.

Trustworthiness and Ethical Considerations

Internal validity was established through data triangulation (combining questionnaire and interview) and member checking, whereby participants verified the interpretations of their interview transcripts and the resulting themes. Quantitative reliability was confirmed via Cronbach's alpha ($\alpha = 0.85$), while qualitative reliability was ensured by engaging two independent researchers in the coding process to achieve inter-rater agreement (>80%). The study also adhered to academic ethics by guaranteeing participant anonymity, obtaining informed consent, and avoiding bias by excluding participants with any conflicts of interest.

RESULT AND DISCUSSION

The Integration of GenAI Influence The Distinct Phases of Students' SRL Within An EFL Context

To investigate the influence of GenAI on the phases of SRL, a quantitative analysis was conducted. The findings from descriptive statistics, Pearson correlation analysis, and a one-way ANOVA provide a detailed view of how GenAI usage relates to students' SRL strategies, and how this relationship is moderated by language proficiency.

Table 1. Frequency of GenAI Use and SRL Strategy Employment

Variable	M	SD
Frequency of GenAI Use	3.85	0.92
Overall SRL Score	4.1	0.75
Goal Setting (Forethought Phase)	4.21	0.88
Strategic Planning (Forethought Phase)	4.33	0.81
Performance Monitoring (Performance Phase)	3.95	0.95
Self-Evaluation (Self-Reflection Phase)	3.82	1.04

Table 1 presents the results of the questionnaire, which were analyzed using descriptive statistics to map the general patterns of GenAI use and reported SRL strategies among the 100 student participants.. On a 5-point Likert scale, the frequency of GenAI use for English learning tasks was moderately high ($M = 3.85$, $SD = 0.92$). This indicates that GenAI tools like ChatGPT have become a regular component of students' learning workflows. Overall, participants reported a high level of self-regulation in their learning ($M = 4.10$, $SD = 0.75$). An analysis of the SRL sub-scales, which correspond to Zimmerman's three-phase model, revealed specific

patterns (Zimmerman, 2002). Strategies related to the forethought phase, such as Goal Setting ($M = 4.21$, $SD = 0.88$) and Strategic Planning ($M = 4.33$, $SD = 0.81$), were the most frequently reported. This suggests that students actively use technology to set learning objectives and organize their study approach. Strategies within the performance phase, such as Performance Monitoring ($M = 3.95$, $SD = 0.95$), and the self-reflection phase, such as Self-Evaluation ($M = 3.82$, $SD = 1.04$), were reported slightly less frequently. This pattern suggests that while students are adept at using tools for planning, the application of these tools for in-task monitoring and post-task reflection may be less consistent.

Table 2. Pearson Correlations Between GenAI Use and SRL Sub-scales

SRL Dimension	Corresponding SRL Phase	Correlation (r) with GenAI Use	Significance (p-value)
Goal Setting	Forethought	0.62	<.01
Strategic Planning	Forethought	0.58	<.01
Performance Monitoring	Performance	0.45	<.01
Self-Evaluation	Self-Reflection	0.25	<.05
Overall SRL Score	All Phases	0.55	<.01

A Pearson correlation analysis was conducted to examine the relationship between the intensity of ChatGPT use and various SRL indicators. The results, summarized in Table 2, reveal a significant positive correlation between the frequency of GenAI use and the overall SRL score ($r = .55$, $p < .01$), indicating that students who use GenAI more frequently also tend to report higher levels of self-regulated learning. The analysis of the sub-scales provides a more nuanced understanding of this relationship. The strongest correlations were found between GenAI use and strategies in the forethought phase. Specifically, there was a strong positive correlation with Goal Setting ($r = .62$, $p < .01$) and Strategic Planning ($r = .58$, $p < .01$). This suggests that GenAI is a powerful tool for helping students analyze tasks, set clear objectives, and devise plans to achieve them. The correlation was moderate for performance phase strategies like Performance Monitoring ($r = .45$, $p < .01$), implying that GenAI is used to some extent for tracking progress and applying cognitive strategies during tasks. Notably, the weakest, though still statistically significant, correlation was observed with self-reflection phase strategies, specifically Self-Evaluation ($r = .25$, $p < .05$). This weaker link suggests that while students may receive feedback from GenAI, they are less inclined to use it for deep learning. This behavior points to a significant risk of fostering dependency on external evaluation rather than cultivating internal evaluative criteria.

Table 3. One-Way ANOVA Results

Statistic	Value
F-statistic	8.45
df	(2, 97)
p-value	<.001

Table 3 summarizes the results of the One-Way ANOVA test. This test was performed to compare the mean overall SRL scores across the three language proficiency strata (low, intermediate, high). The analysis revealed a statistically significant difference in SRL scores among the groups, $F(2, 97) = 8.45$, $p < .001$.

Table 4. The Moderating Effect of English Proficiency on SRL Scores

Proficiency Group	N	M	SD
Low Proficiency	35	3.73	0.89

Intermediate Proficiency	40	4.08	0.71
High Proficiency	25	4.52	0.65

A Tukey's post-hoc test was conducted to identify which specific groups differed. According to Table 4, the results showed that the high-proficiency group ($M = 4.52$, $SD = 0.65$) reported significantly higher SRL scores than both the intermediate-proficiency group ($M = 4.08$, $SD = 0.71$) and the low-proficiency group ($M = 3.73$, $SD = 0.89$). The difference between the intermediate and low-proficiency groups was also significant. This finding suggests that students with higher English proficiency are also more effective self-regulated learners. This aligns with the notion that more efficacious learners are more likely to employ SRL strategies. The quantitative data suggests that proficiency level is a key factor influencing a student's ability to effectively regulate their learning, which in turn may affect how strategically they can leverage tools like GenAI.

Adaptive Strategies for Fostering Learning Independence

To address the second research question concerning adaptive strategies, a thematic analysis of qualitative data from interviews and FGDs with the 100 participants was conducted. The analysis, facilitated by NVivo 12, aimed to identify how students maximize GenAI to enhance learning independence. Two primary themes emerged: GenAI as a Dynamic Scaffolding Mechanism and Mitigating Affective and Sociocultural Barriers. These themes, along with their corresponding sub-themes, are summarized in Table 5.

Table 5. Thematic Analysis of Adaptive Strategies for GenAI Use

Main Theme	Sub-theme	Description
GenAI as a Dynamic Scaffolding Mechanism	Modeling and Structuring	Using GenAI to generate examples, outlines, and vocabulary lists to understand task requirements and structure work.
	Conceptual Clarification	Engaging GenAI in dialogue to receive simplified explanations of complex concepts, such as grammatical rules.
	Learner-Driven Fading	Consciously reducing reliance on GenAI over time as competence and confidence grow, demonstrating metacognitive control.
Mitigating Affective and Sociocultural Barriers	Low-Stakes Practice Environment	Using GenAI as a private, non-judgmental partner to practice language skills, reducing performance anxiety.
	On-Demand Cultural Interpretation	Using GenAI to instantly understand culturally specific idioms, references, or social conventions encountered in texts.

A primary adaptive strategy identified was using GenAI for modeling and structuring complex tasks. Participants consistently reported using tools like ChatGPT to deconstruct assignments that felt overwhelming. By requesting outlines, examples of specific genres (e.g., formal emails), or lists of relevant vocabulary, students could better understand the expectations of a task and organize their approach. As one student noted during an interview, *"For the big essay, I was stuck. I asked ChatGPT for an outline with three main points. It didn't write the essay for me, but it gave me a map. It was like getting the structure first, so I could focus on the ideas."* This use of GenAI as a planning partner aligns directly with the forethought phase of self-regulation. Such support enables students to move past initial hurdles and engage more deeply with the content itself.

Beyond structuring tasks, students demonstrated a sophisticated use of GenAI for conceptual clarification and learner-driven fading. Many participants described engaging the AI in a dialogue to break down complex grammatical rules or concepts that were unclear from

lectures or textbooks. More importantly, a pattern of "fading"—the gradual withdrawal of support—emerged as a key strategy for building autonomy. Students consciously transitioned from heavy reliance to more targeted use. A participant in an FGD explained this metacognitive process: *"At first, I used Google Translate for whole sentences. Now, I try to write it myself and only ask the AI to check my grammar or suggest a better word. I'm trying to use it less and less, like taking off training wheels."* This self-directed reduction of scaffolding demonstrates a high level of self-regulation.

Another significant theme was the use of GenAI to create a low-stakes practice environment, thereby mitigating the affective barriers common in language learning. Fear of making mistakes and being judged by peers or teachers is a significant source of anxiety that can inhibit participation. Participants across all proficiency levels highlighted the value of having a private, non-judgmental conversational partner. One student shared, *"I'm too shy to speak in class because I'm afraid of making mistakes. With ChatGPT, I can practice conversations for hours. It doesn't laugh at me. It just corrects me, so my confidence has really grown."* This psychologically safe space encourages the risk-taking and repetition necessary for building fluency and confidence, directly enhancing motivational and behavioral self-regulation.

Finally, students strategically employed GenAI as an on-demand cultural interpreter to overcome sociocultural knowledge gaps. English texts are often rich with cultural references, idioms, and social conventions that can be opaque to non-native speakers, hindering comprehension and engagement. Participants reported frequently using GenAI to get instant explanations for these elements. For instance, a student explained, *"We were reading a story that mentioned 'a white elephant gift exchange.' I had no idea what that meant. I asked the AI, and it explained the tradition. It helped me understand the character's feelings in the story much better."* This adaptive strategy allows learners to bridge cultural divides in real-time, fostering a deeper and more nuanced understanding of the language as it is used in authentic contexts.

Factors Hindering the Effective Integration of GenAI into SRL Processes

Thematic analysis of the qualitative data also revealed significant factors that hinder the effective integration of GenAI into students' SRL processes. Despite the potential benefits, participants described challenges related to cognitive dependency, technological limitations, and a deficit in critical evaluation skills. Three main themes are summarized in Table 6.

Table 6. Thematic Analysis of Factors Hindering GenAI Integration

Main Theme	Sub-theme	Description
Cognitive & Metacognitive Hindrances	Over-reliance & Cognitive Offloading	Students' tendency to use GenAI to get answers directly, bypassing the cognitive effort needed for learning.
	Illusion of Competence	GenAI's ability to produce polished work masks students' underlying skill gaps, leading to a false sense of mastery.
Technical & Pragmatic Limitations	Inaccuracy & "Hallucinations"	Students' frustration and confusion caused by factually incorrect or nonsensical information generated by AI.
	Algorithmic Bias & Lack of Nuance	AI outputs sometimes reflect stereotypes or lack the subtle sociocultural understanding needed for authentic communication.
Critical Digital Literacy Deficit	Functional vs. Critical Use	Students primarily use GenAI as a functional tool without critically questioning its output, purpose, or biases.

The most pervasive hindrance identified was over-reliance and cognitive offloading. Participants, particularly when facing deadlines, admitted to using GenAI as a shortcut rather

than a learning tool. This behavior involves delegating essential cognitive tasks to the AI, which undermines the development of critical thinking. As one student candidly stated in an FGD, *"Honestly, if I'm in a hurry, I just ask ChatGPT to write the paragraph for me. It's faster than thinking it through myself. I know I probably shouldn't, but it gets the assignment done."* This creates an illusion of competence, where the polished, AI-assisted output masks a student's actual skill deficit. Another student's interview reflected this danger: *"I got a good grade on my last essay, which Grammarly helped me with a lot. But then we had an in-class writing test, and I completely froze. I realized I didn't actually know the grammar rules myself."* This misalignment between perceived and actual ability is a significant risk of unmonitored GenAI use.

Students also expressed significant frustration with the technical and pragmatic limitations of GenAI. A frequently cited issue was the generation of inaccurate information, or "digital hallucinations." One participant described a frustrating experience with research: *"I asked the AI for sources for my research paper, and it gave me a list of articles that looked perfect. But when I tried to find them, half of them didn't exist. It just made them up. I wasted so much time."* Furthermore, students encountered issues with algorithmic bias and a lack of sociocultural nuance. The AI's inability to grasp subtle, context-dependent appropriateness in language was a recurring concern. *"I was practicing a dialogue for a presentation, and the AI suggested a phrase that my lecturer later said was stereotypical and not something people actually say. It was embarrassing,"* a student shared. These limitations erode trust and highlight the AI's shortcomings as a truly knowledgeable interlocutor.

Underpinning these other challenges is a widespread Critical Digital Literacy (CDL) deficit. The data suggests that most students operate at a functional level, using GenAI as a tool to complete tasks without engaging in deeper critical analysis of its outputs or the systems behind them. This was evident in an interview where a student remarked, *"I just use it to get what I need. I don't really think about how it knows what it knows, or if the information is biased. I just assume it's like a better version of Google."* This lack of critical engagement prevents students from recognizing the ideologies embedded in the tools and challenging potential inaccuracies or biases. Without strong CDL, students are ill-equipped to navigate the complexities of AI, making them vulnerable to misinformation and cognitive dependency.

DISCUSSION

The findings paint a clear and consistent picture of GenAI's dualistic nature in the EFL learning landscape. It is neither an undeniable solution for educational challenges nor an inherently destructive force. Instead, its impact is highly contingent, functioning either as a powerful 'cognitive co-pilot' that enhances learning, or as a detrimental 'cognitive crutch' that fosters dependency and undermines skill development (Bai et al., 2023; Zaim et al., 2025). The determining factor that dictates which role the tool assumes is not the technology itself, but the learner's existing capacity for self-regulation and their level of critical digital literacy.

For the proficiently self-regulated learner, GenAI acts as a force multiplier. This technology enhances all three phases of the SRL cycle. It provides strong support for planning in the forethought phase, offers dynamic scaffolding during the performance phase, and delivers immediate feedback for the self-reflection phase. These learners use the tool instrumentally and critically. They maintain agency over their learning process, strategically offloading lower-order tasks to free up cognitive capacity for higher-order thinking, and adaptively using the AI as a Vygotskian scaffold to operate at the upper edge of their Zone of Proximal Development (ZPD) (Cai et al., 2025).

For the learner with less developed self-regulatory skills, however, GenAI becomes a cognitive crutch. It encourages the wholesale offloading of essential cognitive processes, creating illusions of competence that mask underlying skill gaps (Bai et al., 2023; Iku-Silan et al., 2023). This fosters a deep-seated dependency that erodes the very skills of critical thinking, problem-solving, and resilience that are the hallmarks of an independent learner. These students function merely as passive recipients of the tool's outputs and are effectively used by it (Gerlich, 2025; Yue Yim, 2024). They avoid the demanding cognitive engagement that constitutes the very foundation of authentic learning. The critical distinction between these two

outcomes is mediated by a learner's ability to apply self-regulation directly to their use of the technology. This constitutes a meta-level of SRL that has become an essential competency in the 21st century (Molenaar, 2022; Ok et al., 2025).

The results of this study are consistent with previous research in several respects. The findings affirm the potential of GenAI to function as a "cognitive co-pilot" and support the established positive link between technology-supported SRL strategies and educational outcomes (Bughin, 2024; Jelodari et al., 2023; Memon & Kwan, 2025; Zaim et al., 2025). The study also corroborates existing concerns documented in the literature. These risks include the tendency for cognitive offloading to undermine critical thinking (Hastomo et al., 2024; Pilotti et al., 2017; Risko & Gilbert, 2016). The generation of inaccurate information, or "hallucinations," and a lack of sociopragmatic nuance in AI responses were also identified as significant challenges (Alkaissi & McFarlane, 2023; Ji et al., 2023). However, this study also provides several unique contributions to the field. It offers specific quantitative evidence that shows the weakest correlation between GenAI use and the self-reflection phase of SRL. This finding empirically supports the conceptual concern that these tools may foster dependency on external evaluation instead of promoting internal judgment (Elkhataat et al., 2023). The study also identifies the novel concept of "learner-driven fading." This qualitative finding offers new insight into student agency because it shows students actively reducing their reliance on AI, which contrasts with traditional models where the instructor directs the fading of scaffolds. Finally, the study establishes a more granular analytical framework by situating the analysis within Zimmerman's SRL model and positioning Critical Digital Literacy as the key mediating factor (Zhang & Zhang, 2024; Zimmerman, 2002). This framework helps explain how and why GenAI functions as either a "co-pilot" or a "crutch," adding a crucial layer of analysis to the discourse on AI in education, particularly within non-Western contexts.

The pervasive integration of GenAI into students' academic lives necessitates a re-examination and extension of several core learning theories. First, the findings challenge a foundational aspect of Vygotsky's sociocultural theory (Abtahi et al., 2017; Marginson & Dang, 2017; Vygotsky, 1978). The theory emphasizes the primacy of social interaction with a More Knowledgeable Other (MKO) as the engine of learning. The rise of GenAI prompts a critical question: What are the implications when the MKO is an asocial, non-sentient, and culturally ungrounded artificial intelligence? The evidence suggests that while an AI can effectively replicate the informational and procedural functions of scaffolding, it cannot replicate the intersubjectivity, emotional rapport, care, and shared cultural understanding that are characteristic of a human MKO (Sætra, 2025). This forces a theoretical re-evaluation of what is truly essential in the scaffolding process. It suggests that while AI can be a powerful tool for knowledge and skill acquisition, the human, social element remains indispensable for holistic development, particularly for fostering the affective and sociocultural dimensions of communicative competence (Huang et al., 2023; Wu et al., 2025).

Second, established models of self-regulated learning, such as Zimmerman's, may require a new dimension to remain relevant. The classic model focuses on the regulation of cognition, motivation, and behavior as they relate to an academic task (Karacan et al., 2022). The ubiquity of GenAI introduces a new, overarching regulatory challenge: the regulation of technological interaction. Learners must now consciously plan, monitor, and reflect on how they engage with their digital tools, not just how they approach the academic content itself (Liao et al., 2023; Shafiee Rad & Roohani, 2024). Core SRL processes are transformed. For example, "help-seeking" evolves from a social act to a complex process involving prompt engineering, critical evaluation of AI responses, and verification of information (Zhu, 2025). Future SRL models must account for this new layer of metacognitive activity.

Finally, the phenomenon of cognitive offloading requires an extension of Cognitive Load Theory. Traditionally, this theory has focused on the instructional designer's role in managing cognitive load to optimize learning (Gerlich, 2025). GenAI, however, places the power to manage cognitive load directly into the hands of the learner. This is both empowering and perilous. The theory must now account for the learner's active, and often suboptimal, decisions about which cognitive tasks to offload. The central pedagogical question shifts from "How can

we design low-load instruction?" to "How can we teach learners to make wise and strategic decisions about cognitive offloading to ensure that germane, rather than essential, cognitive processes are supported?" (Case et al., 2025; Jose et al., 2025).

The rise of GenAI necessitates a pedagogical shift in TEFL, moving from isolated language instruction to fostering critical digital citizenship. Central to this evolution is the integration of CDL as a foundational competency, where instruction must transcend functional skills like prompt writing to cultivate critical engagement with AI outputs (Cain, 2024; Walter, 2024). Learning tasks should be redesigned to require students not only to use GenAI but also to analyze its biases, verify its claims, and identify omitted perspectives through critical reflection (Dwivedi et al., 2023; Khlaif et al., 2023; Nurchurifiani et al., 2025). Furthermore, to maintain academic integrity, assessment practices must be fundamentally redesigned to shift focus from the final product to the learning process (Amin, 2023; Jin et al., 2025; Song & Song, 2023; Wulyani et al., 2024). This requires a greater emphasis on process-oriented methods such as project-based portfolios, in-class assignments, and oral presentations that demand real-time human interaction. Assessments can also productively leverage GenAI itself by designing tasks that evaluate students' higher-order thinking (Hastomo et al., 2024; Waziana et al., 2024). For instance, students can be required to critique, improve, or fact-check an AI-generated text, thereby demonstrating their analytical and evaluative skills.

Finally, educators must engage in explicit instruction in metacognitive scaffolding. Effective integration of GenAI requires educators to move beyond passive allowance and proactively instruct students on how to engage with it as a learning scaffold instead of a tool of dependency (Wang, 2024; Zhu et al., 2024). This includes demonstrating strategies for gradually "fading" AI support as their skills improve, using the tool for structured self-reflection, and developing a critical awareness of its limitations. Teachers can make the SRL cycle explicit in the classroom and guide students in identifying where and how GenAI can be productively and ethically integrated into each phase (Giannakos et al., 2024; Hamamah et al., 2023; Lo & Hew, 2023).

This research presents a conceptual framework to explain the impact of GenAI on SRL within EFL contexts. The framework itself is a synthesis of existing literature and data. A primary limitation of this work is its theoretical nature because it is not derived from a single, controlled empirical study. The identified trends, therefore, represent a broad analysis. These conclusions require validation through focused empirical research across diverse populations and educational settings. This analysis reveals several critical directions for future inquiry. There is an urgent need for longitudinal research to track the long-term effects of sustained GenAI use on students' language proficiency, SRL capacities, and critical thinking. Comparative studies are also necessary to contrast the impacts of different AI tools on learning outcomes. Furthermore, the field would greatly benefit from interventionist research that tests specific pedagogical strategies designed to foster critical digital literacy. Finally, future work must examine in greater depth how individual learner variables, such as proficiency level and sociocultural background, mediate the complex relationship between GenAI and self-regulated learning.

CONCLUSION

This study reveals a nuanced and dualistic relationship between GenAI usage and students' SRL in an EFL context. Firstly, quantitative findings demonstrate that while GenAI use is positively correlated with overall SRL ($r = .55$). Its influence is uneven across the learning cycle, most significantly enhancing the forethought phase by aiding in goal-setting and strategic planning, while showing a markedly weaker link with the self-reflection phase. Secondly, students are not passive users. They develop sophisticated adaptive strategies to foster independence, employing GenAI as a dynamic scaffolding mechanism for structuring tasks, clarifying concepts, and creating low-stakes environments to mitigate performance anxiety. Thirdly, despite these strategies, effective integration is significantly hindered by factors such as the tendency for cognitive offloading, the risk of developing an "illusion of competence," technical limitations like AI "hallucinations," and an overarching deficit in critical digital

literacy. The pedagogical implications are therefore profound, demanding a curricular shift towards foundational critical digital literacy and a fundamental redesign of assessment to prioritize process over product.

The present study has certain limitations, most notably its single-institution context and its reliance on self-report data. Despite these constraints, the findings open up important avenues for future research. Although the study's correlational design offers valuable insights, it cannot establish causality. Future research should therefore utilize experimental or longitudinal designs to determine the long-term causal impact of GenAI integration on SRL and objective academic performance. Further investigation is warranted in more diverse sociocultural and institutional settings to enhance generalizability. A crucial avenue for future inquiry lies in the development and empirical testing of pedagogical interventions specifically designed to address the identified hindrances. Such studies could focus on creating frameworks that teach students how to critically evaluate AI outputs and strategically utilize them for the self-reflection phase, thereby transforming GenAI from a potential cognitive crutch into a genuine partner in learning.

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AUTHOR CONTRIBUTION STATEMENT

DT conceptualized and designed the study and also performed the significant revisions of the manuscript's content. EN contributed to the overall development and refinement of the manuscript. WA and TH were responsible for the proofreading process and made revisions related to the mechanics of writing. MH conducted the final review and managed the organization of the manuscript for submission. All authors reviewed and provided their approval for the final version of the manuscript at both the initial submission and revision stages of the peer-review process.

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