

ARTICLE



Distributed agency in AI-assisted L2 writing

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Abstract

This longitudinal qualitative study examines distributed agency between human writers and generative AI in the context of L2 writing. Grounded in Bandura’s theory of agency, the study analyzes students’ written texts, reflective accounts, and AI interaction logs collected from Taiwanese university students. The findings indicate that human-AI distributed agency shapes the enactment of L2 writing across intentionality, forethought, self-reactiveness, and self-reflectiveness. Moreover, distributed agency both supports and constrains learners’ engagement, depending on how it is exercised.

Keywords: second language writing; distributed agency; artificial intelligence; CALL

Language(s) Learned in This Study: English

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Introduction

Generative artificial intelligence (GAI) has transformed education, with its compelling text-based responses attracting attention from researchers and educators, particularly in L2 writing. Many studies highlight GAI’s advantages, such as providing instructional support (Moorhouse et al., 2024), reducing teachers’ workload (Guo & Wang, 2024), supporting brainstorming (Jacob et al., 2023), improving content and grammar (Kurt & Kurt, 2024), enabling personalized feedback (Baek et al., 2023), and scaffolding revisions (Strobl et al., 2024). GAI also influences learners by fostering autonomy (Agustini, 2023), sustaining agency (Jacob et al., 2023), enhancing motivation (Huang & Mizumoto, 2024), and reducing anxiety (Shi et al., 2025). However, concerns about potential drawbacks persist, including risks to critical thinking (Barrot, 2023), self-efficacy (Guan et al., 2025), collaboration (Rasul et al., 2023), and cognitive development (Kosmyna et al., 2025). These studies suggest that when learners outsource aspects of learning to GAI, this partnership-like engagement can enhance the writing experience (Jacob et al., 2023; Teng, 2024), yet it may also inadvertently undermine learning performance.

Traditionally, development of AI tools has been grounded in a human-centered ideology, positioning humans as the primary agents with full control over technological interaction. However, Godwin-Jones (2024) argues “agency resides in both the user and in the AI system” (p. 8), and that they affect each other reciprocally. Users of AI technologies exercise agency by shaping the content and direction of their interactions, negotiating meaning through iterative communication, and refining their work through input prompts. Meanwhile, AI tools exert agency not only by processing information and performing social reactions, but also by influencing users’ thoughts and behaviors. This distributed mode of agency underscores the collaborative dynamic between human and AI in shaping both the process and outcomes (Rammert, 2008).

However, much of the existing L2 writing research has focused on how writers agentively use GAI tools to achieve writing goals, with less attention to how GAI, as a distributed agentic partner, shapes writers’ writing processes and learning over time. To address this gap, the present study conducts a one-year

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longitudinal investigation into the long-term impact of GAI on the distribution of agency between EFL writers and AI tools.

Drawing on Bandura's (2001, 2006) four features of agency, we examine this research question: How does human-AI distributed agency shape L2 writers' academic writing in terms of intentionality, forethought, self-reactiveness, and self-reflectiveness?

Literature Review

Agency

Bandura (2001, 2006) conceptualizes human agency as the active role individuals play in contributing to their actions and environment. This perspective positions individuals as agents with the capacity to intentionally exert influence on their thoughts and behaviors. Bandura identifies four features of human agency: (1) *Intentionality* refers to the ability to set goals and the plans required to achieve them. It is a proactive commitment to action, wherein individuals formulate plans and coordinate their efforts to ensure success. Individuals cannot be considered agents of actions they do not intend. (2) *Forethought* extends agency beyond the immediate present, enabling individuals to anticipate the consequences of their actions. While the future itself does not exert a direct causal influence, the ability to foresee potential results gives structure and purpose to present actions, thereby influencing an agent's decision-making. (3) *Self-reactiveness* involves the regulation of one's actions to ensure alignment with established goals. Individuals monitor their course of action, adjusting their behaviors to stay on track. This process entails deliberate decision-making, execution monitoring, and motivational control, bridging the gap between intention and action. (4) *Self-reflectiveness* is the meta-cognitive ability to consciously reflect upon one's own thoughts, actions, and their meaning. Agents do not simply adjust a course of action based on unconscious reflexes; rather, they adjust it by conscious evaluation and reflection. This capability allows for continuous self-improvement and adaptive behavior.

Distributed Agency

Many authors have approached the topic of agency from the perspective of distributed cognition, which broadly refers to the fact that cognition need not always take place solely in the human brain. Rather, some cognitive processes can be understood as emerging from interaction among a group of people or between humans and artifacts. Applying this line of thinking to second language learning and AI tools, Godwin-Jones (2024) views agency as residing "in both the user and in the AI system" (p. 8), highlighting the emergent nature of agency between humans and tools. He challenges the notion of human dominance over tools and proposes a more nuanced and dynamic interplay between human and AI. He highlights the case of Kailing, a participant in Jacob et al. (2023), to show that iterative exchanges with ChatGPT create a collaborative meaning-negotiation process in which both the user and AI shape the learning experience.

Post-humanist researchers treat agency as a distributed property. Rammert (2012) challenges the notion that humans hold full agency while machines lack autonomy in human-machine interactions. He argues agency is best conceptualized as *distributed* in the sense of involving many parallel processes that work in concert and yet are spread across multiple actors, which include humans and artifacts alike. Similarly, in his work on actor-network theory, Latour (2005) attributes agency to objects (pp. 63–86), claiming that reserving agency to humans limits sociologists' ability to describe how objects "act" upon humans or other objects, such as allowing, affording, influencing, forbidding, etc. (p. 72).

In contrast to these post-humanist accounts, Clark and Chalmers' (1998) Extended Mind Thesis offers a more human-centered strand of distributed cognition. They argue cognition is not confined to the brain and can be extended by artifacts. They demonstrate this with a thought experiment in which an Alzheimer's patient depends on a notebook for memory support. Despite their emphasis that human-artifact coupling can form an integrated cognitive system in which computations can be distributed

between the two, they warn against a radical, post-humanist view and cautiously favor an “organism-centered” one in which the brain remains the central locus that initiates and sustains extended cognitive processes (Clark, 2008, p. 123, 139).

Informed by Bandura’s and Clark and Chalmers’ work, we hold that learners cannot have learning agency, distributed or not, without intentional engagement, but that all learners possess the potential for learning agency. Within a human-AI coupled system, agency remains fundamentally human-initiated and -directed, even though its expression is fluid, situational, and co-constructed through contextual, cognitive, and affective conditions.

Methods

Based on Bandura’s agency theory and Clark and Chalmers’ Extended Mind Thesis, this study adopts a qualitative design to examine how GAI contributes to the emergence of Bandura’s four features of agency in EFL writers. We conceptualize the writer and their GAI tool as an interactive human-AI dyad—a cognitive system drawing on both brain-internal and -external resources—and use the methods described below to investigate how agency is distributed within this dyad.

Participants

Thirteen sophomore English majors at a top-tier Taiwanese university participated. They had comparable English learning backgrounds (Table 1) with upper-intermediate to advanced proficiency (CEFR B2–C1) and had completed one year of foundational academic writing instruction prior to the study. Most participants also had approximately one to two years of experience using GAI tools. During the study, they were enrolled in a 36-week, two-semester writing course taught by one of the authors. To mitigate potential bias, the other author participated in data analysis, assignment evaluation, and discussion of findings. Participation was voluntary and had no impact on course grades. All 13 students, whose data were pseudonymized, consented and remained in the study throughout both semesters. Although the participants did not receive remuneration, the teacher-researcher expressed her appreciation for their support.

Course Design

The one-year academic writing course is required for all English majors at the university. Over the two semesters this study investigates, students were required to complete six writing tasks. The first semester’s tasks included cause-effect, definition, and comparison-contrast essays. The second semester’s tasks were an argumentative essay, a synthesized literature review, and a research paper. The course focused on academic writing conventions, structures, rhetoric, writing strategies, and research skills. Students were allowed to decide whether to use GAI during the drafting stage but were required to use it during the feedback review stage. In practice, they all chose to use ChatGPT for both drafting and reviewing.

Data Collection

Qualitative data were gathered from three sources: students’ drafts and final products, chat logs with GAI, and written reflections. First, students submitted all drafts and final products through Moodle, the course’s learning platform. Over the two semesters, six drafts and six final products were collected from each participant. The grading criteria addressed both the writing product and process. On the product side, evaluations emphasized content richness, accuracy of information, and appropriate application of the task-specific writing strategies taught in the course. On the process side, students’ chat logs with GAI were reviewed to understand how they engaged with the tool and to ensure their final texts were not AI-generated, translated from Chinese, or produced through wholesale AI drafting. Students were encouraged to ask in-depth follow-up questions and use GAI feedback to clarify, refine, and expand their ideas. All participants used ChatGPT, as it was the most widely used platform in Taiwan at the time. Given that students might lack GAI literacy, the instructor introduced prompting principles (e.g., using

precise wording, providing contextual information, and assigning roles to GAI) and provided feedback review sheets to guide students' GAI-assisted reviews ([Appendix A](#)). Students could freely accept or reject AI-generated feedback and were encouraged to develop their own prompts beside the provided ones to meet individual needs. They were instructed to initiate a conversation thread with GAI for the review of each writing task, and all their interactions with the AI had to occur within this thread. Upon completing each writing task, students had to submit the chat log, allowing the instructor to review the full interactions. Six chat logs were collected from each student.

Table 1

Participants' Backgrounds

No.	Pseudonym	Gender	First Language	English Proficiency	GAI Tools of Choice
1	Ben	M	Mandarin	High intermediate	ChatGPT, Gemini
2	Jack	M	Mandarin	High intermediate	ChatGPT, Perplexity
3	May	F	Mandarin	High	ChatGPT
4	Esther	F	Mandarin	High intermediate	ChatGPT
5	Ko	F	Mandarin	High intermediate	ChatGPT
6	Vivian	F	Mandarin	High	ChatGPT, Claude
7	Josh	M	Mandarin	High intermediate	ChatGPT, Perplexity
8	Patrick	M	Mandarin	High intermediate	ChatGPT, Grammarly
9	Julian	M	Mandarin	High intermediate	ChatGPT, Gemini
10	Yu	F	Mandarin	High	ChatGPT, Gemini
11	Peggy	F	Mandarin	High intermediate	ChatGPT
12	Henry	M	Mandarin	High intermediate	ChatGPT, Google Translate
13	Tracy	F	Mandarin	High intermediate	ChatGPT

Students also had to write reflections at the end of each semester. The purpose was to explore whether and how Bandura's four features of agency were distributed through their engagement with GAI during writing. To this end, the instructor designed reflection questions grounded in the four features ([Appendix B](#)) to guide the students in reflecting on the feedback from GAI, their interactions, and the overall learning experience. To capture their deep perceptions and critical insights, the questions were provided in both Chinese and English, and students could write in whichever language they were most comfortable with.

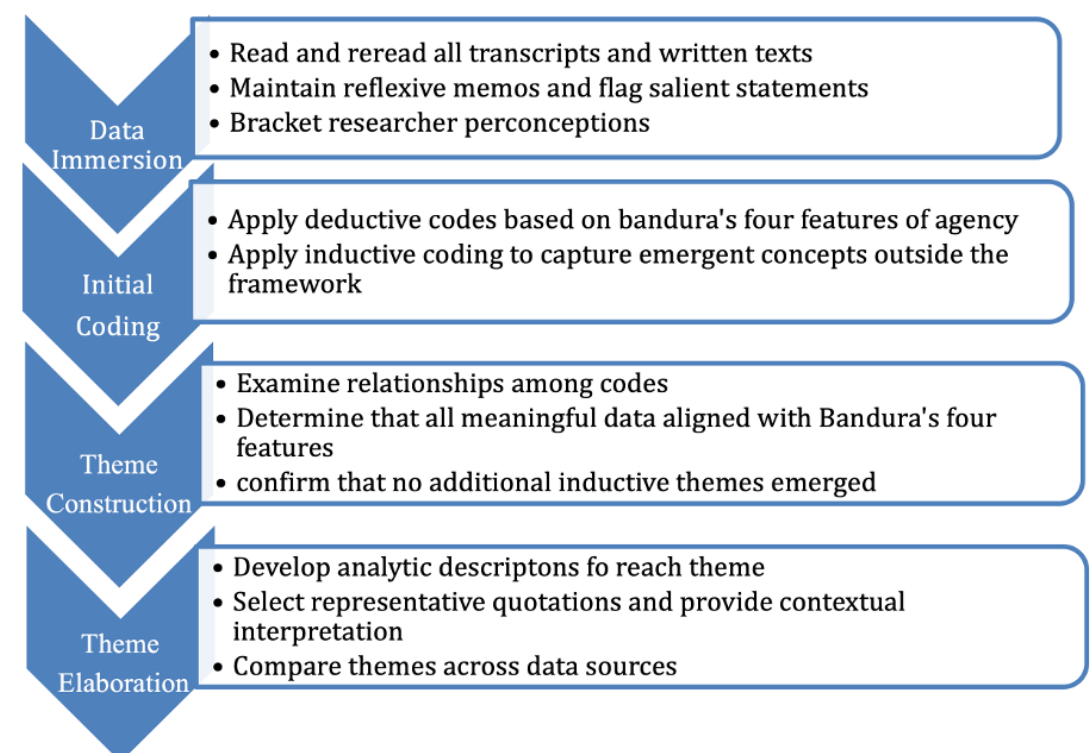
Data Analysis

A combined analytic approach integrating both cross-sectional and longitudinal analyses was adopted, as this approach enables in-depth examination of patterns through comparisons across individuals under the same temporal conditions, while also allowing for the exploration of individual cases over time to trace

developmental trajectories. Students' chat logs and reflections were analyzed following Braun and Clarke's (2006) thematic analysis framework, using Bandura's four features of agency as the deductive thematic codes. Both authors independently coded and interpreted the data. After completing their analyses, they compared findings, discussed discrepancies, and reached consensus through collaborative review. A summary of the analytic procedure is in Figure 1. Through the combined analytic approach and triangulation of data sources, an understanding of how agency was distributed emerged.

Figure 1

Data Analysis Procedure



Findings

This section presents findings from the cross-sectional and longitudinal analysis grounded in the four conceptually distinct and yet functionally interrelated features of agency: intentionality, forethought, self-reactiveness, and self-reflectiveness.

Intentionality

Intentionality in Bandura's (2001) sense refers to a proactive, self-originated commitment to future-directed action, which is a capacity that underpins purposeful engagement and distinguishes agentic behavior from passive reaction or accidents. Moreover, Bandura emphasizes that intentionality is exercised within social constraints or, as he puts it, "situational inducements" (p. 6). Thus, even in a compulsory writing course, students can enact intentionality through the deliberate choices they make when planning, revising, engaging with feedback, and deciding how to interact with GAI. From this perspective, intentionality is inherently a human trait. But while GAI may lack intentionality, it can nonetheless participate in distributed agency by shaping or supporting human goal-directed behavior. Within a human-AI dyad, the GAI can act as cognitive scaffolding that helps the human clarify

ambiguous intentions, refine focus, and sustain motivation. For example, Ben described in his reflections how GAI scaffolded his commitment and intentions:

AI helped me stay on track during Project 3 by breaking it into smaller parts. When I didn't know how to start, I asked for a possible outline. When I was stuck, I asked for the next step. These interactions reduced my stress and helped me avoid procrastination because I always had something to continue.

Ben's enactment of intentionality, i.e., becoming committed to an action, was regulated through human-AI interaction. GAI helped shape, focus, and sustain his intentions by providing a course of action and concrete steps to which he could commit, enabling him to translate that commitment into actions.

Similarly, other students leveraged GAI to clarify or validate the intention behind their writing. In his reflections, Jack described how it supported him in refining the direction of his intended topic:

I developed a topic based on my interest. I then used AI to evaluate the topic to ensure it had sufficient controversy and depth for an argumentative essay.

While the intention originated with Jack, GAI strengthened it by enhancing his confidence and commitment by providing evaluative input that supported his initiated plan.

May's case demonstrates how GAI can play a formative role in the emergence and articulation of intentionality. She explained:

I was interested in the role of AI in the game design industry. I asked AI to generate some potential topics about it and received several suggestions. *This brainstorming session helped me think from angles I hadn't considered before...* One suggestion caught my interest. I then followed up by asking AI to elaborate on both sides of this suggested topic, which helped me evaluate its depth and complexity before making my final decision.

Although May had a general interest in "AI and gaming," her initial goal lacked specificity, and she was uncertain whether it was an appropriate topic to pursue. Through a GAI-facilitated brainstorming session, she was exposed to multiple perspectives she had not considered. This helped May transform her under-defined interest into a clear intention—a specific writing direction to pursue.

Downsides of using GAI, however, were also mentioned by participants. While GAI often supports writers by aligning feedback with their stated intentions, such alignment can sometimes reinforce writers' misconceptions or errors, contrary to their true intentions. For example, Esther reflected that when she asked ChatGPT whether her introduction followed the CARS model, ChatGPT confirmed it did and even provided an analysis to justify its assessment. However, teacher feedback indicated her introduction did not actually follow the CARS model.

In short, GAI can scaffold, sustain, or clarify writers' intentions, but its feedback may also undermine their agency by reinforcing confidence in decisions they would not commit to otherwise.

Forethought

Forethought is the ability to set goals, plan actions, anticipate the consequences of one's actions, and make decisions based on such anticipations (Bandura, 2001). Triangulating data in relation to this definition revealed the following results: (1) In goal setting, GAI supported writers by clarifying and formulating writing objectives; (2) In planning, GAI assisted with idea and structure planning, which involves generating ideas, organizing content, creating outlines, and brainstorming topics; (3) In motivational regulation, GAI reduced writers' anticipated negative emotions associated with writing and enhanced their readiness for execution by helping to structure the overall writing process.

One way GAI contributes to forethought is by supporting writers in organizing and synthesizing literature, a process that requires goal setting, planning, and anticipatory reasoning. In her reflections, Ko talked about how ChatGPT helped her in this process:

The literature review process used to take me forever to complete, but now I can ask ChatGPT to summarize and compare different viewpoints from various sources related to my topic and to present them in a table. It helps me grasp the main arguments and viewpoints quickly, so I can set the direction and plans for my writing.

Figure 2

ChatGPT's Comparison of Different Studies on Ko's Topic

Contrast Analysis: Supportive vs. Critical Perspectives on Woke Culture in Film		
Dimension	Supportive Perspectives	Critical Perspectives
Representation	Highlights the empowerment and increased visibility of marginalized groups, viewing such portrayals as necessary correctives to historical exclusion (e.g., Morah 2024; Igbashangev 2021).	Interprets increased representation as tokenistic or as aesthetic overcorrection that does not address deeper structural inequities (e.g., AlMouslie 2023).
Cultural Impact	Argues that inclusive narratives contribute to nation-building, promote intercultural empathy, and enrich global cinematic discourse.	Suggests that such trends generate "identity fatigue" or function primarily as performative displays of moral virtue without substantive social effect.
Gender & Identity	Frames woke-oriented cinema as redefining gender roles and subverting entrenched stereotypes, offering alternative imaginaries for identity (Fox 2014).	Claims that these portrayals commodify gender struggles and risk reinforcing market-driven narratives of victimhood (Hagelin 2013).
Creative Freedom	Viewed as expanding creative possibilities by diversifying genres, themes, and storytelling perspectives in global film industries.	Raises concerns about ideological standardization, soft censorship, and pressure toward thematic conformity.

Ko's chat log (Figure 2) shows ChatGPT's comparison of multiple sources across different dimensions. Crucially, ChatGPT did more than retrieve sources; it helped Ko visualize intertextual relationships, clarified the main arguments and contrasting perspectives, and highlighted relevant connections. This facilitated her higher-order organization and planning. For many L2 writers, literature comparison is often a source of frustration due to linguistic and cognitive barriers (Yoo, 2025). By structuring and visually representing information, ChatGPT helped Ko overcome those barriers and clarified her aim in a more efficient and focused manner. Through interactions with AI, Ko engaged in strategic planning and refined her goals, making the content of her forethought more defined.

Vivian's interaction with ChatGPT is another case in point. Initially, she intended to write about "ChatGPT and college students" but lacked a specific argument. She then turned to ChatGPT for support, which responded with a structured list of potential argumentative essay topics categorized by themes (Figure 3). This interaction contributed to goal clarification and planning, which are important ingredients of forethought. ChatGPT offered organized choices and ideas, enabling her to evaluate multiple perspectives and engage in the critical anticipatory and planning aspects required for argumentative writing. ChatGPT functioned as cognitive scaffolding that extended Vivian's capacity to anticipate viable argumentative directions and transform a loosely defined idea into a focused plan.

Some students believed interacting with GAI boosted their motivation to write by changing the anticipated emotional consequences of writing. Specifically, some of them had felt a lack of motivation because they anticipated writing would bring frustration, pain, or anxiety. After incorporating GAI into the writing process, however, they began to anticipate less negative emotional outcomes and became more motivated. Josh shared the following transformation:

ChatGPT boosted my writing motivation because it made the pre-writing stages easier and, most importantly, less anxious, especially when under time constraints. For example, when writing the Method and Discussion sections, it provided me with structures and approaches, which helped me quickly clarify my writing direction.

Figure 3

Vivian's Chat Log, Showing Potential Topics Suggested by ChatGPT

i want to write an argumentative essay regarding chatgpt and college students. Any topics suggestions?

Sure! Here are some argumentative essay topic suggestions that focus on ChatGPT and college students, spanning ethical, educational, and practical angles:

- 🔍 **Academic Integrity & Ethics**
 1. Should college students be allowed to use ChatGPT for writing assignments?
 2. Does using ChatGPT for homework constitute academic dishonesty?
 3. Should universities implement stricter policies to detect and prevent ChatGPT misuse?
- 📖 **Learning & Education**
 4. Does ChatGPT enhance or hinder college students' critical thinking skills?
 5. Can ChatGPT be an effective learning companion for college students?
 6. Should professors design assignments that AI tools like ChatGPT cannot complete easily?
- 🧠 **Mental Health & Study Habits**
 7. Can ChatGPT reduce academic stress for college students?
 8. Is reliance on ChatGPT making college students intellectually lazy?
- 📅 **Career & Future Preparation**
 9. Is ChatGPT preparing or harming students for real-world communication and writing?
 10. Should colleges teach students how to responsibly use AI tools like ChatGPT for career readiness?
- 🌐 **Accessibility & Equity**
 11. Does ChatGPT create an unfair advantage for students who are more tech-savvy?
 12. Can ChatGPT help bridge the gap for students with learning disabilities or language barriers?

Forethought includes the ability to anticipate consequences and use that anticipation for motivation. Knowing GAI's ability to provide structures, Josh could anticipate the clarification of his direction that would come with those structures, and that anticipation in turn made him less anxious and more motivated.

Despite the advantages, GAI's role in the emergence of forethought may hinder learning, as Patrick's experience suggests:

Before starting each project, I always engage with AI: I write down my topic and ask AI whether my ideas are accurate and how they could be developed further. It can provide links and summaries of essential readings related to the topic.

However, he reflected at the end of second semester:

Though it is effective in brainstorming, I don't think this process has improved my academic writing skills because it can erode my planning and thinking ability.

His experience highlights the potential danger of a weakened ability to form forethoughts. Using GAI may have the cost of not exercising the user's cognitive skills associated with forethought.

Self-Reactiveness

Self-reactiveness refers to the capacity to self-regulate and enact courses of action through evaluation, adjustment, and adaptation according to one's goals (Bandura, 2006). In academic writing, the goal of a writer is to produce a grammatical, coherent piece of text that accurately expresses the writer's ideas, some of which may be discovered during writing. The analysis showed that in the process of achieving this goal, participants and their GAI tools jointly exercised self-reactiveness through (1) expression scaffolding, (2) problem diagnosing and solving, and (3) idea formation.

One of the most distributed cognitive tasks was idea expression and word choice. Several students identified them as persistent challenges, as they often struggled to find accurate or nuanced vocabulary to convey their intended messages. For example, Julian reflected:

The most difficult part for me is expressing my thoughts in English. Sometimes it feels like my soul is trapped inside my body, unable to communicate with the outside world. With ChatGPT, I can easily transform my thoughts into native-sounding English sentences.

With GAI's assistance, students could jot down rough ideas or write AI prompts in Chinese and receive grammatically and stylistically well-formed sentences that better captured their intended meaning, often elevating the quality of their English expression beyond what they could independently produce. Additionally, AI could generate vocabulary comparison tables, listing synonyms alongside definitions, example sentences, and subtle usage distinctions. These affordances illustrate how self-regulatory functions traditionally performed by the writer are partially distributed to GAI. For example, in her reflections, Yu described an experience where she asked ChatGPT how to say “表格指出” (“the table indicates”) in English, and in response ChatGPT provided various expressions and explained the subtle differences between them (Figure 4). This made Yu realize details she had not noticed before and gave her a wider range of lexical choices.

Another cognitive task related to self-reactiveness that is distributable to GAI is to identify and solve writing problems. L2 writers often lack the metalinguistic awareness or rhetorical sensitivity needed to effectively monitor and evaluate their output, especially when their writing literacy is still developing (Hyland, 2003). While they may recognize their writing is ineffective, they often struggle to identify and solve the issues. In such cases, GAI can play a reactive monitoring role by identifying problems and suggesting improvements based on the user's intended outcome or target genre. By inputting their rough drafts into ChatGPT and providing prompts such as “Make this paragraph clearer,” L2 writers distribute the cognitive burden of error diagnosis to GAI. Jack's reflections illustrate this process:

Usually, I draft my writings with very raw ideas. I throw them into ChatGPT and ask for revision. I often do this 3 to 5 times to make sure the revision aligns with my initial idea. Even if I do not know what problems my writing has, AI can help me detect and fix them.

Jack lacked precise awareness of his writing but nonetheless benefited from GAI's diagnostic capabilities. He noted that prior to using AI, developing such diagnostic awareness “*relied solely on slow and often ineffective internalization processes.*” GAI can function as a diagnostic tool and supplement a writer's self-reactive capacity by identifying and fixing errors and weaknesses that may otherwise go unnoticed.

Moreover, the task of idea formation can be distributed between writer and AI through a recursive co-construction. While drafting about Natural Language Processing (NLP), Henry initially asked ChatGPT to revise his sentence:

Overall, the incorporation of NLP in education has persistently influenced students' learning, presenting both its benefits and inherent drawbacks.

Figure 4

Yu's Chat Log, Showing Word Choices Suggested by ChatGPT

reveal show demonstrate 還有什麼相似的字可以用來說表格指出

很好的問題！在學術寫作中，除了 **reveal**, **show**, 和 **demonstrate** 之外，還有很多詞可以用來描述表格或圖表所「指出、呈現、顯示」的資訊。以下是一些常見又適合學術寫作的動詞，並附上簡短範例：

✅ 常用替代詞（含語氣說明與例句）：

動詞	語氣 / 用法說明	範例
indicate	中性、常用於數據/圖表	Figure 4 indicates a strong preference for academic writing.
illustrate	略具視覺感，常用於圖表/例子	Table 1 illustrates the distribution of responses.
suggest	略帶推論語氣，較不絕對	Figure 5 suggests that most participants rely on ChatGPT for grammar checks.
highlight	強調某重點、趨勢	Figure 6 highlights the difference between writing types.
present	中性偏正式，常用於引介表格資料	Figure 2 presents the participants' proficiency levels.
depict	比 illustrate 更偏視覺化（如圖示、流程）	The chart depicts how participants use ChatGPT in various tasks.
display	類似 show，但略帶視覺呈現語氣	Table 3 displays the frequency of ChatGPT use.
report	偏向研究數據，語氣偏書面	The table reports the percentage of students using ChatGPT weekly.

Taking in what Henry had written, ChatGPT reacted by returning the following suggestion:

Amid this dual nature, the persistent impact of NLP on students' learning unfolds, showcasing a *tapestry* of benefits and inherent drawbacks.

Henry then changed the word *tapestry* in ChatGPT's revised sentence into the word *knitting*. The sentence became:

Amid this dual nature, the persistent impact of NLP on students' learning unfolds, showcasing a *knitting* of benefits and inherent drawbacks.

Through this recursive, iterative process, an agent can sometimes gain unexpected new insights into its own actions. After Henry changed *tapestry* to *knitting*, he asked ChatGPT for another revision based on his new sentence, and it returned the following:

Amidst this dual nature, the persistent impact of NLP on students' learning unfolds, *weaving together a tapestry that showcases both its* benefits and inherent drawbacks.

ChatGPT explained that “[t]his revision maintains the metaphor of a tapestry but uses ‘weaving together’ to describe the **interplay** of benefits and drawbacks more explicitly.” This recursive self-reactive process shifted Henry's understanding, effectively giving him a new idea about the topic. In his reflections, he noted that he initially intended to present NLP's pros and cons separately, but the word “interplay” prompted him to reframe them as interconnected. It is worth emphasizing that while it was ChatGPT that

came up with the words *tapestry* and *weaving*, they were reactions to Henry's original sentence and his later addition of the word *knitting*, respectively. Without Henry, the crucial steps of drafting, revising, and feeding the sentence into the AI for suggestions would not have been taken; without the AI, Henry's discovery of the new approach to his topic would not have happened, either. In this sense, the self-reactive feature of agency was truly distributed between the two.

The benefits discussed above, however, were not uniformly experienced. Several students noted that while AI tools made their writing more polished, the distribution weakened learning and retention. For example, Peggy reported that before using ChatGPT, she would spend hours refining her word choices. After outsourcing the job to GAI, she rarely spent time negotiating lexical choices and found that the vocabulary provided by ChatGPT was often quickly forgotten. She also observed a decline in her spelling accuracy. She stated:

It is satisfying to see my writings become more beautiful and well-structured with ChatGPT's assistance. However, ChatGPT has a terrible impact on my vocabulary, especially spelling. Because AI can recognize typos from contexts, I have started paying less attention to my spelling. Consequently, I often find myself forgetting how to spell, and it impedes my writing competence.

This shows that AI can aid problem-solving while eroding academic skills when users rely on it without attentive engagement.

Besides, the diagnostic function of GAI requires caution. L2 writers with limited proficiency and metacognitive skills may be more likely to accept and apply AI-generated feedback uncritically, which increases their vulnerability to AI hallucinations because they may mistake fluent but inaccurate language, explanations, or citations for reliable information (Ye et al., 2023). Although, as described earlier, Jack engaged in multiple rounds of prompting to ensure that GAI's revisions aligned with his intended meaning and expressed satisfaction with its diagnostic affordances, his limited metacognitive awareness prevented him from detecting problems beyond his own perceptual scope. For example, his final argumentative essay adopted an oversimplified and distorted counterargument presented without supporting evidence, which made it easy to refute and consequently resulted in a straw-man fallacy:

Opponents argue that regulating misinformation generated by Deep Fake technology may be unnecessary because misinformation has been produced by various AI digital tools in a rapidly evolving information landscape. However, researchers argue that regulation is necessary...

Triangulation with Jack's chat logs (Figure 5) reveals that he did attempt to check the adequacy of his arguments. However, GAI responded with positive evaluations and failed to flag the underlying logical fallacy.

Jack's case illustrates the risks of distributing the self-reactive feature of agency to GAI when the human user lacks sufficient metacognitive awareness to monitor and evaluate AI-mediated regulatory performance.

Figure 5

Jack's Chat Log

Content of the arguments

- The first sentence correctly presents a common **counterargument**: that extra regulation is unnecessary because misinformation already exists and AI is just another tool in a changing information ecosystem. cepr
- The second sentence appropriately signals a contrasting **research-based** position that regulation of deepfake misinformation is necessary, which is well supported in recent legal and policy scholarship. theregreview +1

Self-Reflectiveness

Self-reflectiveness refers to an agent's capacity to examine and evaluate their own functioning. In a writer-AI dyad, this feature of agency can be distributed, as reflective appraisal is collaboratively enacted through iterative dialogue. When engaging with GAI, writers often receive repeated evaluative confirmations (e.g., "your argument is coherent and academically appropriate"), which may gradually function as a proxy for self-reflective judgment or shape students' self-reflectiveness.

When asked in their second reflections about the advantages and disadvantages of GAI-mediated feedback, nearly all participants responded positively, particularly emphasizing its effectiveness and nonjudgmental nature. Several students explicitly compared GAI feedback with human feedback and reported that interacting with GAI enhanced their sense of self-efficacy. For example, Ko reflected that compared with engaging with a teaching assistant or the instructor, she felt more relaxed when interacting with GAI because she could freely ask "silly" questions without feeling embarrassed. She further noted that GAI consistently provided affirmative evaluations and empowered her to complete writing tasks beyond what she perceived herself capable of accomplishing independently. Ko's case illustrates writers' confidence and self-efficacy can be shaped by AI-mediated reflective appraisals that they appropriate as evidence of their own competence. In this sense, reflective appraisal is distributed within the human-AI dyad rather than located exclusively within the human writer or teacher.

However, some students showed skepticism. May reflected:

...AI's immediate feedback saved me a lot of time and made me more confident during writing as if I had been liberated from the constraints of L2 writing. However, I am not sure my writing has improved because the knowledge is acquired quickly and often in response to a specific problem. Paradoxically, GAI has become a new constraint to me; it's powerful and hard to resist, but it confuses what I can do with its help and what I can do without it.

These cases reveal ambivalence in terms of the benefits of distributing self-reflectiveness between human and AI. While AI-mediated positive evaluative feedback may strengthen a writer's confidence and self-efficacy, it may also recalibrate self-reflective judgment in ways that obscure the writer's assessment of what they truly know and what they only know with the help of AI.

Agency Distribution over Time

The longitudinal impact of the year-long use of GAI on the participants became differentiated, with learning outcomes diverging according to the level of agentive engagement they exercised. Through data triangulation of students' reflections on whether they believed they could learn deeply through prompting with GAI and their corresponding chat logs, the findings revealed variation. Writers who engaged with GAI in an instrumental, means-ends fashion (Fan et al., 2024; Sweller et al., 2019), asking questions simply to complete a task without critically engaging in the process, tended to forget what they learned easily. However, writers who exercised greater agency tended to report deeper learning.

Although many students initially reported confidence in steering AI interactions, longitudinal data suggest a gradual loss of agentive control as more writing functions were delegated to the tools. In the first semester, most students responded to the reflection question "*During your interaction with GAI, did you feel that you were the agent controlling your writing process...?*" by asserting that they retained full control and used GAI merely to improve their drafts. However, by the end of the second semester, 9 participants (69%) expressed concerns about becoming reliant on GAI. For example, Peggy described herself as the primary agent in the first semester, stating:

Since I drafted my entire writing and only asked specific questions, I think I am the agent of my writing. ChatGPT is only a tool to improve and polish it.

However, in the second semester she acknowledged:

ChatGPT is just so easy to use that I find myself asking for its advice too frequently... it makes me

lazy and less creative, which can turn out to be fatal for me.

Peggy's trajectory reflects a re-distribution of agency across time. As the year progressed, the convenience and affordance of GAI weakened her own agency, leading to an unintentional behavioral drift. Deep learning requires rehearsal, reflective examination, and iterative adjustment. The more a learner distributes these efforts to external artifacts, the less she actively practices and develops the skills. Peggy's case illustrates how over-delegation to GAI can gradually re-distribute writer agency in a potentially detrimental way.

In contrast to the loss of control many students experienced over time, others reported deeper learning with GAI. Ben's year-long engagement with GAI reveals an evolution of distributed agency. His writing performance, improving from an average of 85 in the first semester to 94 in the second, corresponds to qualitative shifts in how he positioned himself in relation to ChatGPT and how he exercised agency.

According to his reflections and chat logs, at the beginning of the first semester Ben was hesitant in using ChatGPT due to limited familiarity and low digital literacy. His interactions were restricted to brainstorming topics, generating subtopics, and drafting thesis statements. At this stage, he and AI operated as largely independent entities, and AI's influence was limited. Toward the end of the first semester, Ben began to employ ChatGPT as a problem-solver. When confronted with challenges in planning, wording, or revision, he increasingly relied on AI for suggestions, definitions, and draft polishing. He also learned to craft more specific prompts, enabling better control over AI responses. At this stage, distributed agency manifested as instrumental and outcome-oriented use of AI for problem solving.

In the second semester, Ben became increasingly aware of the risks of overreliance on AI. He noted that although AI-generated sentences sounded polished, they sometimes diluted his "authorial voice" and undermined his "sense of ownership." In response, he intentionally repositioned ChatGPT's role from a text generator to a "thinking partner" (Warschauer et al., 2023, p. 3). Instead of asking AI to "fix" his writing, he used it to interrogate his interpretations, broaden perspectives, and test the appropriateness of his ideas. He and AI jointly engaged in meaning making. By the end of the second semester, Ben developed a sophisticated ability to orchestrate human-AI interaction, using AI not to replace cognitive effort but to deepen it. He consulted AI to compare synonyms, examine contextual nuances, evaluate coherence, diagnose logical weaknesses, and experiment with rhetorical structures. He prioritized learning through his interactions with GAI. As he explained, "I don't want to just use GAI to finish my writing task. I want to remember what I've learned." Accordingly, he documented what he learned and intentionally applied these new skills in subsequent writing. The human-AI interaction resembled ZPD-like scaffolding (Vygotsky, 1980), with Ben remaining the central agent while ChatGPT served as a learning coach. His reflection illustrates GAI-mediated deep learning:

When learning to write thesis statements and topic sentences, I asked ChatGPT to explain the structure and provide three to five examples and then inquired about the strengths, weaknesses, logic, and tone of each. I wrote down new skills I learned and reviewed them, and intentionally applied them in my next writing. This helped me grasp the structure, wording and rhetoric of academic writing.

His case exemplifies how agency distribution shifts when learners reposition AI. These longitudinal findings suggest that it is the writer's agency, whether to merely finish a task or to actively co-construct knowledge, that determines the depth and quality of learning.

Discussion

Human-AI Dyad as an Integrated Whole of Distributed Agency

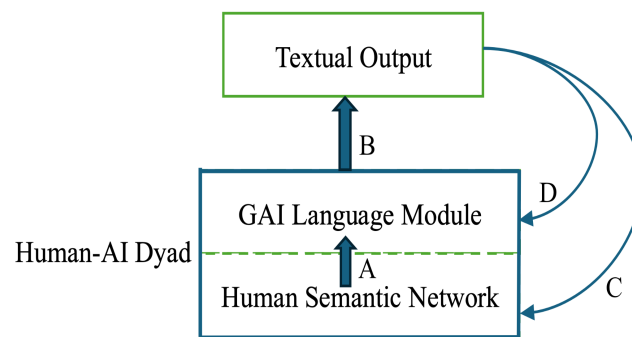
In this paper we have been treating a GAI tool and its human user as an integrated dyad, whose agency is distributed between its two intimately coupled parts in such a way that many of the dyad's agentive

behaviors cannot emerge without either the human or the GAI. As examples in previous sections showed, GAI can be considered an extension of its user's cognitive apparatus that underpins agency, for it can perform functions that give rise to the four fundamental agentic features outlined in Bandura (2001, 2006). This finding not only supports Clark and Chalmers' (1998) argument that cognition is not confined in the human brain but also shows their Extended Mind Thesis can apply to agency specifically.

This new perspective on agency provides a new lens through which we can re-examine previous cognitive models of writing. Take Galbraith's (1999) Knowledge-Constituting Model for example. Galbraith argues the process of writing can facilitate the generation of novel ideas because text generated by the writer, even if incomplete, can be fed back into the writer's semantic network (i.e., the idea generator in the writer's mind) and activate new ideas that were not previously thought of by the writer. We witnessed a similar process in Henry's case, where he came up with a new approach to his topic after seeing the word *interplay* in ChatGPT's final textual output, which, in turn, was a reaction to Henry's revision of an earlier textual output. To capture this dynamic, Galbraith's (1999) original model (p. 142), in which AI played no role, can be adapted into a new one (Figure 6).

Figure 6

Adapted Knowledge-Constituting Model



Arrow A, which represents an information flow from a semantic network to a language module that turns thoughts into linguistic representations, would take place entirely in the human writer's brain in Galbraith's original model. However, we have now seen cases, such as Julian's, where this thought-language conversion can be at least partially distributed to the AI. After the AI uses its language module to generate a textual output (arrow B), the output may feed back to the writer's mental semantic network (arrow C) and stimulate a previously unnoticed idea, as is the case with Henry. Unlike in the original model, a textual output produced by the dyad may also be fed directly into the AI's language module and completely bypass human involvement (arrow D), which may be the case with Peggy, who noticed a gradual decrease in her spelling ability because she did not engage her own language module enough.

The account above is by no means complete, but it demonstrates why cognitive models of writing should be revisited when the writer is no longer a human but a closely coupled human-AI dyad that, as an integrated whole, can perform agentic acts that cannot be performed by its parts alone.

Impacts of Distributed Agency on L2 Writing

Drawing on the findings of this longitudinal study, AI's role in a human-AI dyad is powerful, mediational, yet conditional. In terms of intentionality, AI played a formative role in shaping, clarifying, and sustaining intentions by scaffolding topic generation, refining focus, and validating emerging plans. Regarding forethought, AI extended writers' anticipatory capacities by assisting with planning, outlining, and literature synthesis. Through these functions, AI enabled writers to visualize possible writing trajectories, anticipate challenges, and regulate motivation (Lee et al., 2022; Wei, 2023) by reducing anxiety (Shi, et al., 2025; Washington, 2023) associated with pre-writing uncertainties. With respect to

self-reactiveness, AI assumed a substantial regulatory role by supporting real-time monitoring, diagnosing linguistic and rhetorical problems, and proposing revisions aligned with writers' stated goals. These affordances allowed writers to externalize regulatory functions they lacked the expertise to perform independently. Finally, self-reflectiveness often functioned as a proxy for self-reflective judgment, shaping writers' confidence and self-efficacy (Lee et al., 2022; Shen & Tao, 2025). The findings suggest GAI is powerful, but it does not originate intentions, forethought, actions or reflections. Instead, it mediates how human agency is enacted by translating writers' goals into linguistic realizations, externalizing regulatory and reflective processes, and feeding back alternative representations that writers may appropriate.

However, human-AI distributed agency may also entail negative consequences. When AI feedback aligns with writers' misconceptions, it can reinforce weakly regulated intentions or planning. AI's affirmative feedback may attenuate writers' regulatory control. Moreover, excessively distributing agency to GAI may undermine writers' independent capacity to exercise it. Accordingly, AI's impact is conditional: its affordances do not inherently produce learning gains or losses but depend on how writers harness and regulate AI support.

Harnessing Distributed Agency

There are several factors that foster a writer's ability to harness human-AI distributed agency. First, *domain knowledge* determines whether writers can judge the accuracy, relevance, and rhetorical appropriateness of AI output because domain knowledge constrains metacognitive regulation, especially in early stages (Schraw & Moshman, 1995; see also Dikmen & Burns (2022) on the effects of domain knowledge on trust in AI). L2 writers with limited linguistic or genre knowledge are particularly vulnerable in AI-mediated writing. When domain knowledge is weak, metacognitive regulation is also fragile, reducing writers' capacity to interrogate AI output. This dynamic reflects the "with or without contradiction," whereby learners with greater cognitive resources are better positioned to leverage AI (Warschauer et al., 2023).

Second, *metacognitive awareness* enables writers to harness distributed agency. Because AI-generated revisions and evaluations are not always accurate, writers must possess metacognitive awareness to monitor the relevance and appropriateness of AI output, detect misalignments between AI feedback and rhetorical or learning goals, and decide how and when AI support should be accepted, adapted, or rejected.

Finally, the presence or absence of *exercised agency*—namely, whether students position themselves as active orchestrators oriented toward mastery of learning or as passive recipients oriented toward performance—has proved decisive. This is consistent with Schraw's (1998) distinction between mastery- and performance-oriented learners. Mastery-oriented students engage agentively with GAI by prioritizing learning and competence development, interrogating AI feedback, and deliberately integrating insights into subsequent writing tasks, thereby achieving deeper learning and developmental gains. In contrast, performance-oriented students tend to engage with GAI superficially, focusing on displaying ability, securing grades, and social comparison; such engagement is often accompanied by reduced persistence and heightened reliance on GAI when tasks become challenging. More critically, when human-AI interaction is driven by means-ends performance goals, reflective thinking is frequently delegated to AI without meaningful connection to learners' prior knowledge structures or follow-up cognitive rehearsal. From a cognitive learning perspective, retention and transfer are more likely when new information is meaningfully integrated into existing knowledge schemas (Ausubel, 1968). In the absence of such integration, delegating to AI may yield short-term performance gains and bolster self-efficacy while simultaneously risking the longer-term erosion of writer agency (Barrot, 2023; Guan et al., 2025). This pattern is consistent with what Koriat and Bjork (2005) describe as an illusion of competence, in which learners experience temporary confidence yet cannot independently apply what they have ostensibly learned to subsequent tasks.

Conclusion

This study demonstrates that human-AI distributed agency shapes L2 writing in terms of intentionality, forethought, self-reactiveness, and self-reflectiveness. While GAI can extend L2 writers' cognitive capacity by scaffolding planning, synthesis, evaluation, and idea elaboration, its long-term impact is contingent on how agency is exercised in human-AI interaction. Distributed agency can both support and displace core aspects of learner engagement, depending on how AI is used and how agency is exercised. The pedagogical value of GAI thus lies not in its generative capacity but in writers' agentic orchestration of that capacity. GAI does not inherently improve or impede learning; rather, the degree of critical engagement determines whether distributed agency functions as a catalyst for deep learning or a mechanism of cognitive displacement.

The research is limited by its small and relatively homogeneous cohort of English majors from a single Taiwanese university; therefore, the findings should be interpreted with caution when applied to broader or more diverse contexts. Future research should explore how instructional design and assessment practices can be adapted to foster controlled, agentic collaboration with GAI to help learners use GAI not merely as a shortcut for means-ends writing, but as a catalyst for deep learning.

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References

- Agustini, N. P. O. (2023). Examining the role of ChatGPT as a learning tool in promoting students' English language learning autonomy relevant to Kurikulum Merdeka Belajar. *Edukasia: Jurnal Pendidikan Dan Pembelajaran* [Edukasia: Journal of Education and Learning], 4(2), 921–934. <https://doi.org/10.62775/edukasia.v4i2.373>
- Ausubel, D. P. (1968). *Educational psychology: A cognitive view*. Holt, Rinehart and Winston.
- Baek, C., Tate, T., & Warschauer, M. (2023). *ChatGPT seems too good to be true”: College students' use and perceptions of generative AI* [Preprint]. OSF. <https://doi.org/10.31219/osf.io/6tjpk>
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, 52, 1–26. <https://doi.org/10.1146/annurev.psych.52.1.1>
- Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on psychological science*, 1(2), 164–180. <https://doi.org/10.1111/j.1745-6916.2006.00011.x>
- Barrot, J. S. (2023). Using ChatGPT for second language writing: Pitfalls and potentials. *Assessing Writing*, 57, Article 100745. <https://doi.org/10.1016/j.asw.2023.100745>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Clark, A. (2008). *Supersizing the mind: Embodiment, action, and cognitive extension*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780195333213.001.0001>
- Clark, A., & Chalmers, D. (1998). The extended mind. *Analysis*, 58(1), 7–19. <https://doi.org/10.1093/analys/58.1.7>

- Dikmen, M., & Burns, C. (2022). The effects of domain knowledge on trust in explainable AI and task performance: A case of peer-to-peer lending. *International Journal of Human-Computer Studies*, 162, Article 102792. <https://doi.org/10.1016/j.ijhcs.2022.102792>
- Fan, Y., Tang, L., Le, H., Shen, K., Tan, S., Zhao, Y., Shen, Y., Li, X., & Gašević, D. (2024). Beware of metacognitive laziness: Effects of generative artificial intelligence on learning motivation, processes, and performance. *British Journal of Educational Technology*, 56(2), 489–530. <https://doi.org/10.1111/bjet.13544>
- Galbraith, D. (1999). Writing as a knowledge-constituting process. In M. Torrance & D. Galbraith (Eds.), *Knowing what to write: Conceptual processes in text production* (pp. 139–160). Amsterdam University Press. <https://hdl.handle.net/11245/1.163394>
- Godwin-Jones, R. (2024). Distributed agency in second language learning and teaching through generative AI. *Language Learning & Technology*, 28(2), 5–31. <https://doi.org/10.64152/10125/73570>
- Guan, L., Zhang, Y., & Gu, M. M. (2025). Pre-service teachers' preparedness for AI-integrated education: An investigation from perceptions, capabilities and teachers' identity changes. *Computers and Education: Artificial Intelligence*, 8, Article 100341. <https://doi.org/10.1016/j.caeai.2024.100341>
- Guo, K., & Wang, D. (2024). To resist it or to embrace it? Examining ChatGPT's potential to support teacher feedback in EFL writing. *Education and Information Technologies*, 29, 8435–8463. <https://doi.org/10.1007/s10639-023-12146-0>
- Huang, J., & Mizumoto, A. (2024). The effects of generative AI usage in EFL classrooms on the L2 motivational self system. *Education and Information Technologies*, 30, 6435–6454. <https://doi.org/10.1007/s10639-024-13071-6>
- Hyland, K. (2003). Genre-based pedagogies: A social response to process. *Journal of Second Language Writing*, 12(1), 17–29. [https://doi.org/10.1016/S1060-3743\(02\)00124-8](https://doi.org/10.1016/S1060-3743(02)00124-8)
- Jacob, S., Tate, T., & Warschauer, M. (2023). *Emergent AI-assisted discourse: Case study of a second language writer authoring with ChatGPT*. arXiv. <https://doi.org/10.48550/arXiv.2310.10903>
- Koriat, A., & Bjork, R. A. (2005). Illusions of competence in monitoring one's knowledge during study. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 31(2), 187–194. <https://doi.org/10.1037/0278-7393.31.2.187>
- Kosmyna, N., Hauptmann, E., Yuan, Y. T., Situ, J., Liao, X. H., Beresnitzky, A. V., Braunstein, I., & Maes, P. (2025). *Your brain on ChatGPT: Accumulation of cognitive debt when using an AI assistant for essay writing tasks* [Preprint]. arXiv. <https://doi.org/10.48550/arXiv.2506.08872>
- Kurt, G., & Kurt, Y. (2024). Enhancing L2 writing skills: ChatGPT as an automated feedback tool. *Journal of Information Technology Education: Research*, 23, Article 24. <https://doi.org/10.28945/5370>
- Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. Oxford University Press. <https://doi.org/10.1093/oso/9780199256044.001.0001>
- Lee, Y. F., Hwang, G. J., & Chen, P. Y. (2022). Impacts of an AI-based chatbot on college students' after-class review, academic performance, self-efficacy, learning attitude, and motivation. *Educational Technology Research and Development*, 70(5), 1843–1865. <https://doi.org/10.1007/s11423-022-10142-8>
- Moorhouse, B. L., Wan, Y., Ho, T. Y., & Lin, A. M. (2024). Generative AI-assisted, evidence-informed use of L1 in L2 classrooms. *ELT Journal*, 78(4), 453–465. <https://doi.org/10.1093/elt/ccae033>

- Rammert, W. (2008). Where the action is: Distributed agency between humans, machines, and programs. In U. Seifert, J. H. Kim, & A. Moore (Eds.), *Paradoxes of interactivity: Perspectives for media theory, human-computer interaction, and artistic investigations* (pp. 62–91). transcript Verlag. <https://doi.org/10.14361/9783839408421>
- Rammert, W. (2012). Distributed agency and advanced technology: Or: how to analyze constellations of collective inter-agency. In J.-H. Passoth, B. Peuker, & M. Schillmeier (Eds.), *Agency without actors?: New approaches to collective action* (pp. 89–112). Routledge. <https://doi.org/10.4324/9780203834695>
- Rasul, T., Nair, S., Kalendra, D., Robin, M., de Oliveira Santini, F., Ladeira, W. J., Sun, M., Day, I., Rather, R. A., & Heathcote, L. (2023). The role of ChatGPT in higher education: Benefits, challenges, and future research directions. *Journal of Applied Learning and Teaching*, 6(1), 41–56. <https://doi.org/10.37074/jalt.2023.6.1.29>
- Schraw, G. (1998). Promoting general metacognitive awareness. *Instructional Science*, 26, 113–125. <https://doi.org/10.1023/A:1003044231033>
- Schraw, G., & Moshman, D. (1995). Metacognitive theories. *Educational Psychology Review*, 7, 351–371. <https://doi.org/10.1007/BF02212307>
- Shen, X., & Tao, Y. (2025). Metacognitive strategies, AI-based writing self-efficacy and writing anxiety in AI-assisted writing contexts: A structural equation modeling analysis. *International Journal of TESOL Studies*, 7(1), 70–87. <https://doi.org/10.58304/ijts.20250105>
- Shi, J., Liu, W., & Hu, K. (2025). Exploring how AI literacy and self-regulated learning relate to student writing performance and well-being in generative AI-supported higher education. *Behavioral Sciences*, 15(5), Article 705. <https://doi.org/10.3390/bs15050705>
- Strobl, C., Menke-Bazhutkina, I., Abel, N., & Michel, M. (2024). Adopting ChatGPT as a writing buddy in the advanced L2 writing class. *Technology in Language Teaching & Learning*, 6(1), 1–19. <https://doi.org/10.29140/tl.v6n1.1168>
- Sweller, J., Van Merriënboer, J. J., & Paas, F. (2019). Cognitive architecture and instructional design: 20 years later. *Educational Psychology Review*, 31(2), 261–292. <https://doi.org/10.1007/s10648-019-09465-5>
- Teng, M. F. (2024). “ChatGPT is the companion, not enemies”: EFL learners’ perceptions and experiences in using ChatGPT for feedback in writing. *Computers and Education: Artificial Intelligence*, 7, Article 100270. <https://doi.org/10.1016/j.caeai.2024.100270>
- Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Harvard University Press. <https://doi.org/10.2307/j.ctvjf9vz4>
- Warschauer, M., Tseng, W., Yim, S., Webster, T., Jacob, S., Du, Q., & Tate, T. (2023). The affordances and contradictions of AI-generated text for writers of English as a second or foreign language. *Journal of Second Language Writing*, 62, Article 101071. <https://doi.org/10.1016/j.jslw.2023.101071>
- Washington, J. (2023). The impact of generative artificial intelligence on writer’s self-efficacy: A critical literature review. *SSRN*. <http://dx.doi.org/10.2139/ssrn.4538043>
- Wei, L. (2023). Artificial intelligence in language instruction: Impact on English learning achievement, L2 motivation, and self-regulated learning. *Frontiers in Psychology*, 14, Article 1261955. <https://doi.org/10.3389/fpsyg.2023.1261955>
- Ye, H., Liu, T., Zhang, A., Hua, W., & Jia, W. (2023). *Cognitive mirage: A review of hallucinations in large language models* [Preprint]. arXiv. <https://doi.org/10.48550/arXiv.2309.06794>

Yoo, J. (2025). Reading-writing connections: A systematic review of second language synthesis writing. *L2 Journal*, 17(1), 1–55. <https://doi.org/10.5070/L2.39949>

Appendix A. GAI Review Feedback Sheet

1. Before you start your request to your GAI tool, have you provided the necessary contextual information?
“I am writing an academic _____ essay titled ‘_____’ (state your essay mode and title). I plan to discuss the issue through the following two or three subtopics: _____, _____, and _____ (state your subtopics).”
2. Ask the GAI to act as a writing expert by comparing its revision with your draft, listing the changes made, and explaining the reasons for each change to help you understand academic writing more effectively.
3. Are the subtopics stated in your thesis statement aligned logically with the topic sentences in the body paragraphs?
4. Does the topic sentence in each of your body paragraph reflect the main idea of the discussion?
5. If the GAI does not provide a list of changes or explanations, you can follow up with the prompt below: “Please compare my draft with your revision. List the changes you have made and explain your reasoning or feedback to help me learn academic writing.”
6. You can ask the GAI for feedback on particular aspects of your writing that you would like to confirm or improve (e.g., coherence, citation integration, tone, or academic style).

Appendix B. Reflection Questions

General Questions:

1. What are the challenges you encountered? How did GAI tools help you solve the problem? Please describe and give examples. 寫作時遇到最大的問題為何？GAI 怎麼幫助你解決問題？請舉例說明。
2. What innovative prompts did you create while interacting with GAI? 你在互動過程有哪些自創有效的 prompts?
3. What have you learned from the ChatGPT feedback process? Please list 5 things with examples. 從和 GAI 互動過程你學到什麼？
4. Do you think you can learn deeply through prompting with GAI? Please explain with examples. 你可以透過和 GAI 互動獲得深度學習嗎？

Intentionality

5. When writing Project 2, how did you come up with your topic? Did you use AI to help you? If so, please describe how you used AI to generate your writing topic. 請問你在撰寫 project 2 時，你的題目是如何產生的？有使用到 AI 幫忙嗎？如果有，請舉例說明你如何使用 AI 找到寫作題目。
6. When you lack ideas or inspiration, how do you use AI to help you generate content or writing ideas? 缺發想法或點子時，你會怎麼運用 AI 幫助你產生寫作靈感？

Forethought

7. Before drafting your writing project, how did you use GAI to help you plan your goals, anticipate possible challenges, or envision the expected structure and outcomes of your text? Please describe

how these anticipations guided your writing process. 在打稿之前，是否有使用 GAI 預前規劃寫作方向，了解可能遇到的挑戰，勾勒寫作成果，如果有，請說明這些規劃如何影響你的寫作。

8. Did using GAI change the way you planned your writing compared to planning without GAI? If so, how did it influence your goal-setting, anticipated challenges, or strategy selection during the pre-writing and writing stages? 在寫作前和寫作時，使用 GAI 是否讓你在寫作規劃、預期到的挑戰，和寫作策略都不同於以前沒有使用 GAI 的時候？請說明並舉例。

Reactiveness

9. During Project 3, did AI help you maintain your writing schedule, reduce procrastination, or improve your motivation to write? Describe your interaction strategies with AI and provide examples. 請問在撰寫 Project 3 時，AI 是否幫助你維持寫作進度，減少拖延問題，或是改善寫作動機？請舉例說明你與 AI 互動過程的策略。
10. In Project 3, how did AI assist you in identifying and solving problems during the writing process? Describe the process of identifying the problem and how the interaction with AI helped resolve it, with specific examples. 請問在撰寫 project 3 時，AI 如何協助你發現問題，解決問題？請舉例說明發現問題的過程，以及透過怎樣的互動解決問題。

Reflectiveness

11. When using GAI to assist your writing, what are the advantages and disadvantages? What did you do in response to its limitations? 當使用 GAI 輔助寫作時，有哪些優缺點？你如何處理其功能上的不足之處？
12. During your interaction with GAI, did you feel that you were the agent controlling your writing process, or were there writing aspects over which you felt you had less control? Please provide examples. 在和 GAI 互動過程，你覺得你掌控互動是寫作的主人嗎？哪些部分你缺乏掌控力？

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