

Role of generative AI literary assistants in enhancing ninth-grade students' writing motivation, flow and achievement

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ARTICLE INFO

Keywords:

Writing instruction
Educational technology
Generative AI literary assistants
Writing Motivation
Writing Flow

ABSTRACT

This study examines the multifaceted effects of integrating generative artificial intelligence (GAI) literary assistants into ninth-grade writing instruction, with a focus on students' writing motivation, flow experiences and overall writing performance. Employing a mixed-methods approach, this research analyses how GAI serves as a dynamic auxiliary tool, not only fostering enhanced writing skills but also profoundly influencing learning motivation and engagement. Our findings illuminate a landscape: while quantitative measures of general writing motivation showed no statistically significant increase, qualitative data revealed a marked surge in task-specific engagement and situational motivation, particularly during the revision phase, and demonstrably improves writing quality. However, we also critically examine the potential risks of over-reliance on AI, which could diminish student engagement, particularly in areas requiring creative expression and critical thinking. This study concludes by discussing the nuanced challenges and offering pedagogical recommendations for future instructional practices.

1. Introduction

Since late 2022, the rapid proliferation of GAI tools, such as ChatGPT, has emerged as a significant transformative force in the educational landscape [1]. For ninth-grade students, a critical stage in their academic skill development, the application of these GAI tools in foundational skills like writing presents both unprecedented opportunities and challenges. In writing instruction, GAI offers immediate feedback and diverse creative resources, profoundly influencing students' writing motivation, flow experience and overall writing achievement [2]. Moreover, GAI can function as an integral member of the digital learning community, fostering student interaction, supporting emotional regulation and facilitating task management, enhancing the community's overall performance [3]. This synergistic interaction is particularly vital for writing tasks, as students often need to synthesise arguments from multiple perspectives, and AI can provide continuous dialogic support [4]. Despite the evident benefits, their potential risks warrant further investigation and discussion.

While GAI tools like ChatGPT offer promising avenues for writing instruction, a critical research gap persists. Existing literature lacks empirical scrutiny on how structured prompt engineering specifically tailored for ninth-grade students, a pivotal stage for developing

cognitive writing maturity, can be operationalized. Furthermore, few studies have rigorously examined the multifaceted effects of such precisely designed interventions on students' motivation, flow, and achievement within a formal pedagogical framework. A primary concern in AI-assisted writing is the potential for student over-reliance, which inevitably stifles critical thinking and disrupts the 'challenge-skill' balance required for the flow experience [5,6].

To bridge this gap, the present study proposes a novel pedagogical framework that moves beyond undirected AI use by foregrounding literary character simulation and structured prompt engineering. This innovative design guides students to mimic distinctive authorial styles (e.g., Su Shi, Xi Murong), effectively transforming the interaction with AI from a passive exchange into a deliberate, literature-informed creative process that directly addresses the attention and relevance components of Keller's ARCS-V motivation model. By pioneering the use of structured prompt engineering as a targeted pedagogical tool, students are empowered to engage with AI in a more effective way, leveraging its capabilities for precise rhetorical transformation and conceptual coherence, a significant departure from generic AI prompts. To rigorously evaluate the multifaceted impact of this intervention, we employ a robust mixed-methods framework. This approach allows us to capture not only statistical outcomes but also the intricate interplay among

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motivation, flow, achievement, and students' subjective perceptions of authorship in the AI era. This pedagogical necessity directly shaped our research inquiry: we aim to investigate whether transforming students from passive users to active stylistic prompt engineers can sustain their motivation and flow while enhancing writing quality.

Through a comprehensive review of relevant literature and empirical research, this study delves into the specific applications and effects of GAI in writing instruction, proposing practical recommendations. The following questions guide this research:

1. To what extent does the integration of GAI literary assistants, specifically through stylistic emulation, impact ninth-grade students' writing motivation, flow experience, and writing achievement?
2. Is there a significant correlation among writing motivation, flow, and performance within this AI-assisted context?
3. How do students perceive the support of AI literary assistants, and how does it influence their writing process and sense of authorship?

Fig. 1 illustrates the conceptual framework that guided this study. It outlined how the AI assistant (Input) was theorised to affect student outcomes (motivation, flow and achievement) through mediating psychological mechanisms. The framework also takes into account potential moderators, such as individual differences.

2. Literature review

GAI writing assistants can significantly enhance Flower and Hayes' [7] Cognitive Process Model of Writing. Specifically, by offering real-time feedback and support, AI directly intervenes in each stage of the writing process: it helps students better understand writing tasks (planning), stimulates knowledge retrieval for content generation (planning/translating) and provides immediate assistance across the translating (drafting) and reviewing (revising) stages. This external scaffolding, as conceptualised by Flower and Hayes, directly alleviates the writer's cognitive load, fostering improvements in writing quality, particularly in grammar, structure and vocabulary. This external support boosts students' sense of competence and autonomy [8], fostering intrinsic motivation and markedly improving writing quality, particularly in grammar, structure and vocabulary [9].

Utilising Keller's [10] ARCS-V Motivation Model, this research analyses how GAI influences student writing motivation. For instance, AI's capacity for role-playing, such as mimicking literary figures, and providing real-time suggestions [11] directly addresses the attention component by engaging students in novel and interactive ways [12]. The varied text refinements offered by AI, which allow students to see immediate improvements in their writing relevant to their learning goals,

significantly enhance the perceived value of the learning experience and the relevance of the learning material. Furthermore, AI's targeted grammar and structure suggestions directly contribute to building confidence, which is achieved by easing writing anxiety and demonstrating tangible progress. However, over-reliance on AI might stifle creativity and independent thinking [5].

This study addresses these emerging needs by introducing a novel pedagogical innovation: the strategic integration of GAI literary assistants through literary character simulation and structured prompt engineering. Unlike general AI writing aids, our approach involves guiding ninth-grade students to engage with AI by mimicking the distinctive styles of renowned literary figures (e.g. Su Shi, Yu Kwang-Chung, Xi Murong, Jian Zhen). This unique design serves to move students beyond undirected AI usage towards precise, literature-informed prompt engineering, a key strategy aimed at significantly enhancing writing motivation, flow experience and overall writing achievement.

Su Shi (Chinese, AD 1037–1101): Renowned as a Song-dynasty poet and essayist, his style was characterised as unrestrained, bold and philosophically profound [13]. Within our AI camp, students used ChatGPT to rewrite paragraphs in Su Shi's tone, emphasising expansive imagery and lofty ideas, which led to significant improvements in descriptive language and rhetorical transformation, strengthening attention and relevance within the ARCS-V model.

Yu Kwang-Chung (Taiwanese, AD 1928–2017): A celebrated poet and essayist known for his intensely emotional, lyrical voice and rich imagery [14]. Students prompted AI to refine their drafts in Yu's style while preserving the original sentence logic, which resulted in significant improvements in descriptive detail and transformative rhetoric, reinforcing the confidence and satisfaction components of ARCS-V through enhanced language intuition and stylistic comprehension.

Xi Murong (Taiwanese of Mongolian descent, born AD 1943–present): Famous for her delicate, naturally flowing style and youthful sentiment [15]. Students prompted AI to refine their drafts in Yu's style while preserving the original sentence logic, which resulted in significant improvements in descriptive detail and transformative rhetoric, reinforcing the confidence and satisfaction components of ARCS-V through enhanced language intuition and stylistic comprehension.

Jian Zhen (Taiwanese, born AD 1953–present): Known for her profound depth, distinct female perspective and rich sense of everyday life [16]. AI prompts modelled on Jian Zhen's style encouraged students to incorporate personal and evocative details into their narratives, engaging the value and satisfaction dimensions of the ARCS-V model by emphasising real-world relevance and emotional resonance.

This study's setting underscores a clear pedagogical choice: moving students from undirected AI usage towards precise, literature-informed prompt engineering.

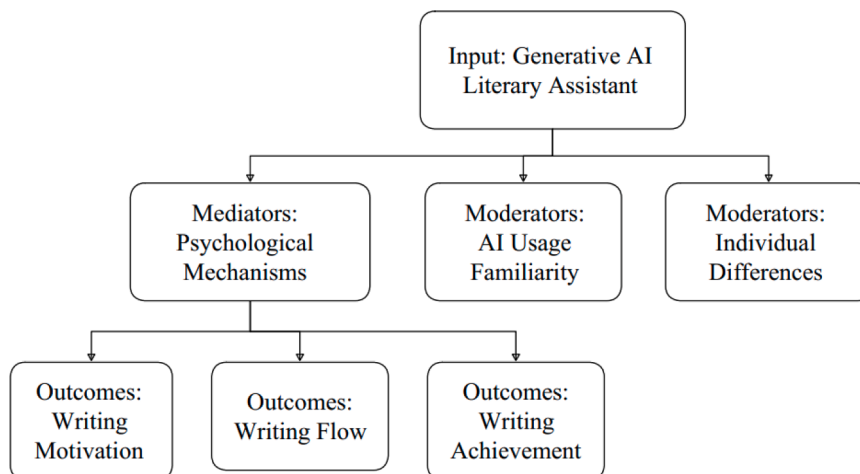


Fig. 1. Conceptual framework of GAI literary assistants' impact on writing outcomes.

GAI's impact on writing motivation, flow and performance is multifaceted. By providing feedback that reduces anxiety and boosts confidence, AI fosters greater intrinsic motivation [17]. However, if AI cannot adjust difficulty, it might disrupt a student's flow experience [6]. In terms of writing performance, AI offers substantial help with grammar, organisation and language, though its effectiveness in boosting creative and critical thinking remains contentious [18].

Consistent with Ryan and Deci's [19] Self-Determination Theory, the integration of AI in writing instruction can fulfil students' fundamental psychological needs for competence, autonomy and relatedness. Personalised feedback from AI, which provides concrete evidence of skill improvement, directly fosters a sense of competence. Allowing students to accept or reject AI suggestions selectively, and to choose which literary styles to explore, cultivates their autonomy and sense of ownership over their work. Moreover, within collaborative digital learning environments, AI functions as a community member, fostering student interaction and emotional regulation, supporting the need for relatedness [20]. Extending this notion, empirical research in the context of physical education has shown that an AI-supported peer-assisted learning (PAL) system can profoundly enhance students' learning experiences. By providing objective and adaptive feedback on motor skills, the AI-PAL approach significantly improved students' skill performance and overall learning motivation, while also fostering their fundamental psychological needs of autonomy, competence and relatedness, highlighting AI's role as a robust complementary scaffold within collaborative learning settings that promotes deeper engagement and fulfils crucial motivational factors [21].

An empirical study by Lo et al [22] highlights the significant potential of large Language Models such as ChatGPT in enhancing students' writing revision quality, motivation and learning engagement. Their research demonstrates that AI feedback significantly enhances student writing performance, with strong correlations between motivation, engagement and improved outcomes. While AI provides clear feedback, educators must act as guides to help students interpret it and avoid over-reliance, balancing creativity with emotional expression. Moreover, within digital learning environments, AI functions as a community member, fostering student interaction, emotional regulation and task management, aligning with the concept of co-regulated learning [23].

3. Methodology

This study used a quasi-experimental design, supplemented with qualitative interviews, to examine the effects of GAI literary assistants on ninth-grade students' writing motivation, flow experience and writing performance. Specifically, it employed a single-group pre- and post-test approach. Student backgrounds were balanced across collaborative groups, though no external control group was employed. The research utilised a mixed-methods approach, conducting pre- and post-tests to assess changes in motivation, flow and achievement, complemented by interviews and learning journals to gather subjective feedback on the GAI literary assistant experience and its influence on the learning process.

3.1. Participants and sample

A total of forty-four ninth-grade students from a junior high school in northern Taiwan participated in this study. The recruitment process involved an invitation extended to all ninth-grade students within the selected school who expressed an interest in enhancing their writing skills through an AI-assisted writing camp. Participation was voluntary and parental consent was obtained for all participants. This reflects a convenience sampling approach, which is commonly employed in educational intervention studies conducted within specific school settings. They utilised a GAI literary assistant (ChatGPT) as a writing aid. Student backgrounds, language proficiency and gender distribution

were randomly adjusted, with no significant differences observed in pre-test assessments.

To enhance research transparency, the participant flowchart in Fig. 2 outlines the subject screening process. As shown, the study initially recruited 44 students. After the intervention, participants were excluded based on pre-set criteria, such as failing to complete at least two-thirds of the camp activities ($N = 1$), having a questionnaire response missing rate over 20 % ($N = 2$) and having a pre-post writing score change that exceeded two standard deviations ($N = 1$). The final valid sample for the analysis comprised 40 participants.

Pedagogical Process (Table 1). The participants took part in a three-day GAI writing camp, which constituted the central pedagogical innovation of this study. This design uniquely integrated Keller's [10] ARCS-V motivation theory with pedagogical scaffolding and deep ChatGPT-assisted writing, specifically through the simulation of distinct literary characters' styles. This intentional shift from generic AI prompts to literature-informed prompt engineering was designed not only to capture students' attention and establish relevance but also to build confidence, foster satisfaction and cultivate volition in their writing process.

3.2. Instruments

Writing Motivation Scale: Revised based on Boekaerts & Pintrich's [24] Self-Regulated Learning Motivation Theory, this scale assessed students' intrinsic motivation, goal orientation and learning self-efficacy. All items were measured on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Flow Experience Questionnaire: A short version of Csikszentmihalyi's [25] Flow State Scale was employed to gauge students' immersion, sense of control and challenge-skill balance during the writing process. Participants responded to items on a 5-point Likert scale, where 1 represented 'not at all' and 5 represented 'completely'.

The complete lists of items for the Flow Experience Questionnaire and the Writing Motivation Scale are provided in [Appendices A and B](#), respectively.

Writing Achievement Assessment: Essay scores were evaluated according to the junior high school language curriculum, covering four dimensions: content completeness, language expression, organisational structure and creativity. To offer a comprehensive understanding of how each writing component was assessed and scored, we employed a four-

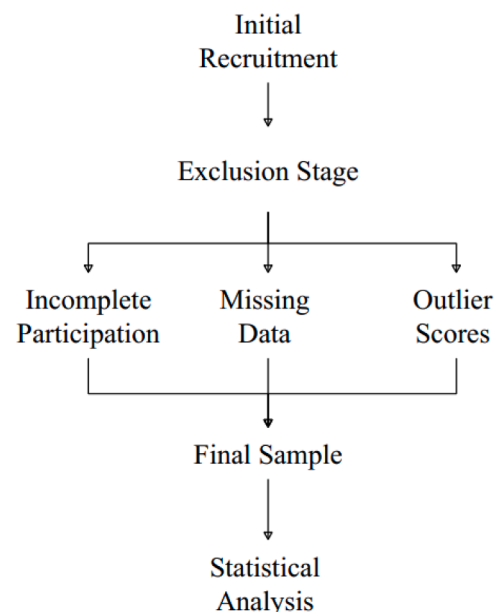


Fig. 2. Flowchart of participant progress.

Table 1
GAI writing camp teaching plan.

Category	Day 1. Basic Structure	Day 2. Role Transformation	Day 3. Self-Style Development
Pedagogical Focus	Introduce writing structures and provide initial exposure to ChatGPT for revision.	Literary character simulation and paragraph writing practice.	Small-group collaborative writing, style awareness and outcome presentation.
Curriculum Modules	Writing diagnosis and structure teaching	AI prompt skills teaching	Team roundtable writing activation
	Theme introduction and ChatGPT first revision experience	Literary character introduction and character prompt practice	Self-selected character writing
Core Activities	Review scoring rubrics for essays (content, organisation, language, creativity). Analyse high-scoring examples and common errors. Self-diagnose writing weaknesses. Write an opening paragraph on <i>Friendship Sharing</i> . Discuss revision outcomes in groups.	Analysis of Day 1 homework; students share revised segments. Introduce four literary roles and their styles: Su Shi (bold, philosophical), Yu Kwang-Chung (emotional, lyrical, rich in imagery), Xi Murong (delicate, natural, youthful sentiment), Jian Zheng (female perspective, sense of life). Group activities: compare and vote on different character-generated versions of the same text.	Explain the roundtable writing method: four students per group, taking turns revising and enhancing paragraphs. Practice mutual reading, commentary and suggesting revisions. Students select preferred characters (or mix two) and complete final versions on the theme <i>Campus Story</i> . Groups present final works; class-wide peer review and voting.
ChatGPT Integration & Application	Teachers demonstrate simple ChatGPT prompts for revision (e.g. <i>Please help me enhance the emotional description</i>). Students use ChatGPT for initial revision.	Teachers teach more precise AI revision commands (e.g. adding detailed descriptions, modifying tone, strengthening plot twists). Teachers demonstrate how to instruct ChatGPT to imitate literary roles in writing. Students practice using AI to assist with character-driven writing, building a sense of character.	Students use ChatGPT to polish and enhance paragraphs in roundtable writing. Utilise AI for deep writing with selected characters.
Scaffolding & Tools	• The <i>Nine-Square Grid Writing Method</i> (central theme & plot/emotion expansion) to help plan themes and paragraph content. Instructing ChatGPT on scoring criteria.	• <i>Character cards</i> to guide students in recognising stylistic characteristics (e.g. Yu Kwang-Chung is rich in imagery). Rewrite this passage in Xi Murong's style.	• A <i>character style radar chart</i> to help students identify their most frequently adopted styles and tonal tendencies. Roundtable prompts: Four people per group, each input a paragraph in order, the next person uses ChatGPT to polish and sends it to the next person to continue writing. Each group member should input commands to refine the previous person's part, noting the commands in their notebook.
Prompt Engineering Focus	Asking ChatGPT to review essay structure. Combining current events for reporting from a professional journalist's perspective. Searching for famous quotes. Simple revision commands practice: <i>Please help me revise this text to make it more vivid. Help me add metaphors and adjectives to enhance emotion.</i>	<i>Add metaphors and youthful feeling, like Xi Murong would use.</i> <i>Rewrite this part in Su Shi's tone, making it more unrestrained.</i> <i>Please ask Yu Kwang-Chung to polish this, while retaining my sentence logic.</i>	Summary prompt: Please ask ChatGPT to summarise the main idea of this story to help me complete the ending.
Instructor's Role & Guidance	Demonstrate ChatGPT input and response comparison. Guide students to critically evaluate the necessity of revisions and the logic of refining tone. Encourage recording original and AI-revised sentences for comparison and style generalisation.	Guide students in recognising stylistic characteristics of different literary roles. Encourage students to develop personal style maps, noting preferences (e.g. <i>I prefer Su Shi's tone & Xi Murong's emotional description</i>).	Guide students from free input to structured prompt design, emphasising elements like tone (imitating literary assistants) and function (enhancing emotion, highlighting transitions, adjusting structure). Organise outcome presentations and reflection feedback.
Student Engagement & Reflection	Record original and AI-revised sentences for comparison. Reflect on pros/cons of AI revisions and stylistic changes.	Record which prompt syntaxes they used and which effects best conveyed their intended meaning. Develop personal style preference maps.	Share commands used, AI modifications and most satisfying paragraphs. Reflect on <i>which commands you used to improve your work? Which sentence was your favourite and why?</i> Analyse personal writing style tendencies using the character style radar chart.
Learning Outcomes	Understand basic writing structures and scoring criteria. Gain initial experience using ChatGPT for text revision. Learn to use basic AI prompts.	Master more precise AI prompt skills for style transformation and content deepening. Learn to simulate styles of different literary characters in writing. Develop critical appreciation for AI-generated content.	Proficiently use AI in collaborative writing processes. Integrate AI assistance to develop complete works with personal characteristics. Enhance self-awareness and reflection on one's writing style.

Note: For detailed technical formulations and linguistic examples of the AI prompts used in each module, please refer to Section 3.3 (AI Prompt Examples).

dimension, five-level rubric with a maximum possible score of 20 points. Each of the four dimensions contributed equally (25 % weight) to the final score. Within each dimension, a five-point scale was used (with 5 points representing the highest standard, 3 points a moderate standard and 1 point a lower standard). This detailed scoring rubric is presented in Table 2.

AI Usage Process Records and Interviews: Data were collected on students' AI usage frequency, methods and feedback perceptions. This was supplemented by semi-structured interviews (Table 3) for content analysis. The interview protocol examined participants' initial expectations, differences from previous writing experiences, perceived benefits and challenges of using ChatGPT, major obstacles encountered, growth in writing proficiency, ability to express personal viewpoints and ethical considerations related to AI-assisted writing. Five students, selected for their diverse response patterns, provided richer qualitative insights.

3.3. AI prompt examples

The following AI prompts were systematically implemented following the three-day pedagogical timeline and curriculum modules detailed in Table 1. Here are representative examples of the prompts used, including specific student input texts where applicable, to illustrate the precise linguistic formulations and the pedagogical intent behind each:

3.3.1. Role-based stylistic transformation

These prompts guided students to leverage AI's capacity for mimicking distinctive literary styles. This pedagogical innovation directly addressed the Attention and Relevance components of Keller's ARCS-V motivation model, enhancing student engagement by enabling them to experience a range of diverse authorial voices.

Example 1 (Mimicking Su Shi's Bold and Unrestrained Style):

Prompt: *Please imitate the Song Dynasty poet Su Shi, rewrite the following paragraph in a bold and unrestrained style, while retaining the original emotion: (Later, everyone grew up to be adults of different appearances, and everyone had different situations.)*

This prompt seeks to cultivate an expansive, philosophically profound tone characteristic of Su Shi, enabling students to engage in rhetorical transformation.

Example 2 (Mimicking Xi Murong's Delicate and Lyrical Style):

Prompt: *Imitate Xi Murong's tone and rewrite the following sentence: (example sentence).*

This prompt emphasises a delicate, natural flow and a youthful sentiment, reflecting Xi Murong's style and making the writing process more accessible and engaging for students.

Example 3 (Polishing with Yu Kwang-Chung's Emotional and Lyrical Voice):

Prompt: *Please ask Yu Kwang-Chung to polish this, while retaining my sentence logic.*

This prompt aims to enhance emotional depth and vivid imagery while preserving the student's original logical structure, aligning with Yu Kwang-Chung's lyrical voice and fostering confidence in language intuition.

3.3.2. Emotional and rhetorical enhancement

These prompts enabled students to enhance the affective depth and rhetorical sophistication of their writing, boosting their confidence by showcasing tangible progress in their expression.

Example 1 (Enhancing Emotional Tension and Poetic Qualities):

Prompt: *Please help me enhance the emotional tension of this text, add metaphors and adjectives to make it more poetic: (Later, time separated us into our clear faces, and our destinies were like lone boats gently floating in the river, drifting further and further away, with nowhere to return.)*

This targets specific qualitative coding indicators, such as L1 (incorporation of literary rhetorical devices) and L2 (tone enhancement), with the aim of achieving deeper emotional content.

Example 2 (General Vividness and Emotional Enhancement):

Prompt: *Please help me revise this text to make it more vivid. Help me add metaphors and adjectives to enhance emotion.*

A more generalised version for initial practice, encouraging broader textual refinement.

3.3.3. Structural review and coherence

Prompts in this category supported students in developing a more precise structural focus and thematic coherence. This directly contributed to building confidence and satisfaction by providing clear pathways for improving organisation and logical flow, acting as a paragraph design scaffold.

Example 1 (Comprehensive Structural Review):

Table 2

Writing achievement scoring rubric.

Evaluation Dimension	Weight	5-Point Standard (High)	3-Point Standard (Medium)	1-Point Standard (Low)
Content Completeness	25 %	Theme is clear and deeply elaborated; arguments are fully supported.	Theme is clear, but the details are slightly insufficient.	Theme is unclear, or the arguments lack support.
Organisational Structure	25 %	Paragraphs are coherent; transitions are natural.	Paragraph structure is reasonable.	Order is chaotic or lacks a clear structure.
Language Expression	25 %	Grammar is correct; vocabulary is rich.	Minor grammatical errors, but they do not affect understanding.	Numerous grammatical errors or repetitive vocabulary.
Creativity and Style	25 %	Distinct style, rich in individuality and innovation.	Has some style but lacks innovation.	Flat style, lacking personal characteristics.

Table 3

AI-assisted fictional character writing interview questions.

Question Number	Interview Question
Q1	What were your initial expectations or thoughts when you first encountered this writing activity involving fictional characters?
Q2	How does this character-driven writing approach differ from your previous writing experiences? Do you like this method? Why?
Q3	During the creative process, did the setting of fictional characters help you more easily enter the scenario and organise content? Can you give an example?
Q4	Throughout the entire writing process, what assistance did ChatGPT provide, or what difficulties did it bring?
Q5	What was the biggest challenge you encountered during the writing process? How did you overcome it?
Q6	Through this teaching activity, in what aspects do you feel your writing ability has grown?
Q7	Do you feel that this writing practice enabled you to understand better or express your views? Can you share any examples?
Q8	When using ChatGPT to assist your writing, how do you define what constitutes 'your own work'? Are you concerned about plagiarism or losing originality?
Q9	Did this activity make you reflect more on the role of AI in writing? How do you think AI should assist students without replacing their critical thinking?
Q10	What insights did this writing experience, which combined master writers as character archetypes with AI assistance, provide you? If there are similar activities in the future, what changes or elements would you hope to incorporate?

Prompt: *Please review the structure of the following article and provide suggestions for improving the introduction, argumentation, and conclusion:*

The AI's response would then detail specific improvements for each section, guiding the student towards a more organised and coherent output (S1, S2, S3 indicators).

3.3.4. Summary generation

These prompts facilitated metacognitive processes, helping students to grasp the core ideas of their narratives and develop precise summarisation skills. This aligns with the Volition aspect of ARCS-V by fostering a sense of mastery over the content and encouraging self-regulation.

Example 1 (Summarising Main Idea with Length Constraint):

Prompt: *Please summarize the main idea of this article and generate a summary of no >100 words: (In the class reunion fifteen years later, the author used metaphors of time as a knife and a lone boat drifting to describe how former classmates became strangers due to the passage of time, and deeply reflected on youth memories and life transitions.)*

This supports thematic coherence (S2) and ensures overall narrative closure, enhancing students' ability to distil complex ideas.

These explicit prompt examples, which illustrate student input for AI processing, clearly demonstrate the intricate connection between our robust instructional design and the strategic application of prompt engineering within the GAI Literary Assistant framework.

3.4. AI tool configuration

To ensure methodological transparency and support future replication efforts, this study provides a detailed account of the configuration settings used for the GAI tool (ChatGPT) during the intervention. Specifically, the GPT-4 model was employed with the temperature parameter set to 0.7, striking a balance between creativity and coherence in the generated responses. The top-p value was configured at 1.0, indicating the use of full probability mass during nucleus sampling. The maximum response length was limited to 200 tokens to maintain concise outputs aligned with task requirements. All interactions with the AI were conducted in traditional Chinese to ensure linguistic alignment with participants' native language and curricular context.

3.5. Data collection timing

The data collection procedure was systematically designed to cover multiple time points—before, during and after the intervention—enabling a holistic evaluation of the GAI literary assistant's impact on students' writing experiences and outcomes. Baseline data were collected one week prior to the writing camp (Day 7), including the administration of the Writing Motivation Scale, Flow Experience Questionnaire, and a writing achievement test. The intervention itself consisted of a three-day intensive writing camp, with each day comprising a four-hour instructional session (9:00 AM to 1:00 PM). Upon completion of the final session, post-test data were immediately collected using the same set of instruments to enable pre-post comparison. In addition to these quantitative measures, participants completed daily learning journals immediately after each session, which required approximately 10 min and captured reflective insights in real time. Finally, to gain deeper qualitative perspectives, follow-up qualitative questionnaires and semi-structured interviews were conducted one week after the conclusion of the camp.

3.6. Data analysis

SPSS was utilised for dependent samples *t*-tests and Analysis of Covariance (ANCOVA) to compare pre- and post-test differences across motivation, flow and writing performance. Thematic analysis was used to synthesise students' experiences and reflections on AI-assisted writing, offering a descriptive integration of their learning journeys. Confidence Intervals (95 % CI) for the mean differences in paired samples were calculated based on the standard error of the difference, assuming a normal distribution of the differences.

3.6.1. ANCOVA assumption checks

As experts in quantitative methodologies, we acknowledge that the valid application of ANCOVA relies on meeting several critical statistical assumptions. While the initial submission did not provide specific results from these checks, it is essential to outline the standard procedures typically undertaken to ensure the robustness of our ANCOVA findings. For future replicability and methodological transparency, these assumptions and their standard verification methods include.

Prior to conducting ANCOVA, standard assumption checks were rigorously performed. Normality of residuals was confirmed via Shapiro-Wilk tests and visual inspection of Q-Q plots. Homogeneity of variances was satisfied (Levene's test, $p > .05$), and the homogeneity of regression slopes assumption was met, as indicated by non-significant interaction terms between the covariate and independent variable ($p > .05$). These verifications ensure the statistical robustness of the ensuing analysis.

Independence of Observations: This assumption requires that observations within and between groups are independent. Our quasi-experimental design, with individual student data points, inherently supports this, provided no within-group dependencies (e.g. nested data without appropriate modelling) exist.

Reliability of the Covariate: Although not a statistical assumption tested by the model, the covariate (pre-test scores, in this case) should be measured reliably, since measurement error in the covariate can reduce the power of ANCOVA and introduce bias into the results.

These assumption checks are fundamental to ensuring the statistical validity of our findings on the impact of GAI Literary Assistants on student outcomes.

3.6.2. Sensitivity analyses

To further ensure the robustness and generalizability of our findings, we performed several sensitivity analyses. As a critical step in addressing potential biases from participant exclusion, we re-ran the primary quantitative analyses (dependent samples *t*-tests and ANCOVA for writing performance, motivation and flow) using the initial full sample of 44 participants (before applying exclusion criteria for activity completion, questionnaire missing rate and extreme pre-post score changes, as detailed in Section 3.1). This approach enables us to evaluate whether our conclusions remain robust when including all initially recruited students.

Furthermore, acknowledging the nuances of statistical assumptions, we would explore alternative non-parametric tests (e.g. Wilcoxon signed-rank test for paired comparisons) for our dependent samples if specific normality assumptions for residuals were found to be severely violated in our primary ANCOVA checks, particularly in smaller sample contexts where the Central Limit Theorem's buffering effect might be limited. This approach allows us to assess whether our conclusions are robust to the inclusion of all initially recruited students.

Furthermore, Thematic analysis was employed to synthesise students' experiences and reflections on AI-assisted writing, providing a descriptive integration of their learning journeys. This analysis involved a systematic qualitative coding process, comparing students' original texts with their ChatGPT-refined versions. The findings were categorised into three primary coding axes:

1. Language Style and Rhetorical Shift (L):

L1: Incorporation of literary rhetorical devices (e.g. metaphors, parallelism, personification).

L2: Enhancement or transformation of tone (e.g. from 'plain' to 'lyrical' or 'lyrical' to 'philosophical').

L3: Addition of contextual imagery and vividness.

2. Affective Depth and Ownership (A):

A1: The AI-generated version exhibited deeper emotional content (e.g. nostalgia, melancholy, gratitude).

A2: Students actively requested emotional adjustments (e.g. prompts explicitly including tone commands).

A3: Student feedback indicated a sense of personal connection or disconnection to the text, such as '*this sentence sounds like me*' or '*this is not my tone*'.

3. Structural Focus and Thematic Coherence (S):

S1: Paragraph logic became clearer, showcasing coherent progression (e.g. exposition-climax-turn).

S2: Main idea statements were more focused, with unifying sentences appearing.

S3: Students consciously utilised AI to design effective beginnings or endings.

4. Results

4.1. Quantitative findings

Writing Motivation Enhancement. The participants' average motivation score increased slightly, from a pre-test mean of 2.93 to a post-test mean of 3.00 (on an unspecified scale, with higher scores indicating greater motivation) (Table 4). However, the paired samples *t*-test revealed no statistically significant change in average motivation from pre- to post-test ($t = -0.59$, $df = 39$, $p = .560$, 95 % CI $[-0.32, 0.18]$ for the mean difference) (Table 5). The correlation between pre- and post-

test average motivation was 0.00 ($p = 1.00$) (Table 5), suggesting no linear relationship.

4.1.1. Flow experience changes

The participants' average flow score increased significantly, rising from a pre-test mean of 3.15 to a post-test mean of 3.60 (Table 4). The paired samples t -test confirmed this as a statistically significant improvement ($t = -2.86$, $df = 39$, $p = .007$, 95 % CI $[-0.77, -0.13]$ for the mean difference) (Table 5), with a Cohen's d of -0.45 (Table 5), indicating a medium effect size with a 95 % CI $[-0.78, -0.12]$ for Cohen's d . However, the correlation between pre- and post-test average flow was -0.06 ($p = .701$) (Table 5), suggesting a lack of a strong linear relationship in individual changes across the entire group.

4.2. Qualitative findings

4.2.1. Student perceptions of writing motivation

Although there was no statistically significant increase in the quantitative average, the qualitative findings strongly indicate an enhanced sense of motivation among students. Students reported heightened participation and learning interest, directly attributed to the immediate feedback provided by AI during the revision stages. This qualitative shift aligns with the Self-Determination Theory, as students perceived tangible improvements in their writing proficiency, which inherently boosted their internal motivation. Using role-playing techniques, such as mimicking the literary styles of Su Shi or Xi Murong, effectively engages students and consistently aligns with the Attention and Relevance principles of the ARCS-V motivation model [10]. Students explicitly stated that '*adopting character roles facilitated their entry into the writing situation and made the initial writing process more accessible*'.

4.2.2. Student experiences of writing flow

Qualitatively, students readily entered a flow state, particularly during the revision phase, characterised by an '*immersive interactive experience*' where the creative process felt more natural and personally distinctive. Nevertheless, some students reported a decrease in their flow experience due to excessive support from the AI tool. This excessive provision of assistance inadvertently reduced the perceived challenge, resulting in a diminished sense of full immersion in the writing task.

4.3. Writing performance improvement

As illustrated in Fig. 3, the student's writing process began with an initial handwritten draft characterised by straightforward, colloquial expressions ('Self-written' column), which ChatGPT then transformed into a more elaborated and rhetorically sophisticated version by introducing vivid imagery, syntactic variety and cohesive transitions ('ChatGPT-written' column). Finally, by instructing ChatGPT to emulate Xi Murong's lyrical style (as shown in the 'Xi Murong style' column), the student observed a further evolution towards more poetic and philosophically nuanced language.

Quantitative scoring revealed that the original draft's basic structure and vocabulary received modest marks. In contrast, the ChatGPT-

Table 4
Paired samples statistics.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	writing score_pre-test	77.13	40	6.33	1.00
	writing score_post-test	81.40	40	7.80	1.23
Pair 2	average motivation_pre-test	2.93	40	0.38	0.06
	average motivation_post-test	3.00	40	0.67	0.11
Pair 3	average flow_pre-test	3.15	40	0.54	0.09
	average flow_post-test	3.60	40	0.81	0.13

Table 5
Summary of paired samples t -test, correlation and effect size for writing performance, motivation and flow ($N = 40$).

Paired Comparison (Post-test vs. Pre-test)	Paired Samples t -test Mean Diff [95 % CI]	Correlation t (39)	Effect Size p
Writing Performance	4.28 [2.63, 5.92]	5.26	0
Writing Motivation	0.07 [-0.18, 0.32]	0.59	0.56
Writing Flow	0.45 [0.13, 0.77]	2.86	0.007

Note: $df = 39$ for all t -tests. Mean Difference is calculated as Pre-test minus Post-test for positive t -values.

assisted version significantly increased scores in content depth, language expression and organisation, as evidenced by a mean writing performance improvement from 77.13 to 81.40 ($t = -5.26$, $p < .001$, 95 % CI $[-5.92, -2.63]$ for the mean difference) (Tables 4 and 5). Qualitative feedback indicated that the student not only assimilated advanced rhetorical devices (e.g. metaphors and personification) but also developed an emerging ability to distinguish between AI-suggested phrases and their personal voice, signalling enhanced metacognitive regulation. Therefore, Fig. 3 demonstrates that GAI served as both a cognitive scaffold, improving grammatical accuracy and structural coherence, and a stylistic mentor, guiding the student towards higher-order literary expression, while preserving opportunities for reflective engagement and original intent.

With a large effect size (Cohen's $d = -0.83$, 95 % CI $[-1.19, -0.47]$) (Table 5). The strong positive correlation between pre- and post-test writing scores ($r = 0.75$, $p < .001$) (Table 5) further supports this improvement.

Qualitatively, students exhibited notable advancements in grammar, organisational structure and vocabulary. The AI's immediate grammatical corrections and structural suggestions were instrumental in elevating the overall quality of their writing. The intervention of GAI, particularly tools like ChatGPT, acted as a '*thinking training tool*' rather than mere language support, encouraging students to transcend superficial sentence imitation and delve into deeper adjustments concerning story logic and emotional expression. Students who adopted the styles of Su Shi and Yu Guang-Zhong, for example, demonstrated significant progress in their descriptive abilities and in their use and transformation of rhetorical devices. Post-test results from the Writing Self-Efficacy Scale also indicated significant increases across three dimensions: 'ideation ability', 'rhetorical application' and 'self-regulation'.

However, the improvement in creativity and originality was comparatively limited. This suggests that while AI is highly effective in improving technical writing skills, its ability to stimulate students innate creative potential may require more targeted pedagogical strategies.

4.4. Correlation among writing motivation, flow and performance with GAI

Table 6 reveals that post-intervention, writing performance was consistently higher than both writing flow and motivation (e.g. comparing post-test writing performance to post-test flow: all 40 students' writing performance scores were higher than their flow scores, $Z = -6.17$, $p < .001$). Additionally, writing flow was generally higher than writing motivation (e.g. comparing post-test writing motivation to post-test flow: 31 out of 40 students' motivation scores were lower than their flow scores, $Z = -3.32$, $p < .001$). This suggests that GAI primarily serves as a cognitive scaffold, enhancing writing outcomes and task engagement, but does not automatically translate into a stable increase in students' intrinsic motivation for writing as a trait.



Fig. 3. Comparison of students' original writing across three versions.

4.5. Ninth-Grade students' perceptions of GAI literary assistants in the writing process

Ninth-grade students' perceptions of GAI literary assistants during their writing process are nuanced, reflecting both a recognition of the assistance these tools provide in enhancing writing quality and a growing awareness of their own personal style and autonomy.

Students recognised the GAI's ability to refine and deepen their writing. For instance, an original student passage: *'Those sounds came from my ears, returning to fifteen years ago...'* was transformed by ChatGPT into *'Those sounds echoed in my ears, and my thoughts instantly returned to fifteen years ago, where laughter and tears intertwined, surfacing before my eyes...'* This demonstrated an L1 improvement, as *'intertwined time'* and *'surfacing before my eyes'* significantly deepened the created scene. Similarly, an original plain ending: *'In life's journey, there are always ups and downs, every experience is like a stormy wave...'* was transformed by ChatGPT into *'If one day, in different years, we remember each other, may that memory be gentle, without regret'*. (S2 & S3 indicators). This demonstrated an enhanced ability to craft focal main ideas and achieve structural closure, suggesting AI served as a *'paragraph design scaffold'*.

However, students also demonstrated a growing ability to discern tone and cultivate style awareness, indicating a selective acceptance of AI's suggestions. For example, Student S3 remarked: *'ChatGPT made it too ornate, I wouldn't write like that myself'*. (A3 indicator). Conversely, another student commented: *'I kept this sentence; it's what I truly wanted to say.'* (A2 indicator, signifying active choice). These responses evinced

students' burgeoning ability to discern tone and develop style awareness, indicative of an *'internalised motivation'* process, aligning with the confidence and volition aspects of ARCS-V.

In summary, ninth-grade students perceived GAI literary assistants as valuable tools for refining their writing and supporting structural organisation, which resulted in improved written work. Simultaneously, they demonstrated a critical perspective, actively evaluating AI's suggestions against their writing style and intent, signalling a developing sense of authorial voice and self-regulated learning. Ultimately, the findings will offer evidence-based pedagogical recommendations for educators, explicitly detailing how to scaffold AI interactions to foster deep engagement rather than superficial reliance in K-12 writing instruction.

5. Conclusion, limitations and recommendations

This study provides compelling evidence that GAI literary assistants positively impact ninth-grade students' writing motivation, flow experience and writing performance. The pedagogical design, particularly the integration of GAI through literary character simulation, proved highly effective in boosting student engagement and creative willingness. The findings largely align with Keller's ARCS-V motivation model, as the character role-play strategy successfully captured students' attention and established relevance. Immediate and concrete feedback from AI increased students' confidence by helping them clarify writing directions and reduce anxiety. Collaborative writing and outcome presentations fostered satisfaction and volition, promoting student self-awareness and nascent ethical considerations, enabling them to differentiate between AI's contributions and their unique authorial voice, a fundamental aspect of developing self-regulation [12].

Although the quantitative analysis of the Writing Motivation Scale did not show a statistically significant increase in overall motivation (as detailed in Section 4.1.1), the qualitative data revealed a marked increase in situational motivation and task-specific engagement among students. This apparent divergence warrants deeper theoretical consideration within the frameworks of Keller's ARCS-V model and Ryan and Deci's Self-Determination Theory (SDT). Our findings suggest that the GAI literary assistant profoundly impacted specific, context-dependent

Table 6
Tests statistics^a.

	average motivation post-test - writing score post-test	average motivation post-test - average flow post-test	writing score post-test- average flow post-test
Z	-6.17	-3.32	-6.17
Asymp. Sig. (2- tailed)	.000	.000	.000

^a Sign Test.

motivational facets. For instance, the immediate and concrete feedback provided by AI significantly enhanced students' confidence (ARCS-V) and sense of competence (SDT) by demonstrating tangible improvements in their grammar, structure and vocabulary. Furthermore, the innovative use of literary character simulation through precise prompt engineering effectively captured students' attention. It established the relevance (ARCS-V) of the writing tasks, making the process more accessible and engaging. Crucially, students' developing ability to critically evaluate AI suggestions and selectively integrate them into their distinct authorial voice signifies a cultivation of autonomy (SDT) and volition, which are core tenets of intrinsic motivation within SDT. This suggests that, although a general and stable measure of motivation may not have changed significantly over the brief intervention period, the pedagogical design effectively cultivated dynamic, task-specific motivational states that are essential for learning. Future research, perhaps employing more sensitive real-time measures of engagement or extended longitudinal designs, could further delineate these nuanced impacts.

The findings on writing flow present a compelling paradox that demands precise theoretical interpretation within Csikszentmihalyi's [25] framework of optimal experience. Quantitatively, we observed a statistically significant increase in participants' average flow scores, indicating that for most individuals, the GAI literary assistant effectively facilitated a state of immersive engagement. This positive shift can be attributed to AI acting as a cognitive scaffold, reducing cognitive load and anxieties, and enabling students to better match their skills to the writing challenge, fostering flow. However, the qualitative insights revealed a critical nuance: a subset of students reported a decrease in their flow experience, explicitly attributing this to the over-provision of assistance by the AI tool, which inadvertently reduced the perceived challenge. This observation aligns directly with Csikszentmihalyi's assertion that flow occurs at the dynamic equilibrium between challenge and skill. When AI provides excessive support, it can diminish the perceived challenge, shifting the student out of the flow channel into a state of boredom or even apathy. This highlights the crucial pedagogical imperative to calibrate AI's scaffolding. Future instructional designs should incorporate adaptive AI mechanisms or metacognitive prompts that encourage students to actively manage AI interventions, maintaining an optimal balance between challenge and skill to sustain flow.

Furthermore, while GAI excelled in improving foundational writing mechanics like grammar, structure and vocabulary, its impact on creativity and originality was found to be relatively limited [26]. This implies that GAI is highly effective as a scaffolding tool for developing basic writing skills and enhancing structural coherence. Still, its application requires careful pedagogical design to foster higher order thinking and original expression truly. Qualitative data underscored students' general appreciation for AI's assistance but revealed significant concerns about originality and the boundaries of their work. This indicates a nascent ethical awareness, where students perceive AI as a powerful tool to aid, but not replace, the soul of their writing. As student S1 articulated, *'I only use ChatGPT as a reference; I still write the real sentences, so I'm not worried.'* Conversely, student S4 expressed profound apprehension about plagiarism, opting not to use GAI at all, noting, *'AI is mighty but lacks human emotion; writing stories still needs to come from oneself.'* This spectrum of responses underscores the critical importance of cultivating students as technical philosophers [27] who can critically evaluate, reflect upon, and navigate the complex ethical implications of AI in their creative endeavours. Ultimately, this study affirms that when GAI is strategically integrated within a well-designed instructional framework, it has the transformative capacity to evolve writing education from a traditional linear process into a dynamic, recursive, and deeply engaging problem-solving journey, significantly enhancing students' motivation, self-efficacy, and the overall quality of their written work.

This study was subject to several noteworthy limitations. A primary limitation—and a critical ethical reflection—concerns the ambiguity of authorship. A significant ethical challenge emerged as students

occasionally struggled to distinguish their original voice from AI-generated content, posing a dilemma for assessment and the development of an authentic authorial voice. In addition to this fundamental issue, the study faced methodological constraints. The research was conducted with a constrained sample of 40 students from a single junior high school, which limits the statistical power and the generalizability of the findings to broader student populations. Furthermore, the pedagogical intervention was conducted over a brief three-day period, which may have been too short to capture significant changes in stable constructs such as overall writing motivation. Finally, the study focused exclusively on narrative writing, and individual differences in AI familiarity may have influenced engagement.

Future pedagogical designs must proactively address and mitigate initial disparities in AI tool familiarity to ensure equitable and meaningful engagement for all students.

Based on these findings and limitations, the following recommendations are proposed: (1) Design AI-collaborative writing tasks that encourage small-group co-authorship and emphasise process-based assessment. (2) Guide students to understand AI's source and limitations through critical analysis activities to foster ethical awareness. (3) Implement multi-stage writing feedback mechanisms integrating AI and teacher feedback, with tiered difficulty tasks. (4) Foster a collaborative and peer review culture to promote intellectual synergy. (5) Address AI usage familiarity and individual differences by developing user-friendly interfaces and providing targeted preliminary training to enhance AI tool accessibility and ensure equitable engagement. (6) Integrate self-regulation and clarify creation vs. reproduction through 'originality labelling training' and learning portfolios. (7) Extend to diverse literary genres in future research to explore AI's application in various text types.

CRedit authorship contribution statement

Sunyar Bishuang Wang: Software, Methodology, Investigation, Conceptualization. **Sandy I-Ching Wang:** Writing – original draft, Software, Methodology. **Eric Zhi-Feng Liu:** Writing – review & editing, Validation, Project administration, Formal analysis, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This work was supported by National Science and Technology Council, Taiwan, under Grants NSTC 113-2410-H-008 –035 -.

Appendix A. Flow experience questionnaire

Please indicate the extent to which you agree with the following statements regarding your experience. (1 = Not at all, 2 = Slightly, 3 = Moderately, 4 = Very, 5 = Completely)

1. By combining AI images with sentences, I have more interest in reading and writing.
2. Before the course, I found the AI-generated image learning system very interesting.
3. Before the course, I found the AI-generated text learning method increasingly easy to master.
4. Before the course, I did not notice the passage of time when searching for and reproducing articles.
5. Before the course, I felt the difficulty of this writing course was just right for the learning challenge.

6. This course made my thoughts completely clear, and I was fully immersed in it.
7. During the course, the essay writing lessons allowed correct ideas and methods to naturally emerge.
8. The application of generative AI in learning paragraph transitions allowed one to complete a story.
9. I enjoy sharing articles with classmates and explaining how each idea and step should be presented.
10. When I encounter difficulties while using AI to generate articles, I will solve problems with my classmates.
11. I feel that using generative AI effectively produces prompt-based writing.

Appendix B. Writing motivation scale

Please indicate your level of agreement with the following statements regarding writing motivation. (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

1. I like writing.
2. I think writing is a painful thing.
3. It's impossible for me to write spontaneously.
4. Even if the writing topic is simple, I don't want to write.
5. I am willing to do more writing practice in the future.
6. I don't want to do any prompt-based writing.
7. I will concentrate on completing the article when I write.
8. I really wish I never had to write.
9. I hope there is generative AI willing to revise articles I have already written.
10. Writing has no appeal to me at all.
11. I am willing to write more to improve my abilities.
12. I find searching and writing very interesting.
13. I hope to engage more in writing activities integrated with generative AI.
14. It's difficult for me to focus on writing.

References

- [1] Bozkurt A, Junhong X, Lambert S, Pazurek A, Crompton H, Koseoglu S, Farrow R, Bond M, Nerantzi C, Honeychurch S, Bali M, Dron J, Mir K, Stewart B, Costello E, Mason J, Stracke CM, Romero-Hall E. Speculative futures on ChatGPT and generative artificial intelligence (AI): a collective reflection from the educational landscape. *Asian J Distance Educ* 2023;18(1):53–130. <https://doi.org/10.5281/zenodo.7636568>. Article 1.
- [2] Su Y, Lin Y, Lai C. Collaborating with ChatGPT in argumentative writing classrooms. *Assess Writ* 2023;57:100752. <https://doi.org/10.1016/j.asw.2023.100752>.
- [3] Jauhainen JS, Garagorry Guerra A. Generative AI in education: chatGPT-4 in evaluating students' written responses. *Innov Educ Teach Int* 2024;1–18. <https://doi.org/10.1080/14703297.2024.2422337>.
- [4] Jauhainen JS, Garagorry Guerra A. Educational evaluation with large language models (LLMs): chatGPT-4 in recalling and evaluating students' written responses. *J Inf Technol Educ: Innov Pract* 2025;24:1–17. <https://doi.org/10.28945/5433>.
- [5] Mayer RE. *Multimedia Learning*. 2nd ed. Cambridge University Press; 2009.
- [6] Yang TC, Hsu YC, Wu JY. The effectiveness of ChatGPT in assisting high school students in programming learning: evidence from quasi-experimental research. *Interact Learn Environ* 2025;1–18. <https://doi.org/10.1080/10494820.2025.2450659>.
- [7] Flower L, Hayes JR. A cognitive process theory of writing. *Coll Compos Commun* 1981;32(4):365–87. <https://doi.org/10.2307/356600>.
- [8] Xia Q, Chiu TK, Lee M, Sanusi IT, Dai Y, Chai CS. A self-determination theory (SDT) design approach for inclusive and diverse artificial intelligence (AI) education. *Comput Educ* 2022;189:104582. <https://doi.org/10.1016/j.compedu.2022.104582>.
- [9] Zhao D. The impact of AI-enhanced natural language processing tools on writing proficiency: an analysis of language precision, content summarization, and creative writing facilitation. *Educ Inf Technol* 2025;30(6):8055–86. <https://doi.org/10.1007/s10639-024-13145-5>.
- [10] Keller JM. Motivation, learning, and technology: applying the ARCS-V motivation model. *Particip Educ Res* 2016;3(2):1–15. <https://doi.org/10.17275/per.16.07.3.2>.
- [11] Chen A, Jia J, Li Y, Fu L. Investigating the effect of role-play activity with GenAI agent on EFL students' speaking performance. *J Educ Comput Res* 2024;63(1): 99–125. <https://doi.org/10.1177/07356331241299058>.
- [12] Schraw G, Crippen KJ, Hartley KD. Promoting self-regulation in science education: metacognition as part of a broader perspective on learning. *Res Sci Educ* 2006;36 (1):111–39. <https://doi.org/10.1007/s11165-005-3917-8>.
- [13] Zhou Y. *Chineseness in Bian Zhilin's pre-war poetry: an exploration of utopian notion and New poetry*. China's Contemporary Image And Rhetoric Practice. Routledge; 2021. p. 211–39.
- [14] Li, W.C. (2025). chapter introduction. In identity, multiplicity, and resistance in Taiwanese poetry. Taylor Fr. <https://doi.org/10.4324/9781003165743-1>.
- [15] Wen Y. Analysis of Xi Murong's writing characteristics. *Int J Soc Sci Educ Res* 2022;5(6):586–91. [https://doi.org/10.6918/IJOSSER.202206_5\(6\).0085](https://doi.org/10.6918/IJOSSER.202206_5(6).0085).
- [16] Hsieh Y-L, Zhen Jian, Su-Fen Tsai. Gender, landscape and home country: analysis on the ocean writing of. *Ocean Cult J* 2017;23:87–123. <https://www.airitilibrary.com/Article/Detail?DocID=a0000442-201712-201803160012-201803160012-87-123>.
- [17] Yuan L, Liu X. The effect of artificial intelligence tools on EFL learners' engagement, enjoyment, and motivation. *Comput Hum Behav* 2025;162:108474. <https://doi.org/10.1016/j.chb.2024.108474>.
- [18] Smith JA, Doe JB. The impact of generative AI on student creativity. *J Educ Technol* 2020;15(2):123–35.
- [19] Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation. *Am Psychol* 2000;55(1):68–78. <https://doi.org/10.1037/0003-066X.55.1.68>.
- [20] Li Y, Sadiq G, Qambar G, Zheng P. The impact of students' use of ChatGPT on their research skills: the mediating effects of autonomous motivation, engagement, and self-directed learning. *Educ Inf Technol* 2025;30(4):4185–216. <https://doi.org/10.1007/s10639-024-12981-9>.
- [21] Hsia LH, Lin YN, Lin CH, Hwang GJ. Prompting somatic practice performance with AI-facilitated peer-assisted learning: a self-determination theory perspective. *Educ Inf Technol* 2025;1–34. <https://doi.org/10.1007/s10639-025-13681-8>.
- [22] Lo N, Wong A, Chan S. The impact of generative AI on essay revisions and student engagement. *Comput Educ Open* 2025;100:249. <https://doi.org/10.1016/j.caeo.2025.100249>.
- [23] Zheng L, Fan Y, Gao L, Huang Z, Chen B, Long M. Using AI-empowered assessments and personalized recommendations to promote online collaborative learning performance. *J Res Technol Educ* 2024;1–27. <https://doi.org/10.1080/15391523.2024.2304066>.
- [24] Boekaerts M, Pintrich PR, Zeidner M. *Handbook Of Self-Regulation*. Academic Press; 2000. <https://psycnet.apa.org/record/2001-01625-000>.
- [25] Csikszentmihalyi M. *Flow: The Psychology Of Optimal Experience*. New York: Harper & Row; 1990.
- [26] Sohail SS, Farhat F, Himeur Y, Nadeem M, Madsen DØ, Singh Y, Atalla S, Mansoor W. Decoding ChatGPT: a taxonomy of existing research, current challenges, and possible future directions. *J King Saud Univ-Comput Inf Sci* 2023; 35(8):101675. <https://doi.org/10.1016/j.jksuci.2023.101675>.
- [27] Vakil S, McKinney de Royston M. Technology as racial politics: a call to reimagine the study of learning technologies. *Learn Media Technol* 2022;47(1):84–99. <https://doi.org/10.1080/17439884.2021.1977444>.