AI-Assisted Academic Writing as Information Literacy: Writing Performance, Student Agency, and Metacognitive Engagement in Higher Education.

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Executive Summary

The rapid adoption of generative artificial intelligence (AI) tools in higher education is transforming how students approach academic writing. This scoping review examines how AI is used in academic writing contexts and synthesizes its effects on writing performance, writing processes, feedback practices, student perceptions, and cognition and agency. A total of 154 studies met inclusion criteria, with 53 studies selected for detailed data extraction and thematic analysis.

Findings indicate that AI tools consistently improve surface-level aspects of writing, including grammatical accuracy, fluency, and organization. However, their impact on higher-order writing skills, such as critical thinking and originality, is more variable. Studies on feedback and revision demonstrate that AI-generated feedback increases revision frequency and effectiveness, particularly when combined with instructor input. Research on student cognition and agency highlights the importance of metacognitive awareness and strategic AI use, with selective engagement supporting stronger learning outcomes than uncritical reliance.

Across the writing process, AI is most effective when used iteratively, supporting planning, drafting, and revision in dynamic workflows. However, literature remains more developed in evaluating writing performance than in examining how students critically engage with AI.

These findings suggest that the educational value of AI depends not only on tool capabilities but on how students integrate AI into their writing practices. Implications include the need to align AI use with information literacy and to emphasize critical, ethical, and reflective engagement in AI-supported writing.

Keywords:
artificial intelligence; academic writing; higher education; generative AI; writing performance; information literacy

Introduction

The rapid integration of generative artificial intelligence (AI) tools such as ChatGPT, Grammarly, and Gemini into higher education has significantly transformed how students approach academic writing. These tools are increasingly used for idea generation, drafting, revision, and editing, positioning AI not only as a support mechanism but as an active participant in the writing process. As a result, academic writing is evolving from a traditionally individual and linear activity into a more iterative, interactive, and technology-mediated practice.

Despite the widespread adoption of AI writing tools, there remains considerable uncertainty regarding their impact on student learning and writing development. Existing research has documented improvements in surface-level writing features such as grammar, fluency, and organization; however, concerns persist about potential negative effects on higher-order thinking, originality, and authorship. At the same time, students report both enthusiasm for AI's efficiency and unease about issues such as overreliance, accuracy, and academic integrity. These competing perspectives reflect a rapidly emerging but fragmented body of literature.

Current research tends to focus on isolated dimensions of AI use, such as performance outcomes or student perceptions, often without integrating broader considerations of writing processes, feedback practices, and cognitive engagement. As a result, there is a need for a comprehensive synthesis that examines not only what AI tools do to written products, but also how students interact with AI throughout the writing process and how these interactions shape learning, agency, and scholarly practice.

This scoping review addresses this need by examining how AI tools are used in academic writing within higher education and synthesizing their effects across five key areas: writing performance, writing process, feedback and revision, student perceptions, and cognition and agency. By mapping the current landscape of research, this review aims to provide a structured understanding of how AI is reshaping academic writing and to identify key patterns, tensions, and gaps that can inform future research and instructional practice.

Methods

Search Strategy and Data Sources

A scoping review methodology was employed to map existing research on the integration of artificial intelligence (AI) writing tools in higher education and their influence on students' academic writing processes, critical thinking, and creativity. Systematic searches were conducted in three major academic databases: ERIC, Web of Science, and PsycINFO. These databases were selected to capture education-focused literature, interdisciplinary research on AI in learning contexts, and cognitive and psychological perspectives related to writing and thinking processes.

Search strategies were developed using thematic concept blocks representing: (1) AI and generative AI writing tools, (2) higher education student populations, (3) academic writing contexts, (4) writing processes, and (5) learning outcomes related to critical thinking and creativity. These blocks were combined using Boolean operators and adapted to the syntax and field conventions of each database. Initial broad searches combined AI-related terms with higher education and academic writing concepts. Additional focused searches incorporated outcome-related terms related to critical thinking, creativity, and writing processes to identify studies addressing specific learning outcomes.

In addition to database searches, supplementary literature searches were conducted using the AI-powered research tool Elicit and the academic search platform Semantic Scholar. These tools were used to identify recent, interdisciplinary, and emerging studies that may not yet have been fully indexed in traditional databases. Records identified through these supplementary searches were screened using the same inclusion and exclusion criteria applied to database search results. Relevant studies not captured through ERIC, Web of Science, or PsycINFO were retained to enhance the comprehensiveness of the review.

Searches focused on recent peer-reviewed empirical studies published in English, with the majority of included studies emerging from 2023 onward, reflecting the rapid development of generative AI technologies in educational contexts. Representative search strings are provided in Appendix A, and a full list of studies included in the analytic subset is provided in Appendix B.

Study Selection and Data Charting

All records retrieved from database searches and supplementary searches were imported into reference management software, and duplicates were removed. Titles and abstracts were screened for relevance based on predefined inclusion criteria. Screening was conducted by two reviewers, with each reviewer responsible for studies retrieved from different database sources while applying shared inclusion and exclusion criteria. Full-text reviews were then conducted for selected studies.

A total of 154 studies met the inclusion criteria following screening. From this set, an analytic subset of 53 studies was selected for detailed data charting and thematic analysis. Studies were prioritized for inclusion in the analytic subset when they demonstrated a direct focus on AI-

assisted academic writing and provided sufficient empirical detail to support thematic coding and synthesis.

Key data were charted for each study in the analytic subset, including the AI tool or technology examined, academic writing context, writing stage (e.g., planning, drafting, revising), research methodology, learning outcomes addressed (e.g., critical thinking, creativity, agency), and principal findings related to AI integration in writing processes.

Synthesis Approach

Consistent with scoping review methodology, study quality was not formally appraised. Instead, findings from the analytic subset were synthesized thematically to map patterns of AI integration in academic writing, reported impacts on critical thinking and creativity, and emerging conceptual trends across the literature. Gaps and underexplored areas were identified to inform future research directions.

Primary themes were assigned based on the principal analytical focus of each study. Themes included writing performance, feedback and revision, student perceptions, cognition and agency, and writing process. When studies addressed multiple dimensions, theme assignment prioritized the primary outcome or phenomenon under investigation to support consistent categorization and synthesis across the dataset.

Use of AI-Assisted Writing Tools

Artificial intelligence tools were used to support the drafting and organization of portions of this manuscript, including the methods section. All AI-assisted content was reviewed, edited, and verified by the authors to ensure accuracy, clarity, and scholarly integrity. Final interpretations, synthesis, and conclusions remain the responsibility of the authors.

Results

Thematic Findings

Analysis of the 53 studies selected for in-depth review revealed five primary thematic areas: writing performance (n = 26), writing process (n = 10), cognition/agency (n = 7), feedback/revision (n = 6), and student perceptions (n = 4). Together, these themes represent the dominant ways in which AI tools are being investigated in relation to academic writing in higher education.

Writing Performance

Nearly half of the studies (n = 26) focused on writing performance outcomes, making it the most dominant theme in the analytic subset. Evidence suggests that AI-assisted approaches—particularly when combined with corpus-based learning—outperform both traditional instruction and single-method approaches, yielding gains in grammar, vocabulary, cohesion, and task response (Rong et al., 2026; Wang et al., 2025; Pryma et al., 2025).

Across studies, AI use was associated with measurable improvements in fluency, accuracy, and lexical diversity, including reported increases in essay length and reductions in language errors (Sharshova et al., 2025; Shi et al., 2025; Hao & Razali, 2025). These findings indicate that AI tools are effective in improving surface-level and structural aspects of writing, including organization, coherence, and linguistic precision (Pryma et al., 2025; Zamorano, 2025; Ding et al., 2025).

However, a common theme emerges regarding higher-order writing skills. While AI-supported writing often results in more fluent and grammatically accurate texts, over-reliance on AI has been associated with reduced originality and weaker argumentation (Tekir, 2026; Pryma et al., 2025). This suggests that improvements in linguistic quality do not necessarily translate into deeper critical or analytical development (Tekir, 2026; Rizkiani, 2024).

Feedback and Revision

Studies focusing on **feedback and revision** (n = 6) highlight AI's role in increasing both the frequency and efficiency of revision practices. AI-generated feedback consistently produces higher revision rates than teacher feedback alone, largely due to its immediacy and the specificity of actionable suggestions provided to students (Tran, 2025; Wang & Xie, 2025).

The most effective outcomes were observed in hybrid feedback models that combine AI and instructor input. In these models, AI tools efficiently address surface-level concerns such as grammar and mechanics, while instructors focus on higher-order issues including argumentation and conceptual development (Tran, 2025; Ding et al., 2025).

Importantly, AI-generated feedback demonstrates moderate to strong consistency when paired with teacher evaluations, suggesting that AI can function as a reliable supplementary assessment tool (Lu et al., 2024; Shi et al., 2025). When integrated effectively, AI feedback both improves revision behavior and also supports students' understanding of instructor feedback (Lu et al., 2024; Guo et al., 2024).

Student Perceptions

Studies examining **student perceptions** (n = 4) indicate broadly positive attitudes toward AI writing tools, particularly in relation to efficiency, clarity, and feedback. Students frequently reported valuing AI for grammar correction, vocabulary enhancement, and the reduction of writing-related anxiety (Song & Song, 2023; Mahapatra, 2024; Seelro & Khan, 2024).

At the same time, students demonstrate a nuanced understanding of AI's limitations. Concerns related to overreliance, diminished critical thinking, and threats to originality are commonly expressed, alongside awareness of ethical issues such as maintaining academic integrity and authentic voice (Wang, 2024; Kim et al., 2025; Black & Tomlinson, 2025).

Notably, students tend to position AI as a **supportive tool rather than a replacement for human intelligence**, emphasizing its role in augmenting rather than substituting their own thinking and writing processes (Yang et al., 2024; Gawlik-Kobylińska, 2024; Black & Tomlinson, 2025).

Cognition and Agency

Research on **cognition and agency** (n = 7) underscores the importance of how students engage with AI tools, rather than simply whether they use them. Studies identify distinct patterns of AI

engagement, each of which produces different learning outcomes (Yang et al., 2024; Nguyen et al., 2024).

Findings consistently indicate that **student agency is a key determinant of effectiveness**. Selective and strategic use of AI supports stronger critical thinking, preservation of personal voice, and deeper engagement with writing tasks (Tekir, 2026; Wang, 2024). In contrast, frequent or uncritical reliance on AI tends to produce fluent but less original writing and reduced cognitive engagement.

Metacognitive awareness, critical reasoning and epistemic beliefs also play a central role, enabling students to critically evaluate AI-generated content and avoid incorporating inaccurate or misleading information (Urban et al., 2025; Tekir, 2026).

Writing Process

Studies focused on the **writing process** (n = 10) demonstrate that students integrate AI tools across all stages of writing, including planning, drafting, and revision. AI is commonly used for both global and local writing concerns such as brainstorming, organizing ideas, grammar, and sentence structure (Wang, 2024; Karanjakwut & Charunsri, 2025; Jacob et al., 2024).

A key pattern across these studies is the importance of active, reflective engagement with AI. Students benefit when AI feedback is used metacognitively rather than passively, through practices such as refining, evaluating, and revising AI-supported writing (Nguyen et al., 2024; Parker et al., 2025; Ren et al., 2025).

These findings point to a broader shift in writing instruction toward hybrid pedagogical models, in which traditional writing practices are complemented by strategic and guided AI use (Hutson et al., 2024; Wang & Ren, 2024). This shift underscores the need for instructional approaches that integrate AI while maintaining emphasis on critical thinking, ethical use, and student authorship (Parker et al., 2025; Hutson et al., 2024).

Discussion

Interpreting the Current Landscape of AI-Assisted Academic Writing

This scoping review reveals a field that is **rapidly expanding but unevenly developed**. The strongest concentration of research focuses on **writing performance**, with consistent evidence that AI tools improve surface-level features such as grammar, organization, and fluency (Pryma et al., 2025; Shi et al., 2025; Hao & Razali, 2025; Sharshova et al., 2025). In contrast, fewer studies examine how students **critically engage with AI**, regulate its use, or develop the

metacognitive skills necessary to use these tools effectively (Yang et al., 2024; Urban et al., 2025; Tekir, 2026). This pattern suggests that the field has prioritized measurable improvements in written products over deeper investigation of how students cognitively engage with AI during writing.

This imbalance suggests that the literature has prioritized the question of **what AI does to writing products** over the more complex question of how students think with and through AI during the writing process (Nguyen et al., 2024; Wang, 2024; Parker et al., 2025). As a result, while there is strong evidence that AI can enhance the quality of written output (Rong et al., 2026; Wang et al., 2025; Zamorano, 2025), there is comparatively less understanding of how it shapes learning, authorship, and intellectual development (Tekir, 2026; Jacob et al., 2024; Khuder, 2025).

Surface-Level Gains and Higher-Order Tradeoffs

A consistent pattern across themes is the distinction between **surface-level improvements** and **higher-order writing abilities**. AI tools reliably support grammatical accuracy, lexical diversity, and structural coherence (Pryma et al., 2025; Tekir, 2026; Aiman et al., 2025). However, findings from studies on cognition and agency indicate that frequent or uncritical reliance on AI may correspond with reduced originality, weaker argumentation, and diminished critical engagement (Tekir, 2026; Pryma et al., 2025; Seelro & Khan, 2024).

This tension highlights a central paradox:

AI can simultaneously improve the quality of written text while potentially constraining the development of deeper writing and thinking skills (Aiman et al., 2025; Rizkiani, 2025).

Rather than framing this as a limitation of AI itself, the findings suggest that outcomes depend heavily on how AI is used (Yang et al., 2024; Tekir, 2026). Strategic, selective engagement with AI appears to preserve critical thinking and authorial voice, whereas passive reliance shifts cognitive effort away from the student (Tekir, 2026; Urban et al., 2025; Pryma et al., 2025).

The Central Role of Student Agency and Metacognition

Across studies on cognition and agency, **student agency emerges as a key determinant of effective AI use**. Learners who adopt reflective and resourceful approaches—questioning, revising, and evaluating AI outputs—demonstrate stronger learning outcomes than those who use AI as a substitute for their own thinking (Yang et al., 2024; Tekir, 2026; Parker et al., 2025).

This aligns closely with concepts in **information literacy**, particularly the need for students to evaluate sources, assess credibility, and engage critically with information systems. In the context of AI, this extends beyond traditional source evaluation to include **evaluation of generated content**, requiring students to interrogate not only accuracy but also reasoning, bias, and completeness (Urban et al., 2025; Wang, 2024; Khuder, 2025).

Metacognitive awareness and epistemic beliefs further shape students' ability to use AI effectively. Students who recognize the limitations of AI and actively monitor their own understanding are better positioned to avoid incorporating inaccurate or misleading information (Urban et al., 2025; Tekir, 2026). These findings suggest that effective AI use is not primarily a technical skill, but a cognitive and epistemic practice (Yang et al., 2024; Urban et al., 2025; Parker et al., 2025).

Implications for AI Literacy and Information Literacy

The findings of this review suggest that AI literacy is best understood as an extension of information literacy rather than as a separate competency domain. The patterns identified across the analytic subset align closely with the concepts articulated in the *ACRL Framework for Information Literacy for Higher Education* (Association of College and Research Libraries [ACRL], 2016).

Several findings are particularly relevant to the ACRL Framework. The theme of writing process reflects the frame *Searching as Strategic Exploration*, as students frequently used AI tools to generate, refine, and organize ideas while navigating complex writing tasks. However, effective use depended on strategic engagement rather than passive acceptance of AI-generated outputs. Similarly, findings related to cognition and agency align with *Research as Inquiry*, as students achieved stronger outcomes when they engaged in iterative questioning, evaluation, and refinement of AI-generated content rather than relying on AI as a source of ready-made answers.

The review also highlights the continuing importance of *Authority Is Constructed and Contextual*. Unlike traditional scholarly sources, AI-generated content often lacks transparent authorship, provenance, and evidentiary support. As a result, students must evaluate not only the accuracy of AI outputs but also the conditions under which those outputs are generated and the limitations of the systems producing them. In addition, the theme of feedback and revision reflects aspects of *Scholarship as Conversation*. While AI can participate in iterative exchanges that support idea development and revision, it does not contribute original scholarship and therefore cannot replace engagement with human authors, disciplinary perspectives, and scholarly discourse.

Taken together, these findings suggest that AI tools should be understood not simply as productivity technologies but as cognitive partners that require ongoing judgment, evaluation, and reflective use. Instructional approaches informed by the ACRL Framework should therefore emphasize critical engagement with AI-generated content, responsible integration of AI into

research and writing workflows, and the development of learner agency in evaluating and applying AI-supported outputs.

Evolving Writing Processes and Pedagogical Shifts

Studies on the writing process indicate that AI is reshaping writing into a more **iterative and interactive activity**, in which students engage in ongoing dialogue with AI systems. This represents a shift away from linear models of writing toward more dynamic workflows that incorporate brainstorming, drafting, and revision in fluid and recursive ways.

At the same time, the most effective uses of AI appear to occur within **hybrid pedagogical models**, where AI complements rather than replaces traditional instruction. In these models, instructors play a critical role in guiding students toward appropriate uses of AI, particularly in distinguishing between surface-level editing and deeper conceptual development.

This shift has significant implications for writing instruction and can be conceptualized as an integrated, iterative model of AI-supported writing. In this model, AI is embedded across multiple stages of the writing process and mediated by student agency and metacognitive awareness. Accordingly, effective instructional approaches should emphasize:

- explicit guidance on when and how to use AI
- structured opportunities for reflection on AI use
- continued emphasis on authorship, argumentation, and critical thinking

Figure 1. AI-Integrated Academic Writing Framework (author-developed synthesis based on findings from the analytic subset).

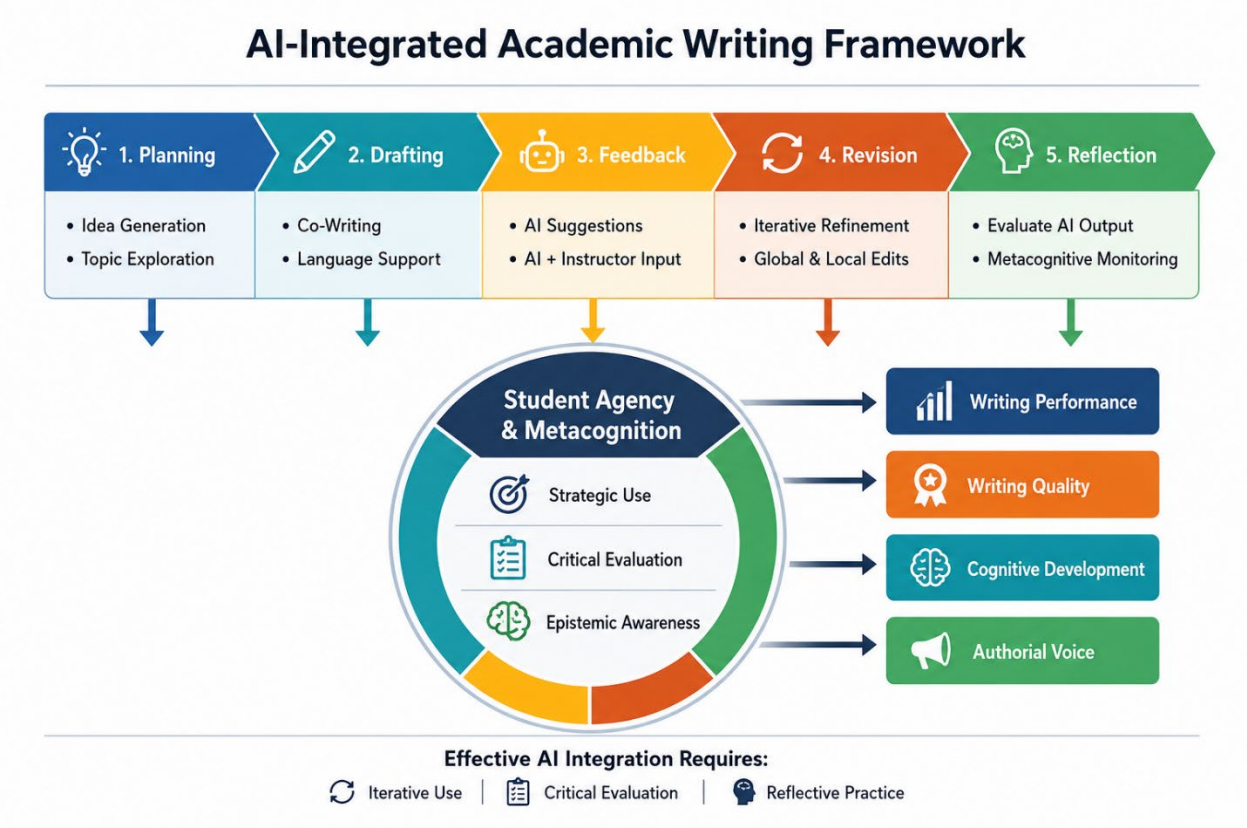

Figure 1 presents an author-developed conceptual synthesis of patterns identified across the analytic subset. It illustrates that AI-supported writing is most effective when integrated iteratively across planning, drafting, feedback, revision, and reflection stages, with student agency and metacognition serving as central mediating factors.

Gaps in Literature and Future Directions

Despite the growing body of research, several gaps remain. First, there is a relative lack of studies examining **long-term learning outcomes**, particularly whether AI-supported writing leads to sustained improvements in writing ability or merely short-term performance gains.

Second, while many studies document improvements in writing quality, fewer examine **how students learn from AI feedback**, including whether they internalize corrections and develop transferable skills.

Third, research on **cognition and agency**, while emerging, remains limited compared to performance-focused studies. More work is needed to understand how AI influences thinking processes, intellectual independence, and knowledge construction over time.

Finally, much of the existing research is concentrated in specific contexts, including **ESL/EFL populations**, raising questions about how findings generalize across disciplines and student populations.

LIMITATIONS

Several limitations should be considered when interpreting the findings of this scoping review. First, although a total of 154 studies met the inclusion criteria, detailed data extraction and thematic analysis were conducted on a subset of 53 studies selected for their direct relevance to AI-assisted academic writing and their suitability for thematic coding and synthesis. While this approach enabled in-depth analysis, it may limit the comprehensiveness of thematic representation and introduces the possibility of selection bias. This purposeful selection prioritizes analytic depth over comprehensive thematic coding of all included studies.

Second, study screening was conducted by two reviewers who divided database results while applying shared inclusion and exclusion criteria. All records were not double-screened, thus formal inter-rater reliability was not calculated; variation in screening judgments may have occurred.

Third, the rapidly evolving nature of AI technologies presents an inherent limitation. Many of the studies included in this review examine early iterations of AI tools, and findings may not fully reflect the capabilities of more recent or emerging systems. This suggests that conclusions should be interpreted as reflective of a dynamic and continuously developing research and technological landscape.

Finally, the included studies vary in methodological design, sample size, and context, with a notable concentration in ESL/EFL learners. Inherently, this limits the ability to generalize findings across all higher education contexts and disciplines. Future research would benefit from more longitudinal studies, diverse populations, and consistent reporting of outcomes to strengthen the evidence base.

CONCLUSION

This scoping review highlights the significant and multifaceted impact of AI tools on academic writing in higher education. The findings indicate that AI is effective in aiding surface-level aspects of writing such as grammatical accuracy, organization, and fluency. However, its

influence on higher-order writing skills ─ critical thinking, originality, authentic voice, and argument development ─ is more dependent on how students engage with these tools.

A central insight emerging from this review is that the educational value of AI is not determined solely by its capabilities, but by the ways in which students use it. Strategic and reflective engagement with AI supports learning, while uncritical reliance may limit cognitive development and reduce intellectual ownership. As such, student agency, critical thinking and evaluation, and metacognitive awareness are critical factors in determining whether AI serves as a tool for learning or a substitute for it.

These findings underscore the importance of thoughtful and responsible integration of AI use within broader frameworks of information literacy and academic writing instruction. Rather than treating AI as an external or disruptive force, educators should focus on developing students' ability to critically evaluate, strategically apply, and ethically incorporate AI into their writing practices.

As AI continues to evolve, future research should move beyond measuring performance outcomes to examine long-term learning, cognitive development, and the changing nature of authorship in AI-mediated environments. By doing so, the field can better understand not only how AI improves writing, but how it shapes the ways students think, learn, and participate in scholarly work.

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Appendix A

Representative Search Strategies by Database

Table A1. Search Strategy for ERIC

Concept Block	Search Terms
AI Writing Tools	"artificial intelligence" OR "generative AI" OR ChatGPT OR "AI writing tool*" OR "large language model*"
Population	"higher education" OR "university student*" OR "college student*" OR undergraduate* OR "graduate student*"
Writing Context	"academic writing" OR "research paper*" OR "academic essay*" OR "thesis writing"
Writing Process	"writing process" OR brainstorming OR revising OR editing OR argumentation
Learning Outcomes	"critical thinking" OR "analytical thinking" OR creativity OR "authorial voice"
Combined Example	(AI Writing Tools) AND (Population) AND (Writing Context) AND (Learning Outcomes)

Table A2. Search Strategy for Web of Science

Concept Block	Search Terms (TS = Topic)
AI Writing Tools	TS=("artificial intelligence" OR "generative AI" OR ChatGPT OR "AI writing tool*" OR "large language model*")
Population	TS=("university student*" OR "college student*" OR undergraduate* OR "graduate student*")
Writing Context	TS=("academic writing" OR "research paper*" OR "academic essay*" OR "thesis writing")
Writing Process	TS=("writing process" OR brainstorming OR revising OR editing OR argumentation)

Learning Outcomes	TS=("critical thinking" OR creativity OR "authorial voice")
Combined Example	(AI Writing Tools) AND (Population) AND (Writing Context) AND (Learning Outcomes)

Table A3. Search Strategy for PsycINFO

Concept Block	**Search Terms**
AI Writing Tools	"artificial intelligence" OR "generative AI" OR ChatGPT OR "AI writing tool*" OR "large language model*"
Population	student* OR undergraduate* OR "college student*" OR "university student*"
Writing Context	"academic writing" OR "research paper*" OR "academic essay*" OR "writing tasks"
Writing Process	"writing process" OR brainstorming OR revising OR editing OR argumentation
Learning Outcomes	"critical thinking" OR metacognition OR creativity OR "learner agency"
Combined Example	(AI Writing Tools) AND (Population) AND (Writing Context) AND (Learning Outcomes)

Search strings were adapted slightly across databases to align with database-specific syntax and controlled vocabulary where applicable.

Appendix B

Included Studies in the Analytic Subset (n = 53)

The following studies were included in the analytic subset and subjected to detailed data extraction and thematic analysis.

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