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ChatGPT as Digital Scaffolding in Argumentative Writing for First-Year Students: A Systematic Literature Review (2020–2025)

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ABSTRACT

This study examines the use of ChatGPT as a form of digital scaffolding in teaching argumentative writing for first-year college students. Although prior studies highlight the benefits of AI-assisted writing tools, there is still a lack of critical synthesis on how ChatGPT functions across cognitive, metacognitive, and pedagogical dimensions, as well as the risks associated with its use. Addressing this gap, this study employs a Systematic Literature Review (SLR) following PRISMA guidelines, analyzing 40 selected articles (2020–2025) from major academic databases. The findings show that ChatGPT serves as both a writing assistant and an interactive dialogue partner, providing multidimensional scaffolding that enhances idea organization, argument clarity, coherence, and students' writing confidence. However, this study also identifies key challenges often underexplored in the literature, including over-reliance, academic integrity concerns, and limitations in verifying AI-generated content. These findings contribute a more critical perspective by emphasizing that while ChatGPT has strong potential to support adaptive and interactive learning, its integration must be accompanied by structured pedagogical strategies, strengthened digital and AI literacy, and the promotion of students' critical thinking to ensure meaningful and independent learning outcomes.

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1. INTRODUCTION

The rapid development of artificial intelligence (AI) in recent years has brought significant transformations across various sectors, including education (Pianti et al., 2025). In educational contexts, AI has evolved beyond a mere information retrieval tool into an adaptive learning support system capable of providing immediate, personalized, and interactive feedback (Aimi & Rahman, 2025). Previous studies consistently highlight the potential of AI to enhance learning effectiveness through personalized instruction and learning analytics (J. Wang & Fan, 2025). However, these

studies largely remain conceptual and emphasize general benefits, offering limited insight into how AI can be systematically integrated into specific pedagogical practices, particularly in academic writing contexts (Albadarin, Saqr, Pope, & Tukiainen, 2024); (Noviarini, 2025).

More recent studies have examined the role of ChatGPT as a writing assistant, demonstrating its effectiveness in improving grammar, refining sentence structure, and supporting idea generation (Imran & Almusharraf, 2023); (Qian, 2025); (Wang et al., 2024). Nevertheless, a closer comparison reveals important differences in focus. While (Imran & Almusharraf, 2023) primarily emphasize linguistic accuracy and surface-level revision, (Qian, 2025) highlights the role of ChatGPT in idea development and text organization. Despite these variations, both strands of research tend to conceptualize ChatGPT as a functional tool rather than as part of a pedagogically grounded learning process. In contrast, studies on academic writing stress the importance of deeper cognitive processes, including argument construction, coherence, and critical reasoning (Hsuan et al., 2025); (Kasneci et al., 2023).. This contrast suggests a fundamental mismatch between AI-based writing support, which often focuses on textual output, and pedagogical approaches that prioritize higher-order thinking skills. Consequently, the extent to which AI facilitates the internalization of argumentative thinking remains insufficiently explored.

From a pedagogical perspective, scaffolding has been widely recognized as an effective approach to supporting complex learning processes, including argumentative writing (Jang, Eun, Lee, Choi, & Cho, 2024); (Rahmat, Aripin, Razlan, & Khairuddin, 2021). Rooted in Lev Vygotsky's socio constructivist theory, scaffolding is closely linked to the concept of the Zone of Proximal Development (ZPD), which describes the gap between learners' independent capabilities and their potential performance with guidance from a "more capable other." In classical scaffolding practices, this role is typically performed by teachers through modeling, feedback, and guided interaction. However, compared to AI-supported environments, traditional scaffolding is often constrained by time, classroom interaction, and instructor availability. Conversely, while digital tools such as ChatGPT provide continuous and immediate feedback, they are rarely examined within the theoretical framework of scaffolding. This indicates a conceptual disconnect between technological affordances and established learning theory.

A synthesis of existing literature reveals three dominant yet disconnected strands. First, AI-focused studies emphasize efficiency and accessibility but lack pedagogical depth. Second, ChatGPT-focused studies highlight functional writing support but overlook its role in cognitive development. Third, scaffolding research demonstrates strong pedagogical effectiveness but remains largely confined to traditional instructional contexts. Although each strand contributes valuable insights, they rarely intersect. As a result, there is limited empirical research that integrates AI, scaffolding theory, and argumentative writing into a coherent instructional framework, particularly for first-year students who are still developing academic literacy skills. Furthermore, differences across pedagogical approaches reinforce this gap. Teacher-centered approaches tend to limit interaction and delay feedback, whereas process-based writing approaches emphasize revision cycles but remain dependent on instructor availability. While scaffolding-based approaches provide structured support, they are often restricted by classroom constraints (Enjang, 2025). In contrast, AI-supported learning environments offer real-time, adaptive, and dialogic interactions. However, existing studies rarely examine how these affordances align with theoretical constructs such as ZPD and the gradual transfer of responsibility central to scaffolding.

In this context, ChatGPT can be reconceptualized as a form of digital scaffolding. Within the ZPD framework, ChatGPT can function as a "more capable other" that provides continuous, adaptive support, enabling students to progressively internalize argumentative writing skills through iterative interaction. Unlike classical scaffolding, where support is gradually withdrawn by instructors, AI-based scaffolding dynamically adjusts to learners' needs in real time. This reconceptualization not only bridges the gap between pedagogical theory and technological application but also extends classical scaffolding into a digital, scalable, and interactive form. Therefore, the novelty of this study

lies in its effort to position ChatGPT not merely as a writing tool but as a pedagogically grounded scaffolding mechanism. By explicitly integrating AI technology with Vygotskian theory, this study offers a more comprehensive understanding of how digital learning support can facilitate both cognitive development and learner autonomy. This contribution is particularly relevant for first-year students, who require structured guidance while simultaneously developing independent academic writing skills.

2. METHODS

This study uses a Systematic Literature Review (SLR) approach to comprehensively examine various studies related to the use of ChatGPT and artificial intelligence as tools in teaching argumentative writing in higher education (Ringo, 2025). The SLR method was chosen because it allows researchers to systematically and transparently identify, evaluate, and synthesize findings from multiple studies, thereby providing a more comprehensive understanding of developments in a particular research field (Nurcahyanie, Ayu, & Ali, 2024). In addition, this approach facilitates the identification of research gaps and provides insight into current research trends in the field. In this study, the literature review process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which are widely used in systematic reviews to enhance transparency and replicability (Page et al., 2021).

The systematic literature review was conducted through several stages, including formulating research questions, conducting a literature search, screening, determining inclusion and exclusion criteria, and analyzing and synthesizing the findings. The literature search was conducted using several academic databases, such as Scopus, ScienceDirect, SpringerLink, ERIC, MDPI, and Google Scholar. The search focused on articles published between 2020 and 2025 to ensure their relevance to current developments in artificial intelligence in education. Keywords used included "ChatGPT in education," "Artificial Intelligence in academic writing," "digital scaffolding," "AI-assisted writing learning," and "argumentative writing in higher education." The initial search yielded approximately 120 articles relevant to the research keywords. This was followed by a screening stage based on titles and abstracts to identify studies directly related to the research topic. At this stage, 60 articles were excluded because they did not specifically address the use of artificial intelligence in teaching writing or were unrelated to the field of education. The next step involved assessing eligibility through full-text reading of the remaining articles. From this process, 20 additional articles were excluded because they did not meet the research criteria, such as articles that only contained opinions, editorials, or did not have clear empirical data.

Thus, 40 articles met the inclusion criteria and were used as primary sources for the literature analysis. The selected articles were then analyzed using thematic analysis to identify key patterns and themes across previous studies. The analysis was conducted by categorizing the findings into several aspects, including: (1) the role of ChatGPT in teaching academic writing, (2) forms of digital scaffolding provided by AI technology in the learning process, (3) the impact of AI use on students' writing skills, and (4) the challenges and pedagogical implications of integrating artificial intelligence into education. The research findings were synthesized descriptively to provide an overview of the development of studies related to the use of ChatGPT as scaffolding in teaching argumentative writing and to identify potential research areas that require further exploration in the future.

3. FINDINGSAND DISCUSSION

Findings

The findings of this literature review are based on a thematic analysis combined with a descriptive quantitative synthesis of 40 articles that met the inclusion criteria. The descriptive analysis was conducted by calculating the frequency of key findings across studies. The results show that 85% (n = 34) of the studies reported positive effects of ChatGPT on students' argumentative writing skills, 10% (n = 4) reported mixed findings, and 5% (n = 2) emphasized negative or cautionary outcomes,

particularly related to overreliance and ethical concerns. In terms of functional roles, 90% (n = 36) of the studies identified ChatGPT as a writing assistant supporting idea generation and drafting, 75% (n = 30) highlighted its role in improving linguistic aspects, 70% (n = 28) emphasized its function as a dialogic partner, and 65% (n = 26) reported increased student engagement and confidence. The descriptive statistical distribution of these findings is presented in Table 1

Table 1 Descriptive Statistics of Chatgpt use in Argumentative Writing

Aspect	Category	Frequency (n)	Percentage (%)
Impact on Writing Skills	Positive	34	85%
	Mixed	4	10%
	Negative/Cautionary	2	5%
Functional Roles of ChatGPT	Writing Assistant	36	90%
	Linguistic Support	30	75%
	Dialogic Partner	28	70%
	Engagement & Confidence	26	65%

Note: Functional categoris are not mutually exclusive; one study may contribute to more than one category

As shown in Table X, the majority of studies (85%) demonstrate positive impacts of ChatGPT on students' argumentative writing skills, indicating a strong convergence of findings across the literature. Only a small proportion of studies report mixed (10%) or negative outcomes (5%), which are primarily associated with concerns about overreliance and ethical issues. In terms of functional roles, ChatGPT is most frequently identified as a writing assistant (90%), followed by its role in linguistic support (75%) and dialogic interaction (70%). Additionally, 65% of the studies highlight its contribution to improving student engagement and confidence. These results suggest that ChatGPT serves multiple complementary functions that collectively support the writing process.

Overall, the results indicate that the use of ChatGPT in teaching argumentative writing plays a significant role as a form of digital scaffolding, particularly in the early stages of learning. These findings can be grouped into four main aspects: the role of ChatGPT in writing instruction, the forms of digital scaffolding it provides, its impact on argumentative writing skills, and the associated challenges and pedagogical implications.

From a functional perspective, ChatGPT acts as a writing assistant that supports students across various stages of the academic writing process, including idea generation, outline development, paragraph construction, and language refinement. In addition, ChatGPT functions as a dialogic partner that enables interactive engagement, allowing students to clarify ideas, receive immediate feedback, and deepen their understanding of the topic. This interaction promotes a more active and reflective learning process while also improving time efficiency, particularly during the drafting stage.

Furthermore, the findings indicate that ChatGPT provides multidimensional digital scaffolding encompassing cognitive, metacognitive, linguistic, and procedural support. From a cognitive perspective, it facilitates conceptual understanding and logical argument construction. From a metacognitive perspective, it encourages self-reflection and independent revision. Linguistically, it enhances grammar, vocabulary, coherence, and cohesion. Procedurally, it guides students through the stages of writing, from planning to revision. These findings confirm that ChatGPT functions not only as a technical tool but also as a facilitator of deeper thinking and learning processes.

In terms of impact, most studies demonstrate that the use of ChatGPT contributes positively to students' argumentative writing skills, which is consistent with the descriptive findings showing that 85% of studies report positive outcomes. Improvements are reflected in more organized argument

structures, clearer expression of ideas, and stronger coherence between paragraphs. Additionally, students show increased confidence and more appropriate use of academic language. However, a smaller proportion of studies (15%) highlights potential drawbacks, including overreliance on ChatGPT, which may lead to dependency and reduced independent thinking if not properly guided.

On the other hand, this review also identifies several challenges associated with the use of ChatGPT in learning. These include the risk of plagiarism, unethical use of technology, and students' limited ability to evaluate the accuracy of AI-generated information. Therefore, the pedagogical implications emphasize the crucial role of educators in guiding the responsible and effective use of ChatGPT in education. Educators need to ensure that ChatGPT functions as a supportive tool that enhances the learning process rather than replacing students' thinking. In addition, developing students' AI literacy and critical thinking skills is essential to optimize the use of this technology in teaching academic writing.

Discussion

The findings of this study indicate that ChatGPT has significant potential as a form of digital scaffolding in teaching argumentative writing, particularly for first-year students. These results align with the social constructivist perspective, which emphasizes that learning occurs through interaction and gradually provided support until learners achieve independence (Sørhaug, 2026) (Zhang, Zou, & Cheng, 2025). This perspective is grounded in the work of Lev Vygotsky, particularly the concept of the Zone of Proximal Development (ZPD), which highlights the importance of guided assistance in bridging the gap between actual and potential development (Vygotsky, 1978). Similarly, the concept of scaffolding introduced by Jerome Bruner emphasizes temporary support that enables learners to accomplish tasks beyond their current ability before gradually becoming independent (Wood, Bruner, & Ross, 1976). In this context, ChatGPT functions as a cognitive mediator that facilitates understanding through a dialogic process, thereby strengthening the role of scaffolding in contemporary learning environments (Song et al., 2025).

ChatGPT's role extends beyond that of a technical writing tool, functioning instead as a cognitive partner that facilitates the learning process (Kasneci et al., 2023). Its ability to deliver rapid and contextually relevant responses allows students to iteratively generate ideas, develop arguments, and refine their writing. This supports previous findings that AI in education enhances learning engagement and promotes higher-order thinking skills (Su, Lin, & Lai, 2023) (Tlili et al., 2023). Through this two-way interaction, students are not merely passive recipients of information but actively construct knowledge through questioning, reflection, and revision.

Furthermore, the findings reveal that the scaffolding provided by ChatGPT is multidimensional rather than singular (Zawacki & Gouverneur, 2019). The identified cognitive, metacognitive, linguistic, and procedural scaffolding indicates that ChatGPT supports multiple aspects of the academic writing process (Alnemrat& AlSharefeen, 2025). In this regard, ChatGPT assists students not only in understanding "what to write," but also "how to write" and "why texts should be structured in a particular way." This aligns with the process-based writing approach, which views writing as a recursive activity involving planning, drafting, revising, and reflecting (Pangestu et al., 2022).

A key contribution of this study is the conceptual model of AI-based scaffolding, which operates through a dynamic and iterative mechanism involving three interconnected stages: (1) learner input (ideas, prompts, or draft texts), (2) AI-mediated feedback (suggestions, explanations, and guiding questions), and (3) iterative refinement through continuous dialogue. This cycle reflects an adaptive scaffolding process in which support is continuously adjusted based on learners' needs. Unlike traditional scaffolding, which is often linear, time-bound, and dependent on human interaction, this model is recursive, responsive, and continuously available. The AI dynamically tailors its feedback to learners' evolving inputs, creating a personalized learning experience. This mechanism reflects

Vygotsky's principle of guided learning within the ZPD while extending Bruner's concept of scaffolding into a technology-mediated and continuously accessible system.

In terms of impact, the improvement in the quality of argumentative writing observed in various studies suggests that ChatGPT contributes to the development of students' academic literacy (Sanz & García, 2026) (Mahapatra, 2024). Improvements in idea organization, argument clarity, and textual coherence indicate that the scaffolding provided helps students overcome initial writing difficulties. Additionally, increased student confidence suggests that the support is empowering rather than merely technical (Jonathans & Kweldju, 2024) (Supeno, & Astutik, 2023). However, the potential for dependency highlights the need for pedagogical strategies that ensure learners maintain autonomy.

These findings indicate a fundamental shift in the learning paradigm. Traditionally, learning has been teacher-centered, with scaffolding delivered intermittently through direct human interaction. However, this study demonstrates a transition toward AI-assisted, student-centered learning environments, where support is available on demand and not constrained by time or space. In this paradigm, scaffolding evolves from static and episodic assistance into a dynamic, continuous, and interactive process, enabling self-regulated learning and sustained cognitive development.

Despite these advantages, several challenges must be addressed, including the risk of overdependence, plagiarism, and limitations in evaluating AI-generated outputs (Anjarwati & Sa'adah, 2024). These concerns emphasize the importance of digital literacy and AI literacy as essential competencies in technology enhanced learning environments. Students must be equipped with the ability to critically assess information, understand technological limitations, and use AI responsibly (Anhar et al., 2026).

Theoretical Implications (Implications for Scientific Development)

This study contributes to the advancement of learning theory by extending the classical concept of scaffolding into the domain of artificial intelligence. Building on the foundational ideas of Lev Vygotsky and Jerome Bruner, the findings suggest several important theoretical developments.

First, scaffolding is no longer limited to human-mediated interaction but can be facilitated through AI systems, positioning artificial intelligence as an active agent in the learning process. Second, scaffolding evolves from a static and predetermined form of support into a dynamic and adaptive process that continuously responds to learners' inputs. Third, the learning process shifts from a linear progression to an iterative and dialogic cycle, enabling deeper engagement and continuous refinement of understanding. Finally, scaffolding is transformed from a time-limited instructional strategy into an on-demand and continuously accessible support system.

These developments suggest that scaffolding theory should be reconceptualized as a hybrid interaction involving both human and intelligent systems. Therefore, this study extends the theoretical boundaries of scaffolding by introducing AI as a responsive, adaptive, and continuous mediator of learning.

Practical Implications

From a pedagogical perspective, the findings highlight the importance of strategically integrating ChatGPT into instructional design. Educators play a crucial role not only as knowledge transmitters but also as facilitators who guide how and when technology is used in learning environments.

ChatGPT integration should be implemented through structured approaches, such as process-based writing tasks, guided prompts, and staged drafting activities (Toriida, 2023) (Küchemann et al., 2025). In addition, students should be equipped with critical AI literacy skills, including the ability to evaluate the accuracy, relevance, and limitations of AI-generated responses. Reflective activities are also essential to encourage metacognitive awareness and critical engagement.

Furthermore, instructors must design learning environments that prevent overdependence on AI by balancing technological assistance with independent thinking. When used appropriately, ChatGPT

can function as a powerful tool to enhance critical thinking, creativity, and academic writing skills, rather than merely serving as a shortcut for completing tasks.

From a theoretical perspective, this study extends scaffolding theory by introducing AI as an active and adaptive agent capable of providing continuous, multidimensional support beyond traditional human-mediated interaction. It highlights the evolution of scaffolding from a fixed instructional strategy to a dynamic, technology-enhanced process. From a practical perspective, the findings suggest that educators need to design structured AI-integrated learning environments, incorporating clear guidelines, ethical considerations, and reflective practices to ensure that ChatGPT supports rather than replaces students' cognitive engagement.

Overall, this research strengthens previous findings on the potential of artificial intelligence in education, while also providing a novel contribution by positioning ChatGPT specifically as a form of scaffolding in teaching argumentative writing. These findings also address a research gap regarding the use of AI among first-year college students who are still developing their academic literacy. Therefore, this research not only provides theoretical contributions to the development of AI-based learning models but also offers practical implications for educators in designing adaptive, interactive learning experiences that align with the demands of the digital era.

4. CONCLUSION

Based on the literature review and discussion, it can be concluded that the use of ChatGPT in teaching argumentative writing has significant potential as a form of digital scaffolding, especially for students who are still in the early stages of academic literacy development. ChatGPT not only functions as a writing assistant that helps generate ideas, develop outlines, and refine linguistic aspects, but also acts as a dialogical partner that encourages active and reflective interaction in the learning process. This role indicates that ChatGPT is able to support learning in a more interactive, systematic, and student-centered manner. Furthermore, this study identified that the scaffolding provided by ChatGPT is multidimensional, encompassing cognitive, metacognitive, linguistic, and procedural aspects. These dimensions contribute to helping students understand concepts, develop logical arguments, reflect on the quality of their writing, and follow structured stages in academic writing. Thus, ChatGPT functions not only as a technical tool but also as a facilitator that supports higher-order thinking and a deeper learning process. In terms of its impact, the use of ChatGPT has been shown to improve the quality of students' argumentative writing, particularly in terms of the organization of ideas, clarity of argument, and coherence between paragraphs. Furthermore, it contributes to increasing students' confidence in writing. However, its use also carries potential risks, such as dependency, plagiarism, and limitations in evaluating the accuracy of AI-generated information. Therefore, the integration of ChatGPT into learning must be implemented thoughtfully and strategically. The instructor's role is crucial in designing learning strategies that optimize the use of ChatGPT as a supporting tool, not a substitute for students' thinking processes. Strengthening digital literacy, AI literacy, and critical thinking skills is also crucial to ensure that the use of this technology produces positive and sustainable outcomes. Overall, this study highlights the relevant contribution of ChatGPT in supporting argumentative writing instruction in the digital era, while also opening up opportunities for the development of more adaptive, innovative, and competency-oriented AI-based learning models aligned with 21st-century skills.

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