Ed Process Int J

www.edupij.com

ISSN 2147-0901 (Print), 2564-8020 (Online)

EDUCATIONAL PROCESS
INTERNATIONAL JOURNAL

Critical Thinking in the Age of AI: A Systematic Review of AI's Effects on Higher Education

Rahyuni Melisa, Ashadi Ashadi, Anita Triastuti, Sari Hidayati, Achmad Salido, Priska Efriani Luansi Ero, Cut Marlini, Zefrin Zefrin, Zaki Al Fuad

Research Article

Cite this article: Melisa, R., Ashadi, A., Triastuti, A., Hidayati, S., Salido, A., Ero, P. E. L., Marlini, C., Zefrin., & Fuad, Z. A. (2025). Critical Thinking in the Age of AI: A Systematic Review of AI's Effects on Higher Education. *Educational Process: International Journal, 14*, e2025031. https://doi.org/10.22521/edupij.2025.14.31

Received December 17, 2024
Accepted January 23, 2025
Published Online January 29, 2025

Keywords:
Critical thinking, ChatGPT, higher education, age of AI, students, learning

Author for correspondence:
Rahyuni Melisa
rahyunimelisa.2023@student.uny.ac.id
Universitas Negeri Yogyakarta, Indonesia

Abstract

Background: Artificial Intelligence has become an invaluable tool in academia, offering instant feedback, personalized learning experiences, and support for various academic tasks. This study investigates the impact of ChatGPT, an AI-driven language model, on developing critical thinking, evaluation, and independent judgment skills among higher education students across various academic disciplines.

Method: This research uses a systematic literature review methodology to examine studies from Scopus and Education Resources Information Center (ERIC), covering publications from 2023 to 2024. A total of 19 documents were included and analyzed in depth to address two research questions: (1) the effect of ChatGPT on the development of student's critical thinking skills in higher education, and (2) the impact of ChatGPT on students' ability to evaluate information and form independent judgments critically

Results: Findings reveal that ChatGPT can enhance students' critical thinking by facilitating quick access to diverse perspectives, aiding information analysis, and supporting argument construction. However, over-reliance on AI can hinder students' motivation for self-reflection and critical evaluation, raising concerns about academic integrity and the verification of AI-generated content.

Conclusions: To maximize the educational benefits of ChatGPT, educators must provide guidance on its responsible use, encouraging students to apply critical judgment and verify information accuracy.

1. Introduction

Rapid advances in artificial intelligence (AI), particularly in natural language processing (NLP), have introduced new tools that are transforming various sectors, including education (Silva & Janes, 2021). One of the most widely used AI tools in education is ChatGPT, a large language model developed by OpenAI (Javaid et al., 2023). ChatGPT offers numerous benefits, such as automated assessment, language translation support, and personalized learning experiences (Javaid et al., 2023; Sok & Heng, 2023). It can also serve as a virtual tutor and facilitate the exchange of research ideas (Sok & Heng, 2023). Moreover, this AI model demonstrates remarkable capabilities in generating human-like text, responding to commands, and engaging in complex problem-solving tasks (Nikolopoulou, 2024).

In higher education, ChatGPT has the potential to reshape the learning experience by providing instant feedback, generating personalized learning materials, and offering innovative approaches to information processing (Adiguzel et al., 2023). Students can use ChatGPT to clarify complex concepts, receive writing assistance, or simulate academic discussions, fostering a more interactive and customized learning environment (Klayklung et al., 2023). Additionally, ChatGPT supports self-directed, independent learning by offering personalized assistance and resources (Baskara, 2023). Educators can leverage this technology to streamline workflows, automate administrative tasks, and develop new methods to engage students through AI-driven learning platforms (Anandhi & Keerthana, 2024). However, the convenience provided by ChatGPT raises concerns regarding academic integrity, privacy, and ethical implications (Rahman & Watanobe, 2023; Tajik & Tajik, 2024).

The presence of ChatGPT raises concerns about the development of critical thinking skills and the potential inhibition of human relationships (Graefen & Fazal, 2024). Overreliance on ChatGPT may diminish analytical thinking skills and impact students' cognitive abilities, particularly in critical thinking (Bai et al., 2023; Baidoo-Anu & Ansah, 2023). Critical thinking, defined as the ability to evaluate information, make reasonable judgments, and arrive at sound decisions, is a critical component of higher education that may be affected by AI usage (Essien et al., 2024). This skill is crucial for 21st-century learners, especially in higher education, where students must develop the capacity to analyze information, solve problems, and make independent decisions (Akhvlediani et al., 2023; Nufus et al., 2023).

Research suggests that while AI can enhance lower-level cognitive skills, it may challenge the development of higher-order thinking (Essien et al., 2024). Easy access to AI support might undermine the development of essential analytical skills, as students may become overly dependent on technology to tackle academic challenges (Murtiningsih et al., 2024). However, some researchers argue that ChatGPT can enhance students' critical thinking by helping them structure their thoughts, refine arguments, and engage in reflective writing (Essel et al., 2024; Tseng & Lin, 2024). ChatGPT has the potential to foster critical thinking through self-regulation, offering frameworks and aiding in the evaluation of generated responses (Berg & Plessis, 2023). Existing literature presents diverse perspectives, with some scholars cautioning that AI tools could hinder the development of critical skills, while others assert that AI can complement learning when applied effectively (Vargas-Murillo et al., 2023). This variation in viewpoints underscores the need for further exploration from different sources and perspectives to understand better the implications, consequences, and recommendations related to ChatGPT's role in higher education.

Several studies have explored using AI tools, such as ChatGPT, in educational settings, examining their potential to enhance learning outcomes. For example, Susnjak (2024) investigated ChatGPT's role in maintaining academic integrity during online assessments, suggesting that although AI models can manage complex multimodal questions, they also introduce risks to academic honesty. Similarly, Duran (2024) analyzed the effects of AI on pedagogical practices and found that while ChatGPT can

https://doi.org/10.22521/edupij.2025.14.31 Published online by Universitepark Press

increase efficiency, it raises concerns about diminishing human interaction and students' critical thinking skills. These studies emphasize AI's dual impact on education, primarily focusing on technical and ethical implications rather than how these tools shape cognitive skills, such as critical thinking.

Additionally, Sánchez-Ruiz et al. (2023) noted that while students quickly adopt ChatGPT for problem-solving, concerns remain about its impact on developing lateral thinking skills, particularly crucial for engineering students. Rahman and Watanobe (2023) and Nikolic et al. (2023) addressed the challenges ChatGPT poses in terms of plagiarism and assessment authenticity, suggesting that the tool's capacity to produce near-perfect answers raises questions about its influence on fostering or hindering critical analysis. While these studies provide valuable insights, they reveal a significant gap in understanding ChatGPT's direct impact on students' cognitive development, particularly in critical thinking.

Despite the growing integration of ChatGPT into educational practices, there remains a lack of systematic analysis of its direct impact on students' critical thinking skills. Previous research has primarily focused only on ChatGPT's utility in enhancing academic performance or maintaining academic integrity without thoroughly examining its effect on students' ability to assess and synthesize information critically. Additionally, the influence of ChatGPT across various academic disciplines still needs to be explored; most studies have focused on STEM fields, with a limited investigation into its effects within the humanities and social sciences.

This study aims to fill this gap by comprehensively analyzing ChatGPT's influence on developing critical thinking skills across disciplines in higher education. It specifically seeks to understand how ChatGPT impacts students' abilities to evaluate information, reason independently, and engage in critical thinking. The following research questions guide this study.

1. How does the use of ChatGPT affect the development of critical thinking skills among university students across different disciplines?

2. What specific effects does ChatGPT have on college students' abilities to critically evaluate information and to form independent judgments in higher education?

2. Literature Review

Artificial intelligence (AI) technologies, such as ChatGPT, have transformed the higher education landscape by providing personalized learning experiences, virtual assistants, automated assessments, content creation, material recommendations, time management tools, research assistance, translation support, and virtual laboratory simulations (Nikolopoulou, 2024). The emergence of ChatGPT has enhanced learner engagement, simplified administrative tasks, and facilitated interdisciplinary collaboration (Dempere et al., 2023). However, concerns exist regarding academic integrity, the development of critical thinking, and potential biases resulting from this technology's advancement (Vargas-Murillo et al., 2023). In response to these concerns, integrating ChatGPT into higher education requires carefully evaluating its implications (Nikolopoulou, 2024). ChatGPT should be viewed as a complementary learning tool that needs critical human evaluation and review (Graefen & Fazal, 2024).

2.1 The Role of Critical Thinking in Higher Education

Critical thinking is a rational and reflective skill focused on assessing beliefs and making informed decisions (Ennis, 2018). It involves objectively analyzing information, logically evaluating data and arguments, and developing creative solutions through careful analysis (Anderson et al., 2001). This skill enables individuals to challenge and revise their views based on verified facts (Ehlers, 2020). Additionally, critical thinking complements other reasoning skills, such as reflection and problem-

https://doi.org/10.22521/edupij.2025.14.31 Published online by Universitepark Press

solving (Michalon & Camacho-Zuñiga, 2023). It encompasses various abilities, including analysis, explanation, interpretation, evaluation, inference, and self-regulation (Facione, 2011). The capacity to critically assess ideas, situations, and arguments is essential for cultivating strong critical thinking skills (Raskin, 2020).

Critical thinking skills are essential in higher education for supporting students' academic success (Andreucci-Annunziata et al., 2023). Students in higher education must be able to analyze, evaluate, and synthesize information to make appropriate decisions and engage in reflective decision-making (Katsamakas et al., 2024). Beyond simple memorization, critical thinking encourages students to explore opposing views, challenge assumptions, and develop well-supported arguments (Berg, 2024). These abilities are crucial for tackling complex problems and adapting to the rapidly evolving demands of diverse professions. As Bennett and Abusalem (2024) defined, critical thinking includes a range of cognitive processes necessary for rigorous academic research and intellectual development, such as interpretation, analysis, evaluation, and inference.

According to (Guo & Lee, 2023), cultivating critical thinking skills in higher education is essential to prepare students for the challenges they will encounter in both personal and professional contexts. This development requires students to engage with diverse perspectives, assess persuasive arguments, and apply their knowledge to practical situations. Critical thinking skills are vital for academic success and for making thoughtful decisions and addressing problems across various professional domains (Supianto et al., 2024). For example, science, law, and business professionals must assess evidence, analyze data, and reach reasoned conclusions (Essien et al., 2024). Consequently, higher education institutions prioritize developing students' critical thinking skills, equipping them to adapt to complex environments and fostering lifelong learning (Fiialka et al., 2023).

Furthermore, critical thinking encourages students to question established views and consider innovative solutions, promoting an environment of inquiry and intellectual curiosity. This approach enhances students' analytical abilities and prepares them to seize new opportunities and face challenges within their areas of study (Berg & Plessis, 2023). Emphasizing critical thinking is vital to ensuring that students are equipped to make meaningful contributions to their communities and professions, especially as higher education continues to evolve amid social changes and technological advancements (Bennett & Abusalem, 2024).

2.2 ChatGPT as a Tool for Enhancing Critical Thinking

The AI-driven language model has become a valuable resource in higher education, offering innovative ways to help students develop critical thinking skills. ChatGPT is an interactive platform that encourages students to explore alternative viewpoints and challenge their preconceptions, fostering greater engagement with academic subjects (You, 2024). For instance, ChatGPT can provide counterarguments, alternative perspectives, or requests for further clarification in response to students' questions or arguments, prompting them to consider topics more thoroughly (İpek et al., 2023). This dynamic exchange of ideas fosters an environment where students can sharpen their critical thinking skills and build stronger, more comprehensive arguments. In addition to enhancing debating skills, ChatGPT also plays a key role in encouraging inquiry and curiosity—both essential components of critical thinking.

As described by Anderson et al. (2001), critical thinking involves taking in information, analyzing, and evaluating it before concluding—a process that can be supported by the interactive conversation ChatGPT provides. By offering students quick and diverse responses to their questions, ChatGPT stimulates further exploration and discovery (Mai et al., 2024). This iterative approach encourages students to delve deeper into complex topics, broadening their understanding and facilitating deeper analysis. In this context, Anderson asserts that the ability to thoroughly understand and evaluate

https://doi.org/10.22521/edupij.2025.14.31 Published online by Universitepark Press

concepts is fundamental to developing critical thinking (Anderson et al., 2001). For instance, students can use ChatGPT to explore different aspects of a subject, such as theoretical frameworks or empirical data, which they can then critically assess and integrate into their work (Mohebi, 2024).

When using ChatGPT to study texts, data, or arguments, students must critically assess the AI's output, compare it with other sources, and make informed judgments (Faisal, 2024). This process, as outlined by Bloom, includes the ability to evaluate information based on relevant criteria, a key component of critical thinking (Anderson et al., 2001). By engaging in these activities, students enhance their evaluative abilities and learn how to navigate the complexities of AI-generated content, ensuring the accuracy and quality of their academic work (Klimova et al., 2024). At this stage, instructors must provide careful guidance to successfully integrate ChatGPT into learning (Bennett & Abusalem, 2024). Educators must ensure that students remain active learners and use ChatGPT to support critical engagement with information rather than as a substitute (Supianto et al., 2024). As Bloom warns, students should actively participate in the learning process, testing and questioning knowledge rather than passively accepting information (Anderson et al., 2001).

3. Methodology

This study employed a systematic literature review method based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, which involves four main stages: identification, screening, eligibility, and inclusion, as illustrated in Figure 1 (Moher et al., 2009; Page et al., 2021). The literature search utilized the Scopus and ERIC databases, covering publications from 2023 to 2024 because ChatGPT was just released at the end of 2022. These databases were selected for their user-friendly interfaces, support for the article screening process, and reputation as widely referenced sources of international journals (Salido et al., 2024). This systematic review aims to provide an overview of the impact of ChatGPT on the development of student's critical thinking skills in higher education. Additionally, this study aims to understand the influence of ChatGPT on students' abilities to evaluate and assess information critically and independently.

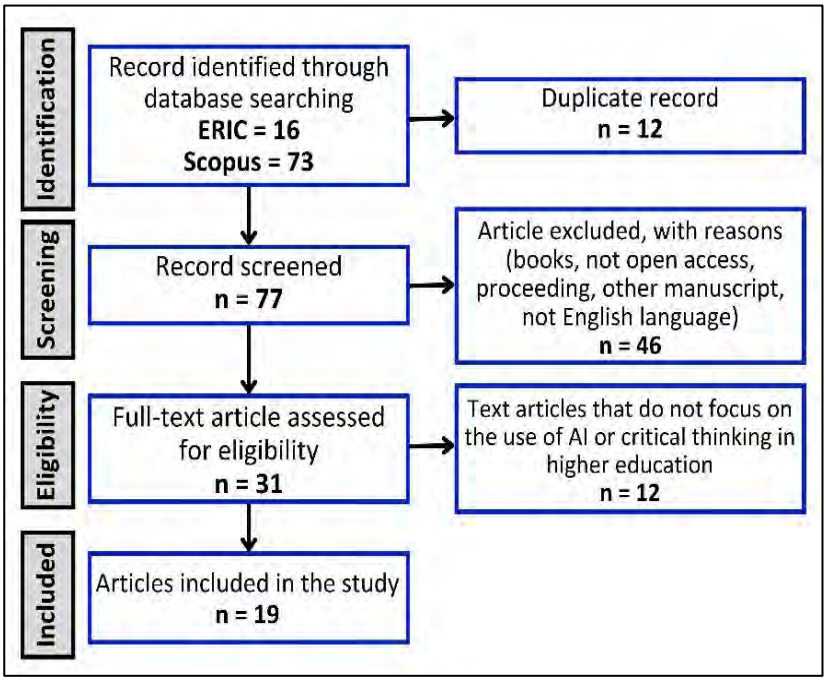

Figure 1. PRISMA flow chart

https://doi.org/10.22521/edupij.2025.14.31 Published online by Universitepark Press

3.1 Literature Search and Study Selection Criteria

The literature search for this study was conducted on August 21, 2024, using the Scopus and ERIC databases. The search string applied was "critical thinking" AND AI AND ChatGPT AND (higher education OR university OR college). After identifying relevant documents, the next step involved filtering to determine which articles met the inclusion criteria for the study. Several criteria were established for the screening process, including removing duplicate documents, applying exclusion and inclusion criteria, focusing on articles relevant to the research objectives, and limiting the selection to empirical research types only.

The ERIC database's inclusion criteria specified "peer-reviewed only" and "Full text available on ERIC." On the Scopus database, the search was refined to include documents categorized as published articles in the final publication stage, sourced from journals, written in English, and openly accessible. The final screening step involved a preliminary reading of the articles to exclude irrelevant content, including eliminating review-type articles.

Figure 1 illustrates that 89 documents were identified in the initial phase, comprising 16 from the ERIC database and 73 from the Scopus database. There were 12 duplicate documents present in both databases. These duplicates were removed, resulting in 77 documents proceeding to the screening phase. During the screening phase, the 77 documents were assessed based on the inclusion and exclusion criteria, eliminating 46 documents. This screening process left 31 documents in the eligibility phase. In this phase, a final screening was conducted using speed reading techniques to determine the relevance of documents to the research objectives. The final screening of these 31 documents resulted in 19 articles being included in the study, while 12 articles were excluded.

3.2 Analyzing of Data

The nineteen selected articles in this systematic literature review were carefully examined and summarized using a deductive thematic analysis approach (Nowell et al., 2017). This approach involved identifying and categorizing themes based on the research questions. Two main themes emerged in response to the research questions: (1) the impact of ChatGPT on the development of student's critical thinking skills in higher education, and (2) the specific influence of ChatGPT on students' ability to evaluate information and form independent judgments critically. Data extraction focused on findings directly relevant to these themes. The extracted data were then synthesized to provide a comprehensive understanding of ChatGPT's role in fostering critical thinking skills among college students and to identify emerging patterns or gaps in the literature. Through a rigorous review process, this study aims to draw meaningful conclusions that contribute to the broader discourse on the role of AI in higher education.

4. Results

The first research question was associated with the perception of boredom between teachers and students in virtual and in-person classes. More teachers (n = 9) considered virtual learning much more boring than offline classes (n = 5). The most common reasons were (i) a lack of ability to sense students' presence and (ii) a one-way, non-interactive essence of teaching.

The systematic review results examine the impact of ChatGPT use in higher education and focus on insights from 19 selected articles. The findings are organized into two overarching themes based on the research: its effects on students' critical thinking development and their evaluative judgement.

4.1 Effects on Students' Critical Thinking Development Across Disciplines

Table 1 provides data on the effects of ChatGPT usage on developing students' critical thinking skills across various domains in higher education. These findings offer research context and insights

into the positive and negative influences of ChatGPT on students' cognitive development and critical thinking abilities across different fields of study in higher education.

Table 1. ChatGPT Effect on Students' Critical Thinking Development

Authors, year	Context	Positive Effect	Negative Effect
(Michel-Villarreal et al., 2023)	Ethnographic approach to understanding ChatGPT's challenges and opportunities.	Not explicitly stated but suggests transformative potential with relevant insights that aid cognitive skill development.	Potential biases in data analysis, with limitations in information replication due to memory constraints.
(Essel et al., 2024)	Mixed-methods approach examining ChatGPT's impact on creative, reflective, and critical thinking in Ghanaian university students.	ChatGPT positively impacts creative and reflective critical thinking, enhancing cognitive skills.	Not mentioned.
(Fiialka et al., 2023)	Survey approach on AI benefits and challenges, including text-generative models like ChatGPT, in Ukrainian education.	Not explicitly stated, but notes personalized learning support, aiding research, content creation, and professional development.	ChatGPT may generate biased or inaccurate information, leading to misconceptions; improper use could limit creativity and reduce critical thinking.
(Michalon & Camacho-Zuñiga, 2023)	Action research on integrating ChatGPT in learning activities for international relations students at a Mexican private university.	ChatGPT strengthens communication skills, critical thinking, and logical reasoning, helping students articulate thoughts and communicate effectively.	Not mentioned.
(Berg & Plessis, 2023)	Qualitative approach to teacher education and training on ChatGPT use in lesson planning, critical thinking, and openness.	ChatGPT provides resources and access to lesson plans, aiding critical thinking and problem-solving skills.	Not mentioned.
(Barana et al., 2023)	Study on mathematical problem-solving and critical thinking,	ChatGPT supports problem-solving strategies and critical thinking by encouraging students to verify solutions and	Risk of misinformation; however, errors can be constructively

	focusing on ChatGPT use for combinatorics.	explore new problem-solving approaches.	recognized and corrected by students.
(Cong-Lem et al., 2024)	Exploration of ChatGPT in teaching English as a Foreign Language (EFL) in Vietnam.	Not directly related to critical thinking but notes ChatGPT's potential in teaching and learning when used responsibly.	Over-reliance on AI could inhibit knowledge development, critical thinking, and language skills.
(Tseng & Lin, 2024)	Innovative integration of ChatGPT in university-level EFL writing courses.	ChatGPT promotes critical thinking and empowers students to enhance writing quality and efficiency through feedback and ideas.	Not mentioned.
(Berg, 2024)	Use of GenAI, including ChatGPT, to enhance teaching practices in a distance-learning master's program in South Africa.	GenAI aids in refining teaching practices, offering personalized tutoring, simplifying English text and translation, organizing assessments, and fostering critical thinking.	Concerns about accuracy, bias, and reliability of GenAI-generated text, which may affect critical thinking.
(Klimova et al., 2024)	Exploration of students' attitudes toward ChatGPT use in foreign language learning.	Not explicitly stated but notes that students are encouraged to use ChatGPT in learning activities; assists teachers in preparing materials and assessments.	ChatGPT challenges teachers to adapt instruction and assessment to enhance cognitive, creative, and critical thinking. Concerns about plagiarism and data privacy.
(Banihashem et al., 2024)	Comparative analysis of ChatGPT-generated feedback and peer feedback on argumentative essay writing in higher education.	Constructive feedback from ChatGPT can complement peer feedback, particularly on cognitive frameworks and critical analysis skills.	Not explicitly stated but mentions that essay quality does not influence feedback from either ChatGPT or students.
(Ogunleye et al., 2024)	Evaluation of GenAI in STEM fields to assess its impact on learning and student development.	GenAI, including ChatGPT, demonstrates good subject knowledge, problem-solving,	Unethical use may limit intellectual challenges necessary for critical thinking and problem-solving; biases may lead

		analytical, and critical thinking skills.	to academic inaccuracies.
(Guo & Lee, 2023)	Exploration of ChatGPT as a large language model for critical thinking in introductory chemistry courses.	ChatGPT enhances critical thinking by offering diverse perspectives and challenging students through analysis and complex concept exploration.	Issues with validating ChatGPT's information sources; some content may lack quality.
(Mohammed et al., 2024)	Exploration of senior pharmacy students' experiences with AI, particularly ChatGPT, through interviews.	Not explicitly stated, but students found ChatGPT useful for academic tasks, particularly writing, saving time on assignments.	Concerns that ChatGPT may not improve critical thinking or writing skills, with continued use possibly reducing motivation to learn new academic skills.
(Stampfl et al., 2024)	Exploration of ChatGPT use in role-playing to enhance learning experiences in a master's program in Cloud Computing.	ChatGPT enhances student engagement, critical thinking, and communication, applying theoretical knowledge effectively and supporting digital literacy aligned with SDGs.	Not mentioned.
(Valova et al., 2024)	Survey-based exploration of ChatGPT's impact on students' critical thinking and intellectual development in education.	Not explicitly stated but notes ChatGPT organizes internet information, saving students time and effort, and provides personalized feedback anytime with internet access.	Risk of students learning incorrect or biased information if they rely on ChatGPT without verifying accuracy. Concerns about academic integrity and plagiarism.
(Chan & Lee, 2023)	Exploration of generative AI use in higher education involving Gen X and Gen Y educators' perspectives.	Not directly related to critical thinking but notes GenAI's productivity, problem-solving, and decision-making support.	Concerns about excessive reliance on AI, ethical implications, and impact on pedagogy.
(Essien et al., 2024)	Mixed-methods approach exploring ChatGPT's impact on critical thinking in UK	GenAI, including ChatGPT, can improve critical thinking, even at lower Bloom's taxonomy levels,	Concerns about reliability, accuracy, and ethical implications. Improper AI integration

	graduate business students.	and inspire advanced educational tool creation.	may shift educators' roles from information providers to facilitators.
(Esmaeil et al., 2023)	Exploration of students' perceptions of ChatGPT in argumentative writing.	Not explicitly stated but notes ChatGPT aids in quickly accessing information, guiding students, and improving argumentative writing efficiency.	Accuracy of ChatGPT's information may be limited; over-reliance may hinder critical thinking and pose plagiarism risks.

Table 1 shows that ChatGPT in higher education has garnered significant attention from researchers across various fields, including digital education, language teaching, mathematical problem-solving, STEM disciplines, chemistry, pharmacy, and business. The analysis shows that ChatGPT has a range of impacts on developing critical thinking skills in higher education. Many studies highlight that ChatGPT can support critical thinking by providing easy access to information, allowing students to broaden their perspectives, and exposing them to various relevant viewpoints. Additionally, ChatGPT is reported to facilitate the learning process, enhance cognitive skills, and enable a more profound understanding through the analysis of complex information. It also aids students in improving their communication and argumentation skills. As a supportive tool, ChatGPT allows students to develop critical thinking in a more structured way, with the assistance of feedback and AI-generated ideas.

However, not all findings indicate positive impacts. Some studies reveal risks of over-dependence on ChatGPT, which may impede the development of students' critical thinking skills. For instance, frequent reliance on AI to complete academic tasks can reduce students' motivation to delve deeper into information and hinder the development of analytical skills. Moreover, concerns about potential biases in ChatGPT's data and the accuracy of the information it provides have been raised. Some studies point out that inaccurate or biased information could lead to misunderstandings, ultimately compromising learning. Issues related to academic integrity, such as plagiarism and data privacy, are risks associated with ChatGPT.

Despite these challenges and potential risks, ChatGPT is regarded as an effective tool for enhancing productivity and offering a more personalized learning experience. Some studies suggest that ChatGPT acts as a catalyst, encouraging students to explore various information sources and hone their problem-solving skills. However, the effectiveness of ChatGPT largely depends on how it is used and students' abilities to verify information and apply a critical lens to AI-generated content.

4.2 Effects on Critical Evaluation and Independent Judgment in Students

Table 2 presents findings on ChatGPT's impact on students' abilities to critically evaluate information and form independent judgments. It underscores how ChatGPT influences. Based on Table 2, various studies indicate that ChatGPT has diverse impacts on students' abilities in critical evaluation and independent judgment across different scientific fields. Many studies suggest that ChatGPT can enhance critical evaluation by providing rapid access to and selection of relevant information. This tool enables students to gain broader perspectives and sharpen their evaluative skills, which helps construct arguments and assess the quality of the information they encounter.

https://doi.org/10.22521/edupij.2025.14.31 Published online by Universitepark Press

Some studies also reveal that ChatGPT boosts students' confidence in evaluating information independently, although concerns remain regarding potential biases in the AI-generated content.

Table 2. Effects of ChatGPT on Critical Evaluation and Independent Judgment

Author (s), Year	Effect on Critical Evaluation	Effect on Independent Judgement
(Michel-Villarreal et al., 2023)	Not specified	Not specified
(Essel et al., 2024)	ChatGPT assists students in selecting and critically evaluating information, enhancing their thinking skills.	Experience with ChatGPT enables students to make better, independent decisions in academic tasks based on careful consideration of the information obtained.
(Fiialka et al., 2023)	ChatGPT helps students evaluate information critically, but they recognize the need to be cautious about potential biases.	Students should exercise caution with ChatGPT to avoid misunderstandings and misuse that could diminish critical thinking and creativity in decision-making.
(Michalon & Camacho-Zuñiga, 2023)	Not explicitly mentioned, but it is indicated that after six sessions using AI, students were able to strengthen their communication, critical thinking, and logical reasoning.	Not specified
(Berg & Plessis, 2023)	Not specified	Not specified
(Barana et al., 2023)	While not explicitly stated, it is noted that students need to verify ChatGPT's solutions and compare them with their own to demonstrate a critical evaluation process.	Not explicitly mentioned, but the study suggests students need to take independent steps to verify solutions and explore new problem-solving approaches.
(Cong-Lem et al., 2024)	Not explicitly mentioned, but teachers perceive AI reliance as a barrier to developing students' critical thinking and language competence.	Not specified
(Tseng & Lin, 2024)	Interaction with GPT-3.5 provides direct feedback that helps students improve writing structure, showing	Students collaborate with GPT-3.5 to develop their own writing style, reflecting their independent decisions on utilizing this technology.

	their ability to evaluate AI-generated information.	
(Berg, 2024)	Not specified	Not specified
(Klimova et al., 2024)	Not explicitly mentioned, but students find this technology useful for learning, despite concerns about its impact.	Not explicitly mentioned, but students are aware of the challenges educators face in adjusting their teaching and assessment approaches.
(Banihashem et al., 2024)	ChatGPT's feedback is descriptive and guides students on essay writing, whereas peer feedback focuses more on identifying issues within the essay.	Students can consider and make decisions based on the feedback they receive.
(Ogunleye et al., 2024)	While GenAI demonstrates subject knowledge, problem-solving, and critical thinking, unethical use may limit students' learning development.	Students independently decide on GenAI use based on their assessments, contributing to understanding how it affects their learning.
(Guo & Lee, 2023)	ChatGPT aids students in confidently posing sharp questions, analyzing information, and understanding complex concepts, although they face challenges in validating information sources.	Students view ChatGPT as a tool that can enhance critical thinking skills.
(Mohammed et al., 2024)	Students recognize that although AI aids in task completion, its use could negatively affect their motivation to learn new academic skills.	While ChatGPT is beneficial, students believe it does not replace the importance of developing critical thinking and writing skills independently.
(Stampfl et al., 2024)	ChatGPT helps students engage and develop critical thinking and communication skills.	Students acknowledge that AI in education assists them in applying practical knowledge and developing other essential skills.
(Valova et al., 2024)	Students tend to accept answers from ChatGPT without verification, which can limit their critical thinking skills, indicating a lack of critical evaluation.	Students may be tempted to use ChatGPT for quick task completion, potentially hindering critical thinking and intellectual growth. No explicit information on independent decision-making.
(Chan & Lee, 2023)	GenAI enhances student productivity and efficiency.	Gen Z students show optimism towards using GenAI in education.

(Essien et al., 2024)	ChatGPT significantly improves critical thinking at basic levels of Bloom's taxonomy.	Not explicitly stated, but suggests students need to consider ethical and accuracy aspects when using AI.
(Esmaeil et al., 2023)	ChatGPT provides information, guidance, and cost/time efficiency, though it has limitations in accuracy. Over-reliance could reduce critical thinking skills.	Students indicate a need for self-regulation in using ChatGPT to avoid plagiarism.

ChatGPT is also seen as a tool that can foster students' independent judgment abilities, albeit with certain risks that need to be anticipated. Several studies emphasize that ChatGPT can help students make academic decisions independently, particularly in situations requiring problem-solving or complex information assessment. However, reliance on AI for academic tasks could diminish students' motivation to deepen their critical thinking skills. Some studies caution that college students should be mindful when using ChatGPT to avoid misunderstandings or undermining their evaluative capabilities.

Moreover, ChatGPT is a supportive tool that aids students in enhancing the quality of their academic work, especially regarding concept comprehension and problem-solving. Many studies suggest that students should verify the accuracy of information provided by ChatGPT and cross-check it with other sources to ensure its reliability. This underscores that, while ChatGPT can facilitate the critical evaluation process, students' active involvement is essential to prevent potential errors or biases in the information received.

5. Discussion

5.1 Effects on Students' Critical Thinking Development Across Disciplines

Findings from various studies suggest that ChatGPT has the potential to support the development of critical thinking in higher education, aligning with the indicators proposed by Facione (2011), which include interpretation, analysis, evaluation, inference, explanation, and self-regulation. ChatGPT can assist students in improving their ability to interpret and analyze information; as Michel-Villarreal et al. (2023) noted, this technology provides diverse insights, enabling students to compare different perspectives. In teaching English as a foreign language (EFL), ChatGPT helps students organize their writing and encourages structural improvement through immediate feedback (Cong-Lem et al., 2024; Tseng & Lin, 2024). This aligns with Ennis (2018) assertion that critical thinking enables individuals to challenge and revise views based on factual evidence. Fiialka et al. (2023) further observed that by offering a broad range of information and perspectives, ChatGPT promotes explanation and inference, which helps students formulate more critical ideas. In this way, ChatGPT supports students' reflective ability in developing hypotheses and assumptions, which is an essential part of critical thinking, where students must evaluate concepts and analyze ideas (Anderson et al., 2001; Raskin, 2020).

ChatGPT also facilitates explanation and evaluation within collaborative learning environments. By offering quick access to relevant information, efficient data processing, and engaging students in analysis and evaluation, ChatGPT promotes the development of critical thinking skills (Chan & Lee, 2023; Esmaeil et al., 2023; Mohammed et al., 2024). It enhances students' communication and logical reasoning skills—key components of critical thinking—by helping them articulate their thoughts

clearly (Michalon & Camacho-Zuñiga, 2023). ChatGPT encourages students to ask critical questions and analyze complex information (Guo & Lee, 2023). By acting as a catalyst for deeper discussions, ChatGPT invites students to engage actively by asking questions and developing explanations based on available data (Barana et al., 2023; Michalon & Camacho-Zuñiga, 2023). These findings are consistent with Ennis (2018) emphasis on analysis and evaluation as crucial to critical thinking, which helps students assess arguments and make informed decisions based on valid data. Barana et al. (2023) also observed that ChatGPT can enhance students' mathematical problem-solving skills by helping them verify their answers against AI-generated problem-solving strategies, aligning with the self-regulation aspect of critical thinking. This statement aligns with Anderson et al. (2001) assertion that evaluating and critiquing information is essential for developing sophisticated reasoning skills, leading to a more comprehensive understanding and integration of knowledge.

However, a primary challenge in using ChatGPT is ensuring that students remain active participants in learning (Sánchez-Ruiz et al., 2023). Students must recognize that ChatGPT is a tool meant to support, not replace, deep and independent critical thinking (Fiialka et al., 2023; Stampfl et al., 2024; Valova et al., 2024). Guo and Lee (2023) emphasized that over-reliance on ChatGPT could reduce students' ability to critically assess the information provided, as AI-generated content may contain biases or inaccuracies. Anderson et al. (2001) noted that critical thinking requires continuous evaluation and reflection on one's conclusions to avoid dependence on any single source of information. Klimova et al. (2024) similarly stressed the importance of self-regulation in using AI technology, enabling students to verify the accuracy of information independently. This finding aligns with Ehlers (2020) perspective that critical thinking involves reflective assessment of beliefs and decisions. Valova et al. (2024) also warned that over-dependence on ChatGPT could hinder the development of deep reflection and analysis skills, essential for becoming independent, critical learners.

Educator guidance is crucial in optimizing ChatGPT's role in fostering critical thinking. Teachers should guide students in using ChatGPT wisely and emphasize the need to verify AI-generated information (Cong-Lem et al., 2024). Mohammed et al. (2024) and Banihashem et al. (2024) noted that effective educator guidance can prevent over-reliance on ChatGPT, helping students strengthen their self-regulation and critical evaluation skills. Ehlers (2020) argues that critical thinking extends beyond acquiring information to include reflective evaluation. Anderson et al. (2001) further emphasized that while external tools and frameworks can aid learning, the internal processes of reflection and self-evaluation are irreplaceable in developing genuine critical thinking. Essien et al. (2024) and Ogunleye et al. (2024) agree, suggesting that guidance in using ChatGPT can help students cultivate the comprehensive critical thinking skills needed for academic and professional success. This finding aligns with Raskin (2020) principles of reflection and self-awareness in critical thinking. Supianto et al. (2024) view that evaluating AI-generated content is essential for enhancing learning.

5.2 Effects on Critical Evaluation and Independent Judgment in Students

Based on findings from various studies, ChatGPT influences the development of students' critical evaluation and decision-making skills. This technology gives students faster access to information, which they can use to assess various solutions to academic challenges (Mohammed et al., 2024). ChatGPT aids students in selecting and critically evaluating information within the context of their academic tasks. For example, research in Ghana demonstrated an increase in students' critical thinking skills following their use of ChatGPT to filter relevant information (Essel et al., 2024). This finding aligns with Facione (2011), who assert that critical thinking requires the ability to analyze, interpret, evaluate, and regulate information. Furthermore, Anderson et al. (2001) emphasizes the

https://doi.org/10.22521/edupij.2025.14.31 Published online by Universitepark Press

importance of understanding and evaluating complex concepts, a process that is greatly facilitated by AI tools like ChatGPT.

Some studies indicate that students develop critical evaluation skills through reflection and engagement with information generated by ChatGPT (Tseng & Lin, 2024). They need to distinguish between the AI's output and their assessments of the information's accuracy Barana et al. (2023), which supports Ennis (2018) emphasis on the role of evaluation and reflection in critical thinking. Thus, ChatGPT in higher education not only facilitates faster problem-solving but also encourages the enhancement of students' critical thinking and independent decision-making skills (Klimova et al., 2024; Michalon & Camacho-Zuñiga, 2023; Stampfl et al., 2024). However, while ChatGPT can streamline learning and task completion, users must apply it judiciously to avoid hindering critical thinking and creativity.

ChatGPT also enhances independent decision-making skills, mainly as students learn when and how to use the technology effectively (Banihashem et al., 2024; Essel et al., 2024; Ogunleye et al., 2024). Additionally, some studies emphasize the importance of adopting a thoughtful approach to using ChatGPT to address challenges associated with AI technology, especially those that could potentially diminish independent decision-making skills (Fiialka et al., 2023; Klimova et al., 2024). This perspective aligns with the findings of Vargas-Murillo et al. (2023), which indicate that while students recognize the advantages of ChatGPT in accelerating task completion, they also understand that informed decisions about its use should be made based on a comprehensive awareness of its benefits and risks. Anderson et al. (2001) framework for thinking critically supports this approach, emphasizing the need for self-regulation and reflection to guide decisions on when and how to integrate AI tools into learning processes. Furthermore, other research suggests that students' experiences with ChatGPT strengthen their capacity for independent thinking and improve their ability to assess academic situations. However, an over-reliance on AI may reduce their motivation to develop other essential skills actively (Fiialka et al., 2023).

The use of ChatGPT shows potential for enhancing critical evaluation skills across various educational contexts. In language education, for example, ChatGPT helps students improve their writing structure and provides immediate, relevant feedback (Klimova et al., 2024; Tseng & Lin, 2024). Anderson et al. (2001) emphasis on iterative learning and constant evaluation aligns with this application, as students continually refine their work based on AI feedback. In mathematical problem-solving, students critically evaluate solutions offered by ChatGPT by comparing them with their own independently generated solutions (Barana et al., 2023). ChatGPT can also suggest alternative solution strategies that enrich students' knowledge. In STEM education, ChatGPT aids students in grasping complex concepts and bolstering their confidence in critical thinking, although they often feel the need to verify information independently (Guo & Lee, 2023). Anderson et al. (2001) also emphasized that the ability to critically evaluate and cross-check information is a core component of developing deep knowledge in scientific and technical fields. Despite its benefits, educator guidance remains essential to ensure students maintain critical evaluation skills and independent judgment when using ChatGPT.

6. Conclusion

This study highlights the impact of AI on students' critical thinking skills and autonomous judgment across various fields of higher education. Examining the literature reveals that the effects of ChatGPT in higher education vary depending on its use. ChatGPT supports the development of critical thinking, critical evaluation, and independent judgment skills by enabling students to access, analyze, and evaluate information more efficiently. These skills strengthen their capacity to think critically and make informed decisions. The tool also broadens students' perspectives and aids in forming comprehensive arguments that are applicable across diverse disciplines. Additionally,

https://doi.org/10.22521/edupij.2025.14.31 Published online by Universitepark Press

ChatGPT facilitates the development of independent judgment by allowing students to explore solutions and make decisions autonomously, boosting their confidence in handling academic tasks.

However, this study also highlights some potential negative impacts. More reliance on ChatGPT may reduce students' motivation to cultivate self-reflection and evaluation skills, essential for deep critical thinking. There is also a risk that students may accept information from ChatGPT without verifying its accuracy, which could hinder their ability to assess and process information critically. To mitigate these challenges, educators must provide appropriate guidance, encourage students to use ChatGPT judiciously and emphasize the importance of verifying AI-generated information's accuracy and potential biases. Furthermore, students should be encouraged to analyze and reflect critically when using ChatGPT. With this approach, ChatGPT can be integrated into higher education as an effective and responsible tool for supporting learning activities and fostering critical skills development.

Based on these findings, educators are advised to provide structured guidance to ensure responsible use of ChatGPT in higher education. This focus includes designing activities that encourage students to critically evaluate and verify AI-generated content, emphasizing the importance of accuracy and awareness of biases. Institutions can develop training programs or workshops that teach students how to effectively use ChatGPT as a tool for enhancing critical thinking, independent judgment, and comprehensive argument formation. Moreover, educators should encourage balanced use by integrating reflective exercises that promote self-evaluation and deep thinking, minimizing the risks of over-reliance on the tool. By fostering these practices, institutions can maximize the benefits of ChatGPT while mitigating its potential drawbacks, ensuring its integration supports meaningful learning and skill development.

7. Limitations and Suggestions

This study has several limitations, primarily its reliance on the Scopus and ERIC databases. Furthermore, most of the data were drawn from descriptive studies rather than empirical experiments or longitudinal research, leaving the long-term effects of ChatGPT on students' critical thinking and evaluation skills largely unexplored. Conducting quantitative research would provide a more comprehensive understanding of ChatGPT's impact on students in higher education.

To address these limitations, future research should explore various strategies for effectively using AI tools to enhance critical thinking skills. Expanding the scope of research to include databases such as Web of Science, Dimensions, Lens, PubMed, and other credible sources could enrich the findings. Additionally, employing quantitative methodologies, such as experimental or longitudinal studies, would offer deeper insights into the long-term impact of ChatGPT on students' critical thinking, evaluation, and independent judgment skills. Such studies would contribute to a nuanced understanding of ChatGPT's role in higher education, guiding students to use this technology responsibly and effectively.

Declarations

Author Contributions.

R.M: conceptualization and writing – original draft. A: supervision. A.T: validation. S.H: data curation. A.S: methodology and writing – review & editing. P.E.L.E: investigation. C.M: formal analysis. Z: resources. Z.A.F: methodology. All authors have read and approved the published on the final version of the article)

Funding. The author of this research declares full responsibility independently regarding the funds required.

Conflict of interest. All authors confirm that there is no conflict of interest regarding the composition of this research publication.

Ethical Approval. This study is a systematic review of existing literature and does not involve the collection or analysis of data from human or animal subjects. Consequently, ethical approval from an institutional review board or ethics committee was not required for the conduct of this research.

Data Availability Statement. The data utilized in this systematic literature review were sourced from publicly accessible academic databases, specifically Scopus and ERIC. These databases were selected for their comprehensive coverage of peer-reviewed literature in the fields relevant to this study. All data supporting the findings of this article are derived from the published studies identified within these databases. Readers can access the original studies through Scopus and ERIC based on the references provided in this article.

Generative AI Usage. In the preparation of this article, generative AI tools such as ChatGPT and Grammarly were employed to enhance the clarity, readability, and grammatical accuracy of the text. ChatGPT was utilized to refine sentence structure, improve coherence, and ensure that the language maintained a formal and professional tone suitable for academic discourse. Additionally, Grammarly was used for grammar correction, punctuation accuracy, and to identify stylistic inconsistencies.

Acknowledgments. Thank you to Yogyakarta State University for their support in completing this article, which is one part of the scientific writing course assignment. In addition, appreciation is also expressed to the Higher Education Funding (Balai Pembiayaan Pendidikan Tinggi/BPPT) and the Education Fund Management Institution (Lembaga Pengelola Dana Pendidikan/LPDP) of the Republic of Indonesia for the assistance and financial support provided in facilitating the author's academic activities.

References

Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology*, *15*(3). https://doi.org/10.30935/cedtech/13152

Akhvlediani, M., Abdaladze, L., & Lataria, K. (2023). The Challenges of the XXI century – development of critical thinking among the students. *KREBSI*, *15*, 275–285. https://doi.org/https://doi.org/10.52340/zssu.2023.15.11

Anandhi, A., & Keerthana, B. (2024). Research in engineering management ai-driven learning : Revolutionizing higher education with ChatGPT. *International Journal of Progressive Research in Engineering Management and Science (IJPREMS)*, *04*(02), 157–160. https://doi.org/10.58257/IJPREMS32676

Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). *A Taxonomy for Learning Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Longman.

Andreucci-Annunziata, P., Riedemann, A., Cortés, S., Mellado, A., del Río, M. T., & Vega-Muñoz, A. (2023). Conceptualizations and instructional strategies on critical thinking in higher education: A systematic review of systematic reviews. *Frontiers in Education*, *8*, 1–18. https://doi.org/10.3389/feduc.2023.1141686

Bai, L., Liu, X., & Su, J. (2023). ChatGPT: The cognitive effects on learning and memory. *Brain-X*, *1*(3), 1–9. https://doi.org/10.1002/brx2.30

Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of chatgpt in promoting teaching and learning. *Journal of*

AI, *7*(1), 52–62. https://doi.org/10.61969/jai.1337500

Banihashem, S. K., Kerman, N. T., Noroozi, O., Moon, J., & Drachsler, H. (2024). Feedback sources in essay writing: Peer-generated or AI-generated feedback? In *International Journal of Educational Technology in Higher Education* (Vol. 21). https://doi.org/10.1186/s41239-024-00455-4

Barana, A., Marchisio, M., & Roman, F. (2023). Fostering problem solving and critical thinking in mathematics through generative artificial intelligence. *20th International Conference on Cognition and Exploratory Learning in Digital Age (CELDA 2023)*, 377–385.

Baskara, F. R. (2023). The promises and pitfalls of using Chat GPT for self-determined learning in higher education: An argumentative review. *Prosiding Seminar Nasional Fakultas Tarbiyah Dan Ilmu Keguruan IAIM Sinjai*, *2*, 95–101. https://doi.org/10.47435/sentikjar.v2i0.1825

Bennett, L., & Abusalem, A. (2024). Artificial intelligence (AI) and its potential impact on the future of higher education. *Athens Journal of Education*, *11*(3), 195–212. https://doi.org/10.30958/aje.11-3-2

Berg, G. van den. (2024). Generative AI and educators: partnering in using open digital content for transforming education. *Open Praxis*, *16*(2), 130–141. https://doi.org/10.55982/openpraxis.16.2.640

Berg, G. van den, & Plessis, E. du. (2023). ChatGPT and generative AI: possibilities for its contribution to lesson planning, critical thinking and openness in teacher education. *Education Sciences*, *13*, 1–12. https://doi.org/10.3390/educsci13100998

Chan, C. K. Y., & Lee, K. K. W. (2023). The AI generation gap: Are Gen Z students more interested in adopting generative AI such as ChatGPT in teaching and learning than their Gen X and millennial generation teachers? *Smart Learning Environments*, 1–23. https://doi.org/10.1186/s40561-023-00269-3

Cong-Lem, N., Tran, T. N., & Nguyen, T. T. (2024). Academic integrity in the age of generative AI: Perceptions and responses of Vietnamese EFL teachers. *Teaching English with Technology*, *24*(1), 28–48. https://doi.org/10.56297/FSYB3031/MXNB7567

Dempere, J., Modugu, K., Hesham, A., & Ramasamy, L. K. (2023). The impact of ChatGPT on higher education. *Frontiers in Education*, *8*(September). https://doi.org/10.3389/feduc.2023.1206936

Duran, V. (2024). Analyzing teacher candidates' arguments on AI integration in education via different Chatbots. *Digital Education Review*, *45*, 68–83. https://doi.org/10.1344/der.2024.45.68-83

Ehlers, U.-D. (2020). *Future Skills-Future Learning and Future Higher Education* (U.-D. Ehlers (ed.)). Springer. https://doi.org/10.1007/978-3-658-29297-3

Ennis, R. H. (2018). Critical Thinking Across the Curriculum: A Vision. *Topoi*, *37*(1), 165–184. https://doi.org/10.1007/s11245-016-9401-4

Esmaeil, A. A. A., Dzulkifli, D. N. A. K., Maakip, I., Matanluk, O. O., & Marshall, S. (2023). Understanding student perception regarding the use of ChatGPT in their argumentative writing: A qualitative inquiry. *Jurnal Komunikasi: Malaysian Journal of Communication*, *39*(4), 150 – 165. https://doi.org/10.17576/JKMJC-2023-3904-08

Essel, H. B., Vlachopoulos, D., Essuman, A. B., & Amankwa, J. O. (2024). ChatGPT effects on cognitive skills of undergraduate students: Receiving instant responses from AI-based conversational large language models (LLMs). *Computers and Education: Artificial Intelligence*, *6*, 1–13. https://doi.org/10.1016/j.caeai.2023.100198

Essien, A., Bukoye, O. T., O'Dea, X., & Kremantzis, M. (2024). The influence of AI text generators on critical thinking skills in UK business schools. *Studies in Higher Education*, *49*(5), 865–882. https://doi.org/10.1080/03075079.2024.2316881

Facione, P. A. (2011). Critical thinking: What it is and why it counts. *Insight Assessment*, *1*(1), 1–23.

Faisal, E. (2024). Unlock the potential for Saudi Arabian higher education: a systematic review of the benefits of ChatGPT. *Frontiers in Education*, *9*(April), 1–12. https://doi.org/10.3389/feduc.2024.1325601

Fiialka, S., Kornieva, Z., & Honcharuk, T. (2023). ChatGPT in Ukrainian education: Problems and prospects. *International Journal of Emerging Technologies in Learning*, *18*(17), 236–250. https://doi.org/10.3991/ijet.v18i17.42215

Graefen, B., & Fazal, N. (2024). From Chat bots to virtual tutors: An overview of Chat GPT's role in the future of education. *Archives of Pharmacy Practice*, *15*(2), 43–52. https://doi.org/10.51847/touppjedsx

Guo, Y., & Lee, D. (2023). Leveraging ChatGPT for enhancing critical thinking skills. *Journal of Chemical Education*, *100*, 4876 – 4883. https://doi.org/10.1021/acs.jchemed.3c00505

İpek, Z. H., Gözüm, A. İ. C., Papadakis, S., & Kallogiannakis, M. (2023). Educational applications of the ChatGPT AI system: A systematic review research. *Educational Process: International Journal*, *12*(3), 26–55. https://doi.org/10.22521/edupij.2023.123.2

Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. (2023). Unlocking the opportunities through ChatGPT Tool towards ameliorating the education system. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, *3*(2), 100115. https://doi.org/10.1016/j.tbench.2023.100115

Katsamakas, E., Pavlov, O. V., & Saklad, R. (2024). Artificial intelligence and the transformation of higher education institutions: A systems approach. *Sustainability*, *16*(14), 6118. https://doi.org/10.3390/su16146118

Klayklung, P., Chocksathaporn, P., Limna, L., Kraiwanit, T., & Jangjarat, K. (2023). Revolutionizing education with ChatGPT: Enhancing learning through conversational AI. *Universal Journal of Educational Research*, *2*(3), 217–225.

Klimova, B., Pikhart, M., & Al-Obaydi, L. H. (2024). Exploring the potential of ChatGPT for foreign language education at the university level. *Frontiers in Psychology*, *15*, 1–10. https://doi.org/10.3389/fpsyg.2024.1269319

Mai, D. T. T., Da, C. Van, & Hanh, N. Van. (2024). The use of ChatGPT in teaching and learning: a systematic review through SWOT analysis approach. *Frontiers in Education*, *9*(February), 1–17. https://doi.org/10.3389/feduc.2024.1328769

Michalon, B., & Camacho-Zuñiga, C. (2023). ChatGPT, a brand-new tool to strengthen timeless competencies. *Frontiers in Education*, *8*, 1–13. https://doi.org/10.3389/feduc.2023.1251163

Michel-Villarreal, R., Vilalta-Perdomo, E., Salinas-Navarro, D. E., Thierry-Aguilera, R., & Gerardou, F. S. (2023). Challenges and opportunities of generative AI for higher education as explained by ChatGPT. *Education Sciences*, *13*, 1–18. https://doi.org/10.3390/educsci13090856

Mohammed, S. I., Jasim, A. L., Al-Jumaili, A. A., Mikhael, E. M., & Ali, F. Z. (2024). Perceptions of senior pharmacy students towards the impact of artificial intelligence on university education and scientific writing: A qualitative study. *Al-Rafidain Journal of Medical Sciences*, *6*(1), 142 – 146.

https://doi.org/10.54133/ajms.v6i1.538

Mohebi, L. (2024). Empowering learners with ChatGPT: Insights from a systematic literature exploration. *Discover Education*, *3*(1). https://doi.org/10.1007/s44217-024-00120-y

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ (Online)*, *339*(7716), 332–336. https://doi.org/10.1136/bmj.b2535

Murtiningsih, S., Sujito, A., & Khin Soe, K. (2024). Challenges of using ChatGPT in education: a digital pedagogy analysis. *International Journal of Evaluation and Research in Education (IJERE)*, *13*(5), 3466. https://doi.org/10.11591/ijere.v13i5.29467

Nikolic, S., Daniel, S., Haque, R., Belkina, M., Hassan, G. M., Grundy, S., Lyden, S., Neal, P., & Sandison, C. (2023). ChatGPT versus engineering education assessment: A multidisciplinary and multi-institutional benchmarking and analysis of this generative artificial intelligence tool to investigate assessment integrity. *European Journal of Engineering Education*, *48*(4), 559 – 614. https://doi.org/10.1080/03043797.2023.2213169

Nikolopoulou, K. (2024). Generative artificial intelligence in higher education: Exploring ways of harnessing pedagogical practices with the assistance of ChatGPT. *International Journal of Changes in Education*, *1*(2), 103–111. https://doi.org/10.47852/bonviewijce42022489

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, *16*(1), 1–13. https://doi.org/10.1177/1609406917733847

Nufus, R. H., Octoviani, R., Eliyana, S., & Sari, I. J. (2023). The Implementation of the Teaching Campus Program on Students' 21st Century Skills: A Systematic Review. *Jurnal Pendidikan Indonesia Gemilang*, *3*(2), 278–294. https://doi.org/10.53889/jpig.v3i2.208

Ogunleye, B., Ibilola, K., Zakariyyah, Ajao, O., Olayinka, O., & Sharma, H. (2024). Higher education assessment practice in the era of generative AI tools. *Journal of Applied Learning & Teaching*, *7*(1), 25–34. https://doi.org/10.37074/jalt.2024.7.1.28 Abstract

Page, M. J., McKenzie, J. E., Bossuyt, P., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The prisma 2020 statement: An updated guideline for reporting systematic reviews. *Medicina Fluminensis*, *57*(4), 444–465. https://doi.org/10.21860/medflum2021_264903

Rahman, M. M., & Watanobe, Y. (2023). ChatGPT for education and research: Opportunities, threats, and strategies. *Applied Sciences (Switzerland)*, *13*(9). https://doi.org/10.3390/app13095783

Raskin, R. (2020). Literacy strategies and instructional modalities in introductory accounting. In *Teaching College-Level Disciplinary Literacy* (pp. 79–105). https://doi.org/https://doi.org/10.1007/978-3-030-39804-0

Salido, A., Sugiman, S., Fauziah, P. Y., Kausar, A., Haskin, S., & Azhar, M. (2024). Parental involvement in students' mathematics activities: A bibliometric analysis. *EURASIA Journal of Mathematics, Science and Technology Education*, *20*(10), 1–13. https://doi.org/https://doi.org/10.29333/ejmste/15179

Sánchez-Ruiz, L. M., Moll-López, S., Nuñez-Pérez, A., Moraño-Fernández, J. A., & Vega-Fleitas, E. (2023). ChatGPT challenges blended learning methodologies in engineering education: A case

study in mathematics. *Applied Sciences (Switzerland)*, *13*. https://doi.org/10.3390/app13106039

Silva, A. de O., & Janes, D. dos S. (2021). The emergence of ChatGPT and its implications for education and academic research in the 21st century. *Review of Artificial Intelligence in Education*, *2*(00), e06. https://doi.org/10.37497/rev.artif.intell.education.v2i00.6

Sok, S., & Heng, K. (2023). ChatGPT for education and research: A review of benefits and risks. *Cambodian Journal of Educational Research*, *3*(1), 110–121. https://doi.org/10.62037/cjer.2023.03.01.06

Stampfl, R., Geyer, B., Deissl-O'meara, M., & Ivkic, I. (2024). Revolutionising role-playing games with ChatGPT. *Advances in Artificial Intelligence and Machine Learning*, *4*(2), 2244 – 2257. https://doi.org/10.54364/aaiml.2024.42129

Supianto, Widyaningrum, R., Wulandari, F., Zainudin, M., Athiyallah, A., & Rizqa, M. (2024). Exploring the factors affecting ChatGPT acceptance among university students. *Multidisciplinary Science Journal*, *6*(12). https://doi.org/10.31893/multiscience.2024273

Susnjak, T. (2024). ChatGPT : The end of online exam integrity ? *Education Sciences*, *14*, 1–20. https://doi.org/10.3390/ educsci14060656

Tajik, E., & Tajik, F. (2024). A comprehensive examination of the potential application of Chat GPT in higher education institutions. *SSRN Electronic Journal*, *April*. https://doi.org/10.2139/ssrn.4699304

Tseng, Y.-C., & Lin, Y.-H. (2024). Enhancing english as a foreign language (EFL) learners' writing with ChatGPT: A university-level course design. *The Electronic Journal of E-Learning*, 78–97. https://doi.org/10.34190/ejel.21.5.3329

Valova, I., Mladenova, T., & Kanev, G. (2024). Students' perception of ChatGPT usage in education. *International Journal of Advanced Computer Science and Applications*, *15*(1), 466 – 473. https://doi.org/10.14569/IJACSA.2024.0150143

Vargas-Murillo, A. R., Pari-Bedoya, I. N. M. de la A., & Guevara-Soto, F. de J. (2023). Challenges and opportunities of AI-assisted learning: A systematic literature review on the impact of ChatGPT usage in higher education. *International Journal of Learning, Teaching and Educational Research*, *22*(7), 122 – 135. https://doi.org/10.26803/ijlter.22.7.7

You, S. (2024). A systematic review of the impact of ChatGPT on higher education. *International Journal of Technology-Enhanced Education*, *3*(1), 1–14. https://doi.org/10.4018/ijtee.343528

About the Contributor(s)

Rahyuni Melisa, is a master's student in English Education at Universitas Negeri Yogyakarta and works as an English teacher. Her research interests focus on learning English for foreign speakers.

Email: rahyunimelisa.2023@student.uny.ac.id
ORCID ID: https://orcid.org/0009-0005-9797-8367

Ashadi, is a Professor of English Education at Universitas Negeri Yogyakarta, where he serves as a lecturer and researcher. He has published numerous articles in reputable international journals. His research interests include English teaching and teacher development.
Email: ashadi@uny.ac.id
ORCID ID: https://orcid.org/0000-0002-5439-2041

Anita Triastuti, is a Professor of English Education at Universitas Negeri Yogyakarta, where she also lectures and researches. She has published extensively in reputable international journals. Her research interests include teacher cognition, instructional curriculum development, teacher education, and English language teaching.
Email: anitatria@uny.ac.id
ORCID ID: https://orcid.org/0000-0002-5485-1842

Sari Hidayati, holds a doctoral degree in English Education from Universitas Negeri Yogyakarta and works as a lecturer and researcher. She has published several articles in reputable international journals. Her research interests include teacher education and English language teaching.
Email: sari_hidayati@uny.ac.id
ORCID ID: https://orcid.org/0000-0002-0356-3074

Achmad Salido, is a lecturer and researcher at the Universitas Sembilanbelas November Kolaka. He is currently pursuing a doctoral degree in elementary education at Universitas Negeri Yogyakarta. His research interests include mathematics education, mathematical thinking, and elementary school mathematics education.
Email: achmadaldo28@gmail.com
ORCID ID: https://orcid.org/0009-0002-4941-7643

Priska Efriani Luansi Ero, is a doctoral student in elementary education at Universitas Negeri Yogyakarta and works as an elementary school teacher. Her research interests focus on elementary school education.
Email: priskaefriani.2022@student.uny.ac.id
ORCID ID: https://orcid.org/0009-0004-1424-8530

Cut Marlini, is a doctoral student in elementary education at Universitas Negeri Yogyakarta and works as a lecturer and researcher. Her research interests are in the field of elementary school education.
Email: cutmarlini.2022@student.uny.ac.id
ORCID ID: http://orcid.org/0009-0007-7612-6792

Zefrin, is a doctoral student in elementary education at Universitas Negeri Yogyakarta and works as an elementary school teacher. His research interests focus on elementary school education.
Email: zefrin.2022@student.uny.ac.id
ORCID ID: https://orcid.org/0009-0003-4180-5091

Zaki Al Fuad, is a doctoral student in elementary education at Universitas Negeri Yogyakarta and works as a lecturer and researcher. His research interests are in the field of elementary school education.
Email: zakial.2022@student.uny.ac.id
ORCID ID: https://orcid.org/0009-0008-2280-4815