INTERNATIONAL JOURNAL OF
EDUCATION, PSYCHOLOGY
AND COUNSELLING
(IJEPC)

www.ijepc.com

GAE
GLOBAL ACADEMIC EXCELLENCE

CHATGPT AND CRITICAL THINKING SKILLS IN HIGHER EDUCATION: AN OVERVIEW

Bawani Selvaraj[1*]

[1] Academy of Language Studies, Universiti Teknologi MARA Kedah
Email: wani190@uitm.edu.my
[*] Corresponding Author

Abstract:

Artificial intelligence (AI) is transforming the teaching and learning paradigm and this shift opens up new possibilities in improving educational outcomes. As a widely adopted tool in higher learning institutions, Chat Generative Pre-Trained Transformer (ChatGPT) helps students engage with content, provide prompt feedback as well as create a learning environment that is interactive. This paper examines three underpinning theoretical frameworks: Scaffolding Theory, Cognitive Load Theory and Dual-Process Theory, in relation to the integration of ChatGPT in educational pursuits. Secondly, it discusses the impact of ChatGPT on students' critical thinking skills in higher learning institutions. These aspects are often overlooked as previous research focus mainly on how ChatGPT enhances students' academic performance and issues pertaining to academic integrity. Hence, this paper offers a cohesive viewpoint that illustrates the incorporation of technology and critical thinking skills in complementing students' learning experiences. ChatGPT has the capacity to provide external assistance, manage limited cognitive resources and serve as facilitation strategy but in the same vein it could also inhibit the development of critical thinking skills. Thus, the use of AI in higher education remains a contested terrain and students need to be guided on how to use ChatGPT responsibly so that the academic standards are not compromised.

Keywords:

ChatGPT, Critical Thinking Skills, Higher Education

Introduction

Artificial intelligence (AI) is a game changer in the 21st century especially in the field of education (Silva & Janes, 2021). OpenAI is an organisation dedicated to developing and conducting research in many AI domains such as data science, robotics, machine learning and

natural language processing (NLP). Chat Generative Pre-Trained Transformer (ChatGPT) is a specific AI model developed by OpenAI, designed to generate text and facilitate conversations based on Generative Pre-Trained Transformer (GPT) architecture. According to Duarte (2025), about 800 million people use ChatGPT on a weekly basis, surpassing other platforms like Facebook and X (Twitter). It is ground breaking in terms of the way students learn to process information, generate learning materials and receive immediate feedback (Adiguzel et al., 2023; Melisa et al., 2025). AI plays a crucial role in tertiary education as it provides an interactive learning environment where students are able to brainstorm, understand complex concepts, get assistance in writing tasks or assignments and participate in academic discussions (Klayklung et al., 2023; Melisa et al., 2025). As such, AI encourages self-directed, autonomous learning by offering personalised resources and support (Baskara, 2023). In addition, educators can use AI to automate administrative tasks and come up with innovative teaching practices using digital platforms to engage and enhance students' learning experiences (Anandhi & Keerthana, 2024; Melisa et al., 2025).

Facione (1990) and 46 other panels who are experts in critical thinking instruction, assessment and theory define critical thinking (CT) as "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based" (p.2). It shows that CT is an integrative process where students should be able to evaluate information, formulate rational judgements and make informed decisions as it is an important part of independent, self-regulated learning (Dumitru & Halpern, 2023; Essien et al., 2024). The advent of AI raises concerns regarding the development of critical thinking skills among university students (Graefen & Fazal, 2024). Existing literature presents various perspectives, with some researchers cautioning that AI could hinder critical analytical skills as students become overly dependent on technology to navigate academic challenges, while others contend that AI can enhance learning when used effectively (Vargas-Murillo et al., 2023; Murtiningsih et al., 2024; Lavidas et al., 2024; Melisa et al., 2025). However, most studies contend that AI platforms are able to promote the development of critical thinking abilities by helping tertiary students organise complex ideas, fine-tune arguments and engage in reflective writing (Essel et al., 2024; Tseng & Lin, 2024). Berg and Plessis (2023) found that ChatGPT facilitates self-regulation when students evaluate AI generated responses, making critical thinking indispensable in the learning process. This paper examines three theoretical frameworks namely Scaffolding Theory, Cognitive Load Theory and Dual-Process Theory in the context of integrating and incorporating ChatGPT in educational pursuits as well as the impact of ChatGPT on students' critical thinking skills in higher learning institutions.

Literature Review

Artificial Intelligence in Higher Education
The incorporation of AI in higher learning institutions is not merely a technological innovation but a fundamental transformation that makes learning more personalised and dynamic (Abrami et al., 2008). ChatGPT's distinctive feature to work with natural language is one reason why it is relevant in the digital age and its use in higher learning institutions has increased significantly over the past two years (Qin et al., 2023; Lavidas et al., 2024). Its ability to disseminate information and ideas are mind-blowing, beyond what we could have ever imagined. Previous studies highlight the dual impact of AI on education, focusing primarily on technological and ethical implications rather than the effects on cognitive skills, such as critical thinking.

Sánchez-Ruiz et al. (2023) found that while students readily adopt AI for problem solving, there are apprehensions about its influence on the development of lateral thinking skills, particularly among engineering students. Rahman and Watanobe (2023) and Nikolic et al. (2023) examined the challenges posed by AI in relation to plagiarism and the authenticity of assessments. They expressed that AI's capability to produce almost perfect responses makes one question if it actually facilitates or hampers critical thinking abilities. However, integrating AI requires modifications in pedagogical methodologies, alongside technological infrastructure. In helping students learn use AI tools, educators need to have the right skills and knowledge as well. Some of the concerns policymakers should look into when making decisions are the digital divide, access and resource allocation to ensure that all students and instructors benefit from AI-enhanced education.

Ravšelj et al. (2025) carried out an online survey on how tertiary learners around the world - 109 countries and territories perceived the use of ChatGPT. Convenience sampling method was employed where 23,218 students (anonymity was preserved) from various faculties and departments voluntarily participated in this study. The minimum age requirement was 18 and they must be users of ChatGPT. Non-ChatGPT users were allowed to answer questions relevant to them. This study complied with the Declaration of Helsinki and General Data Protection Regulation (GDPR), to ensure informed consent and confidentiality of all participants. The questionnaire was translated into Italian, Spanish, Turkish, Japanese, Arabic and Hebrew as the respondents came from diverse cultures and backgrounds. It was then validated with students from Slovenia and pilot test was carried out to ensure its reliability. Forty-two questions (single-choice, open-ended questions and a 5-point Likert scale from 1 - strongly disagree / never to 5 - strongly agree / always) was used to elicit the following information.

1. Socio-demographic characteristics (12 questions)
2. Use of ChatGPT (6 questions)
3. Capabilities (1 question)
4. Regulation and Ethical Concerns (4 questions)
5. Satisfaction and Attitude (2 questions)
6. Study Issues and Outcomes (2 questions)
7. Skills Development (2 questions)
8. Labour market and skills mismatch (2 questions)
9. Emotions (1 question)
10. General Study and Personal Information (8 questions)
11. General Reflections on ChatGPT (1 question)
12. Respondents were also asked if they agree to receive the results of the study (1 question)

The data was analysed using independent t-test, analysis of variance (ANOVA) and Python Library SciPy. The findings indicated that ChatGPT does enhance their overall learning experiences and academic performance. However, it was found to be less effective in classroom learning, interpersonal communication and critical thinking skills among others. Plagiarism as well as social isolation were some of the concerns reported in this study. It is imperative to note that critical thinking skills are crucial for students in higher learning institutions and should be developed in tandem with technology.

Using ChatGPT to Think Critically

ChatGPT is an interactive platform that promotes active engagement, encouraging students to question their beliefs and assumptions in a multicultural world (You, 2024; Butler, 2024). It also acts as a personal online instructor, available round the clock. ChatGPT gives students detailed and comprehensive information, answers and solutions tailored to their needs and level of understanding (Limo et al., 2023; Verma et al., 2023; Melisa et al., 2025). Besides that, ChatGPT encourages and allows them to be curious, a process of inquiry where understanding is gauged via structured questioning. It also gives in-depth explanation on a wide range of topics, making difficult ideas easier to understand with the use of examples and analogies (Whalen & Mouza, 2023). Thus, university students can hone their critical thinking skills as it gives them the opportunity to come up with compelling and comprehensive arguments. Students often use ChatGPT to help them prepare for tests and exams. Interactive revisions make learning more effective especially for those who are academically challenged and with low self-esteem (Baidoo-Anu & Ansah, 2023). For language learners, this can encourage and help them improve their reading, writing, speaking and listening skills (Hong, 2023). However, when using ChatGPT to analyse texts, data or arguments, students are required to critically assess AI's output, comparing it with alternative sources in order to make informed decisions (Faisal, 2024). ChatGPT is also believed to hamper CT and a number of academic institutions have prohibited its use (Lampropoulos & Papadaki, 2025). As such, evaluative skills are pivotal and students must learn to deal with the complexities of AI-generated content, ensuring that their academic work is accurate and of high quality (Klimova et al., 2024). Educators too, must remind and guide their students to use ChatGPT ethically where critical engagement is vital and not as a quick option to complete their tasks.

Theoretical Frameworks

Scaffolding Theory (ST)

Scaffolding is a pedagogical approach that aligns with Vygotsky's (1978) concept of the zone of proximal development. The main goal of scaffolding is to help students build on what they already know and encourage them to be independent learners. Lecturers, teachers, instructors or peers provide temporary support to learners as they acquire new skills or knowledge. Instructional scaffolding is done explicitly by setting clear learning goals and giving students the right amount of help. The support in scaffolding is gradually phased out as learners becomes more competent, allowing them to work independently.

Table 1: How Scaffolding Works

STEP 1: Students' prior knowledge is determined
STEP 2: Setting of learning goals
STEP 3: Instructional strategies on how to break the tasks into smaller, manageable parts
STEP 4: Monitoring students' progress via formative feedback
STEP 5: Gradually phasing out support to encourage independent learning
STEP 6: Continuous monitoring on building content and feedback

Source: https://www.buffalo.edu/catt/teach/develop/build/scaffolding.html

Table 1 shows the workings of scaffolding and educators can use this technique in traditional and online classrooms. ChatGPT serves as an interactive support system that resonates with the fundamental principles of scaffolding. When a question is prompted, ChatGPT is able to come up with all the related information, effectively acting as an initial scaffold. This aligns

with the premise of providing comprehensive support at the early stages of learning. As students interact with ChatGPT, they develop a stronger foundation in problem-solving and regular users see ChatGPT as a way to improve and build on their existing critical thinking skills (Lee & Yeo, 2022; Fabio et al., 2025). However, scaffolding can be time consuming for instructors in terms of planning and implementing it to students of diverse learning needs. ChatGPT, which is supposed to act as a scaffold, may result in overreliance, hampering students' ability to work independently. Assessments too, may not indicate students' actual performance when information is readily available online.

Dual-Process Theory

The dual-process theory (DPT) has changed the way people think about education. Kahneman (2011) outlined two distinct modes of cognitive processing: System 1and System 2. System 1 functions automatically and intuitively, employing prior knowledge and beliefs to form quick judgements without deliberate effort (Cash et al., 2019; Okuhara et al., 2020; Fabio et al., 2025). Conversely, System 2 encompasses deliberate, regulated activities that necessitate enhanced cognitive resources, thereby promoting logical reasoning and critical analysis (Sowden et al., 2019; Zhao & Hu, 2021). Interaction with AI systems like ChatGPT can have significant impact on our thought processes. Long-term use of ChatGPT may cause cognitive dependence, making users become less engaged with System 2. However, ChatGPT's ability to automate information retrieval and processing can reduce the cognitive load on System 2, facilitating a more efficient allocation of cognitive resources in challenging tasks (Hapsari & Wu, 2022; Muthmainnah et al., 2022; Fabio & Suriano, 2023). One can also argue that there could be more to CT than a structured two-system theory as thinking processes cannot be quantified and compartmentalised (Bonnefon, 2018). Moreover, there are possibilities that System 1 could lead to errors in judgment and reasoning when making decisions based on emotion and intuition. As for System 2 which is logical, reflective, slow and deliberate, it can cause mental fatigue and this may result in students relying or resorting to System 1.

Table 2: Dual-Process Theory

System 1	System 2
Emotional	Logical
Intuitive	Reflective
Automatic	Slow
Making fast decisions	Making deliberate decisions

Source: Kahneman (2011). Thinking, Fast and Slow

Cognitive Load Theory

Cognitive Load Theory (CLT) asserts that learning is optimised when extraneous load is minimised (Sweller, 1998). CLT is based on the premise that working memory or short-term memory has a limited capacity and that overloading it can impact learning. Sweller (1998) contends that traditional problem-solving approaches place an excessive cognitive load on students, potentially hindering their learning. Cognitive overload occurs when mental effort needed to finish tasks exceeds the limits of working memory, compromising critical thinking and performance. CLT has been integral to educational research, synthesising concepts from cognitive psychology and instructional design to enhance learning, performance, and training results. Numerous studies support this theory as it provides a thorough understanding of the limitations and strengths of human information processing systems that can be employed to optimise learning environments and instructional strategies (Barbieri et al., 2025; Sundararajan

& Adesope, 2020). Its focus on aligning educational practices with cognitive strengths and limitations significantly influences the teaching and learning methodologies. ChatGPT plays a pivotal role in alleviating information overload. It can help manage cognitive load by taking on some of the cognitive tasks. When users are not overwhelmed by excessive information or complex tasks, their working memory functions more efficiently, leading to improved cognitive processing (Sweller & Chandler, 1994). The optimisation of critical thinking processes, facilitated by AI tools such as ChatGPT for processing complex information, is essential for reducing cognitive burden (Wojtowicz & Loewenstein, 2023). The question that arises is how do we measure cognitive load empirically and how can we determine when overloading occurs? As ChatGPT often gives extensive, detailed information (which could be inaccurate) there are possibilities that students lose interest in analysing or evaluating the information at hand.

The integrated relationship between ChatGPT and cognitive processes highlight the imperative need for external facilitation strategies. However, these frameworks are also open to criticisms as it is not a one- size shoe that fits all learners.

Discussion

An experimental study was carried out among 126 undergraduate and postgraduate students in Italy to investigate the role of ChatGPT in developing complex critical thinking skills and the underpinning theories in this research are scaffolding theory, dual-process theory and cognitive load theory (Fabio et al., 2025). Group 1 consists of 29 students who use ChatGPT two hours every day, Group 2 - 30 students who use ChatGPT one hour daily and the control group - 67 students who have never used ChatGPT. The respondents were randomly selected, between the age of 18-32 (mean age 24.27, SD 5.76). They belong to three different departments – Economics, Psychology and Sciences as the researchers wanted to ensure fair and diverse representation of students from various disciplines. Participation was voluntary, in line with Declaration of Helsinki and informed consent was given to the researchers before the study was carried out. The Ethics Review Board of the University, with the Prot. n. 0135087 del 25/1/2023 - [UOR: SI001165 - Classif. III/11] approved the study.

The instruments used were User Satisfaction Evaluation Questionnaire (USEQ) and Critical Reflective Assessment (CRA). User Satisfaction Evaluation Questionnaire (USEQ) was adapted from USEQ tool (Gil-Gómez et al., 2017; Bernava et al., 2021). It comprised of five items to elicit students' level of knowledge and prior experience with ChatGPT and one item indicating the primary use of ChatGPT on a 5-point Likert-type scale, ranging from 1 (not at all) to 5 (very much). The Cronbach's alpha coefficient was $\alpha = 0.83$, indicating a high degree of internal consistency. The Critical Reflective Assessment (CRA) was designed to evaluate critical thinking abilities through objective, task-based assessments (Fabio et al., 2025). This ensures that the data collected is less susceptible to bias. The one-hour assessment consists of three dilemmas and five questions related to it. For example, Dilemma 1 put forwards claims regarding drug abuse and participants were required to answer five questions by expressing their viewpoints and justifying it. The five dimensions of CRA are cognitive complexity, reasoning style, openness, nature of knowledge and nature of justification. The Cronbach's alpha for CRA is 0.87. Two experts in the field of critical thinking evaluated the responses and the Cohen's Kappa agreement coefficient was 0.95, signifying a high level of agreement between the assessors.

The results indicated that students who use ChatGPT have much better critical thinking skills than those who use it less or not at all (Fabio et al., 2025). Frequent ChatGPT users achieved higher critical thinking scores, however, no significant differences were found between infrequent users and non-users. The analysis revealed significant effects for the variables, with $F (2, 123) = 16.43$, $p < .01$, and $\eta^2 p = .29$. Post-hoc tests were conducted and the paired t-test revealed significant differences between the first and second experimental groups, with $t (58) = 2.32$, $p < 0.01$, and $d = 0.82$. This shows that the first group exhibited superior critical thinking abilities. Significant differences were also observed between the first experimental and control group. $t (101) = 4.11$, $p < .01$, $d = 0.89$, with the first experimental group indicating higher critical thinking levels. However, no significant differences were shown between the second experimental and control group, $t (95) = 0.51$, $p = .23$, $d = 0.81$.

The findings show that scaffolding theory is about giving learners short-term assistance in completing a task or goal and this is what ChatGPT does, acting as a scaffold in improving students' learning experiences. It is a structured interaction that encourages them to think critically by giving access to different ideas and perspectives (Vygotsky, 1978; Fabio et al., 2025). ChatGPT's ability to support cognitive dependence and cognitive resource management is linked to the dual-process theory, which emphasises in finding a balance between swift, instinctive responses and deliberate logical reasoning (Evans, 2008; Sowden et al., 2019). Cognitive load theory puts forward the idea that our working memory can only process a limited amount of information at a time, and ChatGPT can help students access information and organise data efficiently without causing cognitive overload (Sweller & Chandler,1994; Fabio et al., 2025).

The findings are consistent with Hapsari and Wu (2022) and Muthmainnah et al. (2022), who posited that regular interaction with AI conversational systems can improve critical thinking abilities among university students. ChatGPT's ability to feed information and encourage learners to look at things from different perspectives could help them improve their critical thinking skills. To further understand the effectiveness of this technology, educators can use chatbots to create real-life situations and give students interactive experiences that aid them in solving problems and improve their thinking abilities. This help learners understand concepts and rectify mistakes in real time by giving them immediate feedback and personalised solutions or suggestions. Tseng & Lin (2024) found that OpenAI's GPT-3.5 had a positive impact on students' writing skills at a Taiwanese university where fifteen junior and senior English majors participated in this study. Despite being non-native speakers, the use of GPT-3.5 allowed them to generate content, structure their essay logically, provide immediate feedback and reduce dependency on peer reviews. These positive outcomes once again reiterate the importance and significance of using AI applications in enhancing the learning process. Integrating ChatGPT into educational practices can enhance the quality of learning, problem solving and decision-making by fostering critical, analytical and reflective skills (Suriano et al., 2025; Klimova et al., 2024; Michalon & Camacho-Zuñiga, 2023; Stampfl et al., 2024).

Conclusion

While ChatGPT embodies numerous positive aspects, there are notable concerns associated with its usage in higher learning institutions. Among the drawbacks of ChatGPT is that it employs subsymbolic models (neural networks) where validity and reliability of the output remain questionable. When prompted further, ChatGPT acknowledges the fact that it had made errors in churning out incorrect information (Li et al., 2024). In some instances, ChatGPT can

generate a huge amount of data leading to AI hallucination (Arkoudas, 2023; Najafali et al., 2023). Furthermore, over-reliance on AI may inadvertently hinder the development of independent learning and critical thinking skills (Melisa et al., 2025). Even though chatbots can help students learn on their own, completely replacing human instruction is not without its problems. When students routinely use ChatGPT to answer questions or provide solutions without engaging deeply or addressing the underlying issues, they can develop a passive approach towards learning. Automated support can also pose challenges to academic integrity as students may submit AI-generated work as their own. This undermines the educational process and impedes the intrinsic nature of effective learning. In conclusion, AI can be a double-edged sword but the key here is balance – tools like ChatGPT should serve as a catalyst for critical thinking.

Acknowledgement

References

Abrami, P. C., Bernard, R. M., Borokhovski, E., Wade, A., Surkes, M. A., Tamim, R., & Zhang, D. (2008). Instructional Interventions Affecting Critical Thinking Skills and Dispositions: A Stage 1 Meta-Analysis. Review of Educational Research, 78(4), 1102-1134. https://doi.org/10.3102/0034654308326084   Adiguzel, T., Kaya, M. H., and Cansu, F. K. (2023). Transforming education with AI: Investigating the revolutionary capabilities of ChatGPT. *Contemporary Educational Technology*, 15(3). https://doi.org/10.30935/cedtech/13152

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

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

Arkoudas, K. (2023). ChatGPT is no stochastic parrot. But it alsoclaims that 1 is greater than 1. *Philosophy & Technology*, 36(3),54.

Baidoo-Anu, D., and Ansah, L. O. (2023). Education in the age of generative artificial intelligence (AI): Comprehending the prospective advantages of ChatGPT in enhancing teaching and learning. *Journal of AI*, 7(1), 52–62. https://doi.org/10.61969/jai.1337500

Barbieri, C. A., and Rodrigues, J. (2025). Using cognitive load theory to help students who have trouble with maths. *Educational Psychologist*, 60(3), 208–232. https://doi.org/10.1080/00461520.2025.2486138

Baskara, F. R. (2023). The advantages and disadvantages of employing ChatGPT for autonomous learning in higher education: An evaluative critique. *Proceedings of the National Seminar of the Faculty of Tarbiyah and Teacher Education*, IAIM Sinjai, 2, 95–101. https://doi.org/10.47435/sentikjar.v2i0.1825

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

Bernava, G., Nucita, A., Iannizzotto, G., Caprì, T., & Fabio, R. A. (2021). Proteo: A framework for serious games in telerehabilitation. *Applied Sciences, 11*(13), 5935. https://doi.org/10.3390/ app11135935

Bonnefon, Jean-François (2018). The Pros and Cons of Identifying Critical Thinking with System 2 Processing. Topoi 37 (1):113-119.

Butler, H. A. (2024). Predicting Everyday Critical Thinking: A Review of Critical Thinking Assessments. Journal of Intelligence, 12(2), 16.

Cash, P., Daalhuizen, J., Valgeirsdottir, D., and Van Oorschot, R. (2019). A theory-driven design research agenda: Investigating dual-process theory. In the Proceedings of the Design Society: *International Conference on Engineering Design*, 1(1). Cambridge University. https://doi.org/10.1017/dsi.2019.143

Duarte, Fabio. (2025). Number of ChatGPT Users (July 2025). https://explodingtopics.com/blog/chatgpt-users

Dumitru, D., & Halpern, D. F. (2023). Critical Thinking: Creating Job-Proof Skills for the Future Of Work. Journal of Intelligence, 11(10), https://doi.org/10.3390/jintelligence11100194

Essien, A., Bukoye, O. T., O'Dea, X., and Kremantzis, M. (2024). The impact of AI text generators on the development of critical thinking skills in business schools in the UK. *Studies in Higher Education,* 49(5), 865–882.

Essel, H. B., Vlachopoulos, D., Essuman, A. B., and Amankwa, J. O. (2024). ChatGPT's effects on undergraduates' cognitive skills: Getting instant answers 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

Evans, J. S. B. (2008). Two-way accounts of judgement, reasoning, and social cognition. *Annual Review of Psychology*, 59(2), 255–278.

Fabio, R. A., and Suriano, R. (2023). The effect of smartphone usage on tweens' ability to engage in complex critical thinking, *Children*. 10(4), 698.

Fabio, R. A., Plebe, A., and Suriano, R. (2025). An exploratory investigation into the correlation between critical thinking skills and interactions with AI-driven chatbots. *Current Psychology*, 44(9).

Facione, P.A. (1990). *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction*. California Academic Press.

Faisal. (2024). A systematic review of the benefits of ChatGPT can help Saudi Arabian higher education reach its full potential. *Frontiers in Education*, (9). 1–12. https://doi.org/10.3389/feduc.2024.1325601

Gil-Gómez, J. A., Manzano-Hernández, P., Albiol-Pérez, S., Aula- Valero, C., Gil-Gómez, H., & Lozano-Quilis, J. A. (2017). USEQ: A short questionnaire for satisfaction evaluation of virtual rehabilitation systems. *Sensors (Basel, Switzerland),* 17(7), 1589. https://doi.org/10.3390/s17071589

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

Hapsari, I. P., & Wu, T. T. (2022). The AI Chatbots learning model for English speaking skills: Reducing anxiety about speaking, making it more fun, and encouraging critical thinking. *In the International Conference on Innovative Technologies and Learning*, 444–453. Springer International Publishing. https://doi.org/10.1007/978-3-031-15273-3_49

Hong, W. C. H. (2023). The effect of ChatGPT on the instruction and acquisition of foreign languages: Prospects in academia and research. *Journal of Educational Technology and Innovation*, 5(1). https://doi.org/10.614/jeti.v5i

https://www.buffalo.edu/catt/teach/develop/build/scaffolding.html

Kahneman, D. (2011). *Thinking, Fast and Slow*, Penguin Books, London.

Klimova, B., Pikhart, M., and Al-Obaydi, L. H. (2024). Investigating the potential of ChatGPT for higher education in foreign languages. *Frontiers in Psychology*, 15. 1–10. https://doi.org/10.3389/fpsyg.2024.1269319

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

Lampropoulos, Georgios & Papadakis, Stamatios. (2025). The Educational Value of Artificial Intelligence and Social Robots. 10.1007/978-3-031-82915-4_1.

Lavidas, K., Voulgari, I., Papadakis, S., Athanassopoulos, S., Anastasiou, A., Filippidi, A.,

Komis, V., & Karacapilidis, N. (2024). Determinants of Humanities and Social Sciences Students' Intentions to Use Artificial Intelligence Applications for Academic Purposes. Information, *15*(6), 314. https://doi.org/10.3390/info15060314

Lee, D., and Yeo, S. (2022). Creating an AI-powered chatbot to help with responsive maths teaching. Computers & Education, 191. 104646.

Li, B., Wang, C., Bonk, C. J., & Kou, X. (2024). Exploring inventions in self-directed language learning with generative AI: Implemen¬tations and perspectives of YouTube Content Creators. Tech¬Trends, 1–17.

Limo, F. A. F., Tiza, D. R. H., Roque, M. M., Herrera, E. E., Murillo, J. P. M., Huallpa, J. J.,

and Gonzáles, J. L. A. (2023). ChatGPT as a virtual tutor for personalised learning experiences. Przestrzeń Społeczna (Social Space),23(1). 293–312

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

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

Murtiningsih, S., Sujito, A., and Khin Soe, K. (2024). Difficulties of employing ChatGPT in educational contexts: an analysis of digital pedagogy. *International Journal of Evaluation and Research in Education (IJERE)*, 13(5). https://doi.org/10.11591/ijere.v13i5.29467

Muthmainnah, Ibna Seraj, P. M., and Oteir, I. (2022). Playing with AI to learn about technology that lets people and computers work together and to get better at critical thinking in order to keep up with the 21st century. *International Journal of Education Research*, https://doi.org/10.1155/2022/6468995

Najafali, D., Camacho, J. M., Reiche, E., Galbraith, L. G., Morrison, S. D., & Dorafshar, A. H. (2023). Truth or lies? The pitfalls and limitations of ChatGPT in systematic review creation. *Aesthetic Surgery Journal,* 43, 654–NP655. https://doi.org/10.1093/asj/sjad093

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 cross-disciplinary and multi-institutional evaluation and analysis of this generative artificial

intelligence tool to examine assessment integrity. *European Journal of Engineering Education*, 48(4), 559–614. https://doi.org/10.1080/03043797.2023.2213169

Okuhara, T., Ishikawa, H., Okada, H., Ueno, H., & Kiuchi, T. (2020). Dual-process theories to combat the anti-vaccination movement. *Preventive Medicine Reports*, 20. https://doi. org/10.1016/j.pmedr.2020.101205

Qin, C., Zhang, A., Zhang, Z., Chen, J., Yasunaga, M., & Yang, D. (2023). *Is ChatGPT a universal natural language processing task solver?* arXiv Preprint, arXiv:2302.06476. https://doi. org/10.48550/arXiv.2302.06476

Rahman, M. M., and Watanobe, Y. (2023). ChatGPT for education and research: Prospects, challenges, and approaches. *Applied Sciences,*13(9). https://doi.org/10.3390/app13095783

Ravšelj, D., Keržič, D., Tomaževič, N., Umek, L., Brezovar, N., A Iahad, N., Abdulla, A. A., Akopyan, A., Aldana Segura, M. W., AlHumaid, J., Allam, M. F., Alló, M., Andoh, R. P. K., Andronic, O., Arthur, Y. D., Aydın, F., Badran, A., Balbontín-Alvarado, R., Ben Saad, H., Bencsik, A., … Aristovnik, A. (2025). Higher education students' perceptions of ChatGPT: A global study of early reactions. PloS one, 20(2), e0315011. https://doi.org/10.1371/journal.pone.0315011

Sánchez-Ruiz, L. M., Moll-López, S., Nuñez-Pérez, A., Moraño-Fernández, J. A., & Vega-Fleitas, E. (2023). ChatGPT contests integrated learning approaches in engineering education: A case study in mathematics. *Applied Science,* 13. https://doi.org/10.3390/app13106039

Silva, A. de O. and Janes, D. dos S. (2021). The rise of ChatGPT and what it means 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

Sowden, P. T., Pringle, A., & Gabora, L. (2019). The changing nature of creative thinking: Links to dual-process theory. *In Insight and Creativity in Problem Solving ,*40(60). Routledge.

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

Sundararajan, N., and Adesope, O. (2020). Maintain coherence: A meta-analysis of the seductive details effect. *Educational Psychology Review*, 32(3),.707–734.

Suriano, R., Plebe, A., Acciai, A., and Fabio, R. A. (2025). Students can improve their ability to think critically in complex ways by using ChatGPT. *Learning and Instruction*, 95. 102011.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, *12*(2).257–285. https://doi.org/10.1207/s15516709cog1202_4

Sweller, J., & Chandler, P. (1994). Why some things are hard to learn. *Cognitive Science*, 18(3).367–397.

Tseng, Y.-C., and Lin, Y.-H. (2024). A university-level course design for improving the writing of English as a foreign language (EFL) students with ChatGPT. The Electronic Journal of E-Learning, 78–97. https://doi.org/10.34190/ejel.21.5.3329

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

Verma, G., Campbell, T., Melville, W., & Park, B. Y. (2023). Navigating the opportunities and challenges of artificial intelligence: Chat-GPT and generative models in science teacher education. Journal of Science Teacher Education,34(8). 793–798.

Vygotsky, L.S. (1978). Mind in society: The evolution of advanced psychological processes. Harvard University Press.

Whalen, J., & Mouza, C. (2023). ChatGPT: Challenges, opportunities, and ramifications for teacher education. *Contemporary Issues in Technology and Teacher Education*, 23(1). 1–23.

Wojtowicz, Z., and Loewenstein, G. (2023). Cognition: An inquiry into mental economy. *Cognitive Science*,*47*(2). e13252. https://doi.org/10.1111/cogs.13252

You, S. (2024). A methodical examination of ChatGPT's influence on higher education. *International Journal of Technology-Enhanced Education*, 3(1). 1–14. https://doi.org/10.4018/ijtee.343528

Zhao, C., and Hu, Y. (2021). Reflections on adjustments to study strategies employing cognitive load theory and dual processing theory during the initial year of medical school. *Medical Science Educator*, 31, 813–818. https://doi.org/10.1007/s40670-020-01198-3