Ed Process Int J | www.edupij.com
ISSN 2147-0901 | e-ISSN 2564-8020
2023 | ÜNİVERSİTEPARK

EDUCATIONAL PROCESS
INTERNATIONAL JOURNAL

REVIEW ARTICLE

How Can ChatGPT Facilitate Teaching and Learning: Implications for Contemporary Education

Turgut Karakose · Tijen Tülübaş

ARTICLE HISTORY
Received *July 15, 2023*
Accepted *October 19, 2023*
Published Online *November 4, 2023*

CORRESPONDENCE
Turgut Karakose
turgut.karakose@dpu.edu.tr
Faculty of Education, Kutahya Dumlupinar University, Evliya Celebi Campus, 43100, Kutahya, Türkiye.

AUTHOR DETAILS
Additional information about the author is available at the end of the article.

How to cite: *Karakose, T., & Tülübaş, T. (2023). How Can ChatGPT Facilitate Teaching and Learning: Implications for Contemporary Education. Educational Process: International Journal, 12(4): 7-16.*

Background/purpose – ChatGPT stands before educational professionals with all its benefits and pitfalls, urging them to maximize its benefits for all levels of education while consistently searching for ways to minimize its risks. In the same vein, it is gradually recognized as a promising tool to serve the needs of students in the contemporary and forthcoming society. To this end, the present paper seeks to accumulate the wealth of opportunities ChatGPT can offer for the benefit of learners and teachers while also arguing over some implications of this new technology for educational leaders and policy makers.

Materials/methods – This is an argumentative writing based on a review of the literature on the potential benefits of ChatGPT for learning and teaching.

Practical implications – ChatGPT provides students with personalized learning environments, individualized tutoring/feedback, and a great bunch of learning materials. When used with proper guidance and awareness, ChatGPT can facilitate the development of twenty-first century 4C skills (collaboration, communication, critical thinking, and creativity) as well as supporting students with disabilities or learning difficulties. ChatGPT can also help teachers enrich their instruction through providing them with creative ideas and solutions as well as helping them write lesson plans, develop presentations, reach content and materials tailored to their students' needs. ChatGPT can also assist teachers while assessing student work or performance, preparing exams, or designing evaluation rubrics. Recent AI-based technologies such as ChatGPT require the combined efforts of educational leaders and policy makers to prepare a digital- friendly ecology in schools to maximize the benefits of such technologies.

Conclusion – ChatGPT offers many opportunities that could transform the goals, content, processes, and approaches of teaching in a way that caters for the needs of students as the citizens of the future society.

Keywords – ChatGPT, education, artificial intelligence, AI-based technologies, teaching, learning, chatbots

To link to this article – https://dx.doi.org/10.22521/edupij.2023.124.1

1. INTRODUCTION

The twenty-first century has become an era where humanity witnessed unprecedently rapid changes in their lives with the invention of groundbreaking technologies. Recent developments in the field of artificial intelligence (AI) have even brought a new age of change and innovation with all the novel tools and applications providing numerous uses (Adigüzel et al., 2023; Zhai, 2023). With its constantly improving capability to perform tasks that require human intelligence such as understanding and producing human language, learning, or solving complex problems that require both knowledge and wit (Ağaoğlu et al., 2012; Ouyang et al., 2022), AI has already made inroads into a variety of fields including education, and has already been assumed to be a promising tool to serve the needs of students in the contemporary and forthcoming society (Murad et al., 2023; Zhai et al., 2020).

Developments in the science and engineering of AI-based systems have also generated another cutting-edge technology called chatbots, which are defined as intelligent agents capable of processing human language and engaging into human-like conversations (Caldarini et al., 2022; Clarizia et al., 2018). Since the first chatbot, Eliza, was released in 1966 with the role of a psychotherapist, several other chatbots have been developed to serve different purposes such as Apple Siri, Microsoft Cortana, and IBM Watson (Adiguzel et al., 2023; Jeon & Lee, 2023). More recently, though, the most advanced version of an AI-based chatbot was launched under the name ChatGPT (Chat Generative Pre-trained Transformer), which is a large language model (LLM) powered by natural language processing (NLP) technology (Brown et al., 2020). Due to being trained on a vast amount of internet data and capable of self-learning from its interactions with people, ChatGPT is able to produce more credible and plausible responses to queries, and to engage into a more genuine dialogue with its users as compared to previous chatbots (Sobania et al., 2023). ChatGPT also demonstrates the unique feature of remembering and incorporating previous conversations, and thus generating personalized responses depending on the context, tone, needs, or preferences of the user. Having this function, the interaction with ChatGPT gets even more personalized with each round of conversation (Farrokhnia et al., 2023).

Despite the dramatic interest of people with diverse backgrounds short after its first release, ChatGPT has inspired both enthusiasm and skepticism (Su and Yang, 2023), as is often the case in the history of humanity engaging with novelties (Matthews, 2023). Upon the discovery of writing, for example, Plato stated that 'this invention will produce forgetfulness in the minds of those who learn to use it because they will not practice their memory' while, in the same vein, the invention of Google in 2008 inspired a similar interrogation: 'Is Google making us stupid?'. Likewise, when the printing press was first developed, Trithemius, the renowned scholar of the time, argued that handwriting would always be far superior to printing. However, the printing press became a critical turning point in history through taking knowledge from the hands of the few privileged and disseminating it to masses, which in the long run instigated the scientific revolution, French Revolution or the enlightenment era (Henriksen et al., 2023). Take, for instance, the invention of mobile phones, upon which a telecommunications consultant stated that 'But who, today, will say I'm going to ditch the wires in my house and carry the phone around?' in a public speech while the father of mobile phone, Mark Cooper iterated that "cellular phones will absolutely not replace local wire systems. … Even if you project it beyond our lifetimes, it won't be cheap enough'.

The launch of ChatGPT has sparked similar debates about its potential harms and benefits, particularly in the field of education (Farokhnia et al., 2023; Karakose, 2023; Luo et

al., 2023). Some countries or districts even opted for banning the use of ChatGPT for ethical concerns or legal gaps in its use (Whalen & Mouza, 2023), and some universities banned it with concerns over plagiarism and its overuse by students (Times Higher Education, 2022). However, as ChatGPT itself underlined once (Tlili et al., 2023, 18), 'chatbots are here to stay, for better or for worse', and banning or underrating its potential would not simply work. A consensus is already growing among the scholars that ChatGPT harbors significant potential to enhance the delivery of instruction, and leverage student learning with its groundbreaking capabilities of providing its users with adaptive, personalized environments (Atlas, 2023; Luo et al., 2023; Opara et al., 2023). ChatGPT 'offer[s] novel opportunities for educational transformation' (Zhai, 2023, 1), 'provide[s] novel resources that enrich learning experiences beyond conventional methods' (Jeon & Lee, 2023, 2), 'has considerable potential to improve learning, teaching, pedagogical innovations, assessment, and educational administration' (Adiguzel et al. 2023, 4), and acts as a significant 'catalyst for enriching the pedagogical experience' (Murad et al. 2023, 21) as well as educational reforms (Zhai, 2023).

As the arguments over ChatGPT continue, one thing seems to be almost certain that this groundbreaking and rapidly evolving technology has a strong potential to change the way we teach and learn, perhaps for better or worse (Whalen & Mouza, 2023). However, ChatGPT stands before us with all its benefits and pitfalls, urging us to maximize its benefits for all levels of education while consistently searching for ways to minimize its risks (Luo et al., 2023; Zhu et al., 2023). To this end, the present paper seeks to accumulate the wealth of opportunities ChatGPT could offer for the benefit of learners and teachers while also arguing some implications of this new technology for the role of the educational leaders and policy makers so that the required ecology of learning for the twenty-first century student could be established.

2. Key Educational Benefits of ChatGPT

2.1. ChatGPT as a Student Aide

ChatGPT can enhance the learning experience of students in several ways, and thus helps improve their learning outcomes and performance. To begin with, as Zhu et al. (2023) emphasized, ChatGPT potentially offers many opportunities to support the four typical interactions required for effective learning; (1) interaction with learning content (e. g. materials), (2) interaction with others (e. g. teachers, peers), (3) interaction with self (e. g. self-reflection and self-regulation), and (4) interaction with problem-solving tasks (e. g. upgrading knowledge and applying it to situations).

To begin with, ChatGPT can support both the cognitive and affective aspects of students' learning experience through offering a personalized learning environment, and harnessing student motivation in several ways (Xia et al., 2022; Kim et al., 2021). Due to its capacity to facilitate interactive learning and promote individual learning needs, students' engagement with ChatGPT can maximize their abilities and motivation to learn, which would substantially improve their academic performance (Murad et al., 2023). The individualized tutoring and feedback provided by ChatGPT in any subject or task helps students receive timely guidance to understand complex problems or concepts, experiment with more hands-on learning, and engage in practice through a set of individually designed exercises or exam models (Rospigliosi, 2023; Luo et al., 2023). As ChatGPT can understand and respond to queries in several languages, it offers a great advantage for students to receive instant tutoring through asking any questions (Mhlanga, 2023; Sok & Heng, 2023). As a tutor, ChatGPT can facilitate a broad variety of skills such as writing, reading, solving problems of math or physics, and

practicing code writing/programming (Kasneci et al., 2023; Rahman & Watanobe, 2023; Whalen & Mouza, 2023; Yılmaz & Yılmaz, 2023). It can also support students through suggesting useful learning materials such as practice sheets, textbooks, videos, or podcasts that align with their personal needs or preferences (Murad et al., 2023; Xiao, 2023). Through tailoring these cognitive needs, ChatGPT also supports the affective domain of learning as it is reported to provide a more favorable learning experience, more comfortable learning environment, increased self-confidence and reduced anxiety of learning (Adiguzel et al., 2023).

ChatGPT is also considered a practical means of students' interaction with self through promoting their self-directed learning skills (Elbanna & Armstrong, 2023; Murad et al., 2023). The instant and individualized feedback provided by ChatGPT encourage self-regulation and self-reflection, which helps students develop their metacognitive skills and make better decisions to direct their academic performance (Adiguzel et al., 2023; Chiu et al., 2023). In addition, ChatGPT can enhance students' problem-solving skills and encourage them to think out of the box through providing explanations and step-by-step solutions to complex problems (Rahman & Watanobe, 2023).

Regarding the interaction with others, the one-on-one tutoring offered by ChatGPT can compensate for the inadequate self-paced learning opportunities or one-on-one guidance in classrooms with high student-teacher ratios (Chen et al., 2023; Opara et al., 2023). As suggested by Bloom (1984) long ago, such customized learning applications, often absent in traditional classrooms, are essential to enhance student academic performance.

When used with proper guidance and awareness, ChatGPT also bears strong potential to support the development of 4C skills of the twenty-first century; i.e. collaboration, communication, critical thinking, and creativity. The AI technology undergirding ChatGPT is capable of furnishing students' deep thinking and complex skills, which essentially promotes their critical thinking and creativity (Adiguzel et al., 2023; Chiu et al., 2023). For instance, ChatGPT can challenge students through asking questions tailored to their proficiency level or provide them with opportunities of peer assessment, which stimulate their critical thinking to a great extent (Cotton et al., 2023). Similarly, as an intelligent conversational agent, ChatGPT can facilitate students' communication skills through engaging students into debates where they can develop their argumentative skills (Farrohnia et al., 2023), providing interactive conversations in differing contexts where students can practice using social cues appropriately and following the etiquette (Luo et al., 2023). ChatGPT could even satisfy the curiosity of young children and cater for their love for asking questions through answering their endless questions without getting tired and annoyed, which in turn supports their creativity (Luo et al., 2023).

One final benefit of ChatGPT could be for students with disabilities or learning difficulties, who often remain underserved in the contemporary educational environments (Jain et al., 2018; Kasneci et al., 2023). ChatGPT can support the learning journey of these students through designing resources or materials tailoring their special needs, and offering an adjusted learning content and pace (Mhlanga, 2023). As Rahman and Watanobe (2023) suggested, for example, ChatGPT can support the disabled with text-to-speech and speech-to-text integrations. Similarly, with its AI-based technologies, ChatGPT can foster the reading skills of dyslexic students or improve the academic performance of students with autism spectrum disorder (Adiguzel et al., 2023).

2.2. ChatGPT as a Teacher Aide

The fact that ChatGPT offers a wealth of opportunities to promote personalized learning does not mean that the teacher will become redundant but assigns novel roles and stronger responsibilities to teachers (Bower, 2019). Much research on AI-augmented learning environments highlights that the best results could only be achieved with the effective human-AI collaboration, and human teachers are expected to enrich this experience through approaching the process with novel goals, perspectives, acts and decisions (Jeon & Lee, 2023). Technological innovations like ChatGPT have already made knowledge transfer and acquisition much easier than before, changing the knowledge transferring role of the teacher to the role of providing support and assistance so as to harness students' skills to access sources of knowledge, to evaluate knowledge critically, and to form a holistic view of the world through combining these bits of information (Tsai, 2023; Xiao, 2023).

ChatGPT could also become a useful tool for teachers to manage various tasks such as teaching content generation, lesson planning, student assessment and grading (Mondal et al., 2023). Earlier research showed that ChatGPT is capable of offering comprehensive and creative lesson plans (Farrokhnia et al., 2023; Karakose et al., 2023a; Whalen & Mouza, 2023), generating a range of slides for classroom presentations with texts adjusted for students with different age or level (Herft, 2023; Mondal et al., 2023), facilitating their teaching through new ideas and strategies to teach (Luo et al., 2023), and aiding to design customized materials and content in accordance with the course or student requirements (Mondal et al., 2023; Zai, 2023).

With all this support, ChatGPT can help teachers save significant amount of time, which they could use to enhance the quality of their instruction or to engage in professional development. ChatGPT could even itself provide teachers with numerous ways of developing their pedagogical skills and enriching their instruction (Sok & Heng, 2023). Teachers can also use this time to offer more one-to-one feedback to students and design more engaging and differentiated activities in accordance with students' needs and interest (Luo et al., 2023).

Another domain that ChatGPT supports teachers can be the assessment and feedback generation process. ChatGPT can provide teachers with intelligent assistance in generating assessment tools or marking students' work. Although AI-technology has not been developed sufficiently to provide consistent and truthful assessment without guidance, ChatGPT still bears the capability of helping teachers to produce multiple choice or open-ended questions, identify the lexical or grammatical mistakes in written work, score multiple-choice exams, or develop rubrics that may guide both the teacher and the students to evaluate their performance (Cotton et al., 2023; Farrokhnia et al., 2023; Opara et al., 2023).

Implications for Educational Leaders and Policy Makers

The recent developments in the realm of technology are urging educational revolution not only through challenging the traditional methods and approaches of teaching/learning but also requiring substantial changes in the mindsets of educational professionals so as to develop newer perspectives into training students as the citizens of a digital society, and devising novel interventions to equip students with the newly required skill sets. This transformation would not only be achieved through upgrading the competencies and pedagogical practices of teachers, but requires a more global effort of educational leaders and policy makers (Karakose et al., 2023b; Limna et al., 2022; Zhai, 2023).

Under these circumstances, educational leaders are required to practice digital leadership, perhaps more than ever before to construct a digital friendly ecology in schools (Karakose & Tülübaş, 2023; Karakose et al., 2023c). As open-minded, resilient and adaptable leaders equipped with the knowledge of innovative technologies, these educational leaders can maximize the benefits of recent technologies for teaching and learning (Karakose et al., 2021; Tülübaş, Karakose, & Papadakis, 2023; Karakose et al., 2022). In the same vein, policy makers are now expected to practice such leadership through 'engage[ing] in an ongoing process to develop, implement and communicate technology-infused strategic plans aligned with a shared vision … to create, promote and sustain a dynamic, digital age learning culture that [eventually] provides a rigorous, relevant and engaging education for all students' (ISTE, 2023).

Considering the significant impact of today's AI-based technologies, particularly in the case of ChatGPT, it is crucial that educational leaders rationally assess the current situation and develop an appropriate future education plan (Rahman & Watanobe, 2013), and form a balanced response to harness its benefits as well as being vigilant to its pitfalls (Luo et al., 2023). While 'preparing students to thrive in a technology-driven world' (Henriksen et al., 2023), it is equally important 'not to resort to simple and crude blocking measures' (Luo et al., 2023) but to develop effective solutions that ensure the ethical and responsible use of technologies such as ChatGPT (Mhlanga, 2023; Murad et al., 2023). This might necessitate a revaluation of traditional approaches to student learning and assessment as our experiences during COVID-19 revealed (Elbanna & Armstrong, 2023; Tlili et al., 2023) as well as being consistently vigilant to the new developments in the potential of such innovations and provide teachers and students with the training to ensure their beneficial use in educational practice (Jeon & Lee, 2023; Zhu et al., 2023).

3. CONCLUSION

ChatGPT is neither the first AI-based technology that urged a reconsideration of conventional approaches to teaching and learning, nor will it be the last one. In Kranzberg's (1986, 545) terms, ChatGPT is in fact 'neither good nor bad; nor is it neutral', but the way we use it determine whether it will bring benefits or harm (Tülübaş et al., 2023; Whalen & Mouza, 2023). However, recent interest in ChatGPT has shown that it offers a new sea of opportunities that could transform the goals, content, processes, and approaches of teaching in a way that caters for the needs of students as the citizens of a future society that is likely to integrate such intelligent technologies to all aspects of life (Henriksen et al., 2023; Xiao, 2023; Zhai, 2023).

More significantly, as a Professor in Luo et al.'s (2023, 14) study articulated, ChatGPT should better be considered 'as intelligence augmentation (IA), augmenting our human intelligence, as opposed to the technology becoming intelligent. Therefore, we should benefit the variety of resources and facilities that ChatGPT offers in designing tasks that 'cultivate unique skills in students beyond the capabilities of machines' (Zhai, 2023).

DECLARATIONS

Author Contributions Both authors contributed equally to the current research, and they read and approved the final published version of the article.
Conflicts of Interest The author declared no potential conflicts of interest.
Funding The author received no financial support for this article.

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), ep429. https://doi.org/10.30935/cedtech/13152

Ağaoğlu, E., Altınkurt, Y., Yılmaz, K., & Karakose, T. (2012). Opinions of school administrators and teachers about proficiency of school administrators (In Kütahya). *Education and Science,* 37(164), 159-175.

Atlas, S. (2023, July 23). ChatGPT for higher education and professional development: A guide to conversational AI. https://digitalcommons.uri.edu/cba_facpubs/548

Bloom, B. S. (1984). The 2-sigma problem: The search for methods of group instruction as effective as one-to-one tutoring. *Educational Researcher, 13*(6), 4-16. https://doi.org/10.3102/0013189X013006004

Bower, M. (2019). Technology-mediated learning theory. *British Journal of Educational Technology, 50*(3), 1035-1048. https://doi.org/10.1111/bjet.12771

Brown, T. B., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., Neelakantan, A., Shyam, P., Sastry, G., Askell, A., Agarwal, S., Herbert-Voss, A., Krueger, G., Henighan, T., Child, R., Ramesh, A., Ziegler, D. M., Wu, Jeffrey, Winter, C. …, & Amodei, D. (2020). Language models are few-shot learners. *arXiv*. https://arxiv.org/abs/2005.14165

Caldarini, G., Jaf, S., & McGarry, K. (2022). A literature survey of recent advances in Chatbots. *Information, 13*(1), 41. https://doi.org/10.3390/INFO13010041

Chen, Y., Jensen, S., Albert, L. J., Gupta, S., & Lee, T. (2023). Artificial intelligence (AI) student assistants in the classroom: Designing chatbots to support student success. *Information Systems Frontiers, 25*(1), 161-182. https://doi.org/10.1007/s10796-022-10291-4

Chiu, T. K. F., Moorhouse, B. L., Chai, C. S. &, Ismailov, M. (2023). Teacher support and student motivation to learn with Artificial Intelligence (AI) based chatbot. *Interactive Learning Environments*. https://doi.org/10.1080/10494820.2023.2172044

Clarizia, F., Colace, F., Lombardi, M., Pascale, F., & Santaniello, D. (2018). Chatbot: An education support system for student. *International symposium on cyberspace safety and security.* Springer. https://doi.org/10.1007/978-3-030-01689-0_23

Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, 1–12. https://doi.org/10.1080/14703297.2023.2190148

Elbanna, S., & Armstrong, L. (2023). Exploring the integration of ChatGPT in education: adapting for the future. *Management & Sustainability: An Arab Review*. https://doi.org/10.1108/MSAR-03-2023-0016

Farrokhnia, M., Banihashem, S. K., Noroozi, O., & Wals, A. (2023). A SWOT analysis of ChatGPT: Implications for educational practice and research. *Innovations in Education and Teaching International*, 1-15. https://doi.org/10.1080/14703297.2023.2195846

Henriksen, D., Woo, L. J., & Mishra, P. (2023). Creative uses of ChatGPT for education: a conversation with Ethan Mollick. *TechTrends*, 67, 595–600. https://doi.org/10.1007/s11528-023-00862-w

Herft, A. (2023, August 3). A teacher's prompt guide to ChatGPT aligned with 'what works best'. https://drive.google.com/file/d/15qAxnUzOwAPwHzoaKBJd8FAgiOZYcIxq/view?fbclid=IwAR2fRdL5ggq4zU-81FiI8j4BAOp5HqWHC_Ecy2sqKk4EiWXL0FKa5GVz5dE&pli=1 https://doi.org/10.1080/10447318.2020.1801227

International Society for Technology in Education (ISTE). (2023, March 8). Standards for educational leaders. https://www.iste.org/standards/istestandards-for-education-leaders

Jain, M., Kumar, P., Bhansali, I., Liao, Q., Truong, K., & Patel, S. (2018). FarmChat: A conversational agent to answer farmer queries. *Proceedings of ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, 2(4), 1-22. https://doi.org/10.1145/3287048

Jeon, J., & Lee, S. (2023). Large language models in education: A focus on the complementary relationship between human teachers and ChatGPT. *Education and Information Technologies,* 1-20. https://doi.org/10.1007/s10639-023-11834-1

Karakose, T. (2023). The utility of ChatGPT in educational research—Potential opportunities and pitfalls. *Educational Process International Journal*, *12*(2), 7-13. e–https://doi.org/10.22521/edupij.2023.122.1

Karakose, T., & Tülübaş, T. (2023). Digital leadership and sustainable school improvement—A conceptual analysis and implications for future research. *Educational Process International Journal, 12*(1), 7-18. https://doi.org/10.22521/edupij.2023.121.1

Karakose, T., Demirkol, M., Aslan, N., Köse, H., & Yirci, R. (2023a). A conversation with ChatGPT about the impact of the COVID-19 pandemic on education: a comparative review based on human–AI collaboration. *Educational Process: International Journal, 12*(3), 7-25. doi:10.22521/edupij.2023.123.1

Karakose, T., Demirkol, M., Yirci, R., Polat, H., Ozdemir, T. Y., & Tülübaş, T. (2023b). A Conversation with ChatGPT about Digital Leadership and Technology Integration: Comparative Analysis Based on Human–AI Collaboration. *Administrative Sciences, 13*(7), 157. https://doi.org/10.3390/admsci13070157

Karakose, T., Kocabas, I., Yirci, R., Papadakis, S., Ozdemir, T. Y., & Demirkol, M. (2022). The development and evolution of digital leadership: A bibliometric mapping approach-based study. *Sustainability, 14*(23), 16171. https://doi.org/10.3390/su142316171

Karakose, T., Tülübaş, T., Papadakis, S., Yirci, R. (2023c). Evaluating the Intellectual Structure of the Knowledge Base on Transformational School Leadership: A Bibliometric and Science Mapping Analysis. *Education Sciences,* 13, 708. https://doi.org/10.3390/educsci13070708

Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., ... & Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103*, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Kim, J., Merrill, K., Xu, K., & Sellnow, D. D. (2020). My teacher is a machine: Understanding students' perceptions of AI teaching assistants in online education. *International Journal of Human–Computer Interaction, 36*(20), 1902-1911.

Kranzberg, M. (1986). Technology and history: Kranzberg's laws. *Technology and Culture, 27*(3), 544-560. https://doi.org/10.2307/3105385

Limna, P., Jakwatanatham, S., Siripipattanakul, S., Kaewpuang, P., & Sriboonruang, P. (2022, March 14). A review of artificial intelligence (AI) in education during the digital era. *Advance Knowledge for Executives, 1*(1), 1-9. https://ssrn.com/abstract=4160798

Luo, W., He, H., Liu, j. Berson, I. R., Berson, M. J., Zhou, Y., & Li, H. (2023). Aladdin's Genie or Pandora's Box for early childhood education? experts chat on the roles, challenges, and developments of ChatGPT. *Early Education and Development*. https://doi.org/10.1080/10409289.2023.2214181

Matthews, C. (2023, August 18). A brief history of tech skepticism. *Strategy Business.* https://www.strategy-business.com/article/A-brief-history-of-tech-skepticism

Mhlanga, D. (2023, July 28). Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4354422

Mondal, H., Marndi, G., Behera, J. K., & Mondal, S. (2023). ChatGPT for teachers: Practical examples for utilizing artificial intelligence for educational purposes. *Indian Journal of Vascular and Endovascular Surgery.* https://doi.org/10.4103/ijves.ijves_37_23

Murad, I. A., Surameery, N. M. S., & Shakor, M. Y. (2023). Adopting ChatGPT to Enhance Educational Experiences. *International Journal of Information Technology & Computer Engineering*, *3*(05), 20-25. https://doi.org/10.55529/ijitc.35.20.25

Opara, E., Theresa, A.M. -E., & Aduke, T. C. (2023). ChatGPT for teaching, learning and research: Prospects and challenges. *Global Academic Journal of Humanities and Social Sciences, 5*(2), 33–40. https://doi.org/10.36348/gajhss.2023.v05i02.001

Ouyang, F., Zheng, L., & Jiao, P. (2022). Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020. *Education and Information Technologies, 27*(6), 7893–7925. https://doi.org/10.1007/s10639-022-10925-9

Rahman, M. M., & Watanobe, Y. (2023). ChatGPT for education and research: Opportunities, threats, and strategies. *Applied Sciences, 13*(9), 5783. https://doi.org/10.3390/app13095783

Sobania, D., Briesch, M., Hanna, C., & Petke, J. (2023). An analysis of the automatic bug fixing performance of ChatGPT. *arXiv.* https://doi.org/10.48550/arXiv.2301.08653.

Sok, S., & Heng, K. (2023, August 20). ChatGPT for education and research: A review of benefits and risks. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.4378735

Su, J., & Yang, W. (2023). Unlocking the power of ChatGPT: A framework for applying generative AI in education. *ECNU Review of Education*. https://doi.org/10.1177/20965311231168423

Times Higher Education. (2022, July 30). ChatGPT and the rise of AI writers: How should higher education respond?. https://www.timeshighereducation.com/campus/chatgptand-rise-ai-writers-how-should-higher-education-respond

Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments, 10*(1), 15. https://doi.org/10.1186/s40561-023-00237-x

Tsai, Y. C. (2023). Empowering learner-centered instruction: integrating ChatGPT python Api and tinker learning for enhanced creativity and problem-solving skills. *arXiv preprint*. https://doi.org/10.48550/arXiv.2305.00821

Tülübaş, T., Karakose, T., Papadakis, S. (2023). A Holistic Investigation of the Relationship between Digital Addiction and Academic Achievement among Students. *European Journal of Investigation in Health, Psychology and Education,* 13, 2006–2034. https://doi.org/10.3390/ejihpe13100143

Tülübaş, T., Demirkol, M., Ozdemir, T. Y., Polat, H., Karakose, T., & Yirci, R. (2023). An interview with ChatGPT on emergency remote teaching: A comparative analysis based on human–AI collaboration. *Educational Process International Journal*, *12*(2), 93-110. https://doi.org/10.22521/edupij.2023.122.6

Whalen, J., & Mouza, C. (2023, August 21). ChatGPT: Challenges, Opportunities, and Implications for Teacher Education. Contemporary Issues in Technology and Teacher Education, 23(1), 1-23. https://www.learntechlib.org/primary/p/222408/

Xiao, Z. (2023). Educational response in the era of ChatGPT: Prohibition or change. *Geographical Research Bulletin, 2,* 116-119. https://doi.org/10.50908/grb.2.0_116

Yilmaz, R., & Yilmaz, F. G. K. (2023). Augmented intelligence in programming learning: Examining student views on the use of ChatGPT for programming learning. *Computers in Human Behavior: Artificial Humans, 1*(2), 100005. https://doi.org/10.1016/j.chbah.2023.100005

Zhai, X. (2023, August 20). ChatGPT and AI: The game changer for education. *SSRN Electronic Journal* https://ssrn.com/abstract=4389098

Zhai, X., Yin, Y., Pellegrino, J. W., Haudek, K. C., & Shi, L. (2020). Applying machine learning in science assessment: a systematic review. *Studies in Science Education, 56*(1), 111-151. https://doi.org/10.1080/03057267.2020.1735757

Zhu, C., Sun, M., Luo, J., Li, T., & Wang, M. (2023). How to harness the potential of ChatGPT in education? *Knowledge Management & ELearning, 15*(2), 133–152. https://doi.org/10.34105/j.kmel.2023.15.008

ABOUT THE CONTRIBUTOR S

Turgut Karakose is a Professor and Head of the Department of Educational Sciences at Dumlupinar University: Kutahya, Türkiye. His main research interests include educational leadership and management, higher education, psychology, and human behavior. He has published extensively in leading international journals and also authored books and chapters on education/management.
E-mail: turgut.karakose@dpu.edu.tr
ORCID ID: https://orcid.org/0000-0003-0346-8154

Tijen Tülübaş is an Associate Professor of Educational Administration at Dumlupınar University, Kutahya, Turkey. Her research interests include organizational behavior, higher education management, leadership, culture and identity. She has published numerous articles in leading international journals, authored a book and three book chapters on education/management.
Email: tijen.tulubas@dpu.edu.tr
ORCID ID: http://orcid.org/0000-0001-9406-8361