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

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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

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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).

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