

# Guest Editorial

## Education in the World of ChatGPT and Generative AI

**T**HE launch of ChatGPT by OpenAI [1] on 30 November 2022 has triggered immense reactions in various fields of study, including education [2]. Unlike previous versions of chatbots, ChatGPT was trained with large volumes of data to parse text input and generate text outputs and can engage in human-like conversations using natural language, and memory to continue with conversation and interact with users on a large range of topics.

ChatGPT is a type of AI model that is categorized as a foundational model [3] that can handle a range of tasks and can act as the backbone for a wide range of applications. Its versatility presents a huge advantage over other more targeted AI models that focus on specific disciplines or topics, or what was sometimes called “narrow AI.” ChatGPT was built on a large language model called Generative Pre-trained Transformer version 3.5 (GPT-3.5) and its capabilities were further enhanced with the introduction of GPT-4, in March 2023, a multimodal model that accepts textual and image inputs. Besides GPT-4V, other generative AI systems, such as Gemini, Llama 3, and Claude 3, can generate new content for multimodal inputs and outputs, including text, images, audio or video.

Researchers have explored the use of AI in education for decades [4], with the earlier applications being mostly rule-based systems. Early intelligent tutoring systems required laborious analysis of content knowledge to translate it into a series of rules. The advent of machine learning and deep learning allowed for the use of data-driven algorithms to power learning systems, but these were often built for domain-specific systems or applications. Learning technology designers were unshackled from these limitations and constraints with the arrival of ChatGPT and other generative AI. It is not difficult to imagine the reason for significant interest in the application of generative AI within educational contexts. For example, Wang et al. [5] reported the use of prompt engineering to optimize information retrieval in flipped classrooms, and Lee and Zhai [6] used ChatGPT for science teachers’ lesson planning. This enthusiasm, however, was also met with apprehension, leading to the prohibition of the use of generative AI in some educational institutions. While the potential for student use was robust (see Table I), concerns centred around issues, such as plagiarism, excessive reliance on AI in the completion of educational tasks, the potential displacement of human roles, and even AI hallucinations or AI-fabricated information (for example, see McIntosh et al. [7]).

TABLE I  
TAXONOMY OF STUDENT USES OF AND ORIENTATION TO GENERATIVE AI

Role	Description
Ambition Magnifier	Allow learners to engage with more complex forms of problem-based learning or larger projects.
Teacher	Offer a dynamic range of scaffolds to the learner.
Critical Friend	Critique thinking and work, identify gaps and offer suggestions.
Getting Started	Critique thinking and work, identify gaps and offer suggestions.
Rejecting Busy Work	Initial planning, brainstorming, and drafting.
Struggle Avoidance	Complete educational tasks outside the learner’s skill set for them.
Nonuse	Learner does not engage with Generative AI.

Banning ChatGPT could be a stopgap solution, but it invites other questions, such as the practicality of implementation. In some discussions, the idea of reverting to pen-and-paper tests to avoid cheating in examinations was raised. Is banning the use of disruptive technology the only viable solution or are there alternative solutions? Numerous scholars are exploring how generative AI can be harnessed to create a positive impact. For example, ChatGPT can be used to assess essays, act as a personal tutor, help in learning a foreign language, facilitate the creation of teaching content, and act as a teaching assistant.

Ultimately, the key question is how to design learning activities to take advantage of generative AI for learning, while dealing with ethical and governance issues, such as biases, plagiarism, equity, accessibility, and intellectual property. In other words, we need smart design principles and solutions to harness the full potential of generative AI while developing and executing relevant policy and implementation guidelines to deter unethical and unproductive behaviors. At the same time, it is imperative to assess the efficacy and appropriateness of generative AI in an educational setting, as it is the case with all emerging technologies. There is a need to thoroughly examine the effectiveness of this technology and its regulatory implications for appropriate and productive applications in an educational environment.

This Special Issue aims to explore the potential of ChatGPT and other generative AI in the field of education and document, problematize, and address the key challenges and opportunities that arise from the intersection of education and generative AI. It aims to further our understanding of this important and rapidly developing area of research that has an immense impact on education.

The applications of generative AI for education in this Special Issue can be summarized using the following framework (Table II).

TABLE II  
FRAMEWORK FOR USING GENERATIVE AI FOR TEACHING AND LEARNING

	Learning <i>from</i> AI-generated content	Learning <i>with</i> materials or information generated by AI
Student facing	A. Students <i>learning from</i> AI about a topic	B. Students <i>learning with</i> AI: obtaining feedback or being supported for their learning.
Teacher/designer facing	C. Teachers <i>teaching</i>	D. Teachers <i>designing</i> the learning environment for students
	E. Teachers <i>learning about</i> a topic or teaching strategy	F. Teachers <i>learning with</i> AI: being supported for their learning

Learning *from* AI-generated content means that AI is used to generate materials for the topics to be learnt, whereas learning *with* AI means that materials or information generated are used as feedback to the learners, or information used to support learning, such as in generating lesson plans or learning activities. The target audience can be students (K-12 to universities), teachers, or instructional designers. For teachers, it can be teachers taking on the teaching roles or teachers' learning or teachers' professional development.

Students learning about a topic (see Table II, A) is perhaps the immediate application of generative AI that most people could imagine. For example, Wu et al. [8] used AI to auto-generate content for "Hospital Network Architecture and Planning Design." From interviews with Youtubers who were early adopters of ChatGPT, Li et al. [9] proposed a self-directed learning framework for learning *from* ChatGPT. In this Special Issue, there were only two articles under category A, suggesting that researchers are already exploring beyond the most common applications. Most articles in this Special Issue focus on students learning *with* AI (see Table I, B). For example, ChatGPT works as a collaborator in students' writing [10], ChatGPT generates personas for students working on user experience analysis [11], GPT generates word clouds for learners [12], ChatGPT provides feedback to students learning to code [13], ChatGPT assessing students' generated questions [14], generative AI repairing students' coding [15], and ChatGPT answering students' queries of a course [16].

Generative AI can also be used by teachers (see Table I, C) to generate content or materials for students' learning, and this is illustrated in Chen and Wu's [17] article that used text-to-image generative AI to create multimedia materials for teaching Tang Poems to students. Generative AI can also support teaching by generating supporting materials, such as learning scenarios [18], creating teaching or lesson plans [19], or evaluating and refining teachers' feedback to students [20]. In the same way that generative AI supports students' learning, it can also support teachers' learning (see Table I, F), such as supporting teachers' learning from simulated classrooms [21]. Similarly, teachers can also learn about a topic or pedagogical strategies generated by AI (see Table I, E), although there was no such application reported in this Special Issue.

One article that did not fit the approaches in Table I is the study conducted by Ngo et al. [22], who examined students'

perception of the use of ChatGPT from a knowledge management perspective. They reported students' preferences for using ChatGPT for knowledge acquisition over using ChatGPT for sharing and applying knowledge. This article was included because it examines factors that could affect the ways ChatGPT is being used.

The technologies for generative AI are evolving rapidly and they are bringing in new opportunities and challenges for educators. In the embryonic stage of development, policymakers and educators are looking to researchers for evidence and guidance. We hope that this Special Issue will not only record early explorations into the use of generative AI for teaching and learning but will also seed ideas and trigger more innovation in the near future.

SENG CHEE TAN, *Guest Editor*  
National Institute of Education  
Nanyang Technological University  
Singapore 637616  
sengchee.tan@nie.edu.sg

KAY WIJEKUMAR, *Guest Editor*  
Texas A&M University  
College Station, TX 77840, USA

HUAQING HONG, *Guest Editor*  
Shanghai International Studies University  
Shanghai 201613, China

JUSTIN OLMANSON, *Guest Editor*  
University of Nebraska-Lincoln  
Lincoln, NE 68588 USA

ROBERT TWOMEY, *Guest Editor*  
University of California  
San Diego, CA 92110 USA

TANMAY SINHA, *Guest Editor*  
National Institute of Education  
Nanyang Technological University  
Singapore 637616

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