Integrating Generative AI in Education: How ChatGPT Brings Challenges for Future Learning and Teaching

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1. Introduction

ChatGPT, a chatbot based on the Open-AI's generative pre-trained (GPT) language models, has been hailed as a "24/7 tutor" that has transformed the way people view education in just under six months since its debut. (Jason Pohl, 2023; Kara Manke, 2023) The impact of AI on future learning and teaching has sparked discussions that draw parallels to the debates held over 2,000 years ago by renowned Greek philosophers such as Socrates (469-399 B.C.), Plato (427-347 B.C.), and Aristotle (384-322 B.C.). These ancient thinkers delved into theories pertaining to the acquisition and dissemination of new knowledge. By drawing these historical comparisons, we gain valuable insights into the ongoing discourse surrounding the influence of AI in education. Does Socrates' dialectic method, in which truth is discovered through discussions with peers, still have a role in the learning process? Could the peer involved in this case be considered a chatbot?

In the realm of education, there are a set of theories that have been widely recognized as significant contributors to its development. These theories, including constructivism, behaviorism, situated cognition, socio-cultural theory, cognitive load theory, universal design for learning, critical race theory, social learning theory, self-efficacy theory, and self-determination theory, have played a foundational role in shaping the field. While opinions may vary, these theories have been influential in guiding educational practices and understanding the learning process. Moreover, it is important to acknowledge the ongoing transformations raised by ChatGPT, which is rapidly revolutionizing the process of learning and teaching. With its quiet yet profound impact, Generative AI is subtly influencing the trajectory of education's future. As we navigate these changes, it is crucial to consider the potential implications and opportunities that arise from such technological advancements.

2. Theoretical Roots for Education

Since the birth of education, a large number of educational scholars have provided constructive views on the principles and development of education, which have laid the foundation for the development of education. The leading theories are:

- **Constructivism:** Pioneered by Jean Piaget (1896-1980), views learning as an active process of knowledge construction. According to this theory, learners are seen as active participants who construct meaning and knowledge through their interactions

with the world. It highlights the role of prior knowledge, cognitive structures, and individual interpretation in learning. In this approach, the teacher takes on the role of a facilitator or guide who supports learners' active engagement and exploration. Constructivism aims to foster deep understanding, critical thinking, and the ability to apply knowledge in real-world contexts.

- **Behaviorism:** Emerged in the early 1900s, places emphasis on the role of the environment in shaping behavior, with learning occurring through the reinforcement of desired behaviors and the punishment of undesired ones. Learning, according to behaviorism, a passive process influenced by external factors. For instance, in the context of language learning, behaviorism is exemplified by the audio-lingual method, characterized by whole-class repetition, dialogue practice, and immediate correction.

- **Situated cognition:** First proposed by Jean Lave and Etienne Wenger, presents a model of learning within a community of practice. This perspective emphasizes that learning is intimately connected to specific contexts and situations. For instance, learning through sports practice, music rehearsal, job apprenticeships, or even online training via video games. By placing importance on the context, situated cognition invites us to explore alternative learning environments and methodologies that better align with the real-world application of knowledge.

- **Socio-cultural theory:** This theory posits that learning is a social process that is influenced by cultural and societal factors. It emphasizes the role of social interactions, language, and cultural practices in shaping individual learning experiences. It suggests that learning is not solely an individual endeavor but occurs through collaboration, communication, and participation in social activities. When examining the use of generative AI in education through a socio-cultural lens, one would explore how it impacts students' social interactions and relationships with peers and teachers. The focus is on the social and cultural dimensions of learning.

- **Cognitive load theory:** It's a theory that describes how the amount of mental effort required to process information affects learning. This theory suggests that learning is more effective when information is presented in a way that minimizes cognitive load. The use of generative AI in education could be analyzed through this framework to determine how it can be used to present information in a way that is more effective for learning, or conversely, how it may add unnecessary cognitive load and hinder learning.

- **Universal design for learning:** This is an educational framework that promotes flexible approaches to learning that can accommodate the needs of diverse learners. The use of generative AI in education could be evaluated through this framework to determine how it can be used to provide more flexible and personalized learning experiences for students.

- **Critical race theory:** It's a theoretical framework that examines how race and racism intersect with social, cultural, and political power structures. The use of generative AI in education could be examined through its lens to explore how AI may impact issues of equity and access in education.

- **Social learning theory:** It's first proposed by Albert Bandura in the 1960s. It suggests that learning is a social process that is influenced by observation, interaction, and imitation. The integration of AI, such as ChatGPT, into education provides new opportunities for social learning as students can engage with AI-powered agents that model desirable behaviors and provide feedback based on observed actions.

- **Self-efficacy theory:** It was also developed by Albert Bandura, who first introduced the concept in the 1970s. It highlights the influence of an individual's belief in their own ability to succeed. Integrating AI into education can enhance self-efficacy by providing personalized learning experiences and adaptive feedback tailored to individual strengths and weaknesses. AI-powered tools can help students build confidence and motivation by offering support and guidance based on their specific needs and progress.

- **Self-determination theory:** This is a theory

of motivation that posits that people are more likely to be motivated when they feel a sense of autonomy, competence, and relatedness. AI in education can support these factors by offering learners greater autonomy in navigating their educational journey. AI-based platforms can provide personalized learning paths and resources, allowing students to pursue their interests and take ownership of their learning. Additionally, AI can facilitate interactions with peers and educators, fostering a sense of relatedness and social engagement.

3. Challenges Brought

Regarding the coherence of the theories mentioned, it is true that they may not align perfectly with one another. While the theories mentioned in the previous discussion serve as valuable frameworks for understanding learning and teaching process, it is essential to acknowledge their individual strengths and limitations.

ChatGPT does not challenge all of the theories mentioned earlier, but it does align with certain ones, such as the self-efficacy theory and self-determination theory. These theories suggest that when students possess a moderate level of knowledge and a strong desire to learn, interacting with ChatGPT and receiving immediate feedback can potentially be more effective than learning from a human teacher. However, it is important to critically consider whether ChatGPT's effectiveness is inherent or merely appealing. Furthermore, the application of the critical race theory framework to guide the training materials for ChatGPT presents an opportunity to address educational inequality through technological means. However, it is crucial to recognize that this approach relies on the unbiased and comprehensive collection of data, which can be a significant challenge.

In considering the potential advantages of ChatGPT, it is important to also recognize the threats it poses to fundamental principles in education. These threats should be carefully evaluated and addressed to ensure that the integration of ChatGPT aligns with ethical and pedagogical considerations. By critically examining the effectiveness of ChatGPT, acknowledging the nuanced nature of educational theories, and addressing potential challenges and threats, we can develop a more persuasive argument regarding its role in the field of education.

Loss of information processing and critical thinking skills. In constructivist education, students are encouraged to take an active role in their learning by developing their skills in exploring, analyzing, and solving problems. Critical thinking skills are particularly important in shaping students' overall learning experience. Instructors in education often rely on questioning techniques and assignments to sharpen students' ability to evaluate information and develop their own perspectives. However, ChatGPT's rapid information processing and insightful responses challenge traditional approaches, raising questions about the distinctions between human and machine learning. While ChatGPT aims for high accuracy, it lacks the nuanced understanding, creativity, and adaptability inherent in human learning. Furthermore, the ability to learn from mistakes and refine understanding is an essential aspect of human learning, contrasting with ChatGPT's reliance on data-driven algorithms. Integrating ChatGPT into education requires careful consideration of how it can complement rather than replace human interaction and the development of critical thinking skills. By recognizing the unique strengths and limitations of both human and machine learning, we can harness the potential of ChatGPT while preserving the essential aspects of human learning experiences.

Cognitive overload caused by increase of knowledge availability. The Cognitive Load Theory emphasizes that our working memory has limitations, and effective instructional methods should avoid overwhelming it to optimize learning. If a teacher rushes through the content, students may become more confused and retain less information. This is why teaching typically follows a structured approach, with two or three semesters per year, each lasting 14-16 weeks, and a strict syllabus for teachers to follow. Furthermore, while information retention is a crucial aspect of learning, it is not the sole definition. Learning involves the acquisition, understanding, and application of knowledge and skills in meaningful ways. It encompasses critical thinking, problem-solving, and the ability to transfer knowledge to real-world situations. This structure helps students manage their cognitive load, enabling them to engage with the content at a manageable pace, deepen their

understanding, and make connections between different concepts over time. Straying from this approach can disrupt the cognitive load balance and hinder effective learning, regardless of students' efforts. While ChatGPT may seem like a good "teacher" due to its quick responses, it can create the illusion that students are making rapid progress or that they can learn everything quickly. However, this can lead to an inefficient learning process that surpasses the cognitive load capacity and cannot be properly mastered.

Hindered social learning due to reduction of face-to-face interaction. In the learning process, social interaction and collaboration among students, such as group study and peer games, are critical components that provide valuable opportunities to engage with others and learn from their perspectives. Students who overly depend on ChatGPT for answers instead of actively participating in in-depth discussions with their peers and teachers may miss out on the opportunity to acquire knowledge and develop critical thinking skills through meaningful interactions. With the increased use of AI models like ChatGPT, there is a risk of reduced face-to-face interaction, which can impede social learning. To overcome this challenge, reinforcement learning algorithms can be used to allow AI models to learn from the feedback and experiences of other agents in a social context. For example, an AI agent can learn to play a game by observing the strategies and performance of other agents, and then adjust its own strategy based on the outcomes of those interactions. This approach not only enhances the AI model's learning ability but also fosters social interaction among students as they collaborate and compete with each other in a supportive environment.

4. The Future Is Now

History is a continuous process that moves from the present into the future. As humans make progress, they create history and are also shaped by it. Throughout history, new inventions have revolutionized the way people live their lives. For example, the invention of the telegraph enabled messages to be transmitted over long distances, even across oceans and mountains. The introduction of packet switching has given rise to podcasting and instant messaging, transforming the way people communicate. The invention of the electronic computer has significantly increased the speed of human computing power, surpassing the accuracy

levels that humans can achieve.

Each successful invention also leads to a leap in production efficiency, and frees humans from being just a factor of production. The invention of the steam engine during the Industrial Revolution revolutionized production processes, allowing for mass production and freeing humans from labor-intensive tasks; the development of computer technology and automation has led to increased productivity and efficiency in various industries, enabling humans to focus on higher-level tasks that require creativity and problem-solving skills. Innovations in transportation, such as automobiles and airplanes, have not only accelerated the movement of goods and people but have also opened up new opportunities for economic growth and exploration; the advent of the internet and digital technologies has transformed the way information is accessed, shared, and utilized, empowering individuals to become active contributors rather than passive recipients of knowledge.

ChatGPT, an incredible achievement of generative artificial intelligence, has led to the most rapid adoption of any product in human history. As a result, it has become a popular tool for both university students and several tech advanced companies. The question arises whether we should view this product as a tool for cheating and prohibit its use altogether, or should we embrace its potential to enhance the quality and efficiency of education? Moreover, should we announce layoffs or stop hiring individuals whose jobs will be automated by ChatGPT, or should we encourage and recruit employees who can leverage this technology to achieve significant productivity gains for their organizations? This discussion seems to take us back 700 years. While Ibn Khaldun, a prominent Arab historian and philosopher, emphasized the importance of books in society, he also highlighted the connection between a society's wealth, prosperity, and the productive capacity and collective effort of its members.

A popular saying states that there is nothing new under the sun. Even though the great French poet Charles Baudelaire (1821-1867) famously declared photography to be "the refuge of every would-be painter, every painter too ill-endowed or too lazy to complete his studies", he could not have predicted that it would later evolve into an art form under Eduard Steichen (1879-1973). Today, with the

ubiquity of smartphones, anyone now has the potential to become a skilled photographer. Similarly, when calculators were first introduced in college classrooms in the 1970s, it took until the 1980s for them to become widely used. The current popularity of ChatGPT among students suggests that it too may soon become a tool for education, just as calculators did before it. If prohibiting it is futile, let's embrace the integration of generative AI into education, drawing on the valuable insights from learning theories, and witness together the dawn of a new era in the realm of learning and teaching.

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