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ChatGPT and Global Higher Education

Using Artificial Intelligence in Teaching and Learning

Xi Lin, Roy Y. Chan, Shyam Sharma, Krishna Bista



ChatGPT and Global Higher Education: Using Artificial Intelligence in Teaching and Learning

Open Access Edition

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Praise for this book

“This book offers an invaluable roadmap for grappling with the promise and perils of AI’s potential for revolutionizing higher education globally, from developing innovative pedagogies and decolonizing the curriculum to addressing critical ethical, legal, and social implications related to the use of generative AI.”

Lynn C. Pasquerella, President, American Association of Colleges and Universities (AAC&U), Washington, DC, United States

“This book is a timely set of insights into the evolving picture between AI systems and higher education from a global perspective. New technologies are coming quickly in the AI Spring, and works such as these are essential for investigating their role inside and outside the classroom.”

Jasper Roe, Head of the Department of Language School, James Cook University, Singapore

“This comprehensive book looks into the heart of how AI, specifically ChatGPT, can enrich higher education globally. It’s a compelling read for those committed to advancing educational practices through innovation and inclusivity.”

Courtney Brown, Vice President for Impact and Planning, Lumina Foundation, Indianapolis, United States

“ChatGPT and Global Higher Education: Using Artificial Intelligence in Teaching and Learning” is a ground-breaking exploration of the transformative potential of artificial intelligence, with insightful analysis and practical strategies in higher education. Authored by experts at the forefront of AI integration in education, the book is engaging, innovative, and timely. It is an essential read for all the higher education AI enthusiasts.”

Naziema Jappie, Deputy Dean: Teaching & Learning, Centre for Higher Education & Development, University of Cape Town, South Africa

“This well-researched exploration provides both a synthesizing overview of the connections between artificial intelligence and higher education across continents and a pragmatic template in the same volume. This book reveals the transformative potential and ethical complexities of AI and stands out as a must read for those who are curious about the future of global learning.”

Catherine Kleier, Associate Vice President of Faculty Affairs,
Metropolitan State University of Denver, United States

“An insightful exploration into the transformative potential of AI in education, offering practical strategies for leveraging technology to enhance teaching and learning experiences. A must-read guide for educators seeking to harness the power of artificial intelligence in the classroom.”

Pankaj Mittal, Secretary General, Association of Indian Universities,
Former Vice Chancellor of BPS Women University, India

“AI is about to fundamentally transform how higher education supports human development, enhances academic research, and advances the community. This is a very timely and important publication by the STAR Scholars Press.”

Kumer Pial Das, AVP for Research and Innovation,
University of Louisiana at Lafayette, United States

“This book presents a comprehensive exploration and timely examination of the transformative potential of Artificial Intelligence chatbots like ChatGPT in academia. It covers how Artificial Intelligence can reshape pedagogy, aid fostering inclusive learning environments, and redefine research methodologies. This timely volume offers valuable insights and practical guidance for educators, administrators, and policymakers navigating the integration of Artificial Intelligence technologies in higher education. A must-read and compelling resource for those seeking to harness the power of Artificial Intelligence responsibly, effectively, and ethically in the modern educational landscape.”

Michael Gerges, Associate Dean – Faculty of Science and Engineering,
University of Wolverhampton, United Kingdom

“A seminal volume that comes at the right time. While our study, work and life have been transformed by AI, knowingly or otherwise, all must take an active part in managing this revolution comparable to the discovery of fire.”

Jing Luan, Ph.D., Instructor and Author of DME, big data in the early 1990s.
Provost Emeritus, San Mateo Colleges of Silicon Valley, USA

“This very informative book about the use of AI in teaching and learning is a welcome contribution that will undoubtedly help policymakers and academic leaders navigate the disruptive situation created by the arrival of AI platforms like ChatGPT. The chapters edited by Professors Lin, Chan, Sharma, and Bista provide a comprehensive picture of the academic and ethical challenges that generative AI represents, on the one hand, and the great potential offered by these new tools to enhance the learning experience of students, on the other hand.”

Professor Jamil Salmi, Emeritus Professor, Diego Portales University,
Chile and Research Fellow at Boston College, USA

About the Book

The rise of artificial intelligence (AI) tools based on advanced language models, such as ChatGPT and Bard, is transforming industries and professions worldwide, and higher education is no exception. ChatGPT, an AI-powered chatbot developed by OpenAI, has created a substantial amount of conversation and controversy across academia regarding what generative AI means for teaching and learning in the classroom. There is plenty of speculation not only about how those innovations will affect the academic profession but also what unique opportunities and challenges they present to global higher education. In this book, authors delve into the impact of AI and ChatGPT on higher education leadership and management, examining potential opportunities and challenges that this innovative technology presents to teaching, research, program, and policy.

The primary purpose of this volume is to provide a comprehensive, research-driven analysis of AI chatbots' roles in shaping institutions of higher education around the world. By exploring the transformative potential of ChatGPT in academic settings, this timely book aims to bridge the gap between technological innovation and its practical applications. In the long run, we anticipate that this volume will provide valuable insights and guidance for teacher-scholars, university administrators, and policymakers on leveraging this cutting-edge technology effectively and responsibly.

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Prologue

Keeping the Human (Educator) in the Loop

Matthew Salzano

Stony Brook University—SUNY, USA

In May 2023, the United States Department of Education’s Office of Educational Technology (EdTech) released a report: “Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations.” Its first recommendation for educators is “Emphasize Humans in the Loop.” In the Artificial Intelligence (AI) context, human-in-the-loop (HITL) refers to a method of developing algorithms, models, and applications that fundamentally prioritizes human feedback. According to the Stanford Institute for Human-Centered AI, HITL “reframes an automation problem as a Human-Computer Interaction (HCI) design problem,” in turn broadening the development question from “‘how do we build a smarter system?’” to ‘how do we incorporate useful, meaningful human interaction into the system?’” (Wang, 2019, para. 17). The EdTech report identifies HITL as its first and central recommendation as Generative AI systems—like those explored in this volume—are deployed in education.

The report refers to “Always Centering Educators” (catchily transformed into the acronym ACE) because AI “does not have the broad qualities of contextual judgment that people do. Therefore, people must remain responsible for the health and safety of our children, for all students’ educational success and preparation for their futures, and for creating a more equitable and just society” (Cardona et al., 2023, p. 17). In sum, the educator should be in the loop when AI is integrated into education (for more on HITL in education, see Alsharif et al. in Chapter 4 of this volume). Specifically, the ACE approach of the report leads them to advocate for three key areas where educators must be in-the-loop:

1. The loop in which teachers make moment-to-moment decisions as they do the immediate work of teaching.
2. The loop in which teachers prepare for, plan, and reflect on teaching, which includes professional development.
3. The loop in which teachers participate in decisions about the design of AI-enabled technologies, participate in selecting the technologies, and shape the evaluation of technologies—thus setting a context for not only their own classroom but those of fellow teachers as well. (Cardona et al., 2023, p. 26)

Ultimately, the report explicitly states that the Department of Education does not believe generative AI will replace teachers. It will highlight what makes educators

unique, allow them to more routinely access the passion that drives them. “ACE is not just about making teachers’ jobs easier but also making it possible to do what most teachers want to do. [...]for example, understanding their students more deeply and having more time to respond in creative ways to teachable moments” (Cardona et al., 2023, p. 25). While the report is clear about addressing problems with AI alignment, namely along values of transparency, privacy, and bias, the overwhelming tone here is positive: in the view of the report, Generative AI tools could be used for the benefit of educators and students. As some of the chapters in this volume evidence, there is no doubt that this is a possible outcome for AI integration in education. But this is not a foregone conclusion—nor should we treat it as such.

The EdTech report follows a dominant narrative that ties achievements in the development of science and technology with the bettering of society. In this so-called “age of AI,” we are told by powerful tech firms that integration of AI into our everyday life and work will ultimately improve our lives. Take, for example OpenAI, the creators of the now-ubiquitous Generative AI Chatbot ChatGPT. OpenAI has made it their central mission since their founding in 2015 to “ensure that artificial general intelligence—AI systems that are generally smarter than humans—benefits all of humanity” (OpenAI, n.d.). As tech writer Karen Hao (2020) put it, “AGI could be catastrophic without the careful guidance of a benevolent shepherd. OpenAI wants to be that shepherd, and it has carefully crafted its image to fit the bill” (paras. 4-5). What does this say about OpenAI’s idea of the humans, supposedly in the loop, that AI should benefit? My late colleague Misti Yang (2021) asked: “The ovine metaphor raises interesting questions including: Who are the sheep to be protected and herded? ... Can a shepherd who imagines human brains in terms of input-output rates and touts the advantages of being a machine be benevolent?” (p. 2). Her answer was no: even AI purportedly developed for the benefit of humanity will not *actually* benefit us if their view of humans is so reductionist, so unable to appreciate qualities of human education and learning that exceed a computational understanding of input-output.

Despite rhetorics of progress that benefit developers by asserting that technological progress is beneficial or (at worst) neutral, all technologies are the result of particular values and reflect those values. Meredith Broussard (2023) calls the belief that technology will universally benefit society “technochauvinism,” defined as “a kind of bias that considers computational solutions to be superior to all other solutions” (p. 2). In the case of the EdTech report, we can see how technochauvinism appears in the idea that AI integration will “make teachers’ jobs easier.” This statement is warranted by the belief that technology will be quicker and of comparable (if not superior) quality to human effort. It is a *choice*, one guided by assumptions and values about what matters and is valuable for human educators, that is disguised as a deterministic fact of technological development.

In this preface, I want to remind us that AI integration is not neutral and not inevitable: it is contingent. Thus, as educators seeking to investigate what, if any, role these technologies should play in our classrooms, we would be wise to ask ourselves: do the values embedded in the designs of these technologies align with our values as

educators? To open this volume of contributions that probe the potential benefits and pitfalls of using ChatGPT and other generative AI tools in education, I want to open questions about conflicts between the purpose of education and the realities of AI by tugging on that key metaphor of HITL. Is keeping the educator “in the loop” enough? What sort of “educator” is implicitly envisioned in-the-loop?

The history of the phrase “in the loop” is a history of values and technology. According to the Oxford English Dictionary’s (2023) earliest references, “in the loop” and “out of the loop” gained prominence in the 1970s aviation industry. These two earliest entries are instructive for our present moment, which has much in common with the moment the phrase emerged. During the first references, new automated technologies were implemented in Air Traffic Control and Automatic Landing. Similarly, automation is the goal of many AI applications today. The EdTech report mentions, for example, how AI might reduce human effort spent on, e.g., grading and giving feedback. Both are moments of transformative automation accompanied with new “loops.”

In the first reference, the *Sunday Telegraph* (March 1970) referred to “automatic landing has now been perfected, though it will still be necessary to keep the pilot ‘in the loop.’” In this example, “in the loop” refers to the reluctant inclusion of a human in a process meant to exclude human effort and errors for the “perfected” state of the machine. “In the loop” marks the *failure* of optimization—an automation that still requires the involvement of the costly human pilot. Indeed, “finding ways to ‘take the human out of the loop’ was the cornerstone of the Industrial Revolution and fueled the growth of capitalism” (Tacheva & Ramasubramanian, 2023, p. 7).

In the industrial revolution, human laborers were removed from the factory line (taken out of the loop) to be replaced by machines; in this “fourth industrial revolution... even the production and programming of technology can be performed by machines themselves” (Atanososki & Vora, 2019, p. 28). Tacheva and Ramasubramanian (2023) consider this automation and optimization of labor key to what they call “AI Empire,” the term they use to name the “networked and distributed global order [that] is rooted in heteropatriarchy, racial capitalism, white supremacy, and coloniality” that extends from pre-existing systems of power, but specifically makes AI technology possible and dominant through “mechanisms of extractivism, automation, essentialism, surveillance, and containment” (p. 1). AI Empire is circulated in infrastructure (such as through data collection practices that generate material for training Large Language Models and data profiles for microtargeting), in AI products (such as the biased text Sicka discusses in Chapter 5), and in technochauvinism. Tying this automation of labor to “Empire” shows how its appearance is anything but neutral. “In the loop” of AI and education, there was once a human educator doing the tasks with no “loop” to have to be centered within. Now the human educator is deprioritized for the sake of efficiency, but told they are “centered” by being in-the-loop. Like the laborers before them in different epochs of Empire, this educator should be wary if they are simply a placeholder in this loop until their role can be further and further reduced in significance.

The second example from the OED shows how automation can lead to human complacency—by being “out of the loop” *created by the automation*. *Aviation Week* (April, 1976) reported that “automation technology can lead to complacency when it takes the controller ‘out of the loop’ by reducing the need for his interaction with a flightcrew and deemphasizing the cooperative aspects of the air traffic system.” In the example of the “out of the loop” controller, the technochauvinist belief that the technology will be superior is directly refuted. When there was no loop for the controller to be in-or-out of, the controller had to rely on interaction and cooperation with flight crews and the air traffic system. With the introduction of an automated system, and the relegation of the controller to just a part of the loop, communicative and cooperative skills that made a successful controller are relegated to the system. The system thus introduces the potential for these skills to atrophy in the human controller. In fact, “automation-induced complacency” is an active area of organizational behavior research (Merritt et al., 2019). Put in more general terms, the introduction of an automation technology + human loop isn’t necessarily superior, as technochauvinists would claim: it delegates and re-prioritizes, for better and for worse.

Higher education is not air traffic control. The capacities lost when educators turn to AI tools instead of their own expertise may not lead to a crashed plane, but it may ripple in damaging cultural and political effects. Following scholars in critical pedagogy, I believe the process of education produces something more than meeting learning objectives. There is a human quality to the classroom that is “worth offering sanctuary against digital enclosure” (Ashby-King et al., 2021; Salzano & Yang, 2022, p. 79). Writing nearly 40 years before this AI moment, philosopher Richard Rorty (1989) demonstrated this point when he wrote: “The only point in having real live professors around instead of just computer terminals, videotapes, and mimeoed lecture notes is that students need to have freedom enacted before their eyes by actual human beings” (p. 125). To Rorty, higher education is an opportunity for students to truly understand that they “can reshape themselves—that they can rework the self-image foisted on them by their past” (p. 118). The professor’s role is to demonstrate that freedom to question, learn, and transform, and to show to students that they may also participate in that glorious practice. bell hooks (1994), too, referred to education as the practice of freedom: “The classroom, with all its limitations, remains a location of possibility. In that field of possibility we have the opportunity to labor for freedom, to demand of ourselves and our comrades, an openness of mind and heart” (p. 207). This practice of freedom is sustained through actual relationships with students. In mutual relationships, students are inspired to see their education not as a rote exercise of credential-granting for employment but as a transformative experience that generates new capacities of expression and engagement. Bringing students to understand and express this freedom in community is key, in Rorty’s Deweyan-inspired pragmatism, because it equips students with the ability to critically participate in democratic life. Educators can lead students to generate capacities that enrich individuals and their communities. As hooks (1994) writes: it “allows us to face reality even as we collectively imagine ways to move beyond boundaries, to transgress” (207).

AI integration in the classroom, if not done with an appreciation for the educational process beyond input-and-output, can lead to the reproduction of empire and standardization that stifles possibilities of shared humanity that exceed the quantifiable and automatable. For example, in my research about apps and algorithms meant to automate communication between friends, Yang and I found optimization that “rewards happiness, efficiency, and uniformity at the expense of moodiness, messiness, and difference” (Salzano & Yang, 2022, p. 79). These apps still very much had humans-in-the-loop, as users had to input information and act on it. But the apps are still encoded with values about what sorts of communication is valuable and automatable versus worth scripting “out” for more efficiency. We concluded that “apps and algorithms threaten to become the center of a conversational apparatus, reducing human capacities. How can change or connectedness come from conversations bounded by the censorious decisions of an algorithm?” (Salzano & Yang, 2022, p. 87) While we were discussing the civic implications of this interpersonal shift, our insights are even more relevant when applied in the educational context. Educators and students are “more than vessels that consume and regurgitate knowledge,” and they are not simply “variables that can be categorized” (Ashby-King, 2021, p. 3). They are humans, facing all sorts of contextual factors about their identities and environments, and our ability to navigate that is key to something beyond learning. Our (human) practices of (human) education that sustain these (human) relationships should be clearly in our sights as we make decisions about whether we want to just “be in the loop”—or if we want to reject the automated intrusions creating the loops.

In conclusion, I am led to question the easy recommendations of the EdTech report that opened this prologue. How would the Always Centering Educators (ACE) approach proceed, if it were focused on ensuring professors could enact freedom before the eyes of students? With this vision of an educator in mind, what processes are we willing to optimize? What capacities would we prefer not to lose to automation and keep in the realm of the human? It is this critical mindset—that can unsettle our easy definitions of the “educator” who is (or isn’t) “in the loop”—that I hope you will take with you as you read the following pages.

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UNIT 1:
USE OF CHATGPT AND AI IN
GLOBAL HIGHER EDUCATION:
A HISTORICAL VIEW OF
CURRENT INNOVATIONS

Chapter 1

The Impact of Artificial Intelligence (AI) on Global Higher Education: Opportunities and Challenges of Using ChatGPT and Generative AI

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ABSTRACT

This chapter explores the nuanced implications of artificial intelligence (AI), spotlighting the use of ChatGPT and generative AI within the area of higher education. Specifically, this chapter explores AI's transformative potential across industries, positioning ChatGPT as a prime example. By tracing the historical integration of AI in higher education, from initial adoption to advanced applications such as online proctoring and content creation, this chapter addresses pertinent concerns related to data privacy, biases, and ethical considerations. Emphasizing the necessity of understanding faculty and student readiness for ChatGPT integration, this chapter proposes recommendations to address challenges with AI and foster effective utilization. This chapter also highlights the importance of continual dialog and research for asserting AI's pivotal role in shaping the current and future of global higher education. While AI, exemplified by ChatGPT, promises improved educational support, personalized learning, and administrative efficiency, it also prompts inquiries about the future of teaching, learning, and privacy. As such, this introductory chapter advocates ongoing discourse and research to navigate ethical considerations, technological developments, and the broader impact of AI in education, involving diverse stakeholders for responsible and beneficial integration into global higher education.

Keywords: ChatGPT, artificial intelligence (AI), higher education, teaching and learning

INTRODUCTION

As college professors are deeply entrenched in the nexus of technology and higher education, we have embarked on a transformative journey with artificial intelligence (AI), using it as a tool for generating innovative ideas, fostering dynamic discussions,

and navigating the complexities of educational research. Our engagement with ChatGPT not only streamlined our research processes but also enriched our teaching practices. By leveraging its generative capabilities, we've been able to offer personalized learning experiences, stimulate critical thinking, and encourage creative problem-solving among our students. This technology has become indispensable in our quest to cultivate a more interactive, inclusive, and intellectually stimulating academic environment.

Our collective exploration of the potential use of ChatGPT in higher education reflects a broader commitment to embracing emerging technologies that can revolutionize the way knowledge is imparted and acquired. Through rigorous experimentation and open-mindedness, we have witnessed firsthand the profound impact that AI can have on curriculum development, student engagement, and overall educational experience. This book chapter aims to share lessons learned and recent research in the field of AI along with our own experiences and applications of generative AI in academic research. By weaving together our professional perspectives with empirical evidence, we hope to illuminate the path forward for integrating AI into higher education, ensuring that it serves as a catalyst for innovation, inclusivity, and intellectual growth.

AI, which refers to the simulation of human intelligence by computers and other machines, has become a popular topic in all industries, including higher education. AI involves algorithms and software that enable machines to process data, learn from it, and make decisions or take actions to achieve certain goals (McCarthy, 1995). Specifically, AI consists of a wide range of techniques, including machine learning, deep learning, natural language processing, computer vision, etc., and can be applied to various tasks, from simple rule-based processes to complex problem solving and decision making (Russell & Norvig, 2010). With its diverse functionalities, AI has been used in different fields and professions for a while. For instance, in healthcare, AI-driven diagnostic tools assist medical professionals in identifying diseases and predicting patient outcomes (Kumar et al., 2022). In business and finance, AI algorithms are used for fraud detection, trading strategies, and personalized financial recommendations (Cao, 2022). Transportation also benefits from AI through the development of self-driving vehicles, traffic management systems, and predictive maintenance for fleets (Abduljabbar et al., 2019). Additionally, the retail sector uses AI for customer insights, demand forecasting, and supply chain optimization (Oosthuizen et al., 2021). Furthermore, utilizing natural language processing and computer vision, AI enables virtual assistants, such as chatbots and image generators, to facilitate image and speech recognition and make AI an omnipresent and transformative force in modern society (Jurafsky & Martin, 2020). In addition to its growth in the industry, there has been a growing use of AI within academic institutions, and AI has been found to play a prominent role in higher education. This transformative technology is disrupting the way students learn and instructors teach, with applications ranging from personalized learning to advanced data analysis for student success, such as identifying struggling students and offering tailored interventions, enhancing retention rates and overall quality of education (Chatterjee

& Bhattacharjee, 2020; Zawacki-Richter et al., 2019). All of the above applications are emergent and often suffer serious pitfalls, but the potentials are untold and disruptions to the status quo are likely to be sustained, calling for serious attention from scholars and practitioners across the fields.

Through the lens of ChatGPT, a currently popular and prevalent AI-driven tool, this chapter discusses its utilization of and impact on global higher education. Simultaneously, this study addresses several concerns, including data privacy, biases, ethical considerations, and the readiness of faculty and students regarding the integration of ChatGPT into academics. Additionally, this chapter proposes several recommendations to resolve these challenges and foster effective utilization. Finally, this study underscores the importance of continuous dialog and research, to determine the role of ChatGPT and other AI-driven tools in shaping the current and future landscape of international higher education. We seek to model the kinds of discussions and research efforts that we advocate for navigating ethical considerations, technological advancements, and the broader implications of AI in education. These efforts should involve diverse stakeholders and help to advance the responsible and beneficial integration of AI into global higher education, avoiding and mitigating its harm and misuse. With every major invention or disruption comes complex entanglements of opportunities and challenges, and as this chapter highlights, it is the scholars' work to disentangle them as best we can.

LITERATURE REVIEW

AI Implementation and Adoption in Higher Education

In the early 2000s, AI began making inroads into higher education through its integration into learning management systems (LMSs) (Cavus, 2010); these AI-integrated systems could help educators organize course materials and assessments, providing a more structured learning experience for students. In the 2010s, after the Great Recession, there was a surge in AI applications for personalized learning; for example, the use of AI algorithms could recommend courses and content tailored to individual students' needs (Maghsudi et al., 2021). These early adaptive learning systems adjusted the difficulty of content based on a student's progress (Pratama et al., 2023). During the mid-2010s, chatbots and virtual assistants became prevalent in U.S. higher education. AI-powered chatbots have been applied to answer student inquiries, provide information about courses, and guide students through administrative processes, offering a 24/7 support system (Chen et al., 2023; Essel et al., 2022; Lin, 2023). In the late 2010s, higher education institutions around the world began using predictive analytics to identify students at risk of dropping out or falling behind (Seidel & Kutieleh, 2017). AI models analyze data such as attendance, grades, and engagement to support early interventions, enabling educators and academic service units to provide targeted support to struggling students (Shilbayeh & Abonamah, 2021). With the rise of online learning at the dawn of the 2020s (Chan et al., 2021), partly prompted by the pandemic's

boost to distance learning (Singh et al., 2022), AI-powered proctoring tools were introduced to maintain exam integrity for remote proctored exams (Kurni et al., 2023). During the same time, AI-generated content and automated grading systems became prevalent (Schroeder et al., 2022; Ramesh & Sanampudi, 2022), as they may help educators save time, allowing more immediate feedback on assignments and assessments. Today, with the rapid development and accessibility of AI platforms and tools, educational institutions in the United States and abroad are exploring them to enhance students' overall campus experience; at the same time, they are also rightly concerned about a variety of impacts that this evolving technology might have on student learning and the educational enterprise at large. The potential includes implementing AI-driven lifecycle management systems that enable students to monitor their academic journeys, encompassing progress tracking, course history, financial aid sources, volunteer options, and schedule organization (Khare et al., 2018). Yet, the potential pitfalls may include colleges collecting and using private data about students who cross ethical boundaries (McNicol et al., 2023), students who overly rely on the tools and bypass the learning of knowledge and skills and the educational experience (Abdullah & Qolamani, 2024), and AI-dependent education reproducing social biases rather than helping counter them (Baker & Hawn, 2021). Therefore, corresponding solutions must be generated to address these issues.

The Use of ChatGPT in Higher Education

Among the many AI tools available, such as BERT developed by Google, New Bing developed by Microsoft, ChatSonic developed by Writesonic, and Ernie Bot developed by Baidu, ChatGPT developed by OpenAI has recently become the center of attention and has elicited a great number of discussions. ChatGPT is an AI-based chatbot that is proficient in understanding and responding to natural language inputs. It is designed to engage in human-like conversations, responding to natural language prompts with versatility that spans from casual dialog to complex problem solving. It excels not only in understanding the semantics of user queries but also in generating coherent, often contextually relevant responses (Luan et al., 2023). This capacity for natural language processing has positioned ChatGPT as a versatile tool with diverse applications for educational assistance. For example, Lin (2023) explored the potential of ChatGPT as a virtual tutor to assist learners in self-directed learning. In particular, ChatGPT can help learners establish specific learning goals and design personalized learning plans. ChatGPT may also have the potential to locate and access relevant resources based on learners' different learning styles, such as multiple media resources for visual and aural learners, journal articles for learners who prefer more complex readings, and hands-on activities for kinesthetic learners. ChatGPT can monitor and evaluate learners' learning performance by providing suggestions and feedback on their learning progress, including areas for improvement. Finally, ChatGPT can generate self-assessment tools for learners to evaluate their learning progress and then provide personalized recommendations or learning strategies to enhance their learning in a meaningful and constructive way. In short, especially when students are provided with adequate guidance and critical sensibility to avoid

misunderstanding and misuse of AI tools, this type of on-demand support can enhance their learning experience.

Furthermore, ChatGPT can help students learn new languages, practice grammar, and improve their communication skills through conversational practice. For instance, Shaikh et al. (2023) proposed an activity asking students to engage in conversations with ChatGPT on various topics and requesting paragraph generation for different contexts, including formal and informal writing. Students also utilized ChatGPT for identifying, fixing, and receiving suggestions for grammar mistakes, and they practiced vocabulary learning with the assistance of ChatGPT. Their study indicated that ChatGPT can be used as an effective tool for formal English language learning. Additionally, ChatGPT can aid in making educational materials more accessible. It can convert text to speech and generate alternative text for images (Wu et al., 2023a). Moreover, ChatGPT can assist students with disabilities in terms of academic success (Lyerly, 2023). Specifically, ChatGPT can perform as a virtual assistant for students with disabilities with questions or concerns about accommodations, services, or other issues. It can also provide information and resources to these students on a wide range of topics, including disability rights, assistive technology, and accessibility. Such 24/7 support can help students with disabilities know about their rights and responsibilities and access the resources needed to succeed in their academic journeys.

Contemporary Issues with ChatGPT Integration in Higher Education

Although some emerging scholarship has suggested that ChatGPT has the potential to enhance students' adaptability to evolving educational needs and foster independent learning practices, many scholars have raised concerns regarding the embrace of ChatGPT by students and academics. One major argument relates to the data privacy and security issues in regards to ChatGPT. As a conversational AI model, ChatGPT often involves the exchange of personal information and sensitive data, requiring careful attention to safeguard user privacy (Wu et al., 2023b). Key considerations include the secure transmission of data, robust access controls, and the implementation of encryption measures (Sebastian, 2023). Therefore, scholars (Wu et al., 2023b; Ray, 2023) have suggested that developers and organizations establish ethical guidelines for data usage and ensure transparency in informing users about how their data are used. Compliance with relevant data protection regulations is essential, and user education on potential risks and best practices is crucial. In short, striking a balance between the benefits of AI-driven interactions and preserving individual data privacy and security is key to building trust and ensuring responsible AI use in the digital age.

Recent studies have further explored the complexities of ChatGPT's integration into academic settings. Perkins et al. (2023) have highlighted the urgent need for robust mechanisms to detect AI-generated text, suggesting a combination of academic judgment and specialized software to combat misuse within higher education. Concurrently, the analysis of academic integrity policies through corpus linguistics by Perkins and Roe (2023) uncovers the inadequacies in current

frameworks when addressing the challenges posed by AI and other technological advances. Roe and Perkins (2023) examine the portrayal of ChatGPT in UK news media, revealing a spectrum of discourse that may shape public and academic perception. This body of work collectively underscores the imperative for academia to adapt to the generative AI era thoughtfully, balancing the potential benefits with ethical considerations and the integrity of scholarly work (Perkins et al., 2023; Roe et al., 2023). The introduction of the AI assessment scale by Perkins, Furze, Roe, and MacVaugh (2023) marks a significant step towards ethical GenAI assessment, ensuring that the use of generative AI in qualitative analysis remains aligned with academic standards and values.

Another concern focuses on the potential bias and discrimination in ChatGPT systems. ChatGPT learns from vast datasets, and because those data sets represent mainstream and dominant societies' ways of knowing and doing, they tend to contain biases and prejudices especially against minority communities; these problems can manifest in responses that are unfair or discriminatory regarding gender, race, and socioeconomic status (Ray, 2023). Addressing bias in AI systems is a complex challenge, and ongoing efforts are needed to improve the fairness and inclusivity of such AI models. Ray (2023) noted that developers must engage in rigorous testing and refinement to identify and mitigate biases and to make their training data more diverse and representative. It is essential to ensure that the educational uses of ChatGPT and other AI models does not perpetuate or amplify social problems.

Along the same lines, ethical considerations in AI-driven decision-making are paramount in an era where AI is increasingly integral to various aspects of society (Ray, 2023), especially when processes and decisions are not only machine-based but also automated. Ensuring fairness and mitigating bias, maintaining transparency and accountability, safeguarding privacy, and prioritizing security are foundational principles that underpin responsible AI deployment (Ray, 2023; Wu et al., 2023b). It is important to maintain a balance between automated decision-making and human oversight, in addition to an ethical-by-design approach. Moreover, long-term societal impact and the promotion of equity and inclusivity are fundamental ethical considerations (Stah & Eke, 2024). In other words, a conscientious integration of these principles is not merely a matter of practice but also a moral obligation, ensuring that AI-driven decisions align with ethical values, protect human rights, and serve the broader welfare of individuals and communities. Education must be a place where the ethical treatment of all individuals and groups is modeled rather than undermined.

Finally, faculty and student readiness for ChatGPT adoption in educational settings is another challenge. Faculty members responsible for delivering education need to be prepared to effectively integrate ChatGPT into their teaching. However, factors such as confidence, anxiety, and social good may influence some instructors' intention and readiness to effectively implement AI in the classroom (Ayanwale et al., 2022). Other instructors may perpetuate existing biases in education by not realizing that AI-based instructional decisions will be biased against certain students or exclude marginalized groups. They may not realize that students have unequal access to and

ability to use AI tools and platforms, overwhelm students with easily generated content (if not unvetted or unreliable), eschew community and personal touch by relying on AI tools to perform their work, or undermine students' critical thinking by promoting undue trust in AI tools' cognitive abilities. Therefore, as Ayanwale et al. (2022) suggested, professional development programs should be offered to prepare instructors for AI-integrated teaching. This entails gaining proficiency in the technology, understanding its capabilities and limitations, and developing strategies for integrating it into the curriculum. Moreover, faculty should become capable of guiding students on the responsible use of AI-powered tools such as ChatGPT (Halaweh, 2023), by clearly stating in the course syllabus the purpose and limitations of using ChatGPT, as well as providing adequate instructions on how to use it to enhance rather than undermine learning. Below are some examples of academic policy for using ChatGPT effectively in a classroom (Halaweh, 2023; p. 5):

1. ChatGPT is an AI-based tool that helps learners generate texts in a very short amount of time, increasing the ease and efficiency of searching for and finding summarized information and ideas related to the subject of interest and improving learners' writing.
2. Learners need to examine and evaluate the information generated by ChatGPT, as this approach may produce irrelevant or inaccurate information. Learners need to check the source of the information and cite it properly. The texts generated by ChatGPT that were copied and submitted as their final writing were considered plagiarism.
3. Learners should explicitly acknowledge the assistance of ChatGPT in the creation of their work (sections or parts included ideas/issues initially identified via ChatGPT or tasks achieved, such as editing and paraphrasing or calculations).
4. When submitting the final report, learners should provide two files: an audit trail of queries and a reflection report/note.
5. All the reports and assignments created with the help of ChatGPT will be evaluated through viva and presentation to ensure comprehension and understanding of the topics and issues, defending ideas or proof of understanding of program codes, and learners should be ready for any questions or adjustments requested by the instructors in real time during presentation.
6. As learners might be asked to write a report on a single topic or program code for an application, it is expected that there may be some degree of similarity between learner reports. However, in all cases, learners must ensure that their work has a low percentage of similarity (as per the university policy) and is free of plagiarism. Furthermore, the contents of the report must be largely generated by humans (considering the tool used for editing and paraphrasing), not by AI; this can be verified by using AI content detection software tools (e.g., Originality AI, GPTZero).
7. The instructor will carefully inspect any texts that are suspected of plagiarism or have been generated largely by AI, as indicated by detection software, and

make a judgment on such cases to take the most appropriate action, taking into consideration the context of the course and the specific assignment.

On the student side, readiness involves equipping students with the necessary skills to interact with ChatGPT in a productive and responsible manner (Sharma & Yadav, 2022). Beyond just learning to use ChatGPT effectively, students should understand the purpose and scope of its use, as well as critical issues such as the potential for bias and ethical considerations when using it. Students need to develop critical thinking skills to evaluate the accuracy and reliability of information obtained from ChatGPT (Lin, 2023; Lin & Schmidt, 2023) because such AI systems may generate inaccurate and incorrect information (Wu et al., 2023a). They must also understand broader intellectual, ethical, professional, and sociopolitical implications of its use in their education, lives, and careers. In short, faculty and students must be prepared through training and education to effectively use ChatGPT in an educational context while simultaneously being mindful of the ethical, privacy, and critical thinking dimensions of its adoption. This readiness is key for implementing the full potential of AI technology in education while ensuring responsible and informed usage.

DISCUSSION

Recommendations for Higher Education Stakeholders

Due to the challenges discussed above, integrating ChatGPT into educational institutions requires careful planning and execution. First, educational institutions should define clear goals for using tools such as ChatGPT, such as improving student support, enhancing curriculum delivery, or motivating innovative learning experiences. Understanding the specific use cases and desired outcomes can help to leverage specific potentials and avoid or mitigate relevant pitfalls. Moreover, educational institutions should provide comprehensive training for faculty and staff to ensure that they are proficient in adopting AI technologies such as ChatGPT in education (Ayanwale et al., 2022). Educational institutions should offer training programs that equip faculty members with not only the technical skills needed to use ChatGPT effectively but also discipline-specific knowledge for enhancing learning/teaching. In other words, faculty training should extend beyond technical skills, focusing on strategies for effectively using ChatGPT to enhance the learning experience. This also includes understanding the AI model's capabilities and limitations and providing practical guidance on how to integrate it into the curriculum. Faculty should also be trained in recognizing and addressing potential bias and ethical concerns in AI-driven interactions. Educational institutions can facilitate workshops and peer learning to create a collaborative environment for skill development and sharing. Faculty should have access to a variety of professional development opportunities to stay updated on the latest developments in AI and ChatGPT. Educational institutions should encourage faculty members to experiment and share best practices with each other, which can motivate a culture of innovation and continual improvement. Collaboration

with AI developers and experts can also provide valuable insights. In sum, faculty members' readiness to embrace AI technologies such as ChatGPT could significantly impact their successful integration into the educational process. Whereas deliberate and thoughtful approaches can help academic institutions harness the positive and emerging potential of AI tools, unplanned and haphazard adoption can hurt the educational experience for students.

Second, preparing students for an AI-driven world is a vital educational mission. Educational institutions should incorporate AI literacy and digital skills into the curriculum to equip students with the knowledge and capabilities needed to thrive in an AI-enabled society (Ng et al., 2023). This includes understanding the principles and limitations of ChatGPT, recognizing AI-driven decision-making, and fostering critical thinking skills for evaluating AI-generated content (Lin, 2023; Lin & Schmidt, 2023; Sharma & Yadav, 2022). Additionally, institutions of higher education should encourage students to use ChatGPT as a tool for enhancing learning and problem solving (Orrù et al., 2023), rather than bypassing learning; so, while students should learn how to use AI tools to facilitate the processes and skills of research and writing, rather than argue that they don't need to learn these skills because AI tools can do those tasks now. Instructors should provide students with opportunities to collaborate on projects that involve AI systems, fostering their creativity and adaptability. Institutions should also emphasize the ethical use of ChatGPT, teaching students about data privacy, responsible information sharing, and ethical considerations when interacting with AI systems (Ray, 2023; Wu et al., 2023b). The need to prepare students for an AI-driven world extends beyond technical skills. Colleges and universities should nurture skills such as emotional intelligence, complex problem solving, ethical outlook, political awareness, and effective communication, which are essential for students to use AI technologies safely and to adapt to changing workplace dynamics (Sigh & Chouhan, 2023). Encouraging a growth mindset and readiness to embrace technological advancements can equip students to thrive in an AI-driven future, where adaptability and lifelong learning are key to success.

Moreover, educational institutions should evaluate their technical requirements to ensure that they have the necessary infrastructure and support for ChatGPT and integration. They should collaborate with developers and AI experts to tailor integration to the institution's unique needs. They should conduct ongoing assessments and monitor the impact of ChatGPT on education and student learning outcomes to make informed decisions and refinements. They should also involve students and seek feedback to ensure that ChatGPT and generative AI aligns with their needs and expectations. Clear communication with all stakeholders about the integration process, its goals, and ethical considerations are also vital for fostering trust and transparency. Institutions must adopt policies and practices that avoid or mitigate harm and optimize benefits.

Finally, ethical guidelines and best practices are imperative among all stakeholders for the responsible deployment of ChatGPT in education (Ray, 2023; Wu et al., 2023). Higher education organizations should establish clear ethical frameworks that align with legal regulations and ethical principles, additionally seeking to foster

learning and teaching, as well as student experience and faculty and staff rights. These guidelines should include data privacy, security, transparency, fairness, and inclusivity. Faculty and staff should be trained in ethical considerations, particularly in recognizing and addressing potential bias and discriminatory outcomes. Educational institutions should also promote the development of AI systems that are inclusive and consider diverse perspectives and backgrounds (AIContentfy team, 2023). They should engage with broader AI and educational communities to stay informed about evolving ethical standards and best practices. Regular reviews and updates of ethical guidelines and procedures are essential to ensure that AI technologies remain aligned with evolving ethical norms and the best interests of students and educators.

CONCLUSION

As exemplified by ChatGPT, AI holds significant promise in reshaping the landscape of global higher education. It offers enhanced educational support, personalized learning, and advanced administrative tools, improving efficiency and access. However, the integration of AI in tertiary education also raises questions about the future of teaching, learning, and privacy issues. The widespread adoption of AI systems in academia is a reflection of the broader digital transformation that is reshaping education, enhancing accessibility and enabling new levels of customization and personalization in the learning process. The future of global higher education is undoubtedly intertwined with the emergence of AI technologies, as institutions use technology to leverage innovation, inclusivity, and adaptability in an increasingly dynamic educational environment. Therefore, the integration of AI in higher education necessitates ongoing dialog and research. It is important to engage in meaningful discussions that encompass technological developments, ethical considerations, and the practical consequences of AI adoption. This dialog should extend to encompass diverse stakeholders, including educators, students, developers, and policymakers. Moreover, continued formal and informal research is imperative for understanding the psychological, pedagogical, and societal impacts of AI in higher education. Research endeavors should focus on the optimization of AI systems and policies for academic purposes, the identification and mitigation of potential harms, and the exploration of AI's role in shaping postsecondary education of future generations. By fostering open dialog and rigorous research, we can maximize the potential of ChatGPT and generative AI while safeguarding ethical principles and ensuring its responsible and beneficial integration into the field of higher education and student affairs.

ORGANIZATION OF THE BOOK

This book explores the transformative influence of ChatGPT and generative AI across various facets of higher education. Comprising a total of 18 chapters, the book aims to examine ChatGPT's potential impact on global higher education from diverse perspectives. Organized into four themes, these chapters explore the

utilization of ChatGPT in tertiary education, covering perspectives ranging from history to innovation, best practices, standards, and procedures as well as policy implications, ethical considerations, and contemporary issues and trends related to the use of ChatGPT in teaching and learning. Ultimately, the purpose is to engage readers in learning, critiquing, and evaluating topics related to ChatGPT and other AI-driven tools through these insightful contributions.

The first unit, comprising five chapters, commences with an examination of the use of ChatGPT and AI in global higher education. This unit explores the transformative impact of AI technologies on the educational landscape. Specifically, in the current chapter, we explore the implications of ChatGPT for postsecondary education, discussing the challenges and ethical dilemmas associated with its use. We emphasize the adoption of new technologies in education and highlight the need for their responsible integration. In Chapter 2, Kenneth J. Luterbach analyzed the impact of ChatGPT and other AI apps on education. The chapter examined historical analogies to determine the impact of prior technologies on education. He also discussed the distinctive features of ChatGPT and other AI apps and offered insights into their potential to alter educational systems. In Chapter 3, Yankun He and Leslie Cordie investigated the potential of ChatGPT to innovate learning and teaching methodologies in higher education. They specifically examined the effects of ChatGPT on students' learning outcomes, highlighting its positive impact and suggesting a critical role in the future of teaching and learning practices. In Chapter 4, Abdulrahman Alsharif examined the educational implications of generative AI, by comparing the current adoption processes to past technology integration (i.e., a calculator). The chapter emphasized the challenges and drawbacks of AI tools, especially in the context of the COVID-19 pandemic, and underscores the need for continuous research and dialog for responsible integration. In Chapter 5, Bhavika Sicka investigated the potential of ChatGPT in curricular development. The chapter examined ChatGPT's ability to design a decolonial English literature course. While noting this tool's ability to pluralize and internationalize the curriculum, the author warns of ChatGPT's biases and suggests a careful approach to preventing the perpetuation of coloniality.

The second unit, consisting of four chapters, explores best practices, standards, and procedures with ChatGPT, providing lessons learned and recommendations for colleges and universities around the world. In Chapter 6, Lingfei Luan, Xi Lin, Yan Dai, Laura Allen, and Shanhua Hu, focused on STEM education, particularly in psychology and neuroscience. This study evaluated the effectiveness of ChatGPT in enhancing learning by comparing human instructor and ChatGPT feedback in a group project. This study highlighted the potential of AI as an educational tool while acknowledging its limitations in providing personalized and clear feedback. Chapter 7, authored by Ling Angela Xia, Olivia Yiqun Sun, and Charlie Reis, surveyed students at an English as Medium of Instruction (EMI) University in China. This chapter examined these students' attitudes toward and usage patterns of generative AI technologies, emphasizing the importance of proactive engagement by educators and administrators to ensure fair and inclusive access to AI-based technologies. In

Chapter 8, Thatcher A. Spero addressed linguistic inequality in English-medium instruction (EMI) education. The chapter explored the use of ChatGPT to assist EMI students in academic writing by presenting a case study in Japan and emphasizing the transformative potential of AI technology in global higher education. In Chapter 9, Suha Khalil Assayed, Manar Alkhatib, and Khaled Shaalan compared ChatGPT and Seq2Seq chatbot models in the context of high school advising. They provided guidance and advice to prospective undergraduate students, going on to discuss the architecture and performance of both models and emphasize their potential for educational purposes.

The third unit, comprising five chapters, examines policy implications and ethical considerations related to AI through assessment and accountability in higher education. In Chapter 10, Jeffrey C. Sun focused on intellectual property rights in the context of AI. The chapter examined the ownership, usage, and profitability of inventions, works, source codes, and processes arising from AI. Sun further presented case studies to analyze key considerations linked to AI and provided legal frameworks relevant to higher education scholars, leaders, and commentators. In Chapter 11, Lisa M. Rubin addressed concerns about AI's impact on research ethics, covering topics such as informed consent, data privacy, falsification, publication issues, and the benefits of AI for ethical research practices. Rubin's chapter also explored the implications of AI tools in research and presents considerations for researchers, journal editors, and policymakers. In Chapter 12, Bo Zhang focused on teaching and learning, examining the impact and implications of ChatGPT and AI technologies in higher education. Zhang also offered policy recommendations based on a systematic review of areas such as assessments, student competencies, AI-driven workplaces, and a balanced approach to AI adoption. In Chapter 13, Allen Farina explored AI's role in assessing and providing feedback in higher education, discussing the implications of adopting AI, writing comprehensive policies, reassessing traditional evaluation methods, and developing a framework for enhancing the positive effects and mitigating the negative aspects of AI on assessment and feedback. In Chapter 14, Luke Parker, Christopher W. Carter, Alice Karakas, A. Jane Loper, and Ahmad Sokkar investigated the potential impact of ChatGPT in undergraduate assessments. They showed that ChatGPT-generated responses consistently outperformed student grades, raising questions about academic tasks' reliance on AI and emphasizing the need for further research and ethical considerations.

The final unit, consisting of four chapters, explores contemporary issues and trends by integrating ChatGPT in teaching and learning. In Chapter 15, Gabriela Mocanu presented findings from a narrative research study investigating preservice teachers' experiences using ChatGPT for inquiry and reflection. She highlights the potential benefits and limitations of ChatGPT as a tool for teacher education, emphasizing the need for a balanced approach that includes both AI-based interactions and engagement in communities of practice. In Chapter 16, Kim Manh Tuan, Pham Van Thuan, Duong Thi Hoang Yen, and Nguyen Phuong Huyen examine how faculty members' attitudes, behaviors, and university regulations influence student outcomes with AI integration at Vietnam National University Hanoi. The authors

emphasize the importance of cultivating a growth mindset among faculty members. In Chapter 17, Stephan Ruppert explored the potential of ChatGPT in soft-skill training sessions. He proposed a method for using generative AI text models to create context-specific critical incidents, emphasizing the benefits of personalization in training sessions and addressing the limitations and challenges associated with the use of AI in educational settings. In Chapter 18, Hon Jie Teo addresses the impact of ChatGPT on work-based learning (WBL) programs and the roles of WBL coordinators. Teo focused on the need to understand opportunities, challenges, and ethical considerations, highlighting the importance of guiding students through the WBL continuum: career awareness, exploration, and preparation.

This book, as a comprehensive exploration of issues related to the use of ChatGPT as a generative AI technology, brings together diverse perspectives, research findings, and insights to furnish readers with a thorough understanding of the integration of ChatGPT in higher education. The book encompasses insights into using ChatGPT for educational innovation, best practices, standards, and policies. It explores institutional policy implications and ethical considerations while also examining contemporary issues and trends involving ChatGPT in teaching and learning. Essentially, we conceived this book as a forum for different perspectives, diverse experiences, and practical insights related to ChatGPT as a rapidly emerging and wildly popular AI tool. We used the following guiding questions as we gathered and curated the chapters for educators, policy makers, and other potential readers:

1. What are the potential implications of ChatGPT and AI for the internationalization of higher education, particularly in the context of cross-border collaboration and student mobility?
2. How can ChatGPT and AI be used to address the challenges of accessibility and inclusivity for students (e.g., students with disabilities)?
3. What are the potential implications of ChatGPT and AI for intellectual property and academic freedom?
4. What are the potential impacts of ChatGPT and AI on the mental health and well-being of students?
5. What are the potential benefits and challenges of the use of AI in university recruitment?
6. To what extent should colleges and universities develop partnerships with AI companies (e.g., University of Michigan [Maizey; Microsoft]; Arizona State University [OpenAI])?
7. How can faculty and staff timelessly equip themselves better at working in tandem with ChatGPT and AI in the future?

We are keenly aware of the evolving nature of generative AI at colleges and universities. Our main focus was to offer international perspectives and experiences from a diverse group of teacher-scholars and practitioners around the world while leaving readers free to critique and challenge the current and future state of ChatGPT on global higher education.

NOTE

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UNIT 1:
INTEGRATION OF CHATGPT IN
EDUCATION

Chapter 2

Considering the History of Technologies in Education, the Distinctiveness of AI Apps, and the Future of Educational Systems

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ABSTRACT

The emergence of ChatGPT and other AI apps has educators contemplating the impact AI technologies might have on their teaching and educational systems. The history of educational technology cautions against predicting a revolution in education. Yet, unlike prior technologies for teaching and learning, ChatGPT and other generative AI apps produce sentences, paragraphs, essays, reports, computer code, images, and videos as directed by human prompting. To determine how that technology might alter educational systems, this chapter analyzes historical events to derive lessons learned about the impact of prior technologies on education. Then this chapter discusses the distinctive features of ChatGPT and other AI apps, as applied to teaching and learning. Informed by those considerations and the current state of schools and colleges, this chapter discusses the future of educational systems in a world with AI apps and tools.

Keywords: History, educational technology, artificial intelligence (AI), future of education

INTRODUCTION

Today, in schools and colleges throughout the world, teachers and administrators are both intrigued and concerned by the emergence of AI apps, such as automated text generators. Often called *chatbots* or *conversational agents*, freely available text generators respond to human prompts in a conversational manner. Since computers, like toasters, have no sentience or moral purpose, person-to-machine exchanges with ChatGPT and other chatbots are qualitatively different than person-to-person conversations. Whereas human beings utilize their knowledge of language and intelligence to parse and reply to questions, contemporary chatbots leverage Large Language Models (LLMs), neural networks trained on billions of words in books, journal articles, magazines, web pages, and other sources. Details pertaining to LLM development and function, including the manner in which word associations and patterns in texts written by human beings are modeled in a computer network with

over 100 million connections between nodes, the strengths of which are adjusted statistically during training (the inputting of the billions of words), appear in Clarke et al. (2023), Prakash (2023), and Wolfram (2023), for instance. For this chapter, we need only recognize that LLMs enable word generation by chatbots and that the technological sophistication and machine learning capacity of LLMs make chatbots remarkably adept at responding to questions. Indeed, chatbot responses rise to the level of human performance on multiple assessments.

In a comparison of English reading comprehension, the average score of Dutch students attending the most rigorous high school program in the Netherlands was 6.99, whereas ChatGPT-4 scored 8.3 on a 10-point scale (deWinter, 2023). On medical tests, ChatGPT-3 passed or nearly passed the three exams which comprise the United States Medical Licensing Exam (Kung et al., 2023), and ChatGPT-3.5 ranked between the 80th and 92nd percentiles on the past five Medical Specialty Exams (Oztermeli & Oztermeli, 2023). ChatGPT also attained minimal passes (grades of C+) on four law school final exams (Choi et al., 2023), but OpenAI (2023) reports that ChatGPT-4 scored in the top 10% of test takers on a simulated bar exam conducted by OpenAI collaborators, whereas ChatGPT-3.5 scored in the bottom 10%. On the final exam of the Operations Management course in a Master of Business Administration program, ChatGPT-3 received a grade in the B to B- range (Terwiesch, 2023). On an assessment typically given to instructional design students, ChatGPT was prompted to create a needs, task, and learner analysis for a specific instructional context, and the replies from ChatGPT were judged as sufficient to pass for graduate-level work (Parsons & Curry, 2023). Moreover, ChatGPT-4 attained the maximum score (5/5) on 9 of 15 AP exams, scored 4 on another four of those AP exams, and scored 2 on the other two AP exams (OpenAI, 2023). Those results, though imperfect, begin to convey the overall quality of replies provided by ChatGPT. In addition, ChatGPT responds correctly or appropriately to questions about economics, project management, nursing, and water polo, for instance. ChatGPT also writes poetry and prose in the styles of famous poets and authors, with variable success. Overall, the generative capabilities and acceptable, if not laudable, performance in question-answer exchanges across a vast array of topics make ChatGPT and other LLM-based conversational agents breakthrough technologies in person-machine conversations.

Even though ChatGPT often performs well on particular question-answer tasks, it generates unsatisfactory responses at times. In particular, ChatGPT may provide incorrect answers or *hallucinations* or fabricated information such as references to sources that do not exist. When developing the GPT-4 model, OpenAI (2023) implemented a post-training process involving reinforcement learning from human feedback, which improved performance significantly over that of GPT-3.5. Overall, chatbot performance is sufficient for many tasks. Hence, ChatGPT diffused rapidly and is used for a wide variety of purposes. For example, with a suitable prompt, ChatGPT will display key factors causing economic collapse in the 1930s in North America, provide step-by-step directions to connect a specific motor controller to a particular microprocessor, or provide examples demonstrating how one might

include figurative language in a story. Since chatbots make mistakes at times, users are left to decide whether the responses are suitable for their purposes. Gundle (2023), a clinical psychologist, advises against the use of chatbots to seek advice on dating, for instance, but some people do use them for that purpose. However beneficial or dangerous, the machine learning algorithms and generative AI techniques utilized by contemporary chatbots enable person-to-machine conversation at all hours every day. How should we regard such indefatigable machine interlocutors? What impact will ChatGPT and other LLMs have on elementary, secondary, and higher education globally? How might educational practices of the past century be enhanced by machine tutors? How might K-12 schools and colleges adapt?

Fortunately, we can turn to history and analyze the effects of prior technologies on schools and colleges to inform our views about the possible impact of chatbots and other AI apps on contemporary educational systems. Accordingly, this chapter begins with a brief history of technologies in education, which reveals the remarkable stability of educational systems over multiple decades. Second, this chapter describes the variety and distinctiveness of AI apps for teaching, learning, and productivity, which includes discussion of how instructors and students can implement new instructional methods using ChatGPT and other AI apps and tools. Then, drawing on the history of educational technology and in light of the distinctiveness of AI apps, this chapter discusses how educational systems might change in this world with generative AI. One year has elapsed since generative AI apps first diffused widely around the world. Hence, the story of its impact is emerging. The way forward in educational systems will be determined in part by the reactions of students, faculty, and administrators to AI apps and technologies (Alsharif et al., 2024, this volume), which will vary locally and globally. The journey ahead is likely to be enjoyed more by those who are willing to use AI apps and discover how to innovate with them than by those who recoil at the mention of machine learning, generative AI, ChatGPT, or DALL-E.

A HISTORY OF TECHNOLOGIES IN EDUCATION

Since the introduction of radio and television, technology enthusiasts have often vastly overestimated the impact of technologies in education (Saettler, 2004; Watters, 2021). During the past century, advances in technology produced radios and televisions, which enabled the transfer of information through audio and video. Given that Gutenberg invented the moveable-type printing press around 1440, it took nearly five centuries for the mass distribution of information to occur in a form other than text and images on paper. Indeed, radios and televisions revolutionized information transfer. Also, in the past century, computers and devices for digitizing text, images, audio, and video radically changed both the transmission and processing of information. All of those technological advances resulted in greater access to information in schools. With such revolutionary changes, many enthusiasts predicted massive and profound benefits in education. However, there is much more to teaching and learning than access to a device for receiving and transmitting information. The

new technologies were often beneficial to teachers and students but did not have the impact fathomed by technology enthusiasts. Over time, instructors integrated the devices into their teaching practices, which resulted in evolutionary changes to educational systems.

According to innovation diffusion theory advanced by Rogers (2003), new devices and ideas diffuse through a social system as individuals make personal decisions about whether to accept or reject the innovation. Rogers (2003) found that those decisions are based on multiple factors, including the following five factors: (1) *Observability*, opportunity to view the technology in operation; (2) *Trialability*, opportunity to personally test the functionality of the technology; (3) *Complexity*, perception of the time and effort needed to learn how to use the technology; (4) *Relative advantage*, perceived benefit of the new technology compared to alternatives; and (5) *Compatibility to values*. In such light, when a new technology emerges, instructors need time to ensure that it will be better than alternative approaches for helping their students acquire particular instructional objectives. Since many technologies are designed for the masses, not strictly for educators, instructors might also need to create instructional materials for transmission through devices, for instance. Even in the case of an innovation developed for educational purposes, instructors still need to conclude that it will fit their teaching style and be of greater benefit to students than alternative approaches. Then early adopters need to communicate with other teachers their experiences using the new technology with students. Since that professional development process can occur only when instructors are not engaged in lesson planning, teaching, and grading, for instance, multiple months and years often elapse while a technology diffuses through an educational system.

The following cases of instructional radio and television, digital calculators, computer-assisted instruction, information and communication technology, and Massive Open Online Courses (MOOCs) bring attention to factors that affect the diffusion of technological innovations as well as illustrate how the decisions of educators regarding innovations contribute to the stability of educational systems. In some of the following cases, the new technology was found to be unsuitable for instruction and rejected by educators. When deemed acceptable, the willingness of educators to expend the time necessary to engage in professional development to learn how to integrate the technology into their teaching practices enabled its diffusion through schools over time. This accounts in part for the stability of educational systems.

Instructional Radio and Television

In the 1920–1950 period, proponents of instructional radio anticipated revolutionary learning gains. The rationale advanced by George Zook and others was that any inexpensive device capable of transmitting information to large numbers of people effectively would surely result in great educational benefits (George Zook in Marsh, 1937; Saettler, 2004). Yet, even with large investments in educational radio programming by the U.S. Department of Education and private companies,

many people realized that while information delivery was sufficient for generating awareness and piquing interest, mass information delivery of audio was insufficient for learning. This lesson was learned again by enthusiasts of instructional television (TV). As in the case of radio, funds were widely available to create instructional TV programs from approximately 1955 to 1965, and expectations were high that delivering a combination of audio and video would revolutionize education. Instructional TV was expected to solve the problem of overcrowded classrooms due to teacher shortages, but it failed to meet such high expectations. As Heinich (1991, p. 63) noted, “the television people got caught up in the delivery system and thought all one needed was a dynamic personality and a camera.” Indeed, there is more to instruction than information delivery by talking head. One key lesson to learn from the history of instructional radio and television is that technological breakthroughs do not automatically revolutionize education. Indeed, they might have little impact on educational systems. A second lesson is that a revolution in education requires more than inexpensive, effective, and rapid transmission of information to many people.

Digital Calculators

The invention of digital calculators and the capacity to mass produce affordable ones by the mid-1970s were important milestones in the prelude to the information era. Many people readily learned the simple number pad interface and arithmetic calculations were performed much faster and more accurately than they were in the past. In schools, debates ensued over whether to permit students to use a calculator (Pendleton, 1975; Rudnick & Krulik, 1976). There was extreme division over this issue between people on opposing sides and, perhaps at times, within individuals themselves. Many parents and teachers were genuinely concerned, even fearful, that the use of calculators would result in children losing or never acquiring fundamental arithmetic capability. On the other hand, preventing children from using calculators would deprive them of opportunities to use the tool to increase efficiency at complex math tasks and to address real-world problems. This dissonance was captured in a survey by the *Mathematics Teacher* magazine, which revealed that 72% of respondents (teachers and non-teachers) opposed the use of calculators in Grade 7 classrooms, while 96% agreed that the use of calculators would enable the pursuit of real-world problems and increase student motivation (Pendleton, 1975).

Now, half a century after the introduction of calculators, the adaptations teachers made when calculators arrived have been clear for some time. Crucially, professional development opportunities provided teachers with engaging activities that fostered student learning in their classrooms, which improved teacher attitudes toward the use of calculators in schools (Bitter, 1980). Additionally, research has played a role in resolving questions about the effects of calculator use in schools (Banks, 2011). In 1979, the U.S. National Council of Teachers of Mathematics (NCTM) issued a position statement promoting the use of calculators in schools, and Boards of Education in some states eventually required the use of calculators on state exams (Banks, 2011). Over time, as fears diminished about possible harm to students and

teachers learned more about how to help students solve problems with a digital calculator (which is truly much better than a slide rule in many ways), the acceptance of calculators in classrooms became normal. Schools evolved.

Today, elementary school students still learn to add, subtract, multiply, and divide numbers. Once those skills have been mastered and verified as attained, students may begin to use calculators. However, even in Grades 11 and 12, there are times when we, as a society, find value in prohibiting the use of calculators to verify the attainment of fundamental mathematical skills. For example, the SAT prohibits the use of a calculator on one portion of the math test but permits its use on the other portion of the test (College Board, 2023). The initial debates over whether to permit student use of calculators were resolved by prohibiting the use of calculators when students are attaining fundamental arithmetic and mathematical skills. Moreover, students cannot use calculators during tests to verify the attainment of those fundamental skills. The use of calculators is permitted at all other times.

As noted above, when digital calculators became available and affordable, parents and teachers were concerned that the use of the device would prevent the development of the capability to add, subtract, multiply, and divide numbers. Yet, by the early 1980s, calculators were in virtually every home (Seitz & Parks, 1982). Given the ubiquity of calculators and in recognition that their unique features help students address complex mathematical problems, as well as real-world problems, teachers eventually learned how to integrate them into their instruction. Over approximately one decade, most individuals resolved whatever dissonance they had with the use of calculators in the classroom. It became evident that children would attain and retain the skill to add, subtract, multiply, and divide, provided teachers prohibited use of the device when children first learned those skills. Furthermore, when verifying the attainment of fundamental arithmetic skills, teachers and others resolved when to prohibit the use of calculators.

Computer-Assisted Instruction

Since radios and televisions permit only the delivery of information, one might wonder whether a device that also offered cost-effective delivery and automated control of the instructional method would revolutionize education. Indeed, many developers of computer-assisted instruction in the 1960–1990 period anticipated great learning gains relative to traditional instruction. In the early 1960s, with a terminal consisting of a monitor and a keyboard, some learners connected to multimillion-dollar mainframe computers to run instructional software. In particular, the Programmed Logic for Automatic Teaching Operations (PLATO) system and the Time-Shared Interactive Computer-Controlled Information Television (TICCIT) system enabled engagement in lessons to learn mathematics, chemistry, physics, English grammar and spelling, as well as English as a Second Language (ESL) and languages such as Danish, French, German, Italian, Spanish, Swedish, and Thai. By 1980, vacuum tubes and transistors in early computers had been replaced by integrated circuits, and some instructional programs in TICCIT were being ported to microcomputers (Merrill et al., 1980).

Throughout the 1970s and 1980s, there were very large public and private investments in the production of computer-assisted instruction because instructional software was expected to radically improve education. However, as educators and researchers began testing the instructional systems, it became apparent that the results were not going to meet expectations. In fact, many subject matter experts found computer-assisted instruction to be shallow, uninspiring, and absolutely unsatisfactory (Klopfer, 1986). Speaking on behalf of content teachers, Walbert (1989, p. 281) noted that “the computer was not the ‘dream’ teaching tool it was once thought to be.” On the other hand, proponents regarded instructional software as extraordinarily beneficial for learning. In the educational technology discipline, a media methods debate ensued to resolve whether computer-assisted instruction was more or less effective than traditional instruction was.

In the end, Clark (1983, 1991, 1994) won the debate against the Kuliks (Kulik, et al., 1983; Kulik et al., 1985), Kozma (1991), Petkovich and Tennyson (1985), and others by citing research showing no significant difference in learning when comparing traditional instruction to computer-assisted instruction. Learning is sufficiently complex that multiple perspectives can still be brought to the debate, which calls into question whether instructional methods can always be separated from devices, as Clark contends but Luterbach opposes (Clark, 2005; Luterbach, 2005a, 2005b). Setting that intricacy aside, the media methods debate essentially resolved that, with respect to learning, instructional methods matter much more than the delivery system. In the words of Clark (1983, p. 445), “Media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition.” Knowing that result is often key to critical examination of claims that technologies enhance learning. Many believed that instructional software would change education profoundly, but the passage of time has made it evident that computer-assisted instruction did not revolutionize educational systems. Time, effort, and financial investments in computer-assisted instruction advanced educational systems in an evolutionary manner. Having considered the case of computer-assisted instruction, which regards the computer as a tutor, the next section discusses the effects on education of the computer as a tool and a tutee, which exhausts the three roles of a computer in education (Taylor, 1980).

Information and Communication Technologies

It would be difficult to overstate the impact of computers as tools in schools, which began around 1980 when schools and colleges started buying microcomputers. The massive widespread adoption of desktop and laptop computers accelerated through the 1990s due to the benefits of the World Wide Web, which brought WebQuests (Dodge, 1995; March, 2003), and the proliferation of freely available instructional materials. In the early 1990s, Lewis J. Perelman (1992) predicted the end of education because, in his view, the availability of free instruction meant that everyone could learn anything at any time. We still have schools and colleges, and teachers have continued to adapt to technological developments. The transformation from a society

in which information was distributed on paper to one involving mass development and the distribution of digital media marks the transition from the industrial era to the information era. This has also been described as a transition from a literate society in which books were used to improve literacy worldwide to a post-literate society in which information transmission by paper ceded to digital transmission in largely literate societies (Ulmer, 2003; Graham & Dugmore, 2022). Given the introduction of mobile phones in the late 2000s, schoolteachers, as well as college faculty (Farias-Gaytan et al., 2023), faced more disruptions in their classrooms but adapted through professional development activities.

For more than 40 years, curricular standards in schools have been adjusted to align with new technologies. At every turn, teacher preparation programs have modified their instructional materials and methods. That continues today, as does teacher professional development in elementary, secondary, and higher education. Furthermore, thousands of research papers, teacher practitioner articles, books, and conference proceedings document numerous methods, benefits, and issues pertaining to the use of digital tools for teaching and learning. Within that diverse knowledge base, researchers and practitioners discuss a wide variety of topics, such as instructional simulations and games, Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), tablets, and smartphones, as well as instructional methods, such as behavioral instruction, constructivist instruction, project-based learning, problem-based learning, and peer collaboration (e.g., Bishop et al., 2020; Hughes & Roblyer, 2023; Langren et al., 2023; Smaldino et al., 2019; Spector et al., 2014). These efforts have contributed to teacher professional development since the introduction of microcomputers in schools and colleges in the early 1980s. The history lesson of note here is that instructors continually adapt and refine their pedagogical practices to keep pace with technological and pedagogical advances. Decade after decade, including the transition to a new era, teachers adapted by learning how to integrate technologies into their teaching practices to better prepare students for the future. In this manner, continuous professional development has a stabilizing effect on educational systems.

When the computer is in the role of a tutee, students direct the computer to follow their instructions. Seymour Papert (1980) led the way by encouraging students to hypothesize solutions to problems and then test their solutions by implementing them in *Logo*, a computer programming language. Then, Mitchel Resnick introduced the visual drag-and-drop programming environment, *Scratch*, which enabled children to program a computer (Resnick et al., 2009; Resnick, 2019). In 2006, Jeanette Wing introduced *computational thinking*, which became the term used to describe systematic problem solving with and without computers. Although initially slow to diffuse through school systems, efforts by Wing (2006), Brennan and Resnick (2012), Kong and Abelson (2019), Luterbach (2022), and others to promote computational thinking and provide relevant professional development have increased the knowledge and skills of teachers, which in turn enhanced student achievement. The computational thinking movement has also benefitted from curricular mandates that require the acquisition of computer science standards. Furthermore, instructional materials

produced by organizations such as *Hour of Code* (Hourofcode.com, Code.org), *CS4All* (csforall.org), and *AI for All* (ai-4-all.org) have boosted the computational thinking skills of teachers and students. As before, this case includes instructors expending the time and effort necessary to learn how to integrate technologies into their teaching practices to better serve their students. This helps stabilize school systems and advances post-literate society.

Massive Open Online Courses (MOOCs)

As a final case, the introduction of Massive Open Online Courses (MOOCs) prompted predictions of a revolution in education, and some faculty and administrators were concerned about disruptions in their colleges. Today, even though learners can enroll in MOOCs for free or at low cost and can engage in instruction whenever they wish, the dropout problem is high, and the prevalence of MOOCs is declining (Basnet et al., 2022; Billsberry & Alony, 2023; Moreno-Marcos et al., 2020; & Reich & Ruipérez-Valiente, 2019). MOOCs provide yet another example in which the widespread availability of affordable and accessible instruction is insufficient to fundamentally alter educational systems.

Educational Systems Adapt Gradually as Teachers Integrate New Technologies

This brief history of technologies in educational settings presented multiple cases of unfulfilled expectations. Flicking the power switch on radios and televisions in classrooms resulted in the immediate flow of audio and video to students. Proponents of those technologies expected that flow to improve academic achievement considerably. Despite large investments in TV programming and the display of those programs in classrooms through the 1970s, the benefits of the TV programs were strikingly small compared to expectations. However, instructional TV programming was not a failure. School systems purchased TVs, and teachers built activities around the programming. Today, many classrooms are configured to display videos to students, and teachers engage them in discussions and activities pertaining to the videos.

Due to large investments over the past three to four decades, students have been able to readily access engaging and effective instructional materials in the form of digital videos, audio recordings, images, articles, web pages, electronic textbooks, simulations, games, and instructional apps. Again, the developers of those technologies, along with many legislators and parents, expected digital computers and software to improve achievement markedly. However, as before, the impact of the technologies did not meet the inflated expectations. Even though schools and colleges were not radically altered instantly, instructors learned how to integrate the technologies into their teaching practices over time. This gradual adaptation process improved and stabilized the educational systems. In such light, the assimilation of new technologies into educational systems was evolutionary rather than revolutionary.

DISTINCTIVENESS OF AI APPS FOR TEACHING AND LEARNING

Educational systems are resilient, and history often repeats; however, if a technology could significantly alter pedagogical practice favorably, perhaps by saving teachers substantial time on lesson preparation, instructional development, lesson delivery, or provision of feedback, fundamental change to schools and colleges might occur.

Instructors use ChatGPT and other AI apps for multiple purposes. To begin, they may use ChatGPT as a teaching tool to demonstrate how to be more productive when completing various tasks. Some instructors also guide students to use ChatGPT as a machine tutor, which presents content and offers feedback to students. In addition, instructors may seek to customize instruction for each learner through the use of intelligent tutoring and adaptive systems. Additionally, some instructors guide students to use a variety of AI apps for learning, such as *Conversly*, for foreign language practice, and *Tutorai.me*, for automating instructional delivery. Further, instructors may guide students to innovate with AI tools and technologies. In addition, some instructors augment their teaching practice through the use of generative AI apps such as DALL-E for automated image generation and *ClassPoint* for generating quiz questions from PowerPoint slides.

ChatGPT as a Teaching Assistant

To enhance teaching and the attainment of learning outcomes in teacher education, instructors can assign students, all of whom are either preservice or in-service K-12 teachers, tasks that enable them to evaluate the limitations and benefits of ChatGPT. For example, one assignment item might direct the entry of the prompts below into ChatGPT or another chatbot to determine how teachers might refine their lessons. After entering the prompts below, the assignment could also require preservice and in-service teachers to enter additional prompts pertaining to the attainment of specific learning standards for their students.

- Create a lesson plan for a teacher to help students in Grade 9 learn to recognize figurative language in literature and to use figurative language in stories they write.
- Create a worksheet on figurative language to distribute to students in Grade 9.
- Create a lesson plan for a teacher to help students in Grade 6 review the concept of a fraction, and to add and subtract fractions with common and uncommon denominators.
- Create a worksheet with 20 items that Grade 6 students could use to practice adding and subtracting fractions with common and uncommon denominators.
- How might a teacher use educational technologies to enhance physics lessons for high school students?
- What do historians seek to accomplish in their work?

At times, the results from chatbots will be unsatisfactory, owing perhaps to redundancy or lack of specificity, for instance, but at other times, helpful results will

appear. Students can be directed to compare the results produced by chatbots to their own work.

ChatGPT as a Machine Tutor

Since ChatGPT is a conversational agent, it can become a tutor by entering a prompt that begins *Teach me*. For example, when prompted with *Teach me Python programming*, ChatGPT impressively divided the task of learning Python coding into seven components, beginning with installing a Python development environment. Then, ChatGPT provided a sample first program, the traditional print (“Hello, World”) statement. After describing how to run that program, ChatGPT presented and exemplified Python basics, including variables and data types; control flow statements, specifically the *if statement*, *for loop*, and *while loop*. The sixth component presented examples of functions, and the final section described the data structures, particularly Python lists and dictionaries. That succinct presentation introduced the key features of imperative programming languages (Luterbach, 2018, 2022).

ChatGPT’s tutoring is not limited to presentations. When students practice coding, they can submit code to ChatGPT for feedback and ask for explanations of invalid code. For example, with the submission of the code and the prompt below, ChatGPT explained the error detected by the Python compiler and corrected the code.

```

multiplicand = 3
multiplier = 2
print (multiplicand, “ * ”, multiplier)
learnerResponse = input (“Enter answer: ”)

```

Prompt entered into ChatGPT: In the Python code above, why am I getting the error, “name ‘multiplicant’ is not defined?”

In the reply, ChatGPT explained that the code contains a typo. In particular, on Line 3, multiplicand should be multiplicant. ChatGPT fixed the error and provided the corrected code, as shown below.

```

multiplicand = 3
multiplier = 2
print (multiplicand, “ * ”, multiplier)
learnerResponse = input (“Enter answer: ”)

```

In this example, ChatGPT generated a valid response, but that is not always the case.

In addition to error checking, ChatGPT seeks to generate computer code when prompted to provide a program that accomplishes a specific task. The prompt can include a direction to provide code in one or more computer programming languages. In code generation trials, Sarsa et al. (2022) determined that OpenAI’s Codex app

produced sensible code most of the time, and in some cases, the code could be used without modification. Overall, though, they concluded that oversight is necessary in an educational setting to ensure that code generated automatically is suitable for students. Extrapolating this notion of oversight to other content domains seems worthwhile because chatbots have no internal mechanism for assessing the validity of the text generated by the chatbot.

While considering other content domains, what would happen if, for instance, a business, geography, psychology, or history instructor decided to change their role radically by increasing the time spent analyzing student work and providing feedback to students by 50%-90% and reducing the time spent on lesson planning by the same percentage? Conceivably, with little to no time spent on lesson planning, an instructor could begin class by entering a prompt into ChatGPT or any other chatbot and then read and discuss the reply with the students. When the instructor and students completed that discussion, the instructor could enter a new, perhaps related, prompt into ChatGPT and discuss that reply with the students, correcting any hallucinations and inaccuracies. The instructor could repeat that process until the end of class, interjecting humor throughout the session to enhance the joy of learning. The next day, students could be provided the prompt to enter into ChatGPT on their phone, tablet, or laptop, or the prompt could be entered into a computer with its screen projected for all students. Then, students could write a couple of notes about any text in ChatGPT's reply that surprised them or that might be inaccurate, for instance. The instructor would then ask students for their reactions to the text, correct any misconceptions, and interject humor. If the class meets four times a week, 50% of the lesson planning time would have already been saved. Teaching in real time is never simple, but a teacher's role could radically change if ChatGPT was the tutor or even just supplied course content in the manner described.

Customizing Instruction for Each Student

Adaptive instructional systems (AISs) use artificial intelligence (AI) methods to personalize instruction based on content, learner, and pedagogical models (Sleeman & Brown, 1982; Wenger, 1987). Dialog systems between students and pedagogical agent software can assist with assessment and learner modeling (Zapata-Rivera & Forsyth, 2022). Four decades of work in the field of Intelligent Tutoring Systems, which has connections to Learning Analytics and Educational Data Mining, has created a historical record that documents the effectiveness and challenges of human-computer dialog, machine learning for tutoring, cognitive tutors, and intelligent learning environments (Abdelshiheed et al., 2023; Aleven et al., 2006; Baker et al., 2016; Graesser & McNamara, 2010; Kulik & Fletcher, 2016; Lester et al., 2004; McNamara et al., 2019; Paladines & Ramírez, 2020; VanLehn, 2011). Contemporary systems document significant gains in learning, student engagement, and retention through course completion. For example, AISs have succeeded in providing effective instruction to improve the adaptability of Marine infantry squad leaders (Daly et al., 2022) and in simulated lifeboat training (Zeinali-Torbati et al., 2023), for instance. Also, Paradiso et al. (2023) documented a 58% decline in the number of students

who received a grade of D, F, or withdrew from a mathematics course due to the use of an AIS for college algebra.

Innovating with AI Tools and Technologies

With AI tools and technologies, instructors can guide students to create innovative apps with or without coding. AI tools, such as *MindStudio.ai* and *LLMstack.ai*, provide access to LLMs with little or no coding. These tools provide a graphical user interface enabling the selection of an LLM, along with features to include documents or data relevant to the app. A teacher guiding students toward such innovative app creation might enhance the likelihood that the students would make a successful transition to a corporate environment. Davenport et al. (2023) describe two case studies in which employees used no code and low code tools to create innovative apps. To create an app with low code/no code tools, developers follow templates and routine procedures for the most part, but they can add their own variables and use predefined functions to provide access to proprietary documents, for instance. After sufficient testing, the app may be made available to others in the organization.

When complete control over data structures and data processing are desirable, coding is necessary. In this case, a programming student could connect to an Application Programming Interface (API) of an LLM and embellish the reply provided by the model. The Python code below retrieves text from the OpenAI language model called *text-davinci-003*, which is a relatively inexpensive model to use. With a different protocol and at a higher cost, text could also be retrieved from ChatGPT.

```
import os
import openai

openai.api_key = os.getenv("OPENAI_API_KEY")

myPrompt = input("Enter prompt: ")

response = openai.Completion.create(
    model="text-davinci-003",
    prompt=myPrompt,
    max_tokens=500,
    temperature=0)

print(response.choices[0].text)
```

Only six Python statements are needed to take care of initialization, retrieve the user's prompt, call the language model, and display its response. The student programmer could refine the reply from the language model by parsing the `response.choices[0].text` variable or by passing the text in the reply to a text-to-speech generator, for instance.

Enhancing Teacher Productivity and Effectiveness using AI Apps

There are numerous AI apps for teachers. For example, *MagicSchool* (magicschool.ai) enables teachers to differentiate instruction, create assessments, modify lesson plans, or create new ones. In addition, teachers can use *MagicSchool* to help produce newsletters and correspond with parents, for instance.

Instructors can also use *ClassPoint* to create questions from one or more PowerPoint slides and thereby transform a static presentation into an interactive learning experience. The questions generated can be aligned with Bloom's Taxonomy, which includes Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating.

When teachers create multimedia presentations and instruction, they may make their instruction more effective and appealing by including images, audio, or video. On those occasions, teachers may enter a prompt into DALL-E or other image generation software, such as *Stable Diffusion*, *Crayon*, or *Midjourney*, to create an image relevant to attaining the instructional goal. Similarly, instructors might prompt AI apps to create audio and video scripts as well as produce audios and videos for distribution to students for instructional purposes. In those cases, instructors might use *Imideo.ai* or *Lumen*, for instance.

Using AI Apps and Tools in Schools and Colleges

With the introduction of chatbots and other AI apps in schools and colleges, instructors and students have new options for teaching and learning. As discussed above, ChatGPT could be a teaching assistant, a machine tutor, or a supplier of content curated by the teacher. Additionally, instructor productivity and effectiveness might increase through the use of a variety of AI apps. Furthermore, by guiding students to innovate with AI tools and technologies, teachers might change their role considerably if they typically provide direct instruction throughout class. Teachers who generally work as coaches or guides might converse less with students who engage more with ChatGPT or another conversational agent, such as GitHub Copilot Chat.

HOW MIGHT AI ALTER EDUCATIONAL SYSTEMS?

Everyone has some potential to change schools and colleges, but primary stakeholders have direct influence. Schoolteachers, department chairs, assistant principals, principals, and school board members have direct influence on K-12 schools, while adjunct instructors, professors, department chairs, deans, provosts, chancellors or presidents, and boards of trustees exert direct influence on colleges. To assist with reflections on how AI might alter educational systems, this section first considers issues that primary stakeholders must resolve to determine how to change their institutions. Then this section considers the decisions that some of those stakeholders have already made and the effects of those decisions on their institutions.

Influence of Schoolteachers, College Faculty, and Administrators

Moving forward, the trajectory of educational systems is likely to depend largely on schoolteachers, college faculty, and administrators in both K-12 schools and colleges. After all, those stakeholders have a duty to determine how best to serve their students. Strategic decisions will likely turn on their perceptions of the advantages and disadvantages of AI (Dempere et al., 2023; Fütterer et al., 2023). Evaluating the arguments for and against the use of AI technologies is nontrivial because it involves consideration of multiple factors, including relative advantage and compatibility with values (Rogers, 2003). Recalling the calculator case, nearly all respondents (96%) judged that calculators would be beneficial to students, but concern over the retention of fundamental arithmetic skills had 72% of respondents rejecting the use of calculators in Grade 7 classrooms (Pendleton, 1975). Strategic decisions about AI technology will involve much more than pitting a single perceived benefit against a single perceived threat. The strategic decision will also include deliberations about the use of AI technology across multiple content domains. This section considers two cases, writing instruction and computer programming.

Presently, some of the primary stakeholders in schools and colleges want writing to be taught in the future, just as it has been taught in the past to ensure that writing skills are developed continually through school and college. Others are noticing that the post-literate world now includes a tool, a capable chatbot, which can help writers (Dobrin, 2023). Some of those teachers, faculty members, and administrators believe that after students gain the fundamental skills to write sentences, paragraphs, and some essays on their own, it would be okay if they used ChatGPT, especially if there were still points at which writing would be assessed when students were not permitted to use the chatbot. Recalling Rogers (2003), changing writing instruction is compatible with the values of some educators, such as Nicolas (2023), but not with others, including Olejnik (2023).

The writing case is considerably more complex than the calculator case because learning to add, subtract, multiply, and divide takes a great deal less time than learning how to write, and verifying mastery of arithmetic operations requires only a simple comparison of the learner's response to the correct answer. Yet, even though it may well take years, schoolteachers and college faculty members will figure out how best to teach writing in a world with chatbots. Perhaps, as in the calculator case, as teachers retain pedagogical practices to ensure that students will continue to learn to write sentences, paragraphs, and essays, concern about losing the skill to write will diminish and that will make room for increased use of ChatGPT and other chatbots as writing assistants. If retention of skill is not the primary concern, then over the next decade or two, perhaps the defenders of all extant methods of writing instruction, including retention of the freshman composition course, will sense that students need not abstain from the use of a chatbot to share their cultural experience in writing and that they still become critical thinkers when a chatbot assists with the mechanics of writing. Such a change in values, if it comes, will likely occur gradually because some defenders of the status quo value retaining current forms of writing instruction greatly (Olejnik, 2023). They will need to become convinced that students will be

okay if writing instruction changes. Research might assist somewhat in that regard, but the results of studies conflict at times, and the results are not always persuasive. For example, even though TVs have been in homes for approximately fifty years, there is still debate about the effect of TV viewing time on reading achievement despite data showing that there is no statistically significant effect when children six years of age view TV programming less than two hours a day (Supper et al., 2021). In such light, debates over how much writing practice without a chatbot that high school or college students need might well endure for decades.

The writing case has some parallels with teaching computer programming because programming students could use automatic code generation tools, such as GitHub CoPilot, Codex, ChatGPT, or Gemini, to perform their computer programming homework (Prather et al., 2023). One difference, though, might be general acceptance of the use of automatic code generators in practice (post-training) because automatic code generators have ushered in a new programming paradigm (Brady, 2023), whereas there is currently rejection of chatbots for the production of scholarly publications, as in the journal *Science* (Thorp, 2023), or ambivalence and draft policies (Harker, 2023; Hosseini et al., 2023). Critically, at times, novices must grapple with the complexities of writing prose or computer code without the assistance of a teacher, parent, sibling, friend, acquaintance, ChatGPT, or any other conversational agent to learn through practice and reflection. Ultimately, computer programming instructors resolve when students are permitted to use automatic code generators and when such use is not permitted. Additionally, as in the calculator case, at times, instructors may retain assessments of computer programming skills without access to automatic code generators.

One argument advanced in favor of banning the use of ChatGPT or automatic code generators is that students will cheat. First, large numbers of students earnestly seek to acquire skills that will benefit them the rest of their lives. Second, even when a student tricks an instructor into believing that the work submitted was original, there is no tricking the learning process. Students who cheat do not gain knowledge or skill, but students who practice and learn reap the benefits throughout their lives.

After sufficient practice, computer programming students will have gained the capability to modify the functions and statements produced by automatic code generators, which can create acceptable code in some cases but not always (Moradi Dakhel et al., 2023; Nguyen & Nadi, 2022). Similarly, after requisite practice, people who have learned to write sentences, paragraphs, and essays will have acquired sufficient competence and confidence to communicate in writing, and if they choose to use ChatGPT or another chatbot on some occasions, they will have the ability to enter worthwhile prompts and will be able to enhance the text generated by the chatbot through editing and rewriting. Since instructors across many disciplines require students to complete writing assignments, they also need to weigh the advantages and disadvantages of chatbots for their students. Communication between instructors and administrators is important for institutions to resolve how best to serve all students (Lin et al., 2024, this volume).

After the strategic decision is made at schools and colleges, one way or another, individual instructors will make tactical decisions about how best to serve their students, which could run contrary to their institution. Tactical decisions have much to do with considering characteristics of the learners, as well as the instructional goals, which vary markedly in both K-12 schools and colleges. Instructors with students in their teens or older might contemplate the use of chatbots to support the attainment of instructional goals and student self-regulation, which could dramatically alter the instructor's role. Instructors of younger students might turn to chatbots, MagicSchool, or other AI productivity tools to reduce the time spent on activities such as lesson planning and differentiating instruction.

Protection, Confusion, Modification, and Transformation in Educational Systems

In the one year since OpenAI made ChatGPT-3 available to the world, schools and colleges have made their initial assessments of the advantages and disadvantages of generative AI. As discussed previously, some educators and administrators are concerned about student cheating and ensuring that students continue to develop fundamental skills.

In some cases, concerns run very deep, even approaching the level of fear. Those educators and administrators foresee the potential demise of their schools and colleges due to AI technologies. For example, Geoff Barton, head of the Association of School and College Leaders in the United Kingdom, along with other school administrators, regards AI as the “greatest threat to education” because it makes learning trivial, increases cheating, and threatens students’ mental and physical health (Woolcock, 2023). Furthermore, in their view, since governments move too slowly and technology companies cannot be trusted, AI technologies pose “very real and present hazards and dangers” (Woolcock, 2023). Protection is paramount here; these administrators prohibit the use of chatbots in their schools to prevent potential harm that could come to their students through the use of AI apps.

Since assessing the benefits and detriments of AI technologies can be confusing or perplexing, some teachers and administrators initially reacted to protect students by banning the use of ChatGPT. Then, they heard the voices of others in their school systems who allayed some of their concerns about generative AI apps and raised their own concerns about stagnation and academic freedom. They argued persuasively that schools ought to prepare students for the future and that instructors should have the freedom to consider the use of chatbots. Administrators acquiesced and permitted the experimental use of chatbots. Some of the largest school districts in the United States, along with many other school systems, followed this path, including the New York City and Los Angeles school districts (Banks, 2023; Singer 2023).

There are also schools, colleges, and government leaders who, while expressing some uncertainty about the implications of AI in education, regard AI technologies as important for progress and definitely want students to gain AI fluency. Consequently, they are open to modifications in teaching practice. This is evident in the report on AI in education issued by the Office of Educational Technology in the U.S. Department

of Education (Cardona et al., 2023). This pathway of openness is also apparent in the research project titled “*Making AI Generative for Higher Education*,” which is a collaboration among approximately 20 universities and a nonprofit research center to collect and analyze data about challenges and opportunities in colleges due to generative AI. After drawing conclusions justified by the data analyses, the project intends to issue reports to share their findings (Cooper et al., 2023). Furthermore, whether they are part of that project or not, many universities are issuing guidance for instructors as they adapt to generative AI. Such guidance may be provided at the institution or academic department level.

Over the past year, generative AI has been a major theme at many conferences in education. While some presenters expressed uncertainty about the future of educational systems, others conveyed visions of revolutionary transformations to educational systems (Coffey, 2023; Feldstein, 2023). Beyond conferences, Stefania Giannini, Assistant Director-General for Education in the United Nations Educational, Scientific, and Cultural Organization (UNESCO), who speaks of living through at least four prior revolutions in education, anticipates that the one owing to AI in Education might have the greatest impact by far (Giannini, 2023). Furthermore, an expert panel in AI in Education stated, “Artificial Intelligence (AI), machine learning, educational robotics, and related technologies will have powerful impacts on the future of learning” (Roschelle et al., 2020, p. 1). That expert panel also recognized the need for additional research and often mentioned the potential for widespread impact in education due to AI, machine learning, and related techniques. Moreover, the Stanford Institute for Human-Centered Artificial Intelligence has been engaging in research to gain insights into the transformative potential of AI in education (Chen, 2023). Similarly, at the 2023 World Economic Forum, Kopp and Stjerne Thomsen (2023) discussed the potential for AI to accelerate a transformation in educational systems.

In higher education, a noteworthy example of a college in favor of AI in Education is the University of Florida, which is committed to building the first AI University in the United States (University of Florida, 2022, 2023). The University of Florida has made several changes to build its AI University. In particular, the University of Florida AI initiative has centralized the leadership of AI academic efforts, established a Center for the initiative, hired more than 100 additional AI faculty members across the 16 colleges at UF, and delivered more than 200 AI courses to thousands of students, as well as established certificates and micro-credentials. Plus, students and faculty members engage in numerous research projects supported by a supercomputer with more than 65,000 core processing units and an AI Pod with over 1100 GPUs. Moreover, the University of Florida AI initiative has resulted in numerous partnerships to produce AI curricula for K-12 students and to provide professional development to Florida K-12 teachers.

CONCLUSION

AI apps and tools are changing our lives. For some, that change might be perceived as minimal. Face recognition to open a phone is nice; relatively little spam in email is also

a good thing; assistants in the form of *Siri*, *Cortana*, and *Alexa* are useful to a point, but apps for those purposes have been around for some time now. From that point of view, the impact of AI technologies might seem minimal. Alternatively, those who have improved their productivity through the use of AI apps might find the impact considerable, while a person earning a living innovating with AI technologies might regard its impact as exceedingly positive. According to the Gartner Hype Cycle of AI (Perri, 2023), generative AI is at the peak of inflated expectations, which might portend the beginning of a period of disillusionment. Regardless of the current level of excitement over AI in society, these technologies have both benefits and detriments (Dempere et al., 2023; Fütterer et al., 2023).

Instructors may benefit from AI apps and tools when they are used as teaching assistants or machine tutors. Additionally, AI technologies can help instructors differentiate instruction for students. Additionally, instructors can guide students to use AI tools and technologies to create innovative apps. Furthermore, Dempere et al. (2023) document the use of AI apps for research support and automated grading. Some concerns about AI technologies include cheating by students, biased results, possible economic hardship through job loss, uncertainty about the quality of results generated by chatbots, no identification of the sources that contributed to the production of the results generated by chatbots, and the absence of any method to determine those sources given current LLM technology. The benefits and concerns of AI technologies have instructors contemplating whether to integrate them into their teaching practices. An increase in AI fluency through attainment of AI literacy standards (Long & Magerko, 2020; Ng et al., 2021; UNESCO, 2022a) will foster more informed reflection on the benefits and detriments of AI technologies (Ford, 2018; Ng et al., 2021).

The previous section discussed differences in the trajectories of educational systems based on how those with direct influence on those systems resolved the question of whether the advantages of AI technologies outweigh the disadvantages. Similarly, individual choices determine personal trajectories. Things did not go well for Luddites, though after initially rebelling against the mechanization of the textile industry, some of them adapted their skills and ultimately supported the production of garments by machines (Dobrin, 2023). Importantly, unlike the dawn of web technologies, when the only development option required learning the HyperText Markup Language (HTML), there are already multiple entry points into AI. One option is to learn to use AI apps within one or more domains (e.g., chatbots such as *ChatGPT*, *Perplexity*, *Claude*; image generators such as *Midjourney*, *Craiyon*, *Stable Diffusion*, *DALL-E*; apps for teachers such as *MagicSchool*, *ClassPoint*, *Character.ai*; language learning apps such as *Babbel*, *Conversly*, *Duolingo*, *Rosetta Stone*). One could also learn the AI features of more common apps, such as the speech coach in Microsoft PowerPoint. There are also no code/low code tools to explore in addition to programming options. Furthermore, one could focus on one or more issues pertaining to AI technologies, such as machine biases (Schwartz et al., 2022), equal access and opportunity (Bojorquez & Martínez Vega, 2023; UNESCO, 2022b; UNESCO, 2022c), emotional effects of AI (Yalcin & Puntoni, 2023), benefits and

detriments of AI (Darvishi et al., 2024; Maslej et al., 2023; Zhang et al., 2022), multilingual language models (Maslej, 2023; Nicholas & Bhatia, 2023), and augmented human performance (Eapen et al., 2023; Frasson et al., 2023). Lastly, in this chapter, we recall the past, consider the present, and peer into the future.

In educational systems, early adopters of AI technologies have been modifying their schools and colleges for a few years (University of Florida, 2022; Zimmerman, 2018). As increasing numbers of educators gain AI fluency, additional modifications will be made until educational systems restabilize. That is the most likely scenario given the history of technologies in education. Consider this scenario, though. What if, in two to three years, ChatGPT, GitHub Copilot, or another LLM-based app succeeds in responding to the following prompt? “Create an instructional app that uses animation to simulate a planet, comet, or asteroid orbiting the Sun and helps students learn how to calculate the average speed of the orbiting object.” Then what change might come to home schooling and to educational systems?

NOTE

AI tools were not used in any way for the preparation of this chapter.

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Chapter 3

The Influence of ChatGPT on Student Learning Outcomes in Higher Education: A Meta-Analysis of the Initial Empirical Literature

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ABSTRACT

ChatGPT is attracting considerable attention and discussion in the field of higher education. ChatGPT has the potential to innovate learning and teaching methodologies, expand accessibility to knowledge, facilitate student engagement, and bring it to the forefront of educational research. Although articles on the use of ChatGPT in academia have been shared through many publications, most are not empirical in nature, nor have they explored the effect of ChatGPT on student learning outcomes. Given the availability of research studies on higher education, it is critical to attempt to both summarize and synthesize the findings about the influences of ChatGPT on learning. This preliminary study employed a meta-analysis to examine the effects of ChatGPT on students' learning outcomes in higher education. Initial results indicated that ChatGPT had a significant positive effect on learning outcomes and may play a critical role in the future of higher education teaching and learning practices.

Keywords: ChatGPT, higher education, learning outcomes, meta-analysis

INTRODUCTION

Recently, the popularity of ChatGPT (Chat Generative Pre-trained Transformer) has created both debate and discussion regarding the emerging generation of artificial intelligence (AI) technologies (Chavez et al., 2023). ChatGPT is a generative AI chatbot that can produce human-like text based on the input or prompts it receives (OpenAI, 2023). The function of a Large Language Model (LLM) like ChatGPT includes both practical use and creative application for learning and the workplace (Radford et al., 2023). For example, ChatGPT can help the user draft emails, answer questions, write program code, provide tutoring for various subjects, and brainstorm ideas (McFadden, 2023). Yet, questions caused by the use of ChatGPT in education have been particularly intense, with notable discussions on academic integrity (Cotton et al., 2023). Given that AI innovation has the possibility to transform existing educational practices, ChatGPT's incredible ability to execute

complex tasks has evoked differing perspectives in higher education (Baidoo-Anu & Owusu Ansah, 2023). While waiting for the debate in higher education to resolve, college students have been using and continue to use AI in their coursework. For example, a recent survey by Intelligent.com (2023) revealed that nearly one-third of college students reported using ChatGPT for writing assignments or homework. Of these respondents, 78% reported that they had positive experiences studying with ChatGPT.

Existing research studies examining ChatGPT utilization in education provide both positive and negative interpretations when weighing the advantages and risks of learning and instruction. Kohnke et al. (2023), for example, stated that ChatGPT can facilitate language learning by simulating real-life communication and providing students with opportunities to refine their work. However, other research found that the utilization of LLMs such as ChatGPT have the potential to perpetuate and magnify pre-existing biases and inequities (based on coding, human input, and selection of information) by producing assertions that may be false (Kasneci et al., 2023). In many cases, the main method of higher education AI research has been more qualitative in nature, using the method of content analyses to explore the influences of ChatGPT. For example, Sullivan et al. (2023) employed content analysis to investigate news articles that discuss the disruptive impact of ChatGPT on higher education. The findings of their study revealed several themes, including academic integrity concerns, problems with AI outputs, and opportunities for enhancing learning in higher education. In comparison, quantitative studies (i.e., Rasul et al., 2023) have not provided sufficient evidence on the effectiveness of ChatGPT in higher education.

Thus, given the diversity of outcomes from research studies, meta-analysis can be one approach to consolidate divergent findings from the literature. This preliminary study sought to synthesize empirical findings about the impacts of ChatGPT specifically on college student learning outcomes. Using meta-analysis, we attempted to answer this research question: Does ChatGPT improve learning outcomes for college students?

LITERATURE REVIEW

Technology change and progression are occurring at an unprecedented rate, ushering in new paradigms and innovative solutions affecting all aspects of life, including education (Talan & Kalinkara, 2023). Among the emergent technologies, AI has gained notable prominence in the literature, with AI chatbots becoming one of the most widely discussed and debated applications (Mhlanga, 2023; Zarifhonarvar, 2023). These systems utilize deep learning algorithms that have been trained on large volumes of data, which enables them to produce responses that mimic real human conversation and context (Kasneci et al., 2023). The latest version of ChatGPT was launched in November 2022 by the Microsoft-backed company OpenAI. The fourth version of ChatGPT (GPT-4) appears to be revolutionizing the perception of AI due to its ability to comprehend and navigate the complexities of human language

and interactions (Marr, 2023). Sullivan et al. (2023) noted the extensive ability of ChatGPT to produce coherent responses to questions and topics, regardless of discipline. Thus, with its capacity to understand and imitate human-like language patterns more than the previous versions, GPT-4 will have a profound impact on numerous fields, including education (Yilmaz & Yilmaz, 2023), healthcare (Javaid et al., 2023), occupations (Zarifhonarvar, 2023), and industry (George & George, 2023).

ChatGPT in Higher Education

Within higher education, ChatGPT presents the significant potential to help individual learners improve their writing, develop research, provide constructive feedback, and enhance their communication proficiency (Atlas, 2023). ChatGPT is one of the LLMs that can assist in the construction of new knowledge by supporting students' prior knowledge and experiences, engaging them in conversation, and fostering their active participation in the learning process (Rasul et al., 2023). In academic settings, ChatGPT has been successfully implemented as a virtual mentor where it can manage questions and inquiries about various subjects at anytime and anywhere through the Internet (Kasneci et al., 2023). ChatGPT can be particularly helpful for students working independently or participating in online learning, as they might not have a chance to access an instructor immediately (McFadden, 2023). Thus, direct assistance by ChatGPT may alleviate feelings of anxiety in students who are completing assignments, particularly those who may struggle with the content or are reluctant to seek help (Sullivan et al., 2023). Furthermore, ChatGPT serves as valuable educational support by providing simple explanations of complex concepts (Fuchs, 2023).

College students may use ChatGPT to improve their writing skills for assignments or coursework in higher education. Kumar (2023) suggested that ChatGPT shows significant promise as a resource for academic writing skills when utilized in conjunction with actual academic mentoring. For example, college students can use ChatGPT to provide suggestions for organizational structure and grammatical feedback when they work on writing tasks. In addition, ChatGPT was found to increase comprehension of students with disabilities through its ability to sift through large amounts of information and create understandable summaries (Lyerly, 2023).

Although ChatGPT has the potential to offer many benefits for higher education, there are multiple concerns and ethical issues regarding the use of ChatGPT in the academic setting. Several scholars (Kasneci et al., 2023; Marchandot et al., 2023) have discussed academic integrity issues such as plagiarism, cheating, and academic dishonesty related to ChatGPT use. Similarly, in a March 2023 survey of more than 1000 college students, 50% of the students also viewed the use of AI resources (such as ChatGPT) in academic assignments as violations of academic dishonesty and/or plagiarism (Welding, 2023). In addition, the use of ChatGPT in higher education may also provide an unfair advantage to some students. For example, students who use ChatGPT to generate high-quality written assignments are likely to achieve higher scores than their peers who do not have access to the resource, creating or widening

inequities (Cotton et al., 2023). Thus, it is critical for higher education institutions to provide clear standards or policies for the use of AI tools. These guidelines should attempt to ensure equitable access for all students while protecting academic integrity.

ChatGPT's Influence on Learning Outcomes

Learning outcomes refer to students' self-assessment of their accumulated knowledge, the skills they have developed, and their inclination toward further learning (Young et al., 2003). ChatGPT may improve both learning achievements and perceptions of students in higher education. Learning achievement is measured by teacher- or researcher-created tests that assess learners' knowledge gain (Zheng et al., 2023). Learning perception refers to learners' opinions toward learning, such as learning attitudes, learning motivations, and learning experiences (Chen, 2015). Several studies have demonstrated the positive effects of learning. For example, Yilmaz and Yilmaz (2023) investigated the outcomes of programming education while using ChatGPT to develop students' computational thinking skills. Participants in the experimental group developed more advanced thinking skills and had greater motivation than those in the control group. Wei (2023) conducted an experimental study and revealed that ChatGPT improved learning outcomes in a language learning classroom. In contrast, a study by Bašić et al. (2023) reported no significant difference in learning outcomes between a ChatGPT group and the control group when using ChatGPT as an essay writing tool. Li (2023) also found no statistically significant difference in students' intrinsic motivation between two groups (with only one using ChatGPT).

Given these conflicting findings, we propose the following hypothesis for a meta-analysis of the recent empirical literature on using ChatGPT and student learning outcomes in higher education. Our hypotheses are as follows:

H_0 : There is no improvement from the use of ChatGPT on learning outcomes for college students.

H_A : The use of ChatGPT improved learning outcomes for college students.

RESEARCH METHOD

This study was a literature search aimed at identifying relevant studies that assessed the impact of ChatGPT on student learning outcomes in higher education. The methodology for this meta-analysis adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), which provides a comprehensive framework for examining the transparency, accuracy, and overall validity of the research review (Page & Moher, 2017). To gather the initial data for this study, a broad search of the literature was conducted in Google Scholar, Web of Science, Scopus, and Education Resources Information Center (ERIC). The search process is shown in Figure 1. Three sets of keywords were adopted to search articles in title or abstract: (1) ChatGPT-related keywords, including ChatGPT, GPT, and Chat Generative Pre-trained Transformer; (2) higher education-related keywords, including

higher education, university, college, graduate, and undergraduate; and (3) learning achievement-related keywords and learning perception-related keywords, including learning outcome, learning achievement, learning performance, learning perception, learning motivation, learning attitude, learning experiences, and satisfaction. The Boolean operator “AND” was used to connect the three sets of keywords, and “OR” was utilized to connect inside the set. From this search effort, 7378 related references were obtained. We then manually examined the reference list with the aim of identifying the most relevant studies suitable for use in the meta-analysis.

Selection of Research Studies

The inclusion criteria for the search were articles that: (1) focused specifically on the effects of ChatGPT on learning outcomes; (2) were published in English and peer reviewed; (3) included college students in higher education settings as part of their study populations; (4) reported empirical data on learning outcomes; (5) were conducted using quasi-experimental or experimental design; and (6) had full text available with comprehensive information regarding study design and statistical results. Studies were excluded if: (1) their results lacked sufficient information to calculate the effect size; (2) their participants were not college or university students; and (3) they were conference papers, book reviews, news, and abstracts.

A literature search was conducted on December 12, 2023, and preliminary searches returned a total of 7378 research studies. The titles and abstracts of these studies were subsequently screened to exclude those that were not pertinent to the research question. Full-text articles of these shortlisted studies were then reviewed against our inclusion criteria, resulting in a final list of nine studies to be included in our meta-analysis.

After the literature selections were completed, characteristic values were extracted from the original documents to facilitate subsequent analysis, statistics, and computation of effect values (Raudenbush, 2009). Information on the authors, publication years, sample size, discipline, sample size, and education level was recorded. In this study, education levels are divided into two types: (1) level of higher education (undergraduate or graduate) and (2) discipline (categorized into STEM [Science, Technology, Engineering, and Mathematics], and non-STEM). For information on the coding of the original documents, see Table 1.

Statistical Analyses in Meta-Analysis

The meta-analytic procedure included an estimation of effect size, a heterogeneity analysis, and publication bias tests (Raudenbush, 2009). All the analytical procedures were executed employing Stata 17®. The effect of ChatGPT on learning outcomes was estimated using the standardized mean difference (SMD) method, with a 95% confidence interval (CI) applied to provide a reliable range for the estimated effects (Raudenbush, 2009). Effect sizes were quantified as SMD utilizing Cohen’s *d* value, as positive values of Cohen’s *d* imply that the ChatGPT group may exhibit superior learning outcomes relative to the control group (Cohen, 2013). Furthermore, Cohen

(2013) provided threshold values for interpreting effect sizes, with 0.2, 0.5, and 0.8 representing small, medium, and large effect sizes, respectively.

Figure 1: Flow Chart of the Literature Search Processes Coding of the Literature

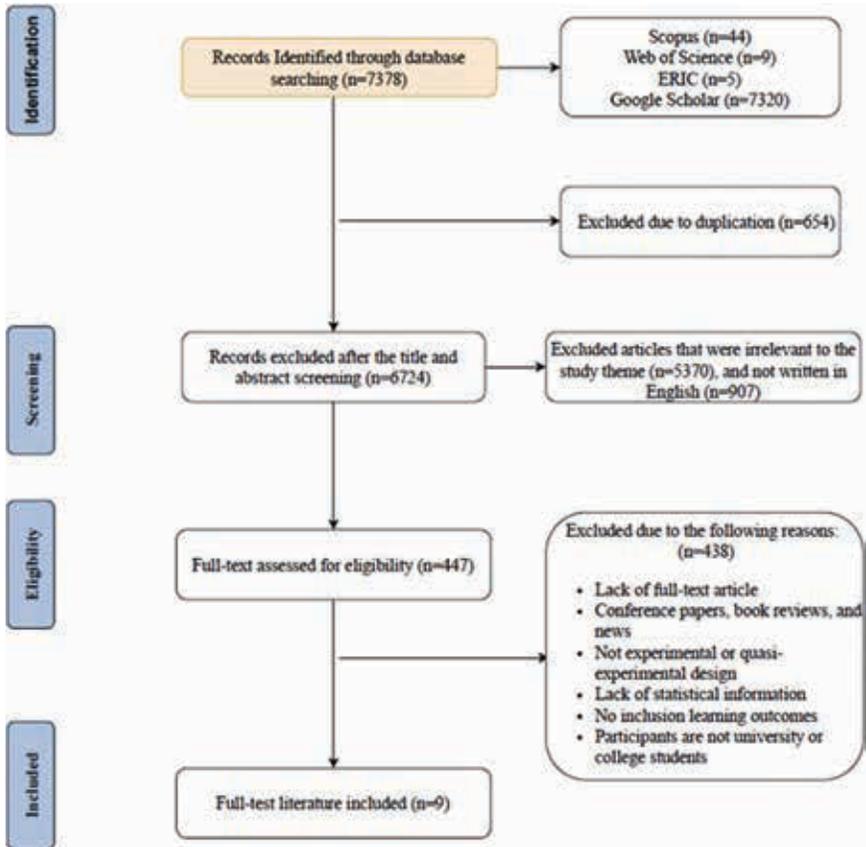


Table 1: Characteristics of Publications Included in the Analyses

Authors (year)	Sample size		Education level	Discipline	Learning Performance
	Experimental Group	Control Group			
Bašić et al. (2023)	9	9	Graduate	STEM	Learning achievement
Escalante et al. (2023)	23	25	Undergraduate	N/A	Learning achievement

Authors (year)	Sample size		Education level	Discipline	Learning Performance
	Experimental Group	Control Group			
Hakiki et al. (2023)	31	31	Undergraduate	N/A	Learning achievement
Li (2023)	42	39	Undergraduate	N/A	Learning achievement Motivation
Qureshi (2023)	10	10	Undergraduate	STEM	Learning achievement
Urban et al. (2023)	57	57	Undergraduate and graduate	Non- and graduate STEM	Learning achievement
Wei (2023)	30	30	Undergraduate	N/A	Learning achievement Motivation
Yildiz (2023)	30	30	Undergraduate	N/A	Learning achievement Motivation
Yilmaz and Yilmaz (2023)	21	24	Undergraduate	STEM	Learning achievement Motivation

The degree of heterogeneity, indicating inconsistency among the studies' results, was determined via the I^2 test. I^2 values within 0%-40% were taken to suggest insignificant heterogeneity, 30%-60% indicated moderate heterogeneity, 50%-90% pointed to substantial heterogeneity, and 75%-100% indicated extensive heterogeneity (Raudenbush, 2009). When confronted with significant heterogeneity in the research data, analyses were conducted utilizing the random-effects model (Raudenbush, 2009). Conversely, in instances of minimal heterogeneity, a fixed-effects model is preferred for analysis (Hedges & Vevea, 1998).

Another concern for the analysis was publication bias, the phenomenon wherein researchers selectively publish beneficial or favorable results (Thornton & Lee, 2000). To ascertain whether our review was impacted by publication bias, we generated a funnel plot (Borenstein et al., 2021). In addition, sensitivity analysis was examined to discern how susceptible the results of the meta-analysis were to changes in its input or assumptions (Borenstein et al., 2021). This method helped to identify if any particular study disproportionately impacted the overall results. We used the basic jackknife method, which involved omitting one study at a time from the meta-analysis and examining whether the overall results were significantly changed.

RESULTS

Heterogeneity Analysis

Based on the statistical principles of meta-analysis, only data with adequate homogeneity could be consolidated (Raudenbush, 2009). Therefore, it was imperative to conduct heterogeneity tests on the multiple studies comprising our datasets to select the appropriate effect model. If there is little to no heterogeneity, a fixed-effect model might be appropriate. However, if there is substantial heterogeneity, a random-effects model, which assumes that the true effect varies between studies, is more suitable. In this study, the I^2 statistic indicated an 82.2% variability in effect sizes attributable to heterogeneity rather than to sampling error. In this case, we choose the random effects model for this study.

Effect size

Effect sizes were computed by the random effects model, which was employed to accommodate variability among different studies (Raudenbush, 2009). Nine studies involving 508 participants were examined in this meta-analysis. An overall significant positive effect size (Cohen's $d = 0.60$, 95% CI [0.28-0.92], $p < 0.001$) in favor of ChatGPT influencing college students' learning outcomes. In other words, college students using ChatGPT had significantly better learning outcomes (Figure 2).

Publication Bias

Publication bias was evaluated in relation to learning outcomes through the funnel plot of the standard error using Cohen's d . From Figure 3, it is apparent that the funnel plot was asymmetrical, indicating the presence of publication bias.

Sensitivity Analysis

Lastly, sensitivity analysis was conducted to assess the robustness of the meta-analysis outcomes by sequentially removing individual studies (Figure 4). The outcomes of the meta-analysis remained consistent when any study was removed. All evaluations were within the range set by the 95% confidence interval (95% CI = [0.23, 0.91]).

DISCUSSION

Due to the innovation and prominence of ChatGPT, numerous publications and scholarly investigations have begun to focus on the implications for learning outcomes in higher education. However, previous empirical research has yielded inconclusive results regarding the impact of ChatGPT. Through a meta-analytic approach, our preliminary study tried to reconcile the disparate findings and probed the influence of ChatGPT on students' learning outcomes in the higher education environment.

Figure 2: Forest Plot of Effect Size (Cohen's d) in Random-Effects Model

Study	Treatment			Control			Cohen's d with 95% CI	Weight (%)
	N	Mean	SD	N	Mean	SD		
Balic (2023)_LA	9	3.92	.46	9	3.92	.57	0.00 [-0.92, 0.92]	3.98
Escalante et al. (2023)_LA	23	33.37	1.908	25	33.68	2.066	-0.16 [-0.72, 0.41]	5.05
Hakiki et al. (2023)_LA	31	81.81	6.353	31	70.45	9.277	1.43 [0.87, 1.99]	5.07
Li (2023)_LA	42	88.8	2.73	39	87.27	3.41	0.50 [0.05, 0.94]	5.39
Li (2023)_M	42	26.17	2.37	39	24.98	2.09	0.53 [0.09, 0.97]	5.38
Li (2023)_IM	42	12.83	1.5	39	12.03	1.27	0.57 [0.13, 1.02]	5.38
Li (2023)_EM	42	13.33	1.48	39	12.95	1.3	0.27 [-0.17, 0.71]	5.40
Qureshi (2023)_LA1	10	100	12.25	10	95	12.65	0.40 [-0.48, 1.29]	4.10
Qureshi (2023)_LA2	10	87.5	20.54	10	68.75	18.4	0.96 [0.04, 1.89]	3.98
Qureshi (2023)_LA3	10	87.5	16.66	10	67.85	15.27	1.23 [0.27, 2.19]	3.89
Qureshi (2023)_LA4	10	81.25	34.23	10	43.75	20.41	1.33 [0.36, 2.30]	3.85
Qureshi (2023)_LA5	10	62.45	36.75	10	33.8	28.24	0.87 [-0.04, 1.79]	4.00
Qureshi (2023)_LA6	10	49.97	32.54	10	19.2	22.49	1.10 [0.16, 2.04]	3.93
Urban et al. (2023)_LA	57	3.6	.89	57	2.99	.86	0.70 [0.32, 1.08]	5.54
Wei (2023)_LA	30	44.39	13.21	30	61.11	14.97	-1.18 [-1.73, -0.64]	5.10
Wei (2023)_M	30	3.04	1.4	30	3.35	1.5	-0.21 [-0.72, 0.29]	5.21
Yildiz (2023)_LA	30	.7067	.13374	30	.35	.22089	1.95 [1.34, 2.57]	4.91
Yildiz (2023)_M	30	1.7271	.11901	30	1.7851	.21286	-0.34 [-0.85, 0.17]	5.21
Yilmaz and Yilmaz (2023)_LA	21	126.73	8.34	24	112.61	15.32	1.12 [0.49, 1.75]	4.86
Yilmaz and Yilmaz (2023)_M	21	96.5	7.62	24	85.17	13.84	1.00 [0.38, 1.62]	4.89
Yilmaz and Yilmaz (2023)_S	21	126.73	8.34	24	112.61	15.32	1.12 [0.49, 1.75]	4.86
Overall							0.60 [0.28, 0.92]	

Note: N is the number of participants, SD is the standard deviation, 95% CI is a 95% confidence interval, LA is learning achievement, M is motivation, IM is intrinsic motivation, EM is extrinsic motivation, and S is skills.

Figure 3: Funnel plot assessing publication bias

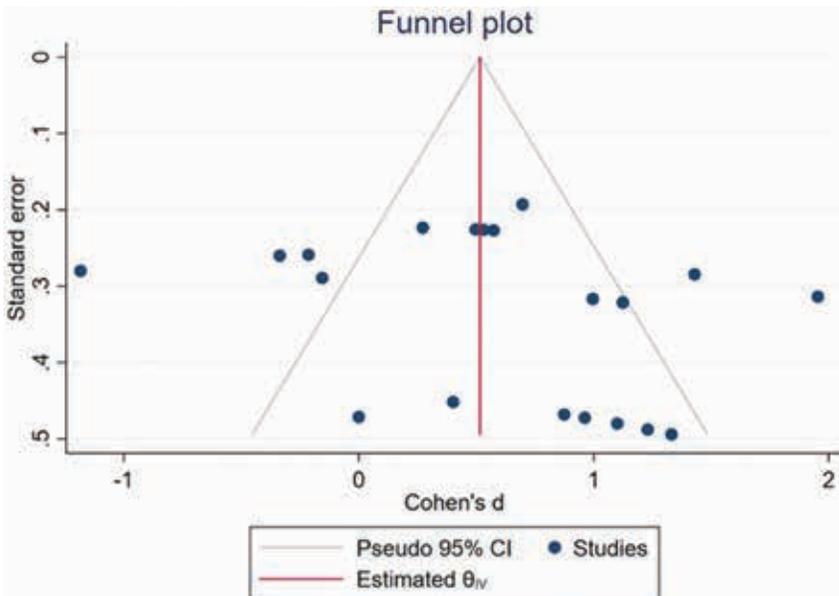
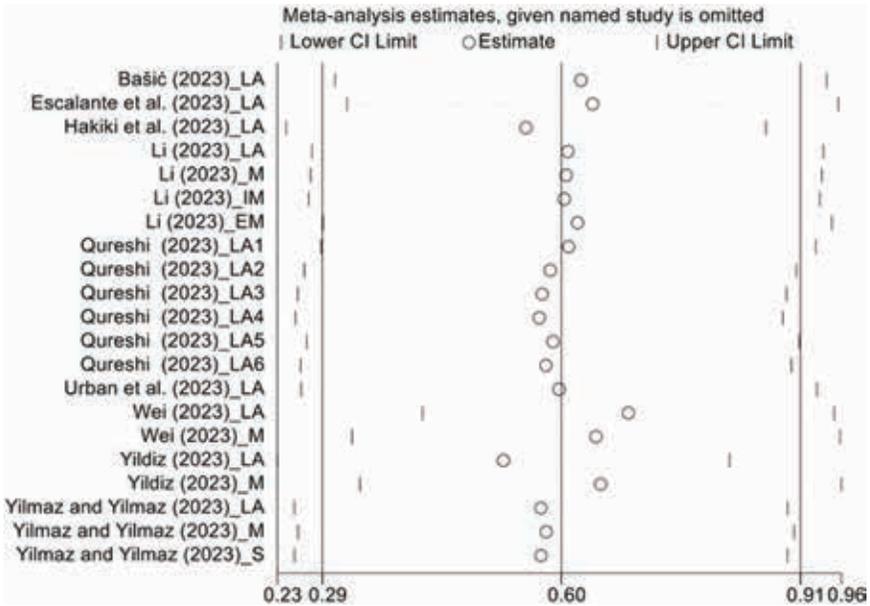


Figure 4: A Plot of Sensitivity Analysis



Note: The 95% CI is the 95% confidence interval.

This meta-analysis offers evidence supporting that ChatGPT promotes university students’ learning outcomes in terms of learning achievements, motivation, and skills. The findings of this research are consistent with previous academic works in which generative AI improves learning performance compared to other traditional instruments (i.e., Baidoo-Anu & Owusu Ansah, 2023; Bandi et al., 2023). The overall effect size calculated in this study indicates a large effect size of ChatGPT on students’ learning outcomes. ChatGPT has crucial capabilities for comprehending and generating human-like text (Radford et al., 2019). Thus, ChatGPT can be harnessed in educational settings to address questions, clarify concepts, and deliver immediate feedback that cultivates a more dynamic educational experience. Moreover, the high degree of personalization and interactivity in ChatGPT might contribute to enhanced learning outcomes, as it can provide learners with individualized tutoring (Baidoo-Anu & Owusu Ansah, 2023). For example, ChatGPT could offer explanations in various languages or in plain terminologies to students with diverse linguistic and educational backgrounds, thus broadening the accessibility of information to wider audiences or learners (Lai et al., 2023). The abilities to provide individual learning might explain why using ChatGPT in higher education settings had effects on students’ learning outcomes according to the studies reviewed.

This study has several limitations, including a lack of depth in studies related to higher educational levels and discipline and publication bias. Due to the limited number of experimental or quasi-experimental studies investigating the impact

of ChatGPT within the realm of higher education, the pool of research included in this meta-analysis is relatively modest, despite comprehensive searches across databases such as Scopus, Web of Science, ERIC, and Google Scholar. Thus, because of the small number of research articles included in the final analysis, the effects of moderators such as education level and discipline could not be fully explored. Students ranging from undergraduate to postgraduate levels may engage with and gain unique advantages from ChatGPT. Likewise, the field of study, whether arts, sciences, or humanities, might influence how beneficially ChatGPT supports the learning journey, considering the distinct educational requirements of each field. The absence of addressing these issues in the analysis means that our findings present a more restricted view, potentially masking specific conditions under which ChatGPT is most beneficial or, conversely, less effective.

Our meta-analysis research revealed publication bias. Several related publications from the original search were omitted due to inaccessibility of the full text and/or insufficient statistical data availability. Moreover, the discussion of using ChatGPT in higher education is a novel topic since the newest version of the LLM has been available for just over one year. Therefore, studies with null or negative findings were mostly inaccessible for inclusion in this meta-analysis, and the results should be interpreted cautiously. In the research literature, studies with positive findings are more likely to be published than are those with null or negative findings (Bespalov et al., 2019). Thus, because of the intense concern regarding the use of AI, publications of studies that report significant benefits associated with utilizing ChatGPT in education might be more prevalent.

Considering the increasing use of ChatGPT in education settings, future studies should seek to diversify the sample by including participants from various higher education levels and disciplines to explore the effects of ChatGPT on learning. Based on the effect of ChatGPT on college students' learning outcomes and the academic concerns noted in the literature review, the use of ChatGPT should include conditions and guidelines in higher education teaching and learning applications. In the higher education classroom, the instructor must have adequate acknowledgment of its use and the opportunity to practice with the resource (Sullivan et al., 2023). Unfortunately, such requirements may be limited, as not all college students have an equal chance of using ChatGPT in their educational studies. Yet, Fauzi et al. (2023) concluded that ChatGPT can significantly improve student productivity by overcoming learning obstacles and enhancing understanding.

Overall, the use of ChatGPT in higher education environments appears to not only improve the effectiveness of teaching and learning but also support diverse students' learning needs. Additional concerns have been raised about the security of student data, privacy, and copyright issues in the higher education environment (Marchandot et al., 2023). Thus, the use of ChatGPT should include teaching college students about ethical use and responsibilities (Mhlanga, 2023). All these concerns point to the importance of exploring the ramifications of AI and the need to develop policies based on research to ensure responsible integration in higher education.

CONCLUSIONS

This study employed meta-analysis to review the empirical literature and integrate the findings to examine the effects of ChatGPT on learning outcomes in higher education. Our results indicated that ChatGPT may have a significant positive effect on students' learning outcomes in terms of learning achievement, motivation, and skills. Despite these limitations, the findings of this study provide some direction and important implications for educators in higher education. ChatGPT holds promise for enhancing college students' learning outcomes. Educators and curriculum designers can utilize ChatGPT to enrich classroom experiences and provide more personalized and engaging learning journeys. These findings suggested that college and university students may benefit from the use of ChatGPT. Future research should provide a more comprehensive understanding of the effects of ChatGPT by considering additional variables that could moderate the effects of ChatGPT on student learning outcomes.

NOTE

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Chapter 4

The Evolution of Technology in Education and the Emerging Role of Generative AI

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ABSTRACT

This chapter explores the implications of generative AI (GAI) tools such as ChatGPT in education, comparing current adoption processes to past technology integration. The rapid advancement of AI has raised concerns about ethical dilemmas and misinformation. Drawing parallels with historical disruptions such as the calculator, this chapter emphasizes the typically slow adoption of new technologies in education and the need to urgently address GAI's challenges. Although tools like ChatGPT offer educational applications, the literature highlights important elements and drawbacks requiring attention for responsible integration. The COVID-19 pandemic accelerated technology use in education. This chapter underscores the need for continuous research and dialogue to leverage GAI's potential in teaching and learning responsibly.

Keywords: Artificial intelligence (AI), ChatGPT, Educational Technology, AI in Education, Generative AI in Education

INTRODUCTION

Nearly a decade ago, artificial intelligence (AI) was incapable of delivering reliable image recognition and language performance tasks at the human level (Kiela et al., 2021). With the rapid advancement of AI, generative AI (GAI) has recently gained significant attention because of its ability to perform various natural language tasks. GAI refers to a class of AI models that are trained to create new data that are similar to the training data it has received (OpenAI, 2022). We define GAI models as models that leverage techniques such as deep learning algorithms and neural networks to generate new content, whether text, images, or other forms of data, that are indistinguishable from human-generated content, which includes novice to expert content (e.g., writing, coding, etc.). This ability to generate realistic and coherent content has opened numerous possibilities and applications in various fields, including education. Educators are concerned about the impact of AI on education as a result of this rapid improvement in its processing capabilities (Zawacki-Richter et al., 2019; Fyfe, 2023; Rudolph et al., 2023). A recent systematic review shed light

on the current state of AI in higher education, revealing several significant gaps and shortcomings. Specifically, the review identified a lack of critical reflection on the challenges and risks (e.g., ethical concerns and false information) associated with the use of AI in higher education, as well as a weak connection to pedagogical perspectives (Zawacki-Richter et al., 2019). Other concerns include the possibility that GAI will enable students to cheat on essays, communicate inaccurate and false information, and inappropriately use assistance (as defined by local teachers) to solve logical assignments (e.g., math and computer programming) (Fyfe, 2023; Rudolph et al., 2023).

Today GAI tools such as ChatGPT are available to the general public, and both teachers and education practitioners have different opinions about ChatGPT's ability to handle complex tasks in the field of education—this development in AI—and the broad ease of accessibility of these tools appears to have the potential to revolutionize current educational practices (Baidoo-Anu & Owusu Ansah, 2023). The literature on the use of GAI in education includes various applications, such as personalized tutoring, language translation, automated essay grading, and interactive and adaptive learning studies (Baidoo-Anu & Owusu Ansah, 2023; Cai et al., 2021). On the other hand, there are numerous studies that detail the drawbacks of GAI tools like ChatGPT, such as a potential reduction in human interaction, limited understanding, reliance on data bias in training data, and privacy concerns (Baidoo-Anu & Owusu Ansah, 2023). These are some of the concerns expressed by educators, but they do not impede the advancement of this technology. Whether it is the internet, smartphone, or GAI, technology is developing quickly, and new tools are being created and will be used by students regardless of how educators feel about them. Our chapter explores the evolution of technology in education and investigates the potential role of GAI in educational settings while examining its implications for teaching and learning processes. By examining the historical integration of technologies (e.g., calculators and video conferencing software) in education, we can make some projections about the potential implications of the current advancements in GAI.

BACKGROUND: THE EVOLUTION OF TECHNOLOGY IN EDUCATION

Technology frequently disrupts established norms, forcing people to question the benefits and downsides of novel technologies (Mander, 1978). A recent example of a technology that disrupted established norms of education is the Internet. Researchers questioned whether the Internet has a positive or negative impact on education (Carr, 2011), and it is very clear how that uncertainty has played out. The case of GAI (e.g., ChatGPT, Midjourney, Bing AI) is still relatively new, and many news articles and nascent literature focus on the negative aspects and harmful applications of this technology (Fyfe 2022; Rudolph et al., al. 2023). For example, Brown and his colleagues suggest the potentially harmful uses of GPT-3, including generating fake news, plagiarism, fairness, bias, and misrepresentation. However, the

authors explain that “Here, we focus on the potential harms of improved language models, not because we believe the harms are necessarily greater, but in order to stimulate efforts to study and mitigate them” (Brown et al., 2020, p. 9). These concerns will slow the adoption of GAI in education by educators, and this phenomenon is not unique to GAI. Despite the emergence of new technologies such as ChatGPT, the education sector has been slow to adopt them and, in many cases, does not use these technologies (Oliver, 2005; Prinsloo & Van Deventer, 2017). Oliver’s (2005) study examined the progress made in educational technology between 1985 and 1995 and concluded that adaptation progress was slow. However, it is important to note that Oliver’s study analyzed research that was performed more than three decades ago. Prinsloo and Deventer (2017) found that higher education institutions are often slow to adopt emerging technologies, usually only adopting them once they become commonplace. This finding suggests that technological adoption in higher education is currently slow. A key distinction in the present situation, however, is public accessibility to emerging technologies; as students and the general public adopt these technologies, educators will be forced to determine how to integrate them quickly.

HISTORICAL EXAMPLE: THE CALCULATOR’S EMERGING ROLE IN EDUCATION OVER TIME

During the mid-1970s, the introduction of calculators into education sparked notable debate (Banks, 2011). Similar to the current situation of ChatGPT in education and its drawbacks (Baidoo-Anu & Owusu Ansah, 2023; Zawacki-Richter et al., 2019), the integration of calculators into classrooms has faced criticism. Some people argue that these devices might lead to overdependence and compromise the acquisition of essential arithmetic skills. Conversely, others highlighted the calculator’s ability to ease complex computations and promote in-depth exploration of advanced mathematical concepts. To understand how new technology is used in schools, we should look back at the stories of calculators. It is important to see how both teachers and students felt about calculators when they first started being used in classrooms and how these perspectives have changed over time.

In 1974, the National Council of Teachers of Mathematics (NCTM) issued a statement advocating for the use of calculators in classrooms (Hembree & Dessart, 1986). Their arguments, as outlined by Suydam (1976), were that calculators could support algorithmic computations, foster the development of mathematical concepts, reduce the need for rote memorization, expand the range of problem-solving tasks, enhance student motivation, and encourage discovery, exploration, and creative thinking. According to Hembree and Dessart’s (1986) meta-analysis, several factors may have contributed to the restrained use of calculators in schools. Notably, the NCTM endorsement of calculators was not universally praised by educators (Hembree & Dessart, 1986; Suydam, 1976). Educators were worried that if students relied too much on these devices, they might neglect basic skills such as writing and doing calculations on paper (Banks, 2011; Hembree & Dessart, 1986). Despite the

dropping cost of calculators at the time, their impressive capabilities ignited debates about their potential overuse and impact on learning outcomes (Hembree & Dessart, 1986).

Among these concerns were issues related to accessibility and the potential impact on students' understanding of basic math skills. In the early 1980s, the College Board introduced a policy allowing the use of calculators in the advanced placement (AP) calculus exam (Banks, 2011). However, this policy was short-lived, as in the mid-1980s, the decision was made to disallow calculators (Banks, 2011). Calculators were banned because of concerns about inequitable access, giving some students an unfair advantage. The views among teachers were mixed with 46% felt that technology had a negative impact on basic math skills, while 25% disagreed and 27% were uncertain. Over time, numerous studies have highlighted the advantages of integrating calculators into teaching and learning processes (Banks, 2011; Doerr & Zangor, 2000; Ellington, 2003; Graham & Thomas, 2000; Hembree & Dessart, 1986; Suydam, 1976). The NCTM identifies the advantages of using calculators: calculator use can enhance student interest, create engaging classroom environments, and contribute to higher levels of student self-concept (Banks, 2011). This evidence has strengthened support for the classroom use of calculators, with organizations such as the NCTM actively promoting their usage (Banks, 2011; Ellington, 2003). According to their website, a comprehensive synthesis of nearly 200 research studies investigating the use of calculators in the classroom concluded:

"In general, the body of research shows that the use of calculators in the teaching and learning of mathematics does not contribute to any negative outcomes for skill development or procedural proficiency but instead enhances the understanding of mathematics concepts and student orientation toward mathematics." (NCTM Website)

The findings of these studies have also informed policymakers, guiding the development of effective and balanced policies regarding calculator use in classrooms (Banks, 2011; Ellington, 2003). For example, the Department of Education (NCES 92-060) highlights the emphasis of the NCTM on the necessity of adapting the mathematics curriculum to align with future demands. As technology continues to advance, the nature of mathematics problems and the methods employed to solve them have undergone significant transformations. One study investigated the effects of the curriculum and evaluation standards of the NCTM and suggested that there was an increase in the use of calculators in schools from 1986 to 1996. According to their study, they explained that the department chair plays a pivotal role in guiding and supporting change within an educational institution (Garet & Mills, 1995). However, departments vary significantly in terms of the resources available to the chair, as do the chair's professional affiliations and dedication to instructional leadership. These variations can significantly impact the chair's ability to effectively lead and facilitate change within their department (Garet & Mills, 1995). The change in teaching and learning practices "entails the construction and institutionalization of a new community of practice, which is facilitated by departmental leadership that encourages teacher collaboration, collegiality, and shared decision making and

supports teachers in developing a new set of values, beliefs, and routines” (Garet & Mills, 1995, p. 387).

Finally, the adoption of calculators in education has witnessed varying perspectives over the years, initiating a crucial debate regarding their use in teaching and learning. Through the collaborative efforts of researchers and organizations such as the NCTM, teachers can look into their recommendations and suggestions and integrate calculators into the classroom. This tension between potential risks and benefits serves as a valuable lesson as we navigate the integration of AI, such as ChatGPT, in education. Careful evaluation of the pros and cons is important for determining the most effective ways to incorporate these advanced tools into the teaching and learning process while also mitigating potential downsides. The literature covers three main highlights in the adoption process of calculators:

1. Studies that explored the effect or use of calculators in teaching and learning (e.g., conducting both surveys and interviews) (Doerr & Zangor, 2000; Goos & Bennison, 2008)
2. Studies that experimented with the use of calculators in teaching and learning (e.g., often experimental design studies) (Graham & Thomas, 2000; Scheuneman et al., 2002)
3. Empirical studies that have aided in understanding the notion of using calculators in teaching and learning have helped shape policies and guidelines (Ellington, 2003; Goos & Bennison, 2008).

The integration of ChatGPT into teaching and learning may follow a similar process as the adoption of calculators in classrooms. However, it will take time and extensive research for teachers and administrators to determine the best practices for utilizing ChatGPT, just as they did with calculators. Adopting any new technology brings valid concerns about its effects on understanding and skills. As with calculators, individual teachers can begin exploring the potential and limitations of ChatGPT as a learning tool for students. Small-scale classroom experiments and data gathering will help develop initial insights. Broader integration will require deliberation and evidence on optimal educational applications. With thoughtful guidance and policies, ChatGPT may become a commonplace aid in enhancing students’ conceptual knowledge and skills, just as calculators have done. The key will be patient- and student-focused implementation and allowing new tools to complement teaching rather than replace educators’ invaluable roles.

COVID-19 PANDEMIC AND TECHNOLOGY’S SUDDEN INTEGRATION

The integration of emerging technologies in higher education generally tends to occur at a slow pace (Oliver, 2005; Prinsloo & Deventer, 2017). However, the COVID-19 pandemic has undoubtedly accelerated the adoption of technology in schools (Annamalai, 2021). Technologies such as Zoom were vital in facilitating

remote learning and communication during this period. Specifically, Zoom, which was already widely used in other sectors (e.g., business), has been instrumental in improving and enhancing the online learning experience for students and educators alike (Dwi Bawanti & Arifani, 2021). However, it is important to recognize that the sudden shift to online teaching during the pandemic does not equate to purposeful and well-planned technology integration over time (Ewing & Cooper, 2021). Notably, after Zoom became widely adopted and commonly used by several higher education institutions during the pandemic, many universities adopted Zoom as their preferred video conferencing software. This widespread adoption of technology has not only facilitated remote learning but also potentially paved the way for more innovative and flexible learning methods. A key difference relative to the prior example, however, was its sudden introduction without long-term planning and study. We wonder whether tools such as ChatGPT will follow a similar unplanned pace and evolution given the speed at which these technologies have been influencing all elements of life.

CHATGPT IN TEACHING AND LEARNING

ChatGPT, as a tool in teaching and learning, has been used in a wide range of disciplinary contexts, such as software, mathematics, chemistry, physics, and biochemistry (Bitzenbauer, 2023; Ghosh & Bir, 2023; Jalil et al., 2023; Sánchez-Ruiz et al., 2023; Seetharaman, 2023; Wardat et al., 2023). In Jalil et al.'s (2023) study, the authors used a set of 40 practice questions related to software testing to evaluate ChatGPT performance. The questions were designed to test students' understanding of various concepts related to software testing, such as test design, test execution, and test automation. They found that the system was able to answer most of them correctly. However, they also noted that ChatGPT struggled with certain types of questions and that its performance varied depending on the complexity of the question and the amount of context provided. The absence of information regarding the ChatGPT version used in the study by the authors prompts a crucial question: could GPT-4 handle these complex questions better?

A case study by Sánchez-Ruiz et al. (2023) explored the integration of ChatGPT into blended mathematics learning in engineering. They tested ChatGPT on solving problems theoretically and numerically. GPT-3.5 correctly solved 90% of the theoretical problems but struggled with computations. GPT-4 improved to 95% success on theoretical problems but also failed calculations. Therefore, while proficient at obtaining theoretical solutions, ChatGPT falls short on numerical solutions. Research shows that blended learning approaches such as flipped classrooms and game-based learning can be effective teaching methods (Sánchez-Ruiz et al., 2023). However, the beginning of AI systems like ChatGPT raises questions about how such technologies could impact the productivity of these blended learning techniques (Sánchez-Ruiz et al., 2023). More research is necessary to understand the influence of ChatGPT on blended engineering education. The key findings were the difference between the theoretical and numerical abilities of

ChatGPT and its potential complications associated with blended learning methods. Further studies should examine the optimal integration of ChatGPT to augment engineering education without disrupting proven blended techniques. A pilot study by Bitzenbauer (2023) explored the use of ChatGPT to develop critical thinking in a physics class. Two activities engaged students. First, students generated texts about photons with ChatGPT. The authors analyzed the accuracy of the survey compared to that of course content and refined the texts using other sources. This activity promoted information validation. Students then discussed the analyses in groups and as a class. Second, students prompted ChatGPT to argue for nonscientific views of photons. Students critiqued the arguments and created counterarguments. Prompts were varied for comparison. This study revealed an increased acceptance of ChatGPT's benefits among students and its potential for everyday classroom use. However, growth in accepting general AI concepts was less distinct than that in accepting ChatGPT specifically.

Ghosh and Bir (2023) investigated whether ChatGPT can solve complex problems in medical biochemistry. They evaluated the proficiency of ChatGPT in addressing intricate biochemistry questions by presenting it with a set of 200 random questions. According to their results, ChatGPT consistently achieved a minimum score of four out of five on all the modules (lower-order and higher-order questions). They also found that, in biochemistry, ChatGPT “can be an excellent tool for solving multiple-choice questions and getting the proper reasoning behind the solution” (p.6). Based on these results, for effective teaching and learning, providing comprehensive reasoning behind an answer is essential for student understanding. ChatGPT can serve as a valuable tool in this context, helping students comprehend complex prompts by offering detailed explanations. However, integrating AI such as ChatGPT into higher education offers benefits but also poses challenges (Crawford et al., 2023; Qureshi, 2023). A study of ChatGPT for programming problems found improved performance but code inaccuracies, highlighting both advantages and limitations (Qureshi, 2023). For assessments, AI tools can provide feedback, highlight gaps, and suggest resources, such as with ChatGPT reviewing early assignments (Crawford et al., 2023). However, AI should not replace student work; it should only augment learning. As AI advances continue, clear academic integrity policies for its use are crucial (Crawford et al., 2023; Qureshi, 2023). Institutions must formulate guidelines on AI pedagogy, define misconduct, and train faculty and students. With thoughtful policies, AI's benefits can be harnessed while upholding academic standards. The potential of ChatGPT in teaching and learning. Along with this, scholars explain that ChatGPT has immense potential to transform education (Adiguzel et al., 2023; Seetharaman, 2023; Wardat et al., 2023). However, integrating ChatGPT into education is still in the early stages.

GUIDING PRINCIPLES FOR RESPONSIBLE INTEGRATION

As the field of GAI matures, creative integration in teaching and learning will become more apparent. Educators are encouraged to adopt GAI responsibly,

ensuring transparency and equity in student learning. Multiple examples from Bitzenbauer (2023), Ghosh & Bir (2023), Jalil et al. (2023), Sánchez-Ruiz et al. (2023), Seetharaman (2023), and Wardat et al. (2023) showcase how educators can apply GAI in their classrooms. In terms of accessibility, ChatGPT can help ensure equitable access to resources and accommodations for students with disabilities. Lyerly (2023) suggested that leveraging ChatGPT for virtual assistance and support can be instrumental in breaking down barriers and assisting students in facing time and location challenges. Although these studies showcase the value and use of ChatGPT, it is important for scholars and practitioners who document their experiences applying GAI in their research or classroom to explicitly mention the model version (e.g., GPT-3.5 or -4), addressing the issue of early research papers missing this detail.

The implementation of GAI in education raises ethical concerns, particularly regarding bias in AI models, data privacy, transparency, opacity, equity, and access (Johri et al., 2023). The development of bias in LLM comes from the training dataset because these data often do not represent everything holistically or fairly (Johri et al., 2023). To know that a bias exists, it often “occurs unintentionally when it demonstrates flawed behavior during actual implementation” (Johri et al., 2023. p.5). Oftentimes, bias occurs when dealing with educational data, more specifically student data (Johri et al., 2023). For equity and access, according to Johri’s work, ML-based technologies have the potential to provide equal treatment to all users. However, it raises concerns about the user’s technological literacy, which will vary and might create an unfair advantage for some users.

When utilizing GAI in teaching, it is critical to carefully review the prompts and instructions provided to the GAI system. Educators should examine them for any potential biases or problems. Additionally, the accuracy and appropriateness of any GAI-generated content must be thoroughly verified before use. Rigorously evaluating both the inputs and outputs allows for the proactive detection of flaws or biases. Taking these steps to validate results is essential to avoid perpetuating discrimination or misinformation when applying GAI in educational contexts. A conscientious human review process is vital for upholding integrity in the use of this emerging technology. This process is called the human in-the-loop process (Johri et al., 2023). Thus, this approach requires human judgment, and the process is not fully automated to ensure reliable results from the GAI system (Gamielien et al., 2023). We recommend not using GAI to make critical educational decisions, such as student assessments or college admissions, without a rigorous framework, methodology, or human-in-the-loop process. There should be clear guidelines, oversight, and validation of any GAI-generated results impacting high-stakes determinations before they are acted upon. Until transparent frameworks ensuring accountability are developed, tested, and implemented, GAI should not autonomously inform decisions such as evaluations and admissions without thorough checks by qualified individuals. To apply GAI in educational settings, we highly recommend utilizing systematic frameworks (e.g., DELICATE and RESPECT) from learning analytics and machine learning approaches to teaching and learning settings (Johri et al., 2023).

Finally, institutions must establish responsible governance of GAI use in education to uphold fairness and equity.

CONCLUSION

In this review, we have discussed the emerging role of ChatGPT as a GAI tool in the field of education. We defined GAI tools as instruments that leverage models and techniques such as deep learning and neural networks to generate new content. This content, whether it be text, images, or other forms of data, is indistinguishable from human-generated content. ChatGPT has gained significant attention because of its proficiency in generating coherent and realistic content comparable to human-written text, simply by prompting the system on a webpage. This ability to generate indistinguishable AI content from human content has opened numerous possibilities and applications in various fields, including education. The rapid adoption of technology during the pandemic (COVID-19), which has facilitated not only communication but also teaching and learning, provides a compelling case for the rapid integration of technological tools into educational contexts under extraordinary circumstances (Annamalai, 2021; Bawanti & Arifani, 2021; Ewing & Cooper, 2021). As scholars, the adoption of calculators offers valuable lessons for future research on technological implementations in education. The history of calculators shows that disruptive technology can positively impact students, despite initial criticism and its slower pace of access relative to tools such as ChatGPT. With careful research and reasoned policies, initial critics changed their views, as research has demonstrated the strengths of calculators in augmenting conceptual math learning. We also cannot overlook the invaluable lesson from the pandemic; the new reality is that there will be rapid technology adoption in education, whether institutions are prepared for it or not. Resorting to the past practices of slow integration (Oliver, 2005; Prinsloo & Deventer, 2017) would be a missed opportunity, and quite frankly naive, in harnessing these technological advancements to their full potential in education.

While there are manifold potential benefits of integrating ChatGPT into teaching and learning, it is crucial to address legitimate concerns surrounding academic integrity, including cheating (Crawford et al., 2023). As researchers, we must consider the potential misuse of this powerful tool and consider how it could be used for deception in an educational context, such as students potentially relying on AI to complete assignments without gaining the necessary knowledge or skills themselves. We openly acknowledge the challenges that accompany the deployment of powerful tools such as ChatGPT in education. These challenges extend beyond cheating, encompassing broader ethical considerations (Wang et al., 2020; Baidoo-Anu, 2023; Akgun & Greenhow, 2021; Mhlanga, 2023). For example, the issue of data privacy and security must be rigorously addressed, as ChatGPT, like any other AI, relies on extensive data inputs. There are also concerns related to ensuring equitable access to technology and preventing the reinforcement of existing differences in the educational landscape (Eke, 2023). Importantly, as we navigate these new waters,

we have the opportunity to learn from our previous experiences with AI tools in education. Past deployments of AI in education have offered crucial insights into the ethical, practical, and pedagogical implications of such technology. ChatGPT represents the next potentially disruptive education technology. Just as calculators found acceptance and enhanced classrooms, so too may ChatGPT and future innovations if they were thoughtfully and proactively integrated. Educators must guide implementation, maximizing benefits while minimizing any drawbacks. With open-minded assessment, disruptions can become constructive.

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Chapter 5

ChatGPT as a Pedagogical Tool for Decolonizing Curriculum

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ABSTRACT

Artificial Intelligence (AI) chatbots can support curricular development and syllabi design. Few (if any) studies have examined the potential of ChatGPT to design progressive, responsive, and critically oriented English literary courses, nor to decolonize English curricula in the context of the Eurocentricizing university. This study examined ChatGPT's ability to design a First-Year English literature course using Govender and Naidoo's (2023) framework for decolonial curricular transformation as its analytical framework. ChatGPT was able to provide thoughtful and comprehensive responses based on the prompts provided, showing promise as a decolonial curriculum design tool. However, ChatGPT did exhibit literary and ideological blindspots, reflective of AI's colonial and neoliberal biases. The findings indicate that ChatGPT can pluralize, internationalize, and indigenize curricula, but caution is warranted, as unchecked AI use in curriculum design could end up perpetuating coloniality instead. Using ChatGPT skillfully has the potential to help educators design inclusive curricula in a more efficient and effective manner.

Keywords: ChatGPT, curriculum design, decentering, decolonization, diversity, first-year English literature, literary studies, internationalization

INTRODUCTION

Universities in the U.S., despite espousing internationalization, paradoxically promote Eurocentric knowledge, values, frameworks, standards, norms, and thought processes as global (Ozyonum, 2023). This tendency is especially pernicious and pervasive in English Studies, a discipline that has historically perpetuated colonialist, racist perspectives and commodified or erased the narratives of the Global South (Wright, 2022). Even the English language itself, while commonly assumed to be a language of neutrality and global communication, is laden with colonial meaning (Pennycook, 1998) and is a political instrument and proof of power (Baldwin, 1979). A decolonial approach to curricular development and internationalization can deobfuscate coloniality in what and how we teach, think, and learn (Park & Francis, 2024) and address the ongoing colonial politics of knowledge in higher education (Stein, 2017). ChatGPT has the potential to contribute immensely to the field of higher education, as it can support curricular development and syllabi design

(Mogali, 2023), including course design for English language learners (Kim et al., 2023), offering educators a powerful tool to reimagine and refine their instructional strategies. Few studies have examined the potential of ChatGPT to decolonize courses, including English literature courses.

I am a woman international educator from a previously colonized nation, teaching First-Year English at a public university in the U.S. In this study, I lean into my content knowledge to examine the potentialities and limitations of ChatGPT to decolonize, internationalize, and indigenize the curriculum. Particularly, I explore ChatGPT's ability to design inclusive course content for an introductory English literature course. I focus on the U.S. postsecondary education context, as it is the site of my labor and locus of my enunciation. First, I present a review of extant scholarship examining the technical aspects of ChatGPT and its potential to be harnessed as a pedagogical tool in higher education. The sections that follow go over theory and purpose, underscoring the urgency of contesting Eurocentrism and heteropatriarchy in education and creating environments that value diverse epistemes. The fourth section details my method, describing a test conducted to determine the suitability of ChatGPT as a tool for designing decolonial curricula. The closing sections assess the usefulness and suitability of ChatGPT as a decolonial pedagogical tool and reflect on the opportunities for and concerns about its role in decolonizing, internationalizing, pluralizing, and progressivizing curricula, with close attention given to the hegemonizing and obfuscating tendencies of AI.

The findings indicate that ChatGPT was able to execute given prompts and design a culturally and intellectually diverse introductory English course, acting as a promising curriculum design tool. However, ChatGPT's recommendations were found to promote popular and canonical non-Western authors and theorists and exhibited literary and ideological blindspots. These findings suggest that instructors can harness ChatGPT as a valuable tool to unsettle whiteness-as-norm and reaffirm alternative and Global South ontologies and epistemologies through curricula. The tool's capacity to streamline the curriculum design process offers educators the advantage of saving time that would otherwise be spent on extensive manual planning and content creation. However, educators should not [over]rely on ChatGPT and be mindful of its hegemonizing and canonizing tendencies, considering that ChatGPT is a black box trained on Euro-skewed data and developed within the capitalist economic paradigm of the modern empire. Educators are thus encouraged to complement technologies with their own content knowledge, empathy, and criticality when developing and implementing progressive, value-driven courses. This article contributes to the ongoing discussion around the implications of AI in education and has significant relevance for researchers and practitioners seeking to navigate the evolving landscape of AI and its impact on education.

LITERATURE REVIEW

ChatGPT is an AI-powered chatbot developed by OpenAI. It was launched as a prototype on 30 November 2022, after which it became available to the public on 30

January 2023. It represents an advancement over earlier language models, including its predecessors, such as GPT-3, which was specifically designed for multi-turn conversations and more contextually relevant interactions. ChatGPT is based on the GPT (Generative Pre-trained Transformer) architecture, specifically GPT-3.5. Large Language Models (LLMs) like GPT-3.5, are pre-trained on a vast corpus of existing text data, can be fine-tuned for specific tasks or applications, and have demonstrated an impressive capacity to process and generate text based on patterns in the data. Unlike other models, such as Recurrent Neural Network (RNN) and Convolutional Neural Network (CNN), GPT is faster and excels at following and ‘understanding’ contexts, resulting in more coherent responses aligned with the user’s intent. Furthermore, ChatGPT supports multiple languages and can adapt the format, length, and content of generated text to meet users’ specifications (Athanasopoulos et al., 2023). While research is still evolving on its implications and applications, ChatGPT offers promising opportunities for global mobility, internationalization, and cross-cultural and cross-linguistic communication (Baskara, 2023).

ChatGPT’s Promise in Teaching and Learning

ChatGPT’s capability of generating high-quality sentences can support teachers, engage learners, personalize learning activities, and develop insight into learner behaviors (Kuhail, et al., 2023), making it valuable for language education (Fryer et al., 2020; Huang et al., 2022; Kim et al., 2023; Kohnke, 2022, 2023; Kohnke et al., 2023; Lee et al., 2020; Zhang & Mao, 2023). The ‘Chat’ signifies its ability to facilitate interactive and dynamic exchanges, making it useful for content generation (Fauzi et al., 2023), knowledge dissemination (Xiao, 2023), writing assistance (Imran & Almusharraf, 2023), and student collaboration (Cotton et al., 2023). ChatGPT can provide a range of expressions and vocabularies that human partners may lack (Huang et al., 2022) and replicate authentic, interactive teaching and learning environments (Adiguzel et al., 2023; Fenster, 2023). It can help with academic writing (Bom, 2023), research streamlining (Huang & Tan, 2023), and scholarly publication (Huh, 2023) and aid educators in discovering, curating, and creating learning materials (Kılınc, 2023). It also holds immense promise for curriculum design and lecture preparation (Mogali, 2023) in areas such as nursing education (Castonguay et al., 2023), medical education (Lee, 2023), management education (Ratten & Jones, 2023), and mathematics (Supriyadi & Kuncoro, 2023), freeing up teachers’ time through task automation and augmentation (Dwivedi et al., 2023).

ChatGPT’s Promise in English Studies

In many universities in the U.S., First-Year English literature courses are required for students in a variety of programs, including arts and sciences (Morris-O’Connor, 2021). The English discipline and departments have historically perpetuated white supremacy, prioritizing rhetorics of the West and delegitimizing World Englishes and the Global South (Wright, 2022). Decolonizing the English literary curriculum reconnects English studies, humanities, and modern international universities

to issues of racial and social justice (Mukherjee & Quayson, 2023). Little, if any, research exists on AI's contributions to decolonizing English courses. What is known is that the arrival of ChatGPT has affected the role of First-Year English courses, pressuring English educators to be more critical about the purpose of English Studies (Greenfield, 2023). Vee (2023) reminded that LLMs are simply tools, and that ChatGPT, in and of itself, is largely incapable of stoking criticality. Any technology, whether as sophisticated as ChatGPT or more rudimentary, can be used to induce or reduce social injustice (Yang, 2023). Despite its limitations, AI can generate and evaluate questions swiftly and with dependable results, enabling English educators to focus on higher-order issues (Lee et al., 2023), such as reorienting the purpose of English Studies. English teachers should be intentional in cultivating critical-mindedness and philosophical inquiry (Vee, 2023).

THEORY

This study was guided by decolonial theory, acknowledging the curriculum as a site of power (Nozaki, 2009). Coloniality in the curriculum naturalizes hegemonic systems organized and inscribed through governing Eurocentric paradigms (Dei, 2012), stratifies knowledge hierarchies (Jansen & Walters, 2022), and preserves and promotes whiteness through the vehicle of higher education (Stein, 2017). Coloniality also delegitimizes and deauthorizes the Global South as a site of knowing (Ndllovu-Gatsheni, 2020) and smothers other modes of knowledge (Hernandez-Carranza et al., 2023). In a seminal essay, Ngũgĩ wa Thiong'o (1972) espoused the disruption and reconceptualization of the Eurocentric English literary curriculum, voicing criticality toward an additive model of literary study centered on perpetuating the myths of empire. Ngũgĩ's (1972) call to abolish the English department was not so much a rejection of English Studies per se but a rejection of intellectual colonization, a reappropriation of English Studies, and a reaffirmation of African languages and literatures, including oral and performative literatures. Ngũgĩ suggested that a decolonized curriculum could reconnect the education system with the cultural, linguistic, and historical realities of the Global South. In both previously colonized countries and settler countries such as the U.S., decolonizing the curriculum usually entails the assertion and centering of Native and Indigenous perspectives (Sapto et al., 2023).

Decolonization—defined as “liberating knowledge from the chokehold of white-supremacist interpretation and thought” (hooks, 2003, p. 3)—seeks to interrupt and undo these harmful and inequitable institutional processes. Decolonization requires delinking from Euro-American thought, reorienting our communal praxis of living (Mignolo, 2018), and placing diverse knowledge on a non-hierarchical, horizontal plane (Radcliffe, 2017). Educators may undertake decolonization through “methodologies and processes of struggle, practice, and praxis that are embodied and situated, that push historical, political, ethical and strategic learnings, and that oblige epistemic, political, ethical, strategic ruptures, and displacements” (Walsh, 2018, p. 48-49). One such pedagogy entails resetting historical imbalances

in the global knowledge reality through curricular revision (Govender & Naidoo, 2023). A curriculum design process that interrogates coloniality and inequitable power structures and, more broadly, reenvisioning traditionally accepted structures of higher education curricular processes and procedures is a prerequisite for envisioning inclusion in higher education (Parson & Weise, 2020). The achievement of social justice for the colonized remains elusive without the decolonization of the curriculum (Govender & Naidoo, 2023). Setting decoloniality and internationalization alongside each other can enable an understanding of race, privilege, knowledge, and positionality, informing ways forward for both agendas (Montgomery & Trahar, 2023).

PURPOSE

The aim of this study was to test the utility of ChatGPT as a decolonial curriculum design tool following Govender and Naidoo's (2023) principles for decentering Eurocentrism in curricula. Specifically, this study aimed to develop a freshman-level English literature course. The purpose of curricular decolonization is to "evaluate and redesign curriculum and (re)build it on a foundation of inclusion and social justice" (Parson & Weise, 2020, p. 94). The purpose of the First-Year English literature course is to introduce students to a broad range of literary forms, exposing students to a diverse range of writers across race, gender, nationality, and time periods. As students engage with reading, they develop skills in literary interpretation, analysis, and critical evaluation (Morris-O'Connor, 2021). A major objective of this course is to cultivate literary criticism as a *discourse* that students actively participate in, recognizing the social and constitutive nature of writing (Sullivan, 1991). A decolonial literature course does not ignore cultural and social-political contexts, but delivers lessons about how literature is shaped by historical forces as well as how literature shapes culture (Doughert, 2021). A curriculum design tool is defined as a tool "utilized to craft effective curricula, unit lessons, or other instructional products" (Khadimally, 2015, p. 33).

METHOD

Positionality

Decolonizing higher education cannot occur without decolonizing the academic self (Wimpenny et al., 2022). Decolonizing methodologies and pedagogies requires decolonial ethics (Zembylas, 2022); hence, this study eschewed the positivistic premise of researcher objectivity and detachment, realizing researcher subjectivity as being integral to knowledge formation, framing, and interpretation, thereby moving away from the methodological imperialism of Euro-Western 'science' (Hlabangane, 2018). While positivism is grounded in the notion that there is a universal truth 'out there,' simply waiting to be grasped, decolonial research recognizes the inherently subjective and contextual nature of knowledge, explicitly centering the political (Matutu, 2019). Central to this methodological approach is emphasis on the reflexive

process, which involves researchers problematizing their positionality in the research (Cousin, 2010). Positionality is defined as aspects of identity such as class, gender, and any other attributes that mark relational positions in society, be they fixed or acquired (Stiedenroth, 2014). I identify as a trilingual cis woman Savarna scholar and early-career educator from a previously colonized country in South Asia. Additionally, as an international student and immigrant, I am positioned as a settler in the U.S.

Ethical Considerations & Trustworthiness

Two major ethical considerations were kept in mind while undertaking the data analysis and interpretation. First, the complexities surrounding ethics in AI, particularly in the context of global representation and historical power dynamics, were taken into account. Particular attention was given to biases within ChatGPT (Byrd, 2023), recognizing that AI systems are embedded in deep histories of colonialism and capitalist accumulation (Tacheva & Ramasubramanian, 2023) and that geographies of codified knowledge have always been characterized by stark core–periphery patterns (Graham et al., 2014), exhibiting clear and significant configurations of ideological and epistemological centralization, marginalization, gaps, and erasures. Biases within ChatGPT were addressed through transparency about the limitations of AI systems. Second, I kept in mind that I, too, as a researcher, have been subtly colonized (Moreira, 2022), subjectivizing the research process. Much like AI, humans are influenced by our ‘training,’ experiences, educational background, and cultural contexts. Acknowledging that all the knowledge is value-laden and that the researcher is the primary research tool (Cousin, 2010), I approached the data analysis with reflexivity and self-conscious recognition (Archer, 2009) to mitigate researcher bias. Critical friendship and collegial interactions served to validate and triangulate the findings (Mena & Russell, 2017).

Several measures were undertaken to seek trustworthiness. First, clear and specific prompts were provided to ChatGPT, guiding the generation of course components. Second, exemplars were provided using previously defined categories validated from research, namely, Govender and Naidoo’s (2023) decolonial principles for curriculum. To enhance transparency, a detailed process of content evaluation was undertaken, initiated by me and subsequently by a team of two other postsecondary English educators. I undertook self-study of my pedagogy through critical friendship (Mena & Russell, 2017) with a senior professor and teacher educator, who critically engaged with my curriculum design and efforts to decolonize my thinking and teaching, thereby helping me address biases and blindspots. Self-study served as a way to think about practice and as a method of inquiry (Kitchen, 2021); inquiring into my identity side-by-side with this study helped me understand how my positionality and background shaped my pedagogy and ideas about education (Coia & Taylor, 2009) and made me more cognizant of issues of social, economic, and epistemic inequity in education (Kitchen et al., 2016). I also relied on self-trust, defined as the “transparency of myself to myself [...] necessary to our sense of ourselves as actors in and on the world” (Coia, 2008, p. 63-64).

Data Collection

The method employed to collect the data involved prompting ChatGPT to design learning content and structure for an introductory college-level English literature course oriented by decolonial praxis. Prompt engineering – also referred to as prompt design, prompt programming, and prompting – is the practice of writing textual inputs for generative systems (Oppenlaender, 2023), a technique that involves providing hints (prompts) to the language model to aid in understanding the task at hand and generating desired results (Lee et al., 2023). The responses generated by ChatGPT when prompted to design a de-Eurocentricized introductory English literature course served as the data. These data encompassed the course description, learning outcomes, content, sequence, assessments, and a unit overview, schedule, and lesson plan. I established broad parameters by specifying my requirements upfront. However, I did not delineate specific and detailed parameters (e.g., what to include or not include) in order to test the AI training data and algorithms.

Teaching Context

First, I introduced myself and my requirements to ChatGPT.

(Prompt) “I am a female adjunct professor of First-Year English at a U.S. public university. I am an international faculty member of South Asian (Global South) origin. I would like to develop a first-year introductory English literature course that decenters Eurocentrism.”

(Response) “Developing a first-year introductory English literature course that decenters Eurocentrism is a commendable endeavor that can offer students a fresh perspective on literary analysis and help them engage critically with colonial legacies [...] The aim of your course is to empower students to critically engage with literature and think beyond traditional narratives. By decentering Eurocentrism, you’re providing them with tools to challenge existing power structures and view literature from a more inclusive lens.”

Course Description

Second, I asked ChatGPT to write a course description.

(Prompt) “Write a course description based on the given information.”

(Response) “In this first-year introductory English literature course, we embark on a transformative journey that challenges conventional narratives and introduces a rich tapestry of global literary voices. Going beyond the traditional Eurocentric lens, we explore a diverse array of literary works from the Global South, authored by voices often marginalized by the mainstream. As an international faculty member of South Asian origin, I bring my unique perspective to guide you through this enlightening exploration.

Through a selection of carefully curated texts, we delve into the depths of human experiences, aspirations, and struggles across cultures and continents. We’ll traverse

landscapes of thought, emotions, and identities, all while transcending geographical boundaries and uncovering stories that illuminate the complexities of colonial legacies and their enduring echoes. Together, we'll critically analyze these works, drawing connections and contrasts that illuminate our shared human condition.

Our literary odyssey encompasses themes that resonate universally: identity, migration, colonialism, social justice, and the intricate tapestries of human relationships. Through the lens of authors hailing from South Asia, Africa, Latin America, the Middle East, and other underrepresented regions, we will explore narratives that open windows to new horizons of understanding. This course celebrates the vibrant mosaic of human expression by delving into global literary movements, including Magical Realism, Postcolonial Literature, African Literature, and more. Engaging with these movements will foster a nuanced understanding of how diverse cultures and histories influence literary creation and innovation.”

Learning Outcomes

Third, I asked ChatGPT to specify learning outcomes based on the given information.

ChatGPT formulated comprehensive course goals, including:

- Critically analyzing diverse literary texts: by engaging in close readings, comparing and contrasting cultural perspectives; and identifying themes, narrative techniques, and stylistic elements unique to non-Western, Black, and Indigenous literary traditions.
- Evaluating the impact of context: by understanding how historical, social, and cultural contexts influence the creation, dissemination, and interpretation of literatures.
- Decentering hegemonic worldviews: by recognizing and critically assessing the limitations of Eurocentric perspectives in and through literature.
- Demonstrating cultural sensitivity and ethical engagement: by expanding appreciation of cultural difference and approaching texts with cultural sensitivity and criticality.
- Articulating connections between global literary traditions: by identifying themes and motifs that transcend cultures while deconstructing Eurocentric universalisms.
- Understanding intersectionality: making connections between gender, race, class, and other identity markers and grappling with power dynamics and representation.
- Constructing cohesive arguments: by developing critical thinking skills and utilizing evidence from texts to support assertions and interpretations.
- Engaging in inclusive and respectful discussions: by making room for diverse viewpoints, active listening, and navigating sensitive topics with empathy.
- Reflecting on positionality: by considering the role of literature in challenging dominant narratives and reflecting on one's own thought and knowledge formations.

- Applying literary analysis to real-world contexts: by recognizing the relevance of literary analysis in interpreting broader societal issues and contemporary global challenges.
- Constructing multidisciplinary connections: by understanding the potential for literature to shape and be shaped by various aspects of human experience.
- Synthesizing learning through creative expression: by creating original projects, affirming original insights, and validating original voices.
- Cultivating empathy and perspective-taking: by recognizing and appreciating the diverse range of human experiences and struggles portrayed in literatures.

Course Content, Structure, and Assessments

Fourth, I asked ChatGPT to set the course content, sequence, and assessments.

ChatGPT generated a 15-week tailorable course, beginning with a course introduction, objectives, expectations, rationale for a decolonial praxis, and an overview of global literary movements (Weeks 1-2). The first segments covered identity and belonging, deep-diving into themes such as immigration, diaspora, and hybridity, discussing how contexts shape subjectivities (Weeks 3-4). The second unit covered colonialism and its aftermath, exploring post/colonial narratives and the impact of colonialism on societies and subjectivities (Weeks 5-6). The course, then, moved toward gender and intersectionality, spotlighting women's authors from various regions (Weeks 7-8). Next, the course traced themes of conflict, oppression, and resistance, focusing on examinations of literatures that challenge dominant narratives and explore alternative perspectives on power and resistance; this included analyzing the role of the literature in advocating for change and social justice (Weeks 9-10). The following unit explored nature and the environment, including the theme of eco-consciousness literature (Weeks 11-12). The penultimate unit focused on family, relationships, and communities across diverse contexts (Weeks 13-14). The course culminated in students presenting on course themes and reflecting on their learning, shifts in perspectives, and growth (Week 15).

The various assessment methods proposed by ChatGPT included weekly reading responses (reflections to encourage critical engagement), analytical essays (essays exploring themes, contexts, and cultural influences, e.g., comparative essays), character voice assignments, group discussions (active participation with peers exploring various perspectives), creative projects (original creative works—written, visual, or artistic—inspired by course themes), and a final project (individual or group presentations summarizing insights gained). As resources to incorporate into the course, ChatGPT recommended the inclusion of a diverse range of literary texts from non-Western cultures; academic articles and critical essays that explore themes and contexts; guest speakers from different cultural backgrounds to provide grounded, first-hand perspectives; and multimedia resources (films, interviews, and podcasts) to enhance understanding.

Course Unit Overview, Schedule, and Lesson Plan

Finally, I selected the “Conflict, Oppression, and Resistance” course unit and requested ChatGPT to develop a unit overview, schedule, and lesson plan.

(Response) “Unit Overview: In this unit, we will delve into the works of marginalized, Black, postcolonial, and Indigenous authors to examine their unique perspectives on conflict, oppression, and resistance. Through careful analysis, discussions, and reflective assignments, we will explore how these authors shed light on historical and contemporary struggles while inspiring narratives of resilience and empowerment.”

ChatGPT, then, laid out a 2-week course schedule, beginning with the open-ended question “What comes to mind when you think of conflict, oppression, and resistance in literature?” to be posed to students. ChatGPT went over course topics, including literary portrayals of oppressions; literary techniques (e.g., metaphors, symbolism, imagery, and narrative structure) employed by marginalized authors to convey the theme of conflict; the role of literature in advocating for social justice; and strategies of empowerment and agency across socio-historical contexts. ChatGPT generated a lesson plan involving class conversations, close readings, and reflective journaling, highlighting the importance of facilitating sensitive discussions and providing additional support to students encountering de/postcolonial perspectives for the first time. Suggested readings included novel excerpts and short stories by Toni Morrison, bell hooks, Joy Harjo, Chimamanda Ngozi Adichie, Ta-Nehisi Coates, Salman Rushdie, Jamaica Kincaid, Chinua Achebe, Audre Lorde, Leslie Marmon Silko, Ngũgĩ wa Thiong’o, Nawal El Saadawi, Frantz Fanon, and Louise Erdrich.

Data Analysis

Open coding was used to break down data into discrete categories and capture key ideas, concepts, or themes in the responses from ChatGPT. Next, axial coding was employed to strategically reassemble the data that were split or fractured during the initial coding process (Saldaña, 2021). Finally, selective coding (theoretical coding) moved the analysis in a theoretical direction (Saldaña, 2021) using Govender and Naidoo’s (2023) framework for decolonial curricular transformation as an analytical guide map. Govender and Naidoo (2023) proposed this framework of decolonial principles and implications as a starting point for curriculum engagement processes. Accordingly, ChatGPT’s responses were analyzed for de-objectifying and humanizing the Global South, [re]contextualizing knowledge, visibilizing the oppressed colonial condition, and recentring denied or subjugated literatures (Govender & Naidoo, 2023). Data was also analyzed for symbolic representations of race, gender, and ethnicity (Govender & Naidoo, 2023). Consideration was given to the centrality of social justice, particularly with regard to epistemologies of the South (Govender & Naidoo, 2023), in the generated data. Finally, ChatGPT’s responses were coded for their ability to unsettle “the over-determination and over-representation of whiteness” (Govender & Naidoo, 2023, p. S63) through the

decentering of the White, male canon. Table 1 provides an overview of Govender and Naidoo's (2023) framework and how ChatGPT's responses aligned with this framework.

Table 1: Govender and Naidoo's (2023) principles for curriculum

Principles for curriculum	Findings from data
Highlighting Eurocentric, colonial, and racist foundations in English literature; Making explicit the genealogy of disciplines.	Course aim highlights critical engagement with colonial legacies in English literature.
Validating multiple epistemologies; Expanding curriculum selection scope; Recognizing multiple knowledge systems.	Course content incorporates Indigenous, Black, Muslim, Asian, and other literatures and theories.
Decentering European knowledge; Disrupting the narrative of white European knowledge as the gold standard.	Course outcomes include critical assessment of the limitations of Eurocentric perspectives in literature.
Including reading lists, authors, and themes not usually 'allowed to exist.'	Select course unit centers alternative, subversive, perspectives on power and resistance.
Incorporating Black-centered relevance; Centering the Black being/subject; Challenging the alienation of African subjects.	Course content includes African/Black American writers such as Toni Morrison, Frantz Fanon, Jamaica Kincaid, Chinua Achebe, and Ngũgĩ wa Thiong'o.
Understanding and challenging the colonial matrix of power.	Teaching context underscores the value of English literature studies for providing tools to challenge existing power structures; Course outcomes mention examining power dynamics and representation.
Educating for an inclusive future.	Course outcomes include cultivation of empathy, ethical engagement, and perspective-taking.
Reformulating teaching content, resources, and instructional approaches.	Lesson plan recommends novel teaching approaches, such as providing extra support to students encountering decolonial perspectives for the first time.

Principles for curriculum	Findings from data
Promoting human interdependence with non-human animals and nature.	Course sequence includes a unit on eco-consciousness literature with a focus on nature and environment.
Connections to the knowledges of people, their contextual life circumstances, Indigenous epistemes, literacies, and ways of knowing.	Course description highlights exploration of human lived experiences, aspirations, and struggles, particularly of voices marginalized by the mainstream.

FINDINGS

When instructed to design an introductory English literature course that decenters Eurocentrism, ChatGPT was able to provide thoughtful and comprehensive responses based on the prompts provided, successfully functioning as a decolonial curriculum design tool. Leveraging an extensive corpus of data, ChatGPT constructed a tailored 15-week course, including a course description, structure, learning outcomes, units, assessments, and a lesson plan, providing insightful suggestions, approaches, and readings that centered Indigenous, Black, Muslim, Asian, and other[ed] perspectives. Based on Govender and Naidoo's (2023) principles for curricular transformation, these findings, for the most part, reveal a comprehensive alignment with decolonial aims. First, the course's overarching goal emphasized critical engagement with colonial legacies in the English literature, aiming to validate non-Western onto-epistemologies and broaden the curriculum selection scope to encompass writers of color. The selection of Black (even radically decolonial) authors/theorists such as Chinua Achebe, Ngũgĩ wa Thiong'o, and Frantz Fanon can expand the intellectual horizons of freshman students, introducing them to post/decolonial thought in culturally affirmative ways. Second, the course sequence included units on topics ranging from immigration, diaspora, and hybridity to conflict, oppression, and resistance, taking a Global South-oriented approach to topics (such as family and community) that have historically been framed in Eurocentric, patriarchal ways.

Third, the course outcomes emphasized evaluating the impact of historical, social, and cultural contexts on the literature, encouraging students to decenter Eurocentric perspectives and critically assessing their limitations. The outcomes also suggested students cultivate cultural sensitivity and ethical engagement, fostering an appreciation for cultural differences and promoting critical approaches to texts. Learning outcomes further encouraged making connections between global literary traditions, exploring intersectionality, constructing cohesive arguments with evidence from texts, and applying literary analysis to real-world contexts. Moreover, students would learn to reflect on positionality, engage in inclusive discussions that respect diverse viewpoints, and value the literature's role in challenging dominant narratives. Fourth, ChatGPT recommended creative and exploratory assessments (such as character voice assignments, collaborative discussions, and reflections

on growth). In contrast to traditional assessments that often narrowly focus on the memorization and regurgitation of information, these novel assessments ask students to think critically, synthesize knowledge, and engage with course content in personally meaningful ways. This approach to assessing students' learning could shift the emphasis from a deficit-based evaluation model to one that highlights and celebrates students' strengths, creativities, subject formations, and growth journeys throughout the course. Furthermore, the course emphasized the value of English Studies in learning empathy, ethical engagement, perspective-taking, and opposition to social injustice.

That being said, I encountered limitations in the proposed course. For starters, while ChatGPT promised to center Indigenous voices, these voices were largely absent. While Native American voices were largely ignored, with the exception of Joy Harjo, the total exclusion of tribal and subaltern voices from non-Western contexts, such as Adivasi and Dalit voices, was especially glaring. The training data of LLM AI tools are extremely limited in regard to knowledge bases from Indigenous communities, including from the Global South (Crowell, 2023). While the indigenization of the curriculum matters for decolonization, especially in the U.S., I pause here to recommend that our understanding of 'indigenous' in the academy be expanded from Native American indigeneity to include Native Black communities and subaltern tribes in the South. Second, while the course included a unit on gender and 'intersectionality' (a framework developed in the West), it brushed over non-Western framings of gender/sexuality and non-Western theorists' engagement with multiple identities. Third, the curriculum failed to address language issues, as advised by Govender and Naidoo (2023). Specifically, the curriculum did not account for linguistic variations in English (e.g., Black and creolized Englishes), an oversight that raises concerns about inclusivity, as standard English may not encapsulate the richness and authenticity of non-White-Anglophonic lived experiences.

Fourth, while ChatGPT recommended the inclusion of short- and long-form prose, it did not include plays and poems (including non-Western forms, e.g., dohas). Fifth, ChatGPT's course largely centered on popular, award-winning, and canonical racialized and 'ethnic' authors; for instance, Joy Harjo is a U.S. Poet Laureate, Arundhati Roy won the Booker Prize, and Chinua Achebe is one of the most widely studied African novelists. Popular literary authors and works (e.g., Kimberlé Crenshaw's intersectionality) tend to have more extensive online presence (e.g., articles, reviews, summaries, and citations), and this abundance of data makes it more likely for ChatGPT to have learned about them during training. Additionally, many 'ethnic' authors write in English, win Western awards, and/or are writing from the vantage point of the Western academy, and can potentially reinscribe Global North perspectives. English instructors are advised to be vigilant of ChatGPT's canonizing tendencies, which may reinforce hegemonic perspectives (even amongst and between non-Western cultures and diasporas), and are encouraged to balance assigning [EuroAmerican] award-winning Anglophone writing and theory with lesser-known authors and theorists (e.g., writers who publish in small presses) in a move toward de-canonizing and de-stratifying English Studies.

Moreover, ChatGPT seemed to ‘understand’ decentering as inclusion rather than dismantling, which points to how decoloniality often gets framed in neoliberal terms. AI tools do what their “masters” have ‘told’ them to, revealing the content in their bellies as their “knowledge” base; such simple facts about machines must inform and caution educators as they seek to enhance (and not allow the undermining of) their own conscious mission of decolonizing education. It is not the AI tool but rather the tool in the hands of the conscious and committed educators that will help to advance the cause of decolonizing education. Decolonization-as-inclusion seeks to insert diverse knowledge into colonial systems of teaching and learning rather than dismantle colonial education (Sicka & Hou, 2023). Such “diversification” may aid the colonial nature of education expand and strengthen itself, adapting and developing resilience against new resistance. A diverse curriculum is not the same as a decolonized curriculum, as the discourse of neoliberal diversity objectifies relations of power and stabilizes them through neoliberal inclusion of figures of difference in ways that make no difference while simultaneously stabilizing social injustices within the realms of higher education (Thompson & Zablotsky, 2016). The literary industry’s lasting white supremacy and the educational system’s lasting white supremacy work in tandem with the capitalist commodification of literature (Kina et al., 2022). Hence, it is recommended that educators who adopt decolonial pedagogies simultaneously adopt deneoliberal praxis. Decentering requires not only legitimizing the Global South but also scrutinizing and confronting neoliberal logics in education. A failure to do so may normalize capitalist commonsense amongst students, allowing coloniality to permeate in education (and life) in subtle ways.

IMPLICATIONS

The implications of this study for English educators—and, more broadly, all educators—are profound. Utilizing ChatGPT in English curriculum design presents several compelling benefits for pluralization and internationalization. One notable benefit is the tool’s capacity for representation beyond the White, cis, androcentric canon, as it generates recommendations that span a diverse array of authors, literary works, and critical theories. This efficiency in content generation could allow educators to access a broader range of perspectives in the curriculum development process, saving time and labor. Additionally, when prompted to decolonize the curriculum, ChatGPT encouraged the exploration of marginalized genres and underappreciated literary traditions (e.g., magical realism), promoting a more comprehensive understanding of diverse cultural expressions. Its polyglot capabilities, while limited (Schott et al., 2023), can enable the incorporation of works originally written in languages beyond English (Athanasopoulos et al., 2023), potentially challenging Western intellectual-historical, philosophical, and paradigmatic axioms. Its outputs can serve as catalysts for critical conversations, prompting discussions around identity, power, and representation. As an adaptable tool, ChatGPT evolves with changing literary and cultural landscapes, ensuring that the curriculum remains dynamic and responsive to emerging voices and movements.

In leveraging these advantages, educators can provide students with more inclusive, representative, and critical education.

These findings also present far-reaching implications that extend beyond the realm of English Studies. In disciplines such as history and sociology, where hegemonic narratives often shape perspectives on cultures and societal structures, AI-driven tools could aid in deconstructing the West and unsettling its own self-select narrative of power. AI tools can generate lively classroom discussions that ask students to critically engage with knowledge conditioned by colonial frameworks that is often sadly passed down, uncomplicated or unquestioned, as normative truths. By leveraging AI's ability to disrupt hegemony and fold in margins, decolonial-minded educators across fields can enhance the representation of underrepresented groups and challenge Western 'reason.' This approach may be particularly transformative in revolutionizing neoliberal STEM (science, technology, engineering, and mathematics) education, which has historically been capitalist, militarist, and imperialist in its imperatives (Takeuchi & Marin, 2022). Promoting intercultural and diverse education requires not only subtle shifts in pedagogy and praxis, such as the progressive use of AI, but also important shifts in consciousness (Gorski, 2008). While scant if any research exists on ChatGPT's capabilities to decolonize and indigenize STEM, future researchers could consider exploring how AI tools can be used to develop STEM courses informed by decolonial principles that recenter Indigenous knowledge systems and promote more holistic, interconnected understandings of nature.

Despite its potential, ChatGPT has notable limitations that warrant careful, vigilant consideration. One significant constraint lies in the inherent biases embedded in its training data, which surfaced in this study's findings. ChatGPT is trained primarily on a Euro-U.S.-centric, English-dominant corpus (Carter & Yang, 2023; Munn et al., 2023), and these data can contain biases prevalent in the online information landscape (Tehzeeb & Raza, 2022). The prevailing concept of truth within AI models revolves around 'ground truth,' the labeled data used for training and validating models. While ground truth is intended to be objective and value neutral, ground truth can be colonially inflected. If certain viewpoints, voices, and vocabularies are overrepresented in the data, ChatGPT may exhibit bias toward those perspectives when generating responses. For example, African data points make up no more than 1% of most industry machine learning data sets (Crowell, 2023). This, in turn, could result in the cloaking of coloniality, frustrating and hindering efforts to disturb whiteness and authentically challenge the status quo. This bias becomes pronounced when dealing with subaltern perspectives, as ChatGPT may prioritize voices that align with hegemonic frameworks, inadvertently sidelining or misrepresenting alternative 'truths.' AI's algorithmic biases have been shown to normalize racist and colonialist narratives (Crawford, 2021; Noble, 2018), necessitating critical discussions about its role in education (Rospigliosi, 2023).

Another limitation of ChatGPT, due to its probabilistic nature, is its tendency to favor popular and canonical works by writers who have accrued academic and sociocultural capital. This bias toward privileged authors/theorists may overshadow the voices of writers/thinkers (particularly outside of the academy) who lack access

to Western, capitalist, ableist modes of knowledge production, dissemination, and authentication. Educators could guide the model away from this default by providing specific, contextual prompts. Furthermore, ChatGPT's reliance on English language data may lead to an underrepresentation of oral and vernacular literature. Additionally, AI models often function as black boxes (Bearman & Ajjawi, 2023) and constitute themselves through the reproduction of language models programmed in the Global North (de Oliveira and Neves, 2023). If the aim of decolonial educators is to alter the Euro-skewed view of the world and its dominative epistemologies (Gardner-McTaggart, 2016), then they must exercise caution when using obfuscatory, corporate-driven models trained primarily in and by the North. Educators are advised to critically engage with ChatGPT's outputs, supplementing their suggestions with their lived knowledge (as well as that of their students) to ensure a more inclusive, nuanced, and genuinely decolonized knowledgescape. Failing to be critical when opting for normative approaches such as AI use in education risks reducing decolonization to a metaphor (Tuck & Yang, 2012) and knowledge to a routinized and codified product.

CONCLUSION

This article emphasized that ChatGPT can be a powerful tool for designing dynamic and cross-cultural curricular content that caters to diverse student interests and learning styles. ChatGPT was shown to challenge the EuroAmerican point-zero perspective by leveraging its vast knowledge base to access a wide range of cultural, historical, and philosophical viewpoints, promoting a more comprehensive understanding of literary issues, conflicts, and themes. This article further emphasized that AI tools should supplement rather than replace human experiential and epistemic expertise. Educators are advised to complement ChatGPT's syllabi and curriculum design with their own readings and subject knowledge and determine whose/what knowledge, stories, philosophies, and literary and research traditions are valuable yet under/invisibilized. Educators are encouraged to adopt a value-driven and progressive approach to curriculum design and teaching, remaining vigilant of AI's hegemonizing tendencies while harnessing the information and ease AI makes available. Instead of relying solely on ChatGPT-generated curricula, knowledge narratives, assessment models, and teaching modalities, educators can exercise critical thinking, compassion, and intentionality to ensure a more comprehensive understanding of what readings, evaluations, approaches, and practices would best suit the needs of their students and working contexts. Finally, it is recommended that educators decolonize and deneoliberalize their own subjectivities and worldviews, a prerequisite for keeping educational tools in check and authentically decolonizing the curriculum.

NOTE

AI tools were not used in any way for the preparation of this chapter.

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UNIT 2:
EFFECTIVE PRACTICES AND
STANDARDS FOR CHATGPT
USE: LESSONS LEARNED AND
RECOMMENDATIONS FOR
COLLEGES AND UNIVERSITIES

Chapter 6

Transforming STEM Education: Leveraging ChatGPT for Enhanced Learning in Psychology and Neuroscience

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ABSTRACT

The role of STEM education plays in promoting societal progress, economic growth, and addressing global issues is widely acknowledged in academic settings. Psychology and neuroscience stand out within the STEM fields due to their interdisciplinary nature, which introduces unique teaching challenges. As universities strive to excel in these areas, they often struggle to balance competing demands. Traditional teaching methods frequently fail to fully engage or deepen student understanding when applied to complex subjects. In this study, 106 undergraduates from one university in China were recruited from the “Introduction to Cognitive Neuroscience” course. They participated in a group project by providing both human instructors’ and ChatGPT’s feedback to evaluate the effectiveness of AI in enhancing STEM education, particularly in psychology and neuroscience. The findings showed no significant differences, indicating that ChatGPT’s feedback may be equal to the effectiveness of human instructors’ feedback. This highlighted the potential of using AI as an educational tool. However, students viewed human feedback as more informative and actionable, possibly reflecting their preparation for online learning. The study also highlighted ChatGPT’s inability to consistently provide personalized, motivating, precise, and clear feedback, unlike human instructors. This emphasizes that, while beneficial, ChatGPT cannot entirely replace human teachers. Therefore, it is proposed that educators could combine the strengths of ChatGPT with traditional methods to enhance learning through technology and invaluable human interaction.

Keywords: STEM education, psychology and neuroscience, traditional educational approaches, ChatGPT, artificial intelligence (AI) tool, learning experience

INTRODUCTION

The pivotal importance of STEM education in fostering societal advancement and economic growth is well established (NRC, 2012). It is instrumental in developing

critical thinking and problem-solving skills, which are essential in addressing complex global challenges, such as climate change, healthcare, and social justice (Honey et al., 2014; Kivunja, 2014; Malik, 2018). The interdisciplinary STEM curriculum integrates scientific research, technology, innovation, and mathematical analysis, thereby offering a holistic educational approach (Sanders, 2009). This comprehensive method not only enhances learning but also prepares students for diverse careers in research, academia, industry, and policy-making (Tai et al., 2006). Furthermore, STEM education plays a vital role in promoting political engagement and social responsibility, contributing to the development of a well-informed society actively involved in addressing community and global issues, which is crucial for creating a more equitable and sustainable future (Mutz, 2002; Hwang et al., 2023; LaForce et al., 2016).

Psychology and neuroscience, two important STEM fields, focus on understanding human behavior and brain functions. They find applications in various areas, including mathematics. These disciplines are experiencing rapid knowledge growth, introducing unique challenges for classroom instruction. Educators must incorporate these complex topics into curriculums that are both accessible and intellectually stimulating. The interdisciplinary nature of these fields requires combining different perspectives from biology, philosophy, and computer science. This process enriched the learning experience of the students. Practically applying theoretical frameworks is crucial. Teaching methods that effectively link conceptual theories to real-world scenarios are needed. To foster the connection between theory and practice, instructors should apply systematic teaching approaches. These include clearly presenting theories and providing applicable examples linking concepts to practical situations. They also provide opportunities for students to apply their knowledge through simulations or projects. Diverse teaching methodologies that involve lectures, discussions, problem-based learning, and reflective practices can facilitate a multifaceted understanding of these subjects.

In STEM education, particularly within psychology and neuroscience, traditional teaching methods often fail to deeply engage students, especially due to the unfamiliarity with extensive terminology and cognitive processes. Rapid advancements necessitate innovative approaches to effectively convey complex ideas. By combining standard practices with evolving demands, integrating technologies such as ChatGPT addresses these challenges. This synthesis establishes a foundation for future breakthroughs and applications across scientific fields. This chapter examines the impact of ChatGPT on enhancing the “*Introduction to Cognitive Neuroscience*” course by focusing on completing rather than replacing human instruction. While ChatGPT offers benefits such as quick responses and accessibility, it cannot replace the nuanced, reflective, and analytical abilities of human educators. A balanced implementation of AI and human teaching can enrich understanding without compromising core skills. This study suggests ChatGPT’s potential as an assistance in psychology and neuroscience education promoting a combination of AI and human interaction. Educators remain central to learning, utilizing AI to optimize understanding while ensuring that personal exchanges continue. Adjusting curricula to monitor attention,

retention, and outcomes across formats can guide instructors toward an effective balance of AI and human-led classes.

LITERATURE REVIEW

In recent years, there has been a growing focus among scholars on the exploration of educational techniques in fields such as psychology and neuroscience. Researchers are aiming to identify effective teaching methods for imparting knowledge in these disciplines to students. There is no consensus on incorporating AI tools into advanced educational settings, but the role of technology in addressing longstanding educational challenges has recently gained increased recognition (Luan et al., 2023). This work aims to contribute to the present discussion by offering a critical appraisal of the role of artificial intelligence in education (AIED). It investigates AIED's prospective capabilities in terms of eliminating entrenched barriers in a variety of interdisciplinary topic areas. Examining AIED's capabilities in relation to preexisting educational constraints is critical for discovering new applications and improving existing ones. ChatGPT, with its powerful natural language processing capabilities, can improve student learning and retention by providing individualized explanations that go beyond what traditional lectures can provide. However, identifying the ideal balance between human and AI training has been difficult and requires additional research. Researchers can drive the continued progress of these technologies in an effective manner by identifying certain areas where advancements in AI are particularly effective.

This study aims to address the gaps in the current literature and provide innovative insights, especially through exploring the use of ChatGPT in an “*Introduction to Cognitive Neuroscience*” course (Zawacki-Richter et al., 2019; Chaudhri et al., 2013; Mozer et al., 2019). Extensive research into STEM education, with a focus on psychology and neuroscience, has revealed the constraints of conventional teaching methods, such as lectures and textbook readings (Varma et al., 2008; Newcombe et al., 2009; Fischer et al., 2010; Wieman, 2014; Bowers, 2016; Michael, 2006). The unique challenges in these fields stem from their interdisciplinary nature, blending concepts from multiple domains, as well as the rapid pace of new discoveries and the growth of scientific knowledge (Chang et al., 2008; Petitto, 2009). Educators aim not only to make complex theories and research accessible to students but also to maintain instruction while maintaining high academic standards of rigor and integrity (Zull, 2002). However, more can be done to overcome entrenched difficulties and maximize learning through new technological approaches in AIED.

The rapid advancement and interdisciplinary aspects of technology significantly impact the evolving pedagogical landscape, particularly in the fields of psychology and neuroscience. Educators are thus encouraged to adopt dynamic and comprehensive educational methods to meet these challenges effectively (Petitto, 2009; Ansari et al., 2011). Traditional teaching methods, including lectures and course readings, have been criticized for their limited capacity to foster meaningful student engagement, especially in complex and abstract subjects (Michael, 2006). Instructors in

psychology and neuroscience face the daunting task of conveying intricate concepts, extensive terminologies, and rapidly progressing research in a manner that is both comprehensible and intellectually stimulating for students (Zull, 2002). Growing attention has been given to the role of AI in enriching educational experiences, particularly in courses that merge theoretical knowledge with practical application, highlighting its emerging importance. The diverse functionalities of AI extend beyond basic academic support to include revolutionary approaches in academic support services and institutional management (Pedro et al., 2019). These functions involve transforming traditional assessment methods, implementing personalized teaching strategies, and analyzing student learning patterns for predictive insights (Zawacki-Richter et al., 2019; Jamaludin et al., 2019). The advancement of adaptive systems and intelligent tutoring systems, key components of AIED, shows considerable promise in elevating student engagement and academic achievement, especially in complex areas such as psychology and neuroscience (Chaudhri et al., 2013; Mozer et al., 2019). However, there is a noticeable gap in related research concerning the direct impact of these AI tools on teaching methodologies and teacher training. This gap underscores the need for a comprehensive framework to effectively apply AI theoretical research to practical teaching methods. This work aims to contribute to the growing field of AI integration in psychology and neuroscience education, seeking to provide essential insights and understanding of the opportunities and challenges associated with this integration (Zafari et al., 2022).

This analytical review focuses on the evolving complexities within STEM education, specifically psychology and neuroscience. These dynamic fields are characterized by their interdisciplinary nature and continuous growth, presenting distinct educational challenges requiring innovative teaching approaches. Within these challenges, AIED has emerged as a powerful stimulus for revolutionary instructional techniques in higher education. Despite potential benefits, few empirical studies have examined deploying advanced AI tools such as ChatGPT in these fields—a gap this study aims to address.

THEORETICAL FRAMEWORK

The proposed research is grounded in a theoretical framework aimed at addressing key gaps in the literature on psychology and neuroscience education. These fields, which explore intricate behavioral and neurological phenomena, face unique pedagogical challenges. Standard educational methods often struggle with the multifaceted nature of these disciplines, which span diverse areas such as biology, computer science, and philosophy (Gazzaniga, 2018; Zull, 2002; Lattuca, 2001; Hook & Farah, 2013). One persistent challenge in these domains is effectively translating theoretical knowledge into practical applications and real-world understanding (Michael, 2006; Schwartz & Gurung, 2012; Dai et al., 2023).

To navigate these challenges, this research explores the potential of artificial intelligence tools, with a specific focus on ChatGPT, to enhance educational experiences in an introductory course on cognitive neuroscience. The utilization

of ChatGPT is positioned as a complementary strategy to traditional teaching methods, aimed at bridging the gap between abstract theoretical concepts and their tangible applications. This approach seeks to leverage the advanced natural language processing capabilities of AI to provide personalized learning experiences, thereby facilitating a deeper understanding of complex topics. The semi-experimental design of this study, involving a control and an experimental group, allows for a rigorous examination of ChatGPT's efficacy in enhancing both the engagement and comprehension levels of students in these intricate subject areas.

This research contributes to the ongoing discourse on the integration of AI in education by offering a nuanced analysis of how such technologies can be employed to overcome the pedagogical obstacles inherent in the teaching of psychology and neuroscience. It acknowledges the irreplaceable value of human educators in fostering critical thinking and analytical skills, positioning AI tools as adjuncts rather than replacements. By examining the synergistic potential of AI and human instruction, the study aims to outline a balanced educational framework that optimizes learning outcomes without diminishing the role of direct human engagement.

The anticipated findings from this study are expected to provide actionable insights into the scalable application of AI tools like ChatGPT in STEM education, specifically within the domains of psychology and neuroscience. This investigation not only addresses a significant gap in the literature but also aligns with the broader educational objective of preparing students to navigate and contribute to a rapidly changing scientific landscape. Through this exploration, the study underscores the importance of adopting innovative educational strategies to enhance the learning experience in STEM fields, thereby equipping students with the knowledge and skills necessary for tackling the multifaceted challenges of the modern world.

Key Concepts in AIED

The integration of AI in education has emerged as a powerful and game-changing force that provides creative and practical answers to long-standing issues related to traditional teaching methods. Incorporating AI into educational environments has had a significant effect, especially in STEM fields such as psychology and neuroscience (Luckin et al., 2016; Gkintoni & Antonopoulou, 2022). The potential of AI to customize learning experiences, adjust to the specific needs of each student, and offer immediate feedback makes it a powerful tool for solving the many pedagogical challenges present in these domains (Zawacki-Richter et al., 2019; Vaswani et al., 2017; Jamaludin et al., 2019). AI-based tutoring systems have demonstrated the potential to improve student engagement and learning results in psychology and neuroscience (Chaudhri et al., 2013; Mozer et al., 2019). Multiple research projects in the AIED illustrate the potential for AI to revolutionize the way teaching methods and practices are approached, but fully realizing such transformations requires overcoming adoption barriers across institutional levels (Luckin & Holmes, 2016).

Feedback is critical in educational settings, as it is an essential means of communication that significantly improves the learning experience in numerous ways. This technique substantially impacts learners' comprehension, directs their

educational routes, and enhances their academic achievements (Hattie & Timperley, 2007; Zhai et al., 2021). Traditionally, feedback in educational environments has been provided primarily by human teachers, who are recognized for their perspectives, practical expertise, and understanding of others. This feedback frequently entails employing an individualized methodology, generating an educational environment that promotes growth, and addressing each learner's unique emotional and intellectual needs. The growth of AI has led to the development of new methods for delivering feedback. The introduction of AI-driven conversational technologies, such as ChatGPT, signifies progress toward a more expedient and empirical methodology in education. AI-powered feedback offers personalized insights that align with each student's learning patterns and accomplishments using extensive datasets and sophisticated algorithms. Conversational bots have the potential to enhance teaching and learning efficiency. However, the usefulness of these devices may vary depending on the specific environment. The utilization of AI-based tools has the potential to augment students' comprehension and achievement, as evidenced in various new applications (Vaswani et al., 2017). Converting this potential into concrete advantages continues to be difficult, as strategic integration plans and comprehensive teacher training in digital skills are essential for effectively aligning the integration of AI with changing educational goals (Flanigan et al., 2023). To ensure successful collaboration between humans and AI, intentional attempts must be made to adequately prepare all parties involved for collaboration rather than relying solely on technology. When properly developed, this support system can provide significant benefits, such as recognizing and resolving demands previously limited by manual limitations. Hence, implementing novel technology without a well-defined strategic blueprint may result in diminished efficacy and cohesion. On the other hand, the careful progress of these technologies can enhance teaching and learning by utilizing their distinct advantages. By strategically incorporating AI, educational institutions may effectively address persistent issues.

Nevertheless, it is essential to acknowledge the indispensable significance of human connection in providing feedback within the educational domain. Human instructors provide crucial qualities that AI lacks, including profound comprehension, emotional acuity, and the ability to decipher intricate student reactions. These experts demonstrate exceptional proficiency in offering assistance, encouragement, and compassionate direction, all of which are crucial for establishing a comprehensive educational atmosphere. Although AI can enhance and supplement the feedback process through its data-driven and tailored capabilities, it should be regarded as a supplementary tool rather than a substitute for human-centered feedback. Human-centered feedback serves as essential for building an affectionate and sympathetic educational experience. In subjects such as psychology and neuroscience, successful learning includes not only the acquisition of factual information but also the comprehension of intricate theoretical principles and their practical application. The educational objectives in these domains typically encompass a range of cognitive and practical proficiencies, including critical thinking, problem solving, and interdisciplinary expertise (Ansari,

2011; Petitto, 2009; Bowers, 2016). Staying current with the most recent research and integrating it into practical applications is essential because these disciplines continually evolve. The significance of this skill is widely acknowledged as a critical objective in education (Gazzaniga, 2018; Zull, 2002; Wu et al., 2021). This study's theoretical framework is founded on critical concepts regarding AI in education, the importance of feedback mechanisms, and specific learning outcomes relevant to psychology and neuroscience. These ideas work together to form a structured lens through which the study topics will be investigated, providing a holistic method for examining the pedagogical potential of ChatGPT in STEM courses. This study develops several research questions and hypothesis based on the theoretical framework and core ideas to investigate the educational potential of ChatGPT in the context of psychology and neuroscience.

RQ1 Does ChatGPT feedback result in improved academic performance in group presentations compared to traditional human feedback?

The first research question aims to assess the efficacy of AI-generated feedback by asking. This question challenges conventional pedagogical methods, opening the door for more adaptive and responsive educational practices. By comparing AI-generated feedback with human feedback, this study aims to offer empirical evidence that could either validate or question the efficacy of AI tools such as ChatGPT in educational settings. This allows for a nuanced exploration of how technology and human expertise can be optimally integrated to enhance learning outcomes.

RQ 2 How do students perceive the quality and utility of feedback provided by ChatGPT in comparison to human-generated feedback?

The second research question focuses on the qualitative aspect of the learning experience. This question is informed by studies that have explored the emotional and nuanced dimensions of feedback, which are areas where AI technologies are still evolving (Zhai et al., 2021). The importance of this question encompasses the holistic learning experience, including student satisfaction and emotional engagement. By delving into student perceptions, the study aims to shed light on the subjective aspects of AI-assisted education, setting the stage for the following hypothesis.

Hypothesis : Incorporating ChatGPT in the “Introduction to Cognitive Neuroscience” course will significantly improve students’ understanding of complex theories and their application in practical settings.

One hypothesis seeks to investigate the broader educational impact of ChatGPT. This hypothesis is inspired by the literature discussing the multifaceted nature of effective learning in psychology and neuroscience, which includes acquiring knowledge and developing critical thinking and problem-solving skills (Ansari, 2011; Petitto, 2009). The hypothesis aims to extend the scope of the study from specific learning tasks to

the broader educational context, thereby offering a more comprehensive view of the potential benefits of integrating ChatGPT into the curriculum.

The research questions and hypothesis are tied to the theoretical framework, offering a multidimensional approach to exploring the educational implications of the ChatGPT. They aim to provide a thorough understanding of how AI can be leveraged to enhance learning experiences in psychology and neuroscience, thereby filling the existing gaps in the literature. The research questions and hypotheses collectively serve as a roadmap for the following empirical investigation, ensuring that the study is grounded in theory and aligned with the identified gaps in existing research.

METHODOLOGY

Building upon the earlier outlined theoretical framework, this investigation employs a mixed-methods empirical research design. This approach is increasingly recognized for its comprehensive insight into educational phenomena (Creswell & Creswell, 2017; Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 2010). The study unfolds within an “*Introduction to Cognitive Neuroscience*” course, segmenting students into two groups: Defendants and Plaintiffs. The Defendants are responsible for selecting, preparing, and delivering research topics, forming the core of the educational intervention. Conversely, the Plaintiffs are tasked with assessing these presentations and offering constructive feedback.

To facilitate a thorough evaluation, the study utilizes a quasiexperimental design. This involves dividing participants into Defendant and Plaintiff groups, each further split, with half receiving feedback from the lecturer (human-generated) and the other half from ChatGPT (AI-generated). This method enables a controlled comparative analysis, essential for bolstering the study’s internal validity, as emphasized by Shadish et al. (2002). This choice mirrors the current trajectory in educational research, which is increasingly focused on pioneering pedagogical approaches. Recent research, for instance, has highlighted the success of embodied play within mixed-reality settings in capturing young children’s engagement with scientific concepts, including scientific modeling (Xu et al., 2019). These findings, though distinct, share foundational elements with this study’s emphasis on cognitive neuroscience. As evidenced in these studies, innovative teaching strategies emphasize the importance of dynamic and interactive learning experiences. These are vital in steering students toward a deeper understanding of scientific concepts and have applicability across various scientific fields. The integration of AI-generated feedback in this study is a stride toward such pedagogical innovation, providing a fresh avenue for student engagement in cognitive neuroscience. The effect of these educational interventions will be quantitatively measured through the grades assigned to final presentations, aligning with the empirical tradition in educational research that values quantifiable outcomes (Creswell & Creswell, 2017; Johnson & Onwuegbuzie, 2004).

In addition to quantitative analysis, qualitative data were collected through semistructured interviews with randomly selected representatives from the

Defendant and Plaintiff groups. These interviews aimed to delve into the nuanced perspectives and emotional responses to the feedback process, a critical aspect of effective learning identified in prior studies (Zhai et al., 2021; Hattie & Timperley, 2007; Nicol & Macfarlane-Dick, 2006; Dou et al., 2017). This mixed-methods approach aligns with and extends the current body of literature, offering a more comprehensive view of the pedagogical potential and limitations of AI-generated feedback in higher education contexts.

Participants

The study involved a diverse group of students enrolled in the ‘*Introduction to Cognitive Neuroscience*’ course. A total of 106 undergraduate students participated in the study. The study participants’ ages ranged from 18 to 25 years old, with a median age of 21. The study’s participant pool displayed a gender distribution near parity, with females constituting 52% and males constituting 48% of the total population. Notably, a substantial portion of the students (approximately 65%) were enrolled in social science disciplines. This category prominently includes psychology, which accounted for 25% of the sample, underlining its significance as a major in the social sciences. The remaining 35% of the participants were distributed across various other disciplines, with 15% from fields such as Computer Science and diverse areas related to the study’s focus. Including demographic information in this study offers a thorough perspective on the pool of participants, which is consistent with the recognized significance of demographic variety in educational research (Creswell & Creswell, 2017).

Procedure

Students were informed about the study during the 4th week of the Spring 2023 semester. The participants were then divided into two groups, Defendant and Plaintiff, based on their expressed preferences and academic interests. The lecture posted 20 research topics related to cognitive neuroscience from which they could choose. Such as “Music and the Brain Description: Examine the effects of music on the brain and cognitive function. Strategy: Share examples of how music can enhance learning, memory, and emotional regulation.” The Defendant groups were required to prepare the presentation slides based on the topic and strategy. The Plaintiff groups evaluated these presentations and offered suggestions for improvement. The evaluation criteria were standardized and shared with all groups in advance to ensure fairness and objectivity. Members were self-selected, allowing for an organic formation of groups. The lecturer evaluated the number of team members on each side and approved the final team member list.

Feedback Assignment and Presentation Preparation

Half of the Defendant and Plaintiff groups were randomly assigned to receive human feedback from the lecturer. The other halves were designated to receive

AI-generated feedback from ChatGPT. This random assignment minimizes selection bias and ensures the study's internal validity.

Data Collection

Quantitative Data

The final grade was the primary metric for evaluating the group presentations' performance. These grades were assessed using a predefined scoring rubric to maintain objectivity. Statistical methods such as t-tests and ANOVA will be employed to analyze these quantitative data, thereby allowing comprehensive analysis of academic performance across different feedback mechanisms (Field, 2013).

Qualitative Data

Semistructured interviews were conducted to capture the nuanced experiences of the students. These interviews collected information on the quality and utility of the feedback received, whether human or AI-generated. The transcribed interviews were subjected to thematic analysis to identify recurring themes and patterns, providing a comprehensive understanding of student experiences (Braun & Clarke, 2006).

RESULTS

The assumptions for the independent samples t test were checked prior to the analysis. The Shapiro–Wilk test indicated that the dependent variable (students' grades) was normally distributed for both the Human and ChatGPT feedback types ($p > .05$). However, the rating data for the question “How useful did you find the feedback provided for improving your learning and assignment performance?” was not normally distributed for the Human feedback ($p < .05$). Add information here about what this may indicate. Levene's test indicated that the assumption of homogeneity of variances was met for “Grade,” $p > .05$ but not for rating data for the question “How useful did you find the feedback provided for improving your learning and assignment performance?” $p < .05$.

Research Question 1: Academic Performance

RQ 1. Does ChatGPT feedback result in improved academic performance in group presentations compared to traditional human feedback?

Table 1. Group Statistics

	Feedback Type	N	Mean	Std. Deviation	Std. Error Mean
Grade	Human	20	81.15	5.994	1.340
	ChatGPT	20	82.10	8.130	1.818

Table 2. Independent Sample Test

		Levene's Test for Equality of Variances		t test for Equality of Means				95% Confidence Interval of the Difference		
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Grade	Equal variances assumed	1.974	.168	-.421	38	.676	-.950	2.259	-5.522	3.622
	Equal variances not assumed			-.421	34.944	.677	-.950	2.259	-5.535	3.635

For Research Question 1, an independent samples t test was conducted to compare the academic performance in group presentations between groups receiving Human and ChatGPT feedback. There was no significant difference in the scores for Human ($M = 81.15, SD = 5.99$) or ChatGPT ($M = 82.10, SD = 8.13$); $t(38) = -.42, p = .168$. The study revealed no significant difference in academic performance between the groups receiving human-generated and ChatGPT-generated feedback. This finding indicates that ChatGPT performance as effective as human instructors in providing feedback that contributes to academic performance.

Research Question 2: Perceived Utility

RQ 2. How do students perceive the quality and utility of feedback provided by ChatGPT in comparison to human-generated feedback?

Table 3. Group Statistics

	Feedback Type	N	Mean	Std. Deviation	Std. Error Mean
How useful did you find the feedback provided for improving your learning and assignment performance? (1-7)	Human	20	6.00	.795	.178
	ChatGPT	20	4.40	1.231	.275

Welch's independent samples t test was used to compare the perceived utility of feedback between the Human and ChatGPT groups due to violating the assumption of homogeneity of variances. There was a significant difference in the scores for Human ($M = 6.00, SD = .80$) and ChatGPT ($M = 4.40, SD = 1.23$); $t(38) = 4.88, p < .001$. This finding suggests that while ChatGPT can perform at a level similar to that of humans in terms of influencing academic performance, it may not yet be as effective at providing feedback that students find helpful or actionable. It is important to note that students' perceptions of the utility of feedback could also be influenced by their readiness for online learning. A recent study revealed that online learning readiness positively influences self-regulated learning among students (Lin & Dai, 2022). Therefore, the utility of human-generated or AI-generated feedback may be further nuanced by factors such as student preparedness for online learning.

Hypothesis : Quality of Feedback

Hypothesis : Incorporating ChatGPT in the "Introduction to Cognitive Neuroscience" course will significantly improve students' understanding of complex theories and their application in practical settings.

To assess the normality of the distribution of scores for various aspects of feedback quality, Shapiro–Wilk tests were conducted for each variable for both the Human and ChatGPT groups. The Shapiro–Wilk test revealed the following results:

Table 4. Independent Sample Test

	Levene's Test for Equality of Variances	t test for Equality of Means								
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
How useful did you find the feedback provided for improving your learning and assignment performance?	Equal variances assumed	6.013	.019	4.883	38	.000	1.600	.328	.937	2.263
	Equal variances not assumed			4.883	32.491	.000	1.600	.328	.933	2.267

- Clarity: The distribution was not normal for the Human group ($p = .005$) but was normal for the ChatGPT group ($p = .121$).
- Precision: The distribution was not normal for either the Human ($p = .010$) or ChatGPT groups ($p = .006$).
- Comprehensiveness: The distribution was not normal for either the Human ($p = .012$) or ChatGPT groups ($p = .044$).
- Relevance: The distributions of the Human ($p = .023$) and ChatGPT ($p = .006$) participants were not normal.
- Constructiveness: The distribution was not normal for the Human group ($p = .006$) but was normal for the ChatGPT group ($p = .061$).
- Consistency: The distribution was not normal for either the Human ($p = .001$) or ChatGPT groups ($p = .018$).
- Engagement: The distribution was not normal for either the Human ($p = .012$) or ChatGPT groups ($p = .017$).
- Personalization: The distribution was not normal for either the Human ($p < .001$) or ChatGPT groups ($p = .021$).
- Motivational quality: The distribution was not normal for either the Human ($p = .001$) or ChatGPT groups ($p = .004$).

The data for most aspects of feedback quality, such as clarity, precision, and comprehensiveness, did not meet the assumption of normality for either the Human or ChatGPT groups, as evidenced by the Shapiro–Wilk test results ($p < .05$) (Field, 2013; Pallant, 2016). Given these violations of normality, nonparametric tests were performed to analyze these variables.

Specifically, nonparametric Mann–Whitney U tests were used to investigate the differences in perceived feedback quality between the Human and ChatGPT groups across nine dimensions to address violations of normality and homogeneity of variances uncovered by the Shapiro–Wilk test. These nine dimensions are consistency, personalization, motivational quality, relevance, precision, clarity, engagement, constructiveness, and comprehensiveness. The results indicated significant differences between the Human and ChatGPT groups in terms of consistency ($U = 36.000, p < .001$), personalization ($U = .000, p < .001$), motivational quality ($U = .000, p < .001$), relevance ($U = 26.000, p < .001$), precision ($U = 1.000, p < .001$), and clarity ($U = 24.500, p < .001$) of the feedback. However, no significant differences were observed for engagement ($U = 155.500, p = .197$), constructiveness ($U = 151.000, p = .160$), or comprehensiveness ($U = 169.500, p = .382$). The results offer a nuanced understanding of the capabilities and limitations of ChatGPT in providing educational feedback. While ChatGPT appears to be on par with human instructors in fostering engagement, constructiveness, and comprehensiveness in feedback, it falls short in providing feedback that students find consistent, personalized, motivational, relevant, precise, and clear. These findings suggest that while AI-based educational tools like ChatGPT can be effective in specific dimensions, human expertise still holds a distinct advantage in several key areas of educational feedback.

DISCUSSION AND CONCLUSION

Advancing educational practices in STEM fields such as psychology and neuroscience requires the incorporation of innovative instructional methods. This study examines ChatGPT, an AI-powered tool, highlighting its significant potential to enrich learning experiences. This study substantially contributes to the academic discourse by assessing the impact of technology-driven education through tools like ChatGPT on student involvement and feedback quality. This exploration reveals the multifaceted role that AI can play in STEM education. ChatGPT exemplifies these AI tools, demonstrating considerable promise in boosting student engagement and the learning journey. However, this analysis emphasizes that careful and thoughtful integration of AI into educational environments is needed. The results also indicate that AI tools such as ChatGPT should be seen as supplements to human instructors' rather than replacements for traditional teaching techniques and educators. Moreover, a comparative evaluation discovers that while innovative, AI-driven feedback still does not match human-generated feedback in critical areas such as consistency, depth of personalization, motivational influence, and clarity of communication.

The findings uncover both the promising and problematic aspects of incorporating AI into educational settings, revealing the opportunities and boundaries of such technological advancement (Chaudhri et al., 2013). This dual nature provides crucial insights for educators, academic institutions, and policymakers, illuminating how AI tools, such as ChatGPT, can be productively combined with traditional, human-led educational approaches. ChatGPT specifically introduces a novel way of offering feedback yet remains supplementary and best used to enhance areas where human intuition, contextual comprehension, and emotional intelligence are paramount (Tapalova et al., 2022; Lin et al., 2023).

While the insights gained from this particular study offer valuable findings on AI's influence within education, some limitations must be acknowledged. With only a small sample size, the results require careful interpretation to avoid overgeneralization (Gamage et al., 2022). Further extensive research is needed to verify and expand the understanding provided in this chapter. Additionally, focusing primarily on feedback quality prompts considering other important aspects that deserve examination. For instance, exploring deeper into topics such as student motivation, long-term educational outcomes, and instructors' level of preparedness when integrating AI tools into their teaching methods could provide helpful context (Mozer et al., 2019; Hudson et al., 2021; Jang et al., 2022). A more comprehensive investigation of these related factors may furnish a useful backdrop and balanced perspective.

In conclusion, this chapter conducts an extensive, in-depth evaluation to thoroughly scrutinize the intersections between AI tool applications and progressive educational approaches, building upon the valuable insights developed by Chaudhri et al. (2013). Using ChatGPT as a case study, the analysis assesses both the potential and limitations of AI. This study furthermore provides critical perspectives for educators and researchers envisioning the future where technological innovations could be thoughtfully integrated with effective teaching methods. The findings

from this research contribute to a nuanced understanding of the complex and multifaceted nature of educational technology and pedagogy. The study also notes that various factors would shape the ever-changing academic landscape, emphasizing both the sophisticated, advanced abilities and constraints of AI-generated feedback. In particular, the study underscores the importance of a supportive, collaborative classroom community for the effectiveness and impact of AI feedback. Recent studies have demonstrated disparities in online community participation between rural and urban students, with prior online learning experience also playing a significant role in student success (Lin et al. 2022). Therefore, the relationship between technological tools and pedagogical approaches remains intricate, with both opportunities and difficulties requiring careful consideration.

The experiment conducted in this chapter involves performing an in-depth analysis exploring the intersection between innovations in artificial intelligence and sophisticated educational techniques (Chaudhri et al., 2013). By examining both the capabilities and constraints of AI technologies such as ChatGPT, with a particular focus on its strengths and limitations, this study lays important groundwork. This approach helps educators and researchers envision how advancing technologies could be thoughtfully integrated with proven teaching methods. It is expected that the results of this study extend beyond a wide range of educational technologies and pedagogies. The examination of the specific capabilities and limitations of AI-generated feedback, predominantly via ChatGPT, illustrates the complexity of the educational context, which is influenced by a broad spectrum of circumstances.

NOTE

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Chapter 7

Hearing Students' Voices: Access, Use Patterns and Attitudes toward Generative AI Technologies among Chinese Students

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ABSTRACT

Higher education institutions face both enthusiasm and apprehension in the wake of rapid advancements in Generative Artificial Intelligence technologies. Students' voices, however, are often lost in debates about GenAI. This study surveyed 718 students at a large English as Medium of Instruction (EMI) University in China to examine their attitudes toward and usage patterns of GenAI. The results indicate that many students have utilized AI technologies in their studies. In addition, various factors, such as gender, academic level and academic interests, influenced students' attitudes toward GenAI. The study emphasizes the importance of proactive engagement by educators and administrators to ensure access to AI-based technologies in learning while also focusing on fairness and inclusivity, as well as the need for comprehensive support and guidance.

Keywords: AI attitude, digital divide, generative AI, higher education, inclusivity

INTRODUCTION

Generative Artificial Intelligence (GenAI) technologies have revolutionized many industries, and education is no exception (e.g., Swiecki et al., 2022; Tang et al., 2021). To date, much attention has been given to the impact of GenAI applications such as ChatGPT on the existing curriculum and assessment at higher education (HE) institutions (Hern, 2022; Huang, 2023; Lindsay, 2023). Some researchers are enthusiastically advocating for the potential of Large Language Models (LLMs). For example, Kasneci et al., (2023) highlighted that LLMs can help develop educational materials, improve students' experiences, and support personalized learning. However, others have emphasized the potential risks of adopting ChatGPT in HE (Linsay, 2023). In short, the HE sector is attempting to keep pace with the rapidly evolving landscape of emerging GenAI technologies and carefully evaluate their potential impact on educational practice.

Despite all the excitement and anxiety, it seems that students' voices and attitudes toward such technologies have been largely neglected. It is crucial to hear students' voices and to treat them as active stakeholders in conversations about GenAI applications. The current research aims to fill this gap by surveying Chinese students'

access, use patterns and attitudes toward GenAI technologies, thus providing insights into their perspectives and the challenges they face when using such technologies. While China has established an AI in education policy (UNESCO, 2023), its implementation varies across the higher education sector, primarily due to differences in digital literacy and access to AI technologies. A notable example of this variance is the current unavailability of ChatGPT accounts in China. Additionally, there is an evident lack of a unified AI literacy program nationwide. Highlighting this issue, Kong et al. (2021), writing the perspectives from Hong Kong universities, assert, “[I]t is time for our society to educate their citizens regarding AI” (p. 2).

LITERATURE REVIEW

The application of AI in education (AIEd) has been the subject of research for almost three decades (Zawacki-Richter et al., 2019). Although the presence of AI in higher education has become increasingly prevalent, many researchers agree that the application of AIEd is still limited (Hinojo-Lucena et al., 2019; Luckin & Cukurova, 2019). Southworth et al., (2023) pointed out that, thus far, most AI applications in higher education seem to be limited to traditional STEM fields. This was also echoed by Zawacki-Richter et al.’s (2019) research findings based on a review of 146 articles on AI application in higher education. Zawacki-Richter et al. (2019) emphasized a notable absence of longitudinal studies investigating the long-term effects of AI applications. In fact, the authors argued that “on a broader scale, educators have just started to explore the potential pedagogical opportunities that AI applications afford for supporting learners during the student life cycle” (Zawacki-Richter et al., 2019, p. 2).

Since its release in November 2022, ChatGPT has generated great interest among various walks of life, including educators in HE institutions. Some educators are excited about the potential benefits that GenAI can bring to personalized learning and adaptive assessment. For example, Kohnke et al., (2023) explored various ways of using ChatGPT in language teaching and learning in university settings. On the other hand, while van Dis et al. (2023) encouraged more members of the academic community to embrace the benefits of AI, the researchers also shared a serious caveat that there remained numerous concerns about the data privacy, bias and ethics surrounding the use of AI in educational settings, which require careful consideration (van Dis et al., 2023). Such concerns have been widely shared by the academic community. Tlili et al. (2023), for instance, conducted a three-stage instrument case study and investigated ten different teaching scenarios in which ChatGPT was used. The findings regarding user experiences revealed various issues, such as cheating, privacy misleading and manipulation. The researchers argued that despite being a powerful tool in education, ChatGPT needs to be used with more caution, and they also called for more guidelines about the safe use of ChatGPT in education (Tlili et al., 2023).

While it is important to understand the perspectives of HE institutions and educators regarding the use of GenAI in learning and teaching activities, it is also imperative to consider students’ attitudes toward this emerging technology. Among the few studies that have examined the use of AI in higher education, researchers

have discovered divergent findings on students' attitudes toward AI. On the one hand, it has been reported that students, in general, have a good understanding of AI and are generally positive about the opportunities and benefits that it presents (e.g., Haryanto & Ali, 2019; Kuleto et al., 2021). On the other hand, other studies have shown that students view the AI chatbot as a novelty rather than an effective learning tool (e.g., Gallacher et al., 2018). Besides, students expressed concerns about the rapid development of AI and the potential risks brought to individuals and society (Jeffrey, 2020). Overall, there is a need to better understand students' nuanced perceptions and attitudes toward the integration of AI in education.

In addition, understanding the factors that influence students' attitudes toward GenAI is essential in tailoring educational approaches and technologies to better suit their needs and preferences. Previous literature showed that factors such as gender, age and education level all play crucial roles in shaping students' attitudes toward technology (Claar et al., 2014, Jeffries et al., 2019). Specifically, it has been found that students' interests in STEM subjects have a profound impact on their attitudes toward technology (e.g., Pauw et al., 2020). However, there is still very limited research on students' attitudes toward GenAI and the external factors that may influence such attitudes. The current study aims to address this gap by trying to answer the following research questions:

1. What are students' awareness and use patterns of GenAI, specifically ChatGPT, as an emerging technology in higher education?
2. What are students' attitudes toward GenAI?
3. To what extent are the attitudes different based on students' demographic characteristics, academic level and majors, and confidence and satisfaction in using GenAI?

RESEARCH METHOD

Research setting and participants

The study is set in a large Chinese English as a Medium of Instruction (EMI) university located in East China. The participants in this study were undergraduate and graduate students from various degree programs currently enrolled at the university. All participants received an email with links to the informed consent form, survey questionnaire, and instructions on how to complete the survey online. It was made clear that participation was completely voluntary and anonymous. In the end, 718 responses were received, 716 of which were complete and valid. Among the participants, 271 students were either currently studying STEM-related majors or considering choosing such majors (e.g., programs from the School of Sciences, School of Mathematics and Physics, School of Advanced Technology, and Academy of Pharmacy), and 379 students were either studying non-STEM majors or considering choosing such majors (e.g., programs from the School of Social Sciences, School of Business and Academy of Future Education). More detailed information about the participants can be found in Table 1.

Table 1: Participants' information (n=716)

	N	Percent
Gender		
Male	249	34.8
Female	432	60.3
Prefer not to answer	35	4.9
Year of Study		
Year 1	117	16.3
Year 2	85	11.9
Year 3	47	6.6
Year 4	35	4.9
Master Students	368	51.4
PhD Students	64	8.9
Academic Field		
STEM	271	37.8
Non-STEM	379	52.9
Not decided	66	9.2

The survey instrument and data analysis

The survey questions were developed based on previous literature and the research questions of the current study. The attitude-related questions were adapted from the General Attitudes toward Artificial Intelligence Scale (GA AIS) developed by Schepman & Rodway (2020). Most of the questions required respondents to rate their level of agreement on a five-point Likert scale, with 1 indicating "I strongly disagree" and 5 indicating "Strongly agree". Some questions allowed students to explain and clarify their answers and provide open-ended responses. The entire online survey took approximately 10 minutes to complete. The participants were given one week to complete the survey. After the submission deadline, all the data collected from the survey were imported into and analyzed by the software package SPSS.

RESULTS

Access, Use Patterns and General Purposes

The results suggested that approximately 99% of the participants had at least heard about one type of GenAI application, with ChatGPT being the most commonly known (94.4%). Most students (76.8%) indicated that they first learned about GenAI

applications from social media or an online advertisement. Among those who had heard about at least one type of GenAI application, only approximately 60% had used this technology. However, it is worth noting that 16% of the students reported that although they were interested in trying the technology, they did not have the opportunity to use it. Moreover, among the GenAI application users, most were using it at least once a week (69.4%), and 20.1% of them were using it daily. The analysis showed that male and female students reported different levels of access to GenAI applications. Male students were much more likely to use GenAI applications than female students were (71.1% vs. 56.0%), and the chi-square test showed that such a difference was significant ($\chi^2 = 15.146$, $p < 0.05$).

When asked about their general purpose in using GenAI applications, the most common responses were for language assistance (37.3%), general curiosity (29.1%) and coursework assistance (18.8%). A large portion (79.3%) reported starting with AI-generated answers to coursework questions, and then integrating these with their own thoughts to complete assignments. Another common approach (53.7%) involved using AI feedback to refine their work. Notably, 13.4% admitted to directly incorporating AI-generated content into their coursework with minimal alterations.

Our survey results also indicated that the students were confident in writing effective prompts and questions for GenAI applications. Among those who used GenAI applications, 65.6% reported being very confident or somewhat confident in their ability to generate a good prompt that could elicit a useful response from the technology. In addition, more than half of those who had used GenAI applications (56.3%) reported that they were very satisfied or satisfied with the responses generated by the technology, and 73.0% of them would recommend the use of GenAI applications to other students.

General Attitudes toward the Use of GenAI

The original GAAIS scale included both positive and negative subscales (12 positive items and 8 negative items). As some of the original items were not relevant to GenAI applications in higher education, we excluded a few irrelevant items and modified the wording of other items. In the end, we included six positive items and five negative items to measure students' general attitudes toward GenAI applications. The revised 11-item scale demonstrated a Cronbach's alpha of 0.73, with scores of 0.88 for the positive subscale and 0.72 for the negative subscale, all within acceptable ranges for social science research.

Overall, students expressed very positive attitudes toward GenAI on the GAAIS scale. Among the six positive items, participants seemed to agree most with the statement "I am impressed by what GenAI (e.g., ChatGPT) can do". However, they were not convinced that "GenAI (e.g., ChatGPT) can perform better than humans." In regard to the negative items, students are least concerned about "GenAI (e.g., ChatGPT) might take control of people." However, they expressed a very strong preference for teachers when asked about "For teaching and learning activities, I would rather interact with a teacher than GenAI (e.g., ChatGPT)".

Factors that may Influence Students' Attitudes toward GenAI

We first looked into how students' self-reported confidence and satisfaction with GenAI correlated with their attitudes. Among those who used GenAI, the correlation analysis revealed a significant positive correlation between students' confidence in using GenAI and their positive attitudes toward it ($r=.44$, $p<0.01$). This indicates that students who feel more confident in using GenAI were likely to have more positive attitudes toward it. Similarly, students who reported higher satisfaction with their experiences using GenAI also exhibited more positive attitudes toward it ($r=.41$, $p<0.01$). Interestingly, our correlation results indicated that students' self-reported confidence and satisfaction with GenAI were significantly correlated with their negative attitudes toward the tool ($r=0.15$, $p<0.01$ and $r=0.17$, $p<0.01$). This shows that students' confidence and satisfaction with GenAI do not assuage their concerns or negative attitudes toward it, but rather contribute to them, indicating that students' confidence and satisfaction with GenAI may play dual roles in shaping their attitudes toward it.

We also examined whether students' academic levels influence their attitudes toward GenAI. The results indicated that although PhD students reported a slightly lower level of agreement with the positive items than did undergraduate students and Master's students, one-way ANOVA tests did not reveal any statistically significant differences in attitudes toward the positive items of GAAIS among students at different academic levels ($F(2, 713) = 1.824$, $p = 0.16$). Similarly, no significant differences were found in the attitudes toward the negative items of GAAIS among students at different academic levels ($F(2, 713) = 0.210$, $p = 0.81$).

We then examined whether students' academic interests and majors influenced their attitudes toward GenAI. Interestingly, our study found that students who are either interested in or are currently pursuing STEM specializations are more likely to have a positive attitude toward GenAI, which is significantly different from students who are pursuing non-STEM specializations or who have not decided which specialization to pursue ($F(2, 713) = 7.366$, $p = 0.001$). However, no such differences were found when comparing students from different academic majors regarding their responses to the negative items of GAAIS ($F(2, 713) = 0.500$, $p = 0.61$).

Gender is another factor that we considered in relation to students' attitudes toward GenAI. Independent t-tests revealed no significant differences in negative attitudes toward GenAI between male and female students ($t = 1.94$, $p > 0.05$). However, male students reported more positive attitudes toward GenAI than female students did ($t = 4.45$, $p < 0.05$). This finding suggested that there may be some gender differences in how students perceive GenAI, with male students generally having more positive attitudes toward it than female students.

DISCUSSION AND CONCLUSIONS

The Digital Divide and Educational Equity

Our findings revealed a significant discrepancy between awareness and actual usage of GenAI technologies among participants. While a majority were aware of these

technologies, only 60% had engaged with them, and a notable 16% reported an inability to access such resources. Furthermore, there was a significant gender disparity in access, with male students having a greater likelihood of using these technologies compared to their female counterparts. This vital concern of access and gender imbalance may intensify current issues related to educational equity and the widening of the digital divide. The digital divide, initially defined as the gap in ownership of digital devices and Internet connectivity, often described as a divide between the “haves” and “have-nots” (Normore & Issa Lahera, 2019), has evolved to encompass not only access to digital tools but also the skills necessary for their effective use (Lythreatis et al., 2022). This broadened perspective highlights that disparities in digital engagement can stem from differences in digital literacy and proficiency. The inability of the students in our study to use GenAI technologies might stem from issues of access, but it could also be linked to a lack of digital skills.

To address the issue of digital equity in education and bridge the digital divide, Normore and Issa Lahera (2019) emphasized the need for a multifaceted approach that includes enhancing school infrastructure, integrating technology into classrooms, and empowering individuals. Specifically, within the university setting, equal access to GenAI tools can be facilitated by acquiring a campus-wide license for one or two GenAI products. This ensures that all students, irrespective of their circumstances, can engage with these technologies. Moreover, educators must be acutely aware of the digital divide when incorporating AI into pedagogical practices. It is essential to support those students who require additional assistance in navigating AI tools. This can be achieved through specialized training sessions and alternative means of engagement for students lacking direct access to these technologies. For example, computer laboratories that are outfitted with AI technologies utilized by instructors or pre-arranged educational resources can provide effective alternatives for these students.

Empowering students is another critical aspect of this multifaceted approach. Educational institutions should focus on developing students’ proficiency in using AI tools, which will enable them to fully leverage the potential benefits of these technologies. Given that gender disparities have been identified as a significant factor in the digital divide, which aligns with the existing literature on the digital divide (Scheerder et al., 2017), targeted initiatives could be particularly beneficial for female students. Initiatives such as student-led campaigns focused on AI usage among female students might be useful in bridging this gap.

Use of ChatGPT with Language Assistance

Our research findings revealed that the most frequently used application of ChatGPT among the participants was for language assistance, such as translation or proofreading. Considering that the research context is a large EMI institution in China where language barriers and difficulties with proofreading are common issues for many students (Macaro & Han, 2020), it is not surprising that ChatGPT was seen as a useful tool for language assistance. Many EMI researchers have noted that language proficiency is a critical factor for students enrolled in EMI institutions (e.g., Rose et

al., 2020), and more language support resources are needed for these students (e.g., Fang, 2018). Our findings about students' usage of GenAI technologies for language assistance highlight their need for such support and the potential for GenAI to provide a solution. However, this also raises the question of the blurred line between acceptable language support and academic dishonesty cases where "unauthorized assistance" is provided by GenAI technologies. Furthermore, it urges educators to reconsider the essential skills they impart to second-language learners, taking into account the present and future scenarios in which AI is intricately intertwined with all or most text-based software, from word processing to email to instant messaging.

Ethics and Boundaries

Academic integrity is one of the most important values in higher education, and our findings revealed that EMI students reported awareness of the ethical considerations involved in using GenAI technologies. These findings also show that students have not fully defined the boundaries for the acceptable use of GenAI tools in academic settings. While some universities have made clear of their stances on the use of GenAI and have updated their academic policies to address the use of GenAI technologies, many others have left decisions to individual departments and teaching staff to make their own decisions on such matters. Prompt and clear guidelines about the use of GenAI technologies must be established so that students could have a thorough understanding of the acceptable boundaries and ethical considerations when using these technologies for language assistance in particular.

Students' Attitudes toward AI

Our study shows that students held mostly positive attitudes toward GenAI. This finding is consistent with the literature (e.g., Haryanto & Ali, 2019; Kuleto et al., 2021). It is important to note, however, that the literature predominantly discusses AI in a broader context, whereas our focus is specifically on GenAI. Despite this, the parallels between our findings and those concerning AI suggest a general consistency in student attitudes toward both domains. Regarding the factors influencing students' attitudes toward GenAI, our research builds upon the findings of Farhi et al. (2023), who noted a correlation between students' usage of GenAI and their perceptions of it. We extend this understanding by highlighting that gender, student confidence and satisfaction with GenAI usage, and their academic interests also significantly influenced their attitudes toward AI.

Additionally, our study reveals that students enrolled in or interested in STEM fields tend to have more favorable views of GenAI. This trend can be attributed to the nature of STEM education, which often involves direct engagement with advanced technologies, including GenAI. Such continuous interaction and exposure not only familiarize students with these technologies but also enhance their understanding and appreciation of their capabilities and benefits. Furthermore, the link between high levels of confidence and satisfaction in using GenAI and the formation of strong views, both positive and negative, about the technology is significant. This

relationship suggests that students who feel proficient and satisfied with GenAI are likely to develop well-formed opinions based on their experiences, which can range from enthusiastic endorsement to critical appraisal, depending on the context of their usage and exposure.

Limitations

The limitations of this study are primarily centered around its specific context and the demographic characteristics of the participants, as well as the study design. Firstly, the research is confined to a Chinese EMI university, which inherently limits the broader applicability of the findings to other educational settings, particularly those with different linguistic and cultural backgrounds. Secondly, the student population at this EMI university predominantly comprises students from richer families. This socioeconomic uniformity could impact the generalizability of the results. Finally, although the cross-sectional survey provides a snapshot of attitudes and experiences at a specific point in time, the rapidly evolving landscape of AI and digital technology means that these findings may quickly become outdated or less relevant. Therefore, longitudinal studies or ongoing research efforts are necessary to keep pace with the rapid changes in this field.

IMPLICATIONS

Our study investigated the awareness, access, use patterns and attitudes of EMI students toward GenAI technologies. The results suggested that more than half of the surveyed EMI students had used a GenAI tool for various academic tasks, and they generally held positive attitudes toward such technologies. However, various factors, such as gender, academic interests and academic level, all significantly influence students' attitudes toward GenAI. Future studies should investigate how GenAI tools can be effectively integrated into academic contexts while ensuring that students are aware of the limitations, risks, and ethical considerations associated with such technologies in order to prepare students for a future very different from the past. More studies are needed to explore what institutions and educators can do to help improve student and staff AI literacy, which is essential for the responsible and effective use of GenAI technologies.

NOTE

AI tools were not used in any way for the preparation of this chapter.

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Chapter 8

Using ChatGPT to Improve Access, Inclusion, and Equity in and Through English-Medium Instruction in Higher Education

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ABSTRACT

Responding to the rapid worldwide expansion of English-medium instruction (EMI) education in recent years at the tertiary level in non-Anglophone countries, this chapter examines the distinct challenges and opportunities that can arise when attempting to utilize artificial intelligence (AI) technology in these settings to ameliorate linguistic inequality amongst students. Specifically, this chapter presents a case study at one university in Japan where ChatGPT was incorporated into teaching pedagogy to assist EMI students of various backgrounds to engage in the process of producing and refining academic writing compositions in a content-based course. Through a critical research approach based on “pragmatic optimism”, this chapter argues that the use of artificial intelligence technology such as ChatGPT for the improvement of EMI education in non-Anglophone countries has transformative potential in global higher education, with relevance to ongoing scholarly discussions of critical internationalization, global citizenship education, and global public good in the 21st century.

Keywords: artificial intelligence (AI), critical internationalization, educational technology, English-medium instruction, global citizenship education, higher education, Japan

INTRODUCTION

Today, higher education is at a crossroads. Spurred on by advancing global interconnection and competition together with massification and major shifts in demographics as well as technological advancements, the “academic revolution” of global higher education that has unfolded over the past half century has transformed the fundamental design, nature, and sociological function of universities worldwide (Altbach et al., 2019). In time, this has resulted in increasing focus on internationalization, with almost all attention being given to economically developed, largely “Western” (N.B: I use the concept of “Western” in this chapter for the heuristical purpose of discussion while acknowledging its scholarly

contestation; e.g., see Hall, 2018) and, more recently, Anglophone countries, due to their preeminent positions within global higher education power hierarchies. However, a slow shift has begun to emerge in which non-Western, non-Anglophone and developing countries are gaining ground in terms of their expansion, status, relevance, and attractiveness (Deardorff et al., 2012). In an age of English-language hegemony, this has compelled an embrace of “Englishization” and a rapid expansion of English-medium instruction (EMI) at the tertiary level (Jenkins, 2019; Galloway & McKinley, 2022), which has been dubbed “the most significant current trend in internationalising higher education” (Parr, 2014, para. 6). This has been noted worldwide, but it is especially pronounced in Asia, with countries such as Japan leading the way through aggressive government-prompted top-down policy initiatives (Galloway et al., 2020). However, the enthusiastic adoption and expansion of Englishization and EMI in Japan, other Asian countries, and the non-Anglophone world around the globe has not been matched by equal attention given to the complexities of teaching and learning that arise (Bradford, 2016; Walkinshaw et al., 2017). Language inequalities amongst students is one of the key issues since EMI classrooms can involve students with a wide range of English proficiency, from native speakers to second language speakers, who have insufficient ability to understand lectures and assignment descriptions. Teachers who employ practices that exclusively cater to just one faction of their classroom population (e.g., only high- or low-level speakers respectively) might exclude others from engaging with the learning community and limiting the value they can gain from their education in this environment. Therefore, to make these environments more accessible, inclusive, and equitable for all, there is an acute need for pedagogical approaches that employ innovations and technologies that can help ensure that students in EMI classrooms with varying English language proficiency can have their diverse learning needs met simultaneously.

This chapter explores the use of artificial intelligence (hereafter “AI”) technology, specifically ChatGPT, to help bridge the language inequalities that exist in EMI classrooms. In particular, it examines the ways in which this tool can be employed in the writing process to support the learning of students who are producing an academic research paper. Using qualitative data collected through surveys, the study provides an analysis of students’ accounts regarding their perceptions of the negative and positive implications of using ChatGPT in this way. The study asks: What are students’ impressions of their experiences using ChatGPT to produce academic compositions in this multilevel EMI setting? The findings indicate that students with varied English language proficiency levels perceived both negative and positive implications, but that their overall impression of the usefulness of this tool for their learning was largely positive. More specifically, this study provides insights into the unique pitfalls and affordances of using ChatGPT (and similar AI technology) in EMI educational environments to manage language inequalities and augment learning by promoting accessibility, inclusion, and equity.

Yet, the relevance of this study goes far beyond the mere technical concern of improving educational processes and outcomes *in* higher education EMI settings. In

fact, there are crucial implications for another revolution that looms in the background that can be facilitated *through* such EMI education. What is being referred to here is a new phase in higher education internationalization (De Wit & Altbach, 2021) in which there are calls for more critical internationalization (Stein et al., 2016) with the aim of higher education institutions contributing positively to the global community (Jones et al., 2021), such as by focusing on cosmopolitan/intercultural/global citizenship education (Deardorff et al. 2012). Some scholars posit that internationalizing higher education can help students develop a sense of global responsibility, cultural awareness, and commitment to addressing global challenges, positioning higher education institutions as crucial contributors to the creation of a more inclusive and just global society (Gacel-Ávila, 2005) by leveraging these institutions' communicative function to serve the global public good (Marginson, 2011). Thus, other scholars have emphasized the opportunities for manifesting this through the internationalization of the curriculum (Leask, 2015; Clifford & Montgomery, 2017), particularly with regard to how this might facilitate international/intercultural understanding and the development of cosmopolitan/global citizens. Considering the complex relationship between identity, language learning, and social change (Norton & Toohey, 2011) and the fact that certain attitudes and identities are known to evolve around English due to its being the current global lingua franca (Jenkins, 2007), there is a great opportunity to advance cosmopolitan/global citizenship education by leveraging English language use and education at universities in non-Anglophone countries where the vast majority of the world's denizens inhabit and are educated. Thus, there is a burgeoning community of scholars with an interest in the implications for EMI in higher education (Jenkins, 2019) and how this might be connected to cosmopolitan/intercultural/global citizenship education in these settings (Fang & Baker, 2021). With these matters in mind, the Discussion section of this chapter zooms out to offer a broader perspective on how the technical improvement of access, inclusion, and equity in EMI higher education settings can be viewed as a feasible pathway for transforming global higher education and society in the 21st century and beyond.

RESEARCH METHODOLOGY AND METHODS

The broader perspective explored in the Discussion section of this chapter is not a random byproduct of the study; rather, it is part of a carefully constructed research design with a particular purpose. Taking a critical approach guided by “pragmatic optimism” (Spero, 2023, p.115), the overarching aim of this study is to explore feasible pathways for education today to help bring about transformative individual, institutional, and social change through global citizenship education and more critical forms of higher education internationalization. This unique approach is derived from an acute cognizance of the common pitfall of critical researchers to indulge in “romantic possibilitarian” rhetoric (Whitty, 1974), which Apple (2000) describes as when “the language of possibility substitutes for a consistent tactical analysis of what the balance of forces actually is and what is necessary to change it” (p. 29).

The study was conducted over the course of a single semester in the spring of 2023 in a specialized EMI department at one university in Japan. At the beginning of the semester, 80 students were recruited to participate in three different EMI courses taught by the same instructor. The participants were divided almost evenly between first- through fourth-year students, who roughly aligned in a standard bell curve distribution of English language proficiency in which approximately 80% of these students self-assessed themselves as falling into the C1 and B2 categories of the Common European Framework of Reference for Languages (AKA “CEFR”, Council of Europe, 2001). In the courses attended by these participants, the instructor designed a guided writing process that required students to utilize ChatGPT to revise and improve their end-of-semester course paper assignment. The students revised their papers in two separate rounds of drafts, and in each round they were provided specific guidelines and prompts for using ChatGPT to revise certain aspects of their work (e.g., determining if the essay prompt was answered correctly and fully, improving coherence and cohesion, refining language, etc.). After each round, the students completed a feedback survey in which they analyzed their use of ChatGPT by providing short-answer responses to open-ended questions inquiring about what they learned and how they felt about the value of this educational experience.

The findings of the study presented in this chapter are based on an analysis of data collected through the ChatGPT post-use surveys. The students’ written responses in these surveys were extracted and input into MAXQDA software for in-depth analysis. The data were coded in multiple rounds (Maxwell, 2013), first to determine the general themes of positive and negative impressions and then to identify the most common specific areas of note within those themes. Student comments that aptly represented these areas were then selected for inclusion in this chapter’s Findings section in order to more concretely illustrate common patterns.

FINDINGS

Analysis of the data in this study offers key findings that provide insight into both the unique challenges and opportunities of utilizing AI technologies and chatbots such as ChatGPT in EMI education. Overall, regardless of their level of language competency, students’ impressions of the usefulness of ChatGPT for their learning in this context were overwhelmingly positive. Importantly, the specific positive aspects they highlighted point to the ways that access, inclusion, and equity can be bolstered by strategically incorporating such technology in the learning processes of these distinctive educational environments. However, the students also indicated some negative apprehensions. For simplicity, student responses were edited for language clarity and categorized according to patterns that were identified in the data analysis process based on the preponderance of particular themes that were consistently noted by the study participants. Ultimately, these findings provide a platform for the end of this chapter, which explores the broader implications for the use of AI in EMI higher education for transforming global higher education and global society through its contributions to the development of critical internationalization and global citizenship education moving forward.

Students' Negative Impressions of ChatGPT Use

Regarding the negative views indicated by the students in this study, two key patterns were identified in the data relating to impacts on: 1) the writing composition itself, and 2) the students' learning.

Negative Impacts on Writing Composition

One universal trend identified through the data analysis in this study was the acute awareness that students had about the negative effects of using ChatGPT for their writing. Their initial wariness was indicated in the students' descriptions of the tool as "scary" and "untrustworthy", as well as their consistent highlighting of its inherent "limitations". More specifically, they showed particular concern for the ways in which this tool resulted in their loss of voice as a writer and for the ways that ChatGPT would change or omit key information in its revision of their initially written text. For instance, one student wrote:

Although ChatGPT can make my essay more simple and short, it deleted many of the most important contexts of the sentences, so the grammar might have improved, but the whole logic of my essay does not make any sense, and I started to feel like this is not my own paper.

Negative Impacts on Learning

The students in this study also particularly highlighted their concern about how ChatGPT use might undermine their learning in both the short and long term. More specifically, they pointed out how the use of this tool might stagnate their development as writers and critical thinkers. To these points, one student commented:

It [ChatGPT] definitely made my paper look so much better than before. However, it still feels a bit strange even if I followed the instructions for using it since I'm still relying on advice from the AI instead of relying on my own ideas. As a result, I feel like I didn't use my brain as much and didn't develop my skills as much as I could.

Students' Positive Impressions of ChatGPT Use

Regarding the positive views indicated by the students in this study, five key patterns were identified in the data relating to: 1) receiving timely and constructive feedback, 2) fulfilling assignment expectations, 3) adhering to academic writing conventions, 4) improving language and academic writing styles, and 5) supporting linguistic and writing development.

Positive Point 1: Receiving Timely and Constructive Feedback

The participants in this study indicated that the use of ChatGPT supported the students' simultaneous language and content skill development. Specifically, the students emphasized the value of receiving immediate and objective feedback on their language and content abilities. Demonstrating these points, one student explained:

Using ChatGPT enhanced the clarity of my paper, which has been an enlightening experience. Using ChatGPT has allowed me to receive immediate feedback and suggestions, enabling me to refine my writing style and enhance the coherence and effectiveness of my essay overall. It was very helpful that ChatGPT gave me an honest review for my paper because friends or classmates are sometimes too nice to point out my mistakes or don't recognize them at all.

Positive Point 2: Fulfilling Assignment Expectations

The students in this study also indicated that the use of ChatGPT helped them to more fully comprehend the assignment requirements. Notably, they highlighted how this enabled them to perform better on assessments. Explaining this point, one student wrote:

ChatGPT told me which essay prompt questions were answered and which questions weren't so it helped me to get a clear understanding of which question to address more in detail, but also which question doesn't need much editing. ChatGPT can make me realize the purpose of the paper to improve my writing, and it guides me when thinking about where to start with the improvements.

Positive Point 3: Adhering to Academic Writing Conventions

Additionally, the students in this study indicated that the use of ChatGPT could assist them in following English academic writing conventions to succeed in academic research paper assessments. Specifically, they noted that ChatGPT helped them improve their writing structural organization and flow. For instance, relating to this point, one student wrote:

ChatGPT made my paper better by giving it more clarity. I was able to check whether my sentence had a logical flow and whether my topic sentence included every key point I wrote in the contents. I noticed I sometimes went off topic in my paragraphs, and it helped me realize that.

Positive Point 4: Improving Language and Academic Writing Style

Moreover, the students in this study indicated that ChatGPT could provide specific feedback on their English language use and academic writing style. According to their reports, this allowed them to develop their English vocabulary and grammar as well as their use of rhetorical expressions to improve the cohesion and coherence in their writing composition. To this point, one student commented:

ChatGPT has been really helpful in expanding my vocabulary, language proficiency and grammar. The model's extensive knowledge base has allowed me to explore alternative word choices and expressions. It used some difficult words, so it also uses the words and vocabulary that I do not know, so it was a good opportunity to find new words at the same time. Especially in grammar usage, I was able to improve my paper in more understandable English, and I also realized that I wrote some sentences too informal and need to rewrite them in academic forms.

Positive Point 5: Supporting Ongoing Linguistic and Writing Development

Not only did students in this study find the use of ChatGPT to be helpful with improving their assigned writing composition for this course, but they also recognized the ways that it could contribute to their ongoing linguistic and writing development over time. Importantly, the students in this study consistently noted how using ChatGPT throughout the writing process raised their self-awareness of their own tendencies and weaknesses in English language proficiency and English academic writing ability, which they claimed could help their ongoing development beyond this assignment/course. To this point, one student mentioned:

After using ChatGPT, I can look back at my original version and see the difference between the ChatGPT version, so that I can find my grammar and essay structure issues to help prevent myself from making the same mistakes the next time. Also, I can ask ChatGPT to find a more academic vocabulary that will help my essay sound more like a university-level student's work next time. For example, I change the word "lack" to "fall short of". And I learned that it is best to make sure that we will use ChatGPT only as a tool to make our paper better in a collective and effective way and not depend too much on it.

The Discussion section that now follows will consider these findings holistically while elaborating on their implications.

DISCUSSION

Pragmatically speaking, the findings of this study demonstrate how the use of AI technology such as ChatGPT can improve EMI education learning by helping to address some common challenges that arise in these settings (Walkinshaw et al., 2017). One educational aspect that tends to be lacking in EMI education is the provision of feedback that can support students' simultaneous development of language and content skills. However, the students in this study indicated that the use of ChatGPT did support such skill development because they could receive feedback immediately, plus the feedback they received was constructive because it provided an objective analysis of both their language and content abilities. Another problem in EMI education is that oftentimes students cannot perform well on assessments because they do not even have a high enough English language ability to fully comprehend their assignment requirements. Yet, the students in this study indicated that the use of ChatGPT helped them identify and overcome this pitfall. Another challenge for EMI students is following English academic writing conventions to perform successfully on academic research paper assessments, since many of these students have not been thoroughly trained (or trained at all) in such skills prior to joining their EMI program. However, the students in this study indicated that the use of ChatGPT could assist them with this process and that the tool helped them improve their writing structural organization and flow. Although many EMI educators are not trained in language education and lack either the ability or will to provide specific feedback to students on their English language use and academic writing style, the students in this study indicated that ChatGPT could provide such feedback, and that

this allowed them to develop their English vocabulary and grammar as well as their use of rhetorical expressions to improve cohesion and coherence in their writing composition. On top of all of this, the students in this study recognized the ways in which using ChatGPT could contribute to their ongoing linguistic and writing development over time. Importantly, they noted how using ChatGPT throughout the writing process raised their self-awareness of their own tendencies and weaknesses in English language proficiency and English academic writing ability, which they claimed could help their ongoing development beyond that specific assignment/course.

The positive points of ChatGPT use experienced by students across the full spectrum of English language competency levels in this study's EMI educational setting indicate how the differentiated learning facilitated by this technology made learning more accessible, inclusive, and equitable. Despite the language inequalities amongst them, analysis of the data from this study indicated that the incorporation of ChatGPT in the writing process enabled *all* students to be able to participate in the same learning tasks, develop linguistic and academic competencies according to their own individual needs, and thus have more equal opportunities to successfully meet the final assessment criteria. Moreover, the opportunity to practice using ChatGPT in this controlled learning environment seems to have helped the students to more deeply understand both its affordances and limitations so that they could utilize it more effectively and appropriately in the future on their own. From this perspective, even students' negative impressions of ChatGPT use can result in a net positive outcome.

Overall, the core themes of this book resonate throughout this chapter, which echoes the sentiments of numerous authors (e.g. Lin et al., 2024) who emphasize the need for teachers to provide adequate guidance and stimulate critical sensibility so that students can avail themselves of the unique learning opportunities afforded by AI tools like ChatGPT while avoiding misusing them in ways that undermine learning processes. Despite the widespread hand wringing in academics about AI use by students, simply rejecting the use of AI technology such as ChatGPT is not only questionably feasible but also inadvisable given the opportunity loss that would result in both academic and social terms. Refusing to accept this technology's existence or even outrightly prohibiting its utilization in education will not provide a solution to its potential risks but rather raise the possibility of its misuse. On the other hand, if such technology is freely allowed or incorporated into learning in ways that are not carefully structured to the degree that they were in this chapter's case example, then it is likely that this approach will undermine the learning process as well (e.g., in ways such as those recognized in the negative impressions of students in this study). For this reason, in 2023, a consortium of top UK universities associated with the Russell Group (2023) agreed to guidelines governing the use of AI technology in academia in an effort to find a balance between responsibly using this technology and avoiding its mishandling. The universities of all countries would be wise to follow this lead, but beyond this, it is advisable for universities in non-Anglophone countries that are providing EMI education to further refine such policies and provide faculty

instructional training to help teachers incorporate the use of this technology in ways that are suited to the unique learning needs and desirable outcomes for EMI students specifically. As this chapter's study demonstrates, AI technologies such as ChatGPT offer an *opportunity* to overcome language inequalities among students, which commonly act as barriers to accessibility, inclusion, and equity in EMI educational environments. This broadens the scope of student populations for whom EMI education might be considered possible, desirable, or useful (including second-language English speakers of various proficiency levels as well as native English speakers). Yet, just like all technologies, the realization of such potential benefits is not implicit or guaranteed; rather, it depends on the ways in which users (teachers and students) apply the technology in nuanced ways within particular contexts to achieve particular outcomes (as was demonstrated by this study). Which now brings us back to this chapter's earlier claim about the need for new models of teacher training in EMI education to prepare university educators to deliver AI-integrated teaching that can help bring about transformative individual, institutional, and social change.

Incorporating AI technology like ChatGPT offers an opportunity to increase access, inclusion, and equity not only *in* but also *through* EMI higher education. Indeed, it can be argued that the use of AI technology in higher education EMI educational settings is not just a tool for enhancing academic learning, but one which also can have important transformative impacts at the individual, institutional, national, and global levels. Innovative utilization of this technology that makes EMI education accessible, inclusive, equitable and more desirable for a wider scope of student populations with varying levels of English language proficiency simultaneously allows for more opportunities for international/intercultural learning in the world outside of the Anglophone sphere. This can bolster the internationalization efforts of higher education institutions in the non-Anglophone sphere by helping them to draw in more foreign students who will increase the diversity of their student bodies. The interactions amongst these students as well as those between them and domestic students offer opportunities for international/intercultural learning that is prone to transforming student world perspectives, values, beliefs, and identities (Otten, 2003). Such demographic and ideational shifts on campus are likely to raise awareness of the need and stimulate action for more comprehensive internationalization at the institutional level (Hudzik, 2011) and potentially more focus on "Internationalization at Home" (Leask, 2015), which could have a broad impact on the identities and dispositions of the student body. Furthermore, if the country's higher education system increases its number of universities where this type of institutional transformation has occurred, then there are bound to be "spillover effects" that have transformative influences on the national society (Lane, 2015). Moreover, if more non-Anglophone countries are able to advance internationalization efforts in this way in their higher education institutions and systems, then they will continue to increase their global competitiveness vis-à-vis those in Anglophone (primarily "Western") countries and be able to increasingly draw in larger shares of internationally mobile students and faculty. Over time,

such developments offer opportunities for transformations of not only global higher education, but also global society if they bring about more critical forms of internationalization that challenge the status quo of Eurocentric knowledge production, exploitative relationships, and inequitable access to resources (Stein et al., 2016). Since the majority of the world inhabits the non-Anglophone sphere, this would be a significant transformation of the educational experiences of the global citizens of tomorrow. Thus, if the higher education institutions in these settings can facilitate more diverse forms of cosmopolitan/intercultural/global citizenship education (Dearnorff et al. 2012), then this would amount to a real manifestation of positive contributions to the global community (Jones et al., 2021) and global public good (Marginson, 2011).

CONCLUSION

If current trends continue, more and more students in higher education globally will be educated in EMI courses and programs in non-Anglophone countries, so there is an urgent need to place more focus on the nuances of teaching and learning in these environments where the majority of next-generation global citizens will be educated. The use of technology to simultaneously meet the learning needs of students with varying English language abilities in these learning environments offers tremendous potential from both an academic and sociological perspective, and AI technologies such as ChatGPT have been shown in this chapter to be an effective tool for achieving these goals. However, if EMI education is to be meaningfully connected to efforts toward global citizenship education in these settings, then new models for teacher training will need to be developed that can prepare instructors for AI-integrated teaching (Ayanwale et al., 2022) while drawing on insights and practices from experts in the areas of cosmopolitan/intercultural/global citizenship (Osler & Starkey, 2015), second language critical pedagogy (Crookes, 2010), and critical language teacher education (Hawkins & Norton, 2009). This will likely require a re-thinking of the role of teachers and students in EMI classrooms in conjunction with a re-examination of the learning objectives and processes in EMI courses and programs, along with a wholesale re-evaluation of the value of an EMI education itself in this imminent age of ubiquitous AI use.

NOTE

AI tools were not used in any way for the preparation of this chapter.

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Chapter 9

A Comparative Study of ChatGPT and Seq2Seq Chatbot for Effective Students Advising

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ABSTRACT

Artificial Intelligence (AI) chatbots are increasingly becoming a part of students' lives, from school learning to university admissions and orientations. AI chatbots are finding ways to facilitate and improve learning experiences. Moreover, AI chatbots employ state-of-the-art deep learning algorithms, along with different techniques of natural language processing (NLP). For example, Seq2Seq-based chatbots adopt deep learning algorithms powered by different Recurrent Neural Networks (RNNs), such as Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU). Moreover, the Bidirectional Encoder Representations from Transformers (BERT) model is the first language model that adopts the self-attention mechanism by using bidirectional transformers and comparing the weights of input sequences all together. On the other hand, the Generative Pre-Trained Transformer (GPT) is another advanced language model trained by using the autoregressive model. Interestingly, Open.AI developed multiple generations of GPT based on the basic GPT architecture such as GPT-2, GPT-3 and GPT-4, as large multimodal models trained on larger volumes of data by using different kinds of domains, including education, health, business, economy, etc. This paper aims to focus on domain-specific educational purposes, particularly for advising prospective undergraduate students, by answering enquiries such as university admission tests, applications deadline, college-level courses,, the selection of suitable majors and universities and others. Additionally, this paper compared the architecture and performance of both the ChatGPT and Seq2Seq chatbot models, specifically for providing guidance and advice to prospective students.

Keywords: Advising, artificial intelligence (AI), chatbot, chatgpt, deep learning, education, natural language processing (NLP), seq2seq

INTRODUCTION

Seq2Seq is an encoder-decoder deep learning model powered by different Recurrent Neural Networks (RNNs) (Jin et al., 2021). This model is represented by taking a sequential input and generating a sequential output; however, the sequential data come into different formats, including text, speech, videos and more. The architecture of this model includes two main components: the Encoder and the

Decoder. Though, this model enhances different tasks and applications, such as machine translation, text summarization, question answering, and others. In addition to the Seq2Seq model, other chatbots have adopted the transformer model by using stacks of self-attention layers instead of recurrent neural networks (RNNs) or convolutional neural networks (CNNs). Nevertheless, some models, such as Bidirectional Encoder Representations from Transformers (BERT) use an encoder only from the Transformer model without having a decoder. Interestingly, the BERT model is the first language model that adopts the self-attention mechanism by using bidirectional Transformers and comparing the weights of input sequences all together, as this model works by focusing more on understanding particular content in given texts; accordingly, it can work effectively in some specific tasks, such as sentiment analysis and question answering (QA). On the other hand, the Generative Pre-Trained Transformer (GPT) is another advanced language model trained by using the autoregressive model by using the transformer decoder only; the input text is directly fed into the decoder, then generates the result by passing it through self-attention mechanisms (Zong & Krishnamachari, 2022). As a result, the GPT can effectively predict future words based on past words (Ethayarajh, 2019). Indeed, both GPT and BERT can understand languages semantically and syntactically, as both are trained on a large corpus of words; BERT is trained on English Wikipedia and thousands of books, and it is trained on approximately 800 million words. Whereas, GPT was trained on additional web pages from different resources, including books, articles and other texts from Common Crawl which can be fine-tuned to define other domains for other specific purposes (Ghojogh & Ghodsi, 2020).

The process of getting admission to competitive colleges and universities has caused significant stress among high school and prospective undergraduate students due to various academic and social demands (Pascoe et al., 2020). For example, standardized university admission tests and extracurricular activities are essential tasks for junior and senior high school students, especially for those targeting admission to top colleges and universities. In addition, students need to determine how to obtain financial aid to fund their education. Indeed, they need a quick, clear and instant response to all their questions and enquiries. Therefore, college-career advisers can play an essential role in students' success (American School Counselor Association [ASCA], 2019). Most high schools have a limited budget for employing a college-career adviser, and according to Blake (2020), some schools consider the role of a college career counselor a luxury rather than a necessity. However, disadvantaged schools cannot afford to hire this role, making it a low priority for them as well, consequently, students will not be prepared properly for colleges compared to other prepared students. Hence, prospective undergraduate students can benefit from having an intelligent and affordable advising chatbot to help them in their academic future by providing them with instant support and advice. Today, AI chatbots use state-of-the-art natural language processing (NLP) with advanced deep learning as well as machine learning algorithms to improve the performance of AI chatbots in predicting user requests (Assayed et al., 2023a; Regin et al., 2022; Siswanto et al., 2022). Numerous authors have focused on generative AI chatbots

by using Sequence-to-Sequence (Seq2Seq) across various domains (Sojasingarayar, 2020; Thomas et al., 2022; Wang et al., 2022).

Interestingly, OpenAI, as one of the leading cutting-edge organizations in artificial intelligence (AI) solutions, has developed multiple generations of GPT based on the basic GPT architecture including GPT-2, GPT-3 and GPT-4 as large multimodal models that trained on larger volumes of data (Lund & Wang, 2023). However, this paper aims to compare the performance and effectiveness of both the ChatGPT and Seq2Seq models, specifically for providing advice to prospective undergraduate students. This paper is organized as follows. The first section describes the AI chatbot architecture including the Seq2Seq and GPT chatbots. The next section explains and compares the role of AI chatbots in advising students, while the final section presents the conclusion.

AI-CHATBOT ARCHITECTURE

AI chatbots use state-of-the-art deep learning algorithms with different techniques of natural language processing (NLP) to enhance their performance. The Seq2Seq-based chatbots adopted deep learning algorithms powered by different RNNs as well as other language models, such as BERT and GPT.

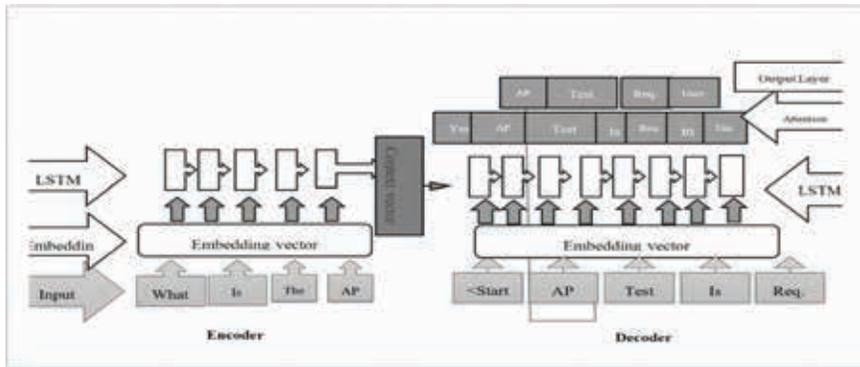
Seq2Seq (Encoder-Decoder) Chatbot

The Seq2Seq learning model starts with processing sequence inputs such as questions, enquiries or any other inputs, and then encodes the texts into a fixed-length vector called the context vector; accordingly, the decoder uses the context vector to generate the answers (Palasundram et al., 2021; Szűcs & Huszti 2029). The Seq2Seq chatbot was developed by using different neural network techniques; for example, some authors and developers have used a deep learning approach with deploying Long Short-Term Memory (LSTM) (Islam et al. 2019; Park et al., 2018). However, other studies (Egonmwan & Chali, 2019; Rahali & Akhloufi, 2021) integrated attention mechanisms and transformers with sequence-to-sequence models to focus more on important sequences in the data (Ragab et al., 2021; Zhang, 2022) by comparing each element in the sequence with all other elements in the sequence; thus, a comprehensive outlook to all sequence, which can select the most related text. Figure 1 shows the main architecture of the Seq2Seq chatbot using the attention mechanism in the output layer.

Seq2Seq2 Domain

The encoder-decoder Seq2Seq model is trained by using pairs of input and output sequences, which are usually annotated by humans. Several studies adopted specific domains for performing certain tasks (Raman et al., 2022; Alokaili et al., 2020) compared with pre-trained models such as GPT, BERT and other language models that use self-supervised and unsupervised learning without human-annotated labels (Zhou et al., 2021).

Figure 1: The main architecture of the Seq2Seq chatbot with an attention mechanism.



ChatGPT

GPT was developed by OpenAI in 2018 and is one of the most important advanced language models trained by using an autoregressive model to predict future words based on past words. OpenAI released different versions of GPT, including GPT-2, GPT-3 and GPT-4 (Lund & Wang, 2023). In fact, GPT adopts the multi-head attention mechanism based on the Transformer architecture. However, the Transformer architecture is considered a new generation of RNN and LSTM because it can enhance the model by considering long-sequence dependencies effectively, as described in paper *Attention is all you need* by Vaswani et al. (2017), as shown in Figure 2.

Interestingly, not all pre-trained models use both encoder and decoder as do Seq2Seq models. For instance, BERT uses only an encoder, whereas GPT uses a decoder to predict the next word with the probabilities and to generate a new long sentence. Therefore, the BERT (encoder) is used mainly for classification, question-answering and summarization, whereas the GPT is more efficient at translating and generating stories and essays. However, these types of large language models are trained on massive amounts of data.

GPT Domain

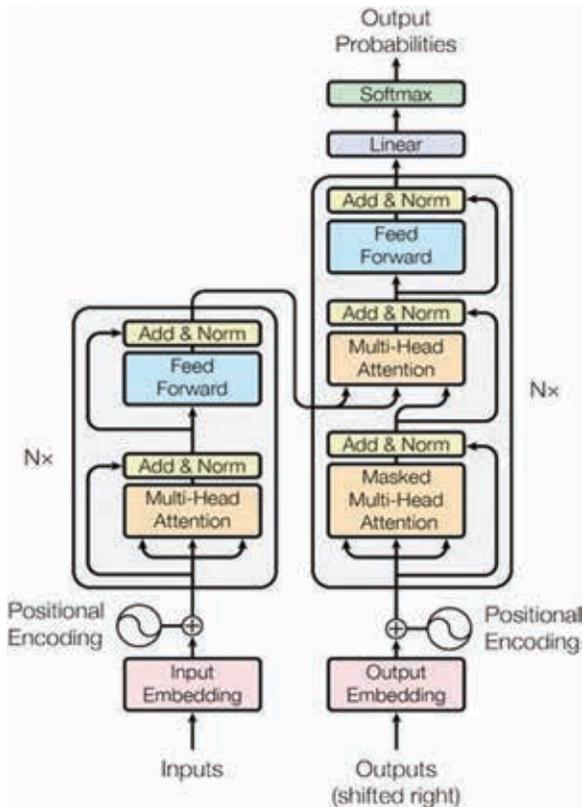
The GPT models are pre-trained on large unlabeled textual corpora, which is called unsupervised learning, as some language pre-trained models perform more powerfully in natural language tasks (Hegde & Patil, 2020). Though, GPT is considered a general purpose model that is trained in various domains not specific to a particular task; it includes technology, politics, sciences, humanities, health, etc., and etc. Accordingly, it can be able to generate a response based on the patterns that are learned.

AI-CHATBOT FOR STUDENT ADVISING

Prospective undergraduate students need to select their right majors and suitable universities. According to a qualitative study conducted by Soppe et al. (2019), which

included interviewing 61 prospective students at four Dutch universities to study the impacts of selecting best-fit programs on student success, the findings reveal that students who feel that they are not satisfied with their major or university are not only less likely to graduate on time but may also be more prone to dropping out of higher education. When students change majors in universities, graduation can slow down, as extra credit might be necessary to fulfill the requirements of the new major. Interestingly, the results of a research study on the impacts of switching majors (Liu et al., 2021) show that, despite the lower completion rate for bachelor's degrees, it can, on the other hand, increase the completion rate for certificate programs. Henceforth, it is important to provide effective advice to students, helping them to decide their majors successfully by exposing them to policies related to shifting majors such as course-sequencing and any additional credits that might be required.

Figure 2: The Transformer-model architecture (Vaswani et al., 2017)



Despite the vital role of academic advisors, particularly high school seniors, only a few researchers have studied advising chatbots in this stage of high schools. Some studies focused on the impacts of using chatbots for learning rather than for advising; for instance, a quantitative study conducted by Forman et al. (2023) with

70 high school students explained that some school students use the ChatGPT by focusing on short-term benefits, such as quickly completing their assignments and summarizing some texts. In addition, numerous studies have focused on the impact of AI chatbots, including deep learning and other language models, on colleges and universities (Firat, 2023; Choi et al., 2023; Bilquise et al., 2022). However, Assayed et al. (2023b) developed a chatbot powered by neural network algorithms to assist students in high schools in categorizing their enquiries based on the type of questions they asked. However, El Hefny et al. (2012) developed another chatbot called Jooka for supporting new students who want to enroll at the German University in Cairo. Furthermore, Meshram et al. (2021) developed a chatbot named College Enquiry that aims to answer admission-related questions, such as admission requirements, college tuition, majors that are offered, and more.

Seq2Seq and GPT Advising Chatbot

The introduction section of this study explained the academic and social demands for prospective undergraduate students. For example, high school students experience high levels of stress regarding university applications, deadlines, university admission tests and other standardized academic tests, especially for students who are interested in applying to top universities. As a result, students need precise and short answers from the chatbot without any confusion, and students would not be satisfied with the open scope and unclear answers. According to the empirical study conducted on engineering students by Shoufan (2023), students who use ChatGPT must have good knowledge and background of the field that they are looking for in order to generate a suitable response; otherwise, students would not be satisfied with the results. Shoufan (2023) concluded that ChatGPT could be an effective tool if educators and instructors guide students properly in selecting the right prompt and evaluating their responses.

Interestingly, several studies highlighted the importance of effectively educating and training university students before using ChatGPT (Shoufan, 2023; Fuchs, 2023) in order to avoid confusion in the answers. However, this raises concerns about the use of ChatGPT by prospective students who already have stress and struggle in applying to universities as well as selecting the best-fit university and major. For example, some prospective students might need to apply to universities in both the USA and the UK, as both of these countries have different deadlines and different approaches in the application process. Therefore, these students need specific guidance and support using a trusted chatbot trained on a specific and known dataset without misleading them with wrong information. According to the review study conducted by Perera & Lankathilaka, ChatGPT can raise significant concerns about fairness and bias due to the large amount of information used in its training. Moreover, some restrictions in terms of using open-domain chatbots are highlighted by Skantze & Dođruöz (2023), who evaluated the limitations of open-domain chatbots compared to human-to-human conversations by assessing interactions with ChatGPT in terms of serving it as an interactive search engine without engaging in small talk. Consequently, they stated that training chatbots in

an open domain can cause a lack of coherent answers, as the data are randomly associated without knowledge regarding the conversation or the people whom it is supposed to be about. Therefore, students need to clarify more details about their enquiry in order to receive a clear and precise answer.

In contrast, the Seq2Seq chatbot generates a response to users from specialized and known corpus that focus on their interests; as a result, users will be more satisfied with short and clear answers. Several authors studied the impact of having an open domain chatbot; for example, Qiu et al. (2017) proposed an open domain chatbot that chat log of the online customer service by using the Seq2Seq chatbot, and other authors focused on the educational domain in particular university and college data (Daswani et al., 2020; Khin et al., 2020; Lamba & Hsu, 2021). According to Lin et al. (2023), a chatbot should be able to identify user enquiries and objectives of the contexts by applying different strategies and techniques to allow the chatbot to learn effectively in order to respond accurately with an appropriate answer.

CONCLUSION

Nowadays, AI chatbots employ both NLP and state-of-the-art deep learning and machine learning algorithms to improve the performance of AI chatbots. For example, Seq2Seq-based chatbots adopt deep learning algorithms powered by different RNNs, such as LSTM & GRU. However, others have adopted the transformer model by using stacks of self-attention layers instead of RNNs or CNN.

In contrast, the Bidirectional Encoder Representations from Transformers (BERT) model is the first language model that adopts the self-attention mechanism by using bidirectional Transformers and compares the weights of input sequences all together. Moreover, the GPT is another advanced language model trained by using an autoregressive model that considers the left context when making predictions compared to BERT, which takes into account both the left and right contexts. Interestingly, GPT models such as ChatGPT are pre-trained on large unlabeled textual corpora, which is called unsupervised learning, whereas some language retrained models perform much better in some natural language tasks, such as machine translation and text summarization.

On the other hand, training chatbots in the open-domain can cause a lack of coherent answers, as the data are randomly associated without knowledge regarding the conversation or the people whom it is supposed about. As a result, tasks such as advising and answering precise questions may not provide acceptable results for students. For example, high school seniors and prospective students undergo high levels of stress regarding university applications, deadlines, university admission tests and other standardized academic tests, especially for students who are interested in applying to top universities. As a result, these students need to receive clear and precise answers about their specific requests. However, Seq2Seq chatbots trained in specific domains, particularly in student advising for colleges and majors, can generate responses to students from specialized and known domains that can focus

more on their interests. Accordingly, students can be more satisfied with the accurate and clear answers generated from such chatbots.

NOTE

AI tools were not used in any way for the preparation of this chapter.

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UNIT 3:
CURRENT TRENDS AND
POTENTIAL FUTURE IMPACTS

Chapter 10

Generative Creations, Code, and Data: How Intellectual Property Rights Over Ownership, Use, and Image Apply to Higher education

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ABSTRACT

With the growth of artificial intelligence (AI) within higher education, intellectual property rights related to the intangible assets identified and created through AI have emerged as a central inquiry. Who owns, may use, and may collect monetary gains associated with inventions, artistic or original works, replication of derivative works, literary expressions, source codes, applications, trade names, and innovative processes that emerge from AI? This multi-part question drives the discussion of this chapter through technology, legal, and corporate scientific translations that are critical for higher education scholars, leaders, and pundits. Using three case studies to dissect the core analyses of intellectual property and unveil the key considerations connected with AI, this chapter considers the macro-level issues pertaining to the economic, political, and social contexts and the micro-level factors centered around the legal parameters, technological advancements, and competing interests.

Keywords: Higher education, intellectual property, technology, artificial intelligence (AI), law, postsecondary education

INTRODUCTION

As artificial intelligence (AI) expands within higher education, intellectual property rights surrounding the intangible assets it identifies and creates have become a central concern. This multifaceted question drives the focus of this chapter: who owns, uses, and profits from inventions, artistic or original works, derivative adaptations, literary expressions, source codes, applications, trade names, and innovative processes arising from AI? To explore this, this chapter draws upon technology, law, and translations of corporate science relevant to higher education scholars, leaders, and commentators. Three case studies dissect core analyses of intellectual property and unveil key considerations linked to AI. The discussion expands beyond AI to encompass related technologies and systems within higher education, offering readers context and legal frameworks. It considers both macro-level issues (economic, political, and social) and micro-level factors (legal parameters, technological advancements, and competing

interests) to highlight established laws, inferences from related legal sources, and clear legal gaps.

Intellectual Property of Emergent Technology in Higher Education

Artificial Intelligence (AI)

The recognition of artificial intelligence originated from higher education. AI is the overarching nomenclature for integrated actions involving a machine's processing in a manner that models cognitive processing. Early artificial intelligence (AI) scholar Alan Turing created the Automatic Computing Engine (ACE), a pioneering computer capable of retaining both programs and data. Later, Turing (1950) posed the pivotal question "Can machines think?" In exploring computers and intelligence, he introduced the "imitation game" as a means of evaluating computer-generated analyses through a question-response format. John McCarthy (1955) later posited that computers of the time could not outdo human cognitive processing, attributing this to "our inability to write programs taking full advantage of what we have" rather than a lack of machine capacity (p. 2). McCarthy is widely credited with coining the phrase "artificial intelligence" in 1956 (Anyoha, 2017; Council of Europe, n.d.; Smith et al., 2006; Strickland, 2021). He defined it as "the science and engineering of making intelligent machines" (McCarthy, 2007, p. 2).

In higher education, AI engineering and analyses advanced more rapidly in the 2000s with faster processing and higher volumes of data processing. For instance, data volume levels moved from gigabytes to terabytes to petabytes to exabytes to zettabytes to yottabytes. For higher education, especially for academic researchers, exponential power increases present more opportunities for multi-layered analyses and predictions. Accordingly, AI and computational outputs based on data predictions have emerged with greater accuracy and speed with increased computational power, larger datasets, more sophisticated algorithms, better autonomous systems, and complex layered neural networks. Processing and outputs increasingly involve a significant reduction in human direction, correction, and analyses (Dzieza, 2023).

Machine learning, a form of AI, involves automatic machine adaptations with minimal human intervention (Deepak et al., 2022). Deep learning, another subset of AI, processes even greater amounts of data, utilizing complex neural networks to conduct continuous representation rounds and determine subsequent prediction and action steps (Jia, 2017). It essentially mimics brain behavior by learning and correcting from vast data sets. These outputs generate diverse outcomes, including decisions, scripts, codes, plans, and action steps, applicable across various fields, from corporate financial modeling to molecular effects in progressive diseases, weather pattern analysis for global climate change, and even essays for college courses. However, it is crucial to note that such complex algorithmic computations with meaningful outputs have been present in higher education for decades.

Suffice it to say, in higher education, AI was launched well before the ChatGPT craze, which today is envisioned by some as threatening academic experiences because

an AI platform has the capacity to construct college reports, essays, playscripts, and computer code (McMurtrie, 2023; Scott, 2023; Sun & Bruton, 2023). Campus leaders reacted to ChatGPT, citing concerns over academic integrity, privacy, algorithmic biases, and commercialization impacts (Gorelick & McDonald, 2023; Inside Higher Ed, 2023; Lonas, 2023; Sun, 2023; Turner, 2023). While AI critics reference the demise of academic learning and development, proponents of AI, exploratory AI users, and even AI critics share a common concern. They recognize the policy and legal complications associated with the intersection of AI and intellectual property (Appel et al., 2023; D'Agostino, 2023).

AI and Higher Education

Research on AI in higher education remains rather scant relative to that in other topical areas within the study of higher education. The limited literature may reflect the relatively new introduction of AI to many higher education and social science scholars, who have only realized the effects of AI-enabled technologies in recent years (see, e.g., Abdous, 2023, *Chronicle of Higher Education*, 2023). More recently, however, there is empirical evidence of tremendous growth in literature availability in recent years. According to Crompton and Burke (2023), the data indicate a 150% increase in publications addressing AI in higher education when comparing 2019–2020 to 2021–2022. Although the total numbers of literature are still limited, with fewer than 200 published articles spanning multiple social, behavioral, and education fields, prior to 2022, the recent surge in new literature contributions demonstrates interest and examination of this topic.

Given the nascent stage of this field, inquiry into AI in higher education remains narrow and focused within the current literature. A predominant focus lies on examining student learning and its impacts. These studies typically explore opportunities and capabilities across stakeholders. For instance, Diwan et al. (2023) investigate learner capabilities and AI usage to enhance engagement and conclude that AI presents auxiliary learning content through narrative fragments that build upon learner development. Similarly, Ali and Abdel-Haq (2021) explore educator capabilities and the usefulness of AI applications in higher education. Wang et al. (2023) examine AI capabilities from a resource-based perspective and find that AI contributes to student self-efficacy and improved learning performance. These findings have significant implications for higher education, highlighting the role of AI in directing the learning process and the importance of AI literacy and resources at the postsecondary level.

Although the extant literature largely informs readers about postsecondary student learning impacts, meta-based studies reveal the full array of categories in which researchers have examined AI in higher education. These studies illuminate established knowledge and draw attention to knowledge gaps. For instance, Kabudi et al. (2021) present a meta-review of AI-focused articles within the context of higher education. Drawing from a wider dataset than Crompton and Burke (2023), they review eight databases (i.e., ACM, Web of Science, EBSCOhost, Wiley, SAGE Journals, IEEE Xplore, Scopus, and Taylor and Francis), identifying 147 research

papers published between 2014 and 2020. They construct a systematic mapping approach to link research relationships and trends and identify literature gaps. The study findings illuminate patterns with AI approaches used to address learning interventions along with algorithmic models, frameworks employed to structure adaptive learning, redesign influences used as learning techniques, and AI evaluation in the learning setting. Although mapping offers useful cluster and networked analyses of the extant literature, the focus of this paper and many others, which perform learning-enabled analysis, only present challenges and ethical issues from a learner capabilities perspective.

Likewise, Zhai and his co-authors (2021) present data from their content analysis of 100 scholarly papers studying the use of AI in the education setting. Using the Social Sciences Citation Index database from 2010 to 2020, they identify 63 empirical papers and 37 analytic papers. The study reveals that the literature examining AI and education intersections may be classified into three areas—the “development layer (classification, matching, recommendation, and deep learning), application layer (feedback, reasoning, and adaptive learning), and integration layer (affection computing, role-playing, immersive learning, and gamification)” (p. 1). These categories illuminate the growing proliferation of research addressing AI in education, and they also highlight the gaps in the literature. The authors call attention to research gaps into areas such as AI educational understandings about the Internet of Things, swarm intelligence, deep learning, neuroscience, and student learning assessment. At the same time, the authors raise concerns associated with “inappropriate use of AI techniques, changing roles of teachers and students, as well as social and ethical issues.” Inherently, these social and ethical concerns omit a foundational inquiry about the legal parameters, particularly intellectual property, as a governing area to determine data access, rights, and usage, which are fundamental to AI.

In a related area investigating the administrative governance of AI in higher education, the literature touches upon organizational decisions and parameters associated with AI in higher education. To illustrate, Hashim et al. (2022) examine the colleges building competitive advantage through rapidly changing technologies, particularly AI. George and Wooden (2023) address the organizational design, efficiencies, and strategic positioning that AI offers universities. While these organizational and system-based approaches offer many opportunities for higher education institutions, there are clear drawbacks and problems associated with using AI in higher education (Rahm & Rahm-Skågeby, 2023). Nonetheless, the higher education literature is rather bereft of examinations associated with organizational concerns about intellectual property, a fundamental inquiry associated with AI usage in higher education. Yet, the literature is quick to reference that AI poses real concerns. As Chiang (2023) prognosticates, “[m]y worst fear is that AI will shrink individual freedom. Our best hope for AI is that it advances individual freedom” (para. 10). Notably, the literature on AI in higher education requires an examination of intellectual property rights, access, and ownership.

AI, Higher Education, and Intellectual Property (IP)

Overview of IP Law

Intellectual property is often defined as the work of the mind. Aligned with this concept, legal researchers and courts (e.g., Daniel et al., 2012) cite the U.S. Constitution, which incorporates legal rights that give Congress the power to “promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries” (U.S. Const., Art. I, Sec. 8, Cl. 8.). This chapter centers on three primary forms of intellectual property prevalent within higher education.

A patent is a federal protection granting the patent holder the right to exclude others from making, using, selling, distributing, or importing the patented subject matter, which is typically some type of invention. In the U.S., federal law protects three types of patents: utility, design, and plant (Conditions for Patentability, 2023). Although each type of patent has specific standards for federal protection, obtaining a U.S. patent requires patent seekers to meet four underlying conditions: usefulness, such as operationally functional or product application; clear description explaining how to make and use the invention; evidence of its novelty, so it is clearly new and not previously created or available; and nonobviousness with some unexpected or surprising aspect that cannot be easily predictable on its use (Patentability of Inventions, 2015). The critical point lies in the filing of the patent, as protection is contingent on the filing rather than the first to invent.

While a patent is focused on protecting the exclusive rights of the creator or holder of an invention, copyright pertains to original works of authorship. Under federal law, the U.S. Copyright Act (2023) defines “original works of authorship” as works that are “fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device” (§102(a)). Simply put, copyrighted works must be both original expressions and fixed in tangible forms, such as literary works; musical works, including any accompanying words; dramatic works, including any accompanying music; pantomimes and choreographic works; pictorial, graphic, and sculptural works; motion pictures and other audiovisual works; sound recordings; and architectural works (U.S. Copyright Act, 2023).

Copyright law, however, has federal statutory provisions and case law that have carved out exceptions to exclusive ownership rights of copyright holders. The law outlines four considerations allowing fair use of copyrighted works: the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes; the nature of the copyrighted work; the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and the effect of the use upon the potential market for or value of the copyrighted work (U.S. Copyright Act, 2023). Considering these factors, courts have granted fair use when copyrighted works have presented a “transformative” use that alters the original work with a “new expression, meaning, or message” (Andy Warhol

Foundation for the Visual Arts v. Goldsmith, 2023, p. 1281; Campbell v. Acuff-Rose Music, 1994, p. 579)

Finally, intellectual property protections also extend to trademarks, trade names, and trade secrets. These protections are governed by multiple sources of law, but they broadly protect interests associated with a person or entity, such as a university logo, the script of the university name, or a university seal. Specifically, a trademark is a distinct, protected insignia or sign associated with a good, service, or organization, such as a university (Lanham Act, 2023). A trade name is a distinct, registered, and protected business name. Finally, trade secrets, which are governed by state law, involve protected information such as a formula, technique, program, or process that has economic value.

IP Law as Applied in Higher Education

The concept of intellectual property is associated with an individual or entity's interests and corresponding rights (Daniel et al., 2012). Intellectual property, as defined by Sun and Baez (2009), revolves around the "res" or the intrinsic "thing" that imparts value within higher education. Specifically, they defined intellectual property as "the intangible items that typically produce or create products, processes, expressions, marks, or nonpublic information" (Sun & Baez, 2009, p. 1).

When examining this intrinsic "thing," the extant literature on intellectual property of emerging technologies in higher education has largely fallen into three categories (Sun and Baez, 2009; Daniel et al., in press). In one category, higher education research addressing intellectual property from emerging technologies has examined challenged ownership rights and replication usage. Drawing on copyright law principles, these studies have centered on exploring interests and contested rights. For instance, research on intellectual property rights of faculty, course designers, and universities over courses, especially online learning formats, as well as course reading packets, has been conducted (American University Library, 2010; Flaherty, 2020; Kranch, 2008; Sun & Baez, 2009). These studies have primarily uncovered a neoliberal emphasis on commodifying academic learning and reducing authority among faculty.

In the second category, higher education research focusing on intellectual property from emerging technologies has examined the contested transformation and licensing usage of works used and created in higher education. For instance, these studies have explored university inventions and creations, examining their commercial viability; challenges associated with spin-off products and services; licensing arrangements; and experiences with alleged infringements of university property, especially concerning biomedical research findings, pharmaceutical creations, and engineered equipment inventions (Kulkarni, 1995; Patel, 1996; Sun & Baez, 2009; Thursby & Kemp, 2002; Walsh et al., 2007). Drawing primarily on patent law principles, these studies have considered the philosophical stances on rights and interests, power plays associated with negotiated environments, and economic returns and financial investments associated with intellectual property filings, particularly patents.

In the third category, higher education research focusing on intellectual property from emerging technologies has explored the effects of manipulation and deceit usage in the context of intellectual property and related interests. For instance, this research has explored the name, image, and likeness of college athletes and contested the usage of university trademarks and trade names on various social media platforms and websites (Holden et al., 2022; Sun & Baez, 2009; Younes & Alsharqawi, 2020). Relying on trademark principles and rights of publicity laws, these studies have illuminated the shifting economic and financial gains for college athletes, the state policy emergence to control and grant greater access to college athletes, the reputational harm associated with misleading logos, and the confusion and misattribution arising from unfair trade practices or closely related trade names and logos.

IP Law in Higher Education under AI Technology

Although IP law in higher education has historically examined the *res* or thing to be protected, the actual property or corpus at issue transcends a mere legal interest, as demonstrated by prior research. Particularly, intellectual property interests within technology-mediated applications in higher education raise questions about faculty motivations, especially considering academic capitalist rewards (Slaughter & Rhoades, 1993, 2009) and the impact of intellectual commons and intervention policies by governments and universities (Ehondor, 2020; Rooksby, 2016). While much of the literature often portrays intellectual property with a deficit or constrained research approach, highlighting the drawbacks of knowledge commodification, it also reveals research productivity stemming from IP creation outputs, such as generating new knowledge, funding sources, and research and development resources (Kashyap & Agrawal, 2020). These studies suggest that examinations of intellectual property interests are not solely political or economic inquiries and that there are more than legal parameters and emergent technology considerations. These studies suggest that similar inquiries of legal constructs and analyses are worthy of exploration to understand the intellectual property of AI as applied in the context of higher education. Thus, the examination requires a multi-level set of factors in several dimensions, including economic, political, and social dimensions.

Sun and Baez (2009) propose and examine such an approach. Rather than simply reducing the property to a legal interest within higher education, they recognized the knowledge commodity within the information age as having value within economic, political, and social contexts to consider at the macro-level. Furthermore, they recognize that the framework includes mediating factors, which take into account the legal parameters, technological advancements, and competing interests of various parties. Collectively, macro factors (i.e., economic, political, and social contexts) and mediating factors (i.e., legal parameters, technological advancements, and competing interests) explain intellectual property analysis, account for corresponding interests and rights, and, in turn, shape behaviors within higher education. In short, the framework output informs higher education leaders, researchers, and students about the attendant rights from the policy narrative at the federal/state level as well as

the institutional level. Accordingly, the three remaining subsections below offer insights into intellectual property law for patents, copyrights, and trade names as areas for examining the intellectual property of emerging technologies used in higher education.

Three Cases: Findings and Analysis

Building on the preceding section, which delineates key intellectual property provisions, defines relevant terms, and provides a literature review, this section introduces three illustrative case types to contextualize the economic, political, and social dimensions associated with intellectual property inquiries in higher education when new technologies are at issue. Through these cases, we aim to elucidate the practical legal parameters, the significance of technological advancements, and the competing interests at stake—factors crucial for comprehending AI intellectual property within higher education. Notably, generative AI introduces new terrain, shedding light on gaps in the law.

To contextualize the economic, political, and social dimensions, it is informative to describe the developments that necessitate an intellectual property interest. Generative AI utilizes neural networks based on large language models trained to pull and process massive amounts of data, potentially from multiple sources, to create, perform, and evaluate new and original content (Harris, 2023). Generative AI tools such as ChatGPT for textual outputs from specific queries, RapidMiner for data analytics generation, Synthesia for avatars and other video generation tools, Fireflies for noting or transcription services, and Craiyon for images and photorealistic generation have captured the interest and usage of the general population due to their broad accessibility. Beyond commercially available tools, other forms of AI also influence AI use in higher education. For instance, biomedical researchers in higher education have leveraged generative adversarial networks (GANs) for image generation and manipulation in medical imaging research to produce MRI, CT, and other scans (Lan et al., 2020; Saad et al., 2023). Similarly, academic researchers have employed recurrent neural networks (RNNs) to generate complex sequences (e.g., DNA sequences, protein structures) for study and analysis (Shen et al., 2018).

Generative AI poses practical problems in law, as does AI development and the interests of the parties involved in the AI space. In part, these problems have arisen for three reasons. First, the law has not adapted to AI. Second, AI technologies, such as design and development processes and features, are not well known to shape policies and laws. Third, the technology itself can generate steps and analyses that are not easily predictable and may raise new, unforeseen approaches. To illustrate higher education's analysis of AI and intellectual property, this chapter draws on recent, albeit limited, case law in this field and integrates existing laws for corollary analysis, as cases specific to AI in the realm of intellectual property are scarce. This effort addresses how the law treats the creator or inventor of intellectual property from AI-generated outputs, distinguishes between human and AI contributions warranting IP protections, and resolves unauthorized and manipulative creations and inventions arising from AI.

Who is the creator or inventor?

As established, generative AI raises questions about the ownership of intellectual property. With academic researchers delving into generative AI works, determining the attribution of the creator or inventor presents a practical inquiry. To date, only one federal case has fully addressed this issue.

In 2022, a federal appellate court ruled that an AI system cannot be an inventor and qualify for a patent. In 2019, computer scientist Stephen Thaler submitted two patent applications to the U.S. Patent and Trademark Office (USPTO). In identifying the inventor, he reported his AI system, Device for the Autonomous Bootstrapping of Unified Science (DABUS), as the sole inventor. The USPTO rejected Thaler's submission. According to Thaler, he "develops and runs AI systems that generate patentable inventions," yet Thaler asserted that he "did not contribute to the conception of these inventions and that any person having skill in the art could have taken DABUS' output and reduced the ideas in the applications to practice" (Thaler, 2022, p. 1209). However, he "filed a document purporting to assign himself all of DABUS' rights as an inventor" (Thaler, 2022, p. 1210). After the USPTO denial of the applications and their reconsideration, Thaler sued for judicial review, and the federal trial court ruled in favor of the USPTO. Thaler appealed, and the federal appellate court agreed with the outcome, emphasizing that a patent application requires a natural person to be identified as the inventor and making AI generators or other technological outputs incapable of inventor status.

This ruling is consistent with other decisions. For instance, a federal appellate court previously decided that a monkey, which took a selfie, could not achieve copyright protection. Like in the *Thaler* case, the court pronounced, "more broadly, animals other than humans — lack statutory standing to sue under the Copyright Act" (Naruto v. Slater, 2018, p. 426). Furthermore, records from the U.S. Copyright Office (2021) present past denials of copyright protection based on "a mural painted by an elephant;" "an application for a song naming the Holy Spirit as the author of the work;" and "a claim based on cut marks, defects, and other qualities found in natural stone — to name a few examples." Similarly, U.S. Copyright Office (2021) denials have occurred in machine-based expressions of other forms, for example, "converting a work from analog to digital format, such as transferring a motion picture from VHS to DVD" or "transposing a song from B-major to C-major."

Together, these cases make it clear that machine-generated intellectual property lacks an identifiable creator or inventor under both patent and copyright laws. At present, federal statutes refer to a person as a creator or inventor, and established case law and patent rulings have remained consistent in interpreting a person as a human being, not even a university. Nonetheless, after a human person files as inventor or creator, that individual may assign rights, such as licensing, sales, and distribution, to an entity such as a university, academic spin-off, other organizational unit, or another person.

What is the contribution that warrants the IP protections?

Because AI systems draw on massive datasets, such as large language models, to create, simulate, and execute analyses, matters of data ownership and licensing are paramount. From an intellectual property perspective, we ask: who owns the data used to train AI systems, and how should the data be licensed for AI research and development? Who is authorized to determine the data privacy and security protocols and approvals when handling sensitive data for AI design and research? Similarly, data ownership and licensing are further heightened when considering data that are aggregated from multiple sources. We should ask: who has consented and how was that determined? What are the protocols for obtaining access to the data? What are the proper data usage approaches and conditions, and under what basis may universities appropriately aggregate the data for AI research purposes? Another initial and fundamental question is how to examine the contribution of AI and its impacts on drawing from existing protected works. Two cases involving AI scrapping and training from copyrighted works offer partial insights into the state of the law, the complexities of AI technology, and competing interests.

The first case involves the scrapping of copyrighted materials in which copyright management information (CMI) is removed or altered. In May 2023, a federal court entertained the possibility that an AI tool may have removed or altered the CMI attached to the copyrighted objects on program codes to warrant a copyright infringement (see *Doe 1 v. Github, 2023*, pp. 18-21). In that case, a team of software developers sued GitHub, Microsoft, and a group of OpenAI companies associated with the development and funding of two AI coding tools, Copilot and Codex, for copyright infringement. The technology companies GitHub, Microsoft,¹ and OpenAI own and operate Copilot, a machine learning AI tool that suggests code to developers as they work on projects, and Codex serves as the general programming model under which Copilot operates by converting natural language into code before being integrated into Copilot. Through algorithmic design, the AI trained off publicly available code, including open-source projects. Codex and Copilot “were not programmed to treat attribution, copyright notices, and license terms as legally essential” (*Doe 1 v. Github, 2023*, p. 5). Instead, “Copilot reproduces licensed code used in training data as output with missing or incorrect attribution, copyright notices, and license terms. This violates the open-source licenses of “tens of thousands—possibly millions—of software developers” (*Github, 2023*, p. 5).

According to the plaintiff developers, the defendants (i.e., technology companies) removed or altered and distributed the copyrighted code despite knowing that their actions would induce infringement. The defendants disagreed, arguing that their efforts did not affirmatively or actively remove CMI, and that their AI tool merely conducted “passive non-inclusion of CMI” (*Doe 1 v. Github, 2023*, p. 19). Unconvinced by the technology companies’ description of the process, the federal court declared that this “semantic distinction is not meaningful” (*Doe 1 v. Github, 2023*, p. 19). The court concluded that the developers adequately presented their

1 In 2018, Microsoft acquired GitHub making Microsoft a party to the lawsuit.

claim of copyright infringement, indicating how the companies knew of CMI but trained the AI tool to ignore or remove it (Github, 2023, p. 19).² Although this federal court decision did not conclude a final outcome to the case, it marked a significant “win” for the developers when the court ruled on the motion to dismiss the case, holding that the case should move forward because the developers pled at least one of the claims sufficiently to warrant a full case review. That ruling may lead to a settlement or other outcome, but it suggests that copyrighted materials, when used as training data for AI models, present the potential to prevail on an infringement claim when the CMI is altered or removed.

The outcome of using IP-protected works for training may be different if CMI alteration or removal are not at issue. In July 2023, a federal court expressed a slightly different observation about training data for AI models (*Andersen v. Stability AI*, 2023). In that case, a group of artists brought a class action suit against Stability AI, Midjourney, and DeviantArt, three AI tools using text-to-image generators. The artists claimed that these companies used billions of copyrighted images, which they scraped from the web without copyright permission. The companies acknowledge the use of existing images, but they argued that the images were simply used as training images for their AI models. The artists disagreed, describing how the copyrighted images were stored and incorporated without consent or payment to the artists to train the AI tool. Although the hearing outcome for this case has not been decided, the federal judge presided over the hearing expressed, “I don’t think the claim regarding output images is plausible at the moment, because there’s no substantial similarity” between the copyrighted images and AI-generated images (*Andersen v. Stability AI*, 2023). Processing the volume and technique used, the judge expressed that the AI tools in question draw on “five billion compressed images”, making it “implausible that [the artists’] works are involved” in the final outputs of the AI generator (*Andersen v. Stability AI*, 2023). In the end, the federal judge permitted the artists an opportunity to amend their complaint to offer more facts, which could support the alleged pleadings against the technology companies (*Andersen v. Stability AI*, 2023). Consequently, there is no firm outcome and rule of law to follow; however, the judge’s statements at the hearing suggest that AI training, which learns from billions of copyrighted media sources and has no substantially similar media as the output, may overcome assertions of copyright infringement.

Similarly, in a case involving Google and Oracle, the U.S. Supreme Court ruled that the source code used for a Java application programming interface (API), drawing only on “what was needed to allow users to put their accrued talents to work in a new and transformative program,” satisfied the fair use doctrine, making it permissible under copyright law (*Google v. Oracle America*, 2021, p. 1209). In that case, Google drew on 11,000 lines of source code from the Java API so that the Android mobile

2 The case ruled on three claims in favor of the developers, but for purposes of this paper, the CMI issue is the focused outcome. Additionally, since this case, Github and Microsoft have filed other motions, which are pending an outcome, to dismiss this case. See *Doe 1 v. Github*, Civ. No. 4:22-cv-6823-JST (N.D. Cal. June 29, 2023), filed on June 29, 2023, and hearing expected on Sept. 14, 2023.

operating system could be developed. This case is significant because if the Court had barred fair use of the code, the decision would have forced technology companies and software engineers to create incompatible standards and designs to comply with the law. For instance, how would a university student information system and learning management system communicate? Without interoperability, universities would resort to a single platform for much of their technology needs—limiting options and, potentially, learning environments. Put simply, intellectual property law permits some non-exclusive uses to otherwise protected intellectual property, and the AI context unearthing these legal gaps or intended (or perhaps fortuitous) legal openings allows for AI development and expansion.

Who is responsible for unauthorized and manipulative creations and inventions?

The prior subsection addressed the unauthorized use of intellectual property for the purpose of training. Expanding on that examination, this subsection explores the unauthorized use of intellectual property for the purposes of manipulation or having the effect of deception, specifically “deepfakes”.

A portmanteau of “deep learning” and “fake,” deepfake is a generated media, such as a manufactured image, video, or voice clone, that has the effect of deceiving or hoaxing another (Westerlund, 2019). As discussed in the previous section, removal or alteration of the CMI, such as images used for training, would violate federal copyright law. However, according to another court hearing, generative AI using media scraped from the web without copyright permission might not arise to infringement. Although not dispositive as a legal rule, one court suggests that generative AI, in some instances, may lead to transformative work when there appears to be no substantial similarity between the original and new works (*Andersen v. Stability AI*, 2023). Simply put, generative AI may qualify as fair use.

An argument exists that a deepfake may appear to have a transformative application by offering a new purpose and message to the formerly copyrighted material. Although this matter has not been squarely decided among the courts, the fair use doctrine, as currently constructed, offers a compelling argument defending a copyright infringement challenge. This exemption to copyright protection could change if Congress changes the federal copyright law to include unauthorized manipulation of protected works with the purpose of deceiving or harming another person or entity. In the context of higher education, it is likely that parties would need to demonstrate that the damage sustained includes reputational harm to the university that steers prospective students away or redirects trust and interest in the university for its research and development or commercialization efforts.

While copyright law in its present state offers limited possibilities, deepfakes present other direct and related arguments for the infringement of intellectual property. Notably, in higher education, deepfakes have been employed to alter trademarks such as brand names, slogans, and logos. For instance, AI-generated deepfakes have appeared to twist brand language in a negative light, present false endorsements using nonconsensual personas, and alter marks with sexually suggestive images

(Coffee, 2022; Gorton et al., 2021; Tenbarge, 2023). These usages trigger trademark infringement claims under the Lanham Act (2023) based on the likelihood of confusion between the owner of the trademark and the alleged improper user of the trademark (See Ullrich, 2022).

Similarly, deepfakes may violate the legal “right of publicity” with the unauthorized use of another’s name, image, and likeness. Although this claim is generally considered a tort violation (i.e., a private party against another for harm caused), in some countries, this right of publicity is considered an intellectual property right. Most evidently, concern for publicity rights has been directed at college athletes (NCAA v. Alston, 2020). Prior to a U.S. Supreme Court case, *NCAA v. Alston*, college athletes could not benefit financially from advertisements, endorsements, television or movie production usage, or gaming avatars that presented them in some form. In that case, the Court held that the athletic league rules prohibiting college athletes from receiving financial rewards or compensation for their name, image, and likeness violated the Sherman Antitrust Act (2023). Although the legal justification that ultimately struck the athletic policy is an unfair trade practices law, the case sets intellectual property interests in one’s name, image, and likeness into motion.

Additionally, in an environment of AI and deepfakes, the concerns about data protection, privacy, and the right of publicity extend beyond athletes and include professors, staff, and campus leadership. The Federal Trade Commission Act (2023) specifically protects organizations from unfair or deceptive acts or practices that affect commerce, deceptive business practices, and unfair methods of competition. Thus, if a deepfake appears in the form of a voice clone of the university president expressing discriminatory language, a manipulated image of a professor in a sexually compromising position, or an altered university seal placed in false light, laws generally address these matters; however, the AI complexity is as follows: who is the party of the improper trademark, trade name, or other protected media? Is it the AI tool, the owner of the AI generator, the AI user who created the media, or the distributor who may not know of its falsity? How does this analysis change when the AI draws on an unauthorized and manipulative creation or invention to replicate elements of it but learns enough to generate more harmful or damaging media? In short, in this setting, legal rules exist, but the gaps in law applied to generative AI are greater and murkier.

DISCUSSIONS

The findings suggest that the current law inadequately addresses AI or machine-generated intellectual property. Regarding creation attribution, AI or machine-generated intellectual property lacks protection unless a person is identified as the intellectual property holder. Additionally, the current legal framework allows AI or machine usage of protected intellectual property when copyright management information is not intentionally altered or removed and the protected work is just one of many (e.g., one of five billion images) considered during AI model training. In other words, the AI examination of protected work becomes immaterial and does

not present a substantial similarity; it can hardly be referenced as an infringement. These first two findings also suggest that current U.S. law on patent protection conflicts with the fundamental principles of AI because the law centers on the *res*, or the inventive matter, as opposed to the AI inventor and relies on the nonobviousness test based on a person of ordinary skill in the art as opposed to the obviousness of AI technology. Furthermore, the findings demonstrate that a generated output with the effect of deceiving or hoaxing others may be protected under copyright law, a type of intellectual property law; however, it may also violate the right of publicity, another intellectual property protection, as well as non-intellectual property laws such as harassment, election law violations, privacy, and sexual misconduct violations. This chapter also illustrates that the law may account for unauthorized and manipulative creations and inventions. On one hand, the law may permit such AI behaviors as fair use for transformative, commentary, or parody applications. On the other hand, usage may trigger other protections, such as trademarks, leading to infringement or improper use when the media is used to confuse or deceive. Despite the law's provisions to protect intellectual property owners, the identity of the infringing party has not been fully addressed when the actions are machine-based.

Adding to the existing literature on AI in higher education, this study shows that the contributions of AI extend much further than inquiries about learners, as many other researchers have written. Instead, this literature contributes to the emerging line of inquiry about the organizational effects of ethical and foundational inquiry about AI in higher education (see, e.g., Zhai, et al., 2021). Specifically, this study significantly contributes to our understanding of legal parameters, highlighting the effects of non-human IP holders and AI training models on the immaterial use of protected intellectual property. This immaterial effect is recognized when examining potentially five billion protected works, and the output does not resemble any of these protected works. The chapter also delves into technological advancements involving big data, drawing on volume, velocity, variety, and veracity. The existing literature on AI in higher education does not regularly address the characteristics of big data, shaping new capabilities and considerations in determining intellectual property rights. Equally important, this chapter emphasizes the competing interests of various parties, including the protective interest of higher education leaders for the university and its market positioning, aligning with prior researchers (Hashim et al., 2022). It also highlights the researcher's concern for design and outputs, reflecting Chiang's (2023) worries about academic freedom and the attribution of work. Additionally, the U.S. Patent and Trademark Office's interest in identifying a human person as the inventor or creator of the IP, and the IP holder's right to block an AI training experience without attribution or payment, are discussed (Rahm & Rahm-Skågeby, 2023).

Beyond the substantive findings of this study, the adopted framework considers macro-level issues related to economic, political, and social contexts, along with micro-level factors focusing on legal parameters, technological advancements, and competing interests. This approach offers a workable method for examining intellectual property through emerging technologies used in higher education.

Importantly, the chapter provides insights into generative AI as it relates to the intellectual property of emerging technologies used in higher education. While the existing literature raises concerns about AI's intellectual property, the nascent literature on AI intellectual property within higher education has presented a limited analysis of the law. This chapter draws on developing case law, existing legal rules, and corollary legal sources to present the state of intellectual property law when examining AI in higher education.

CONCLUSION

Congress, statehouses, and government agencies are currently examining AI technology and policy (Sun & Bruton, 2023). Although applications extend beyond higher education, they are heavily influenced and informed by higher education. These policy discussions have revolved around key areas such as technology safeguards, data protection protocols, innovation continuity, economic incentives, and legal realities. For instance, the Blumenthal-Hawley Bipartisan Framework on Artificial Intelligence emerged from multiple hearings and outlines priorities such as establishing a licensing regime led by an independent oversight body, ensuring legal accountability for harm, defending national security, fostering international competition, promoting public transparency, and protecting consumers and children (Blumenthal, 2023). Ultimately, AI offers many possibilities, and the developments from higher education will become more crucial in shaping the intellectual property law of emerging technologies.

NOTE

AI tools were not used in any way for the preparation of this chapter.

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Chapter 11

ChatGPT and Research Ethics

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ABSTRACT

This chapter addresses concerns about artificial intelligence and its impact on research ethics and writing for publication through a review of the literature in four major topical areas: informed consent and data privacy, falsification and other research issues, publication issues, and the benefits of AI to ethical research practices. These concerns encompass the development of a research study, research design, data collection, and analysis of results. AI has the potential to falsify literature, data, and conclusions. Human subjects research is affected by AI tools pertaining to informed consent, data privacy, human behavior modeling by AI and bots, and research design. Journal editors and publishers have concerns regarding copyright, attribution, plagiarism, and authorship, and whether or not AI tools can be listed as an author or just cited only. Considerations of reducing bias and maintaining research quality are addressed. The benefits of AI tools in research, as well as the implications of AI in the context of research ethics for researchers, journal editors, and policymakers, are presented.

Keywords: data privacy, falsification, human subjects, informed consent, policy, publishing, research ethics

INTRODUCTION

This chapter highlights, through a literature review, concerns associated with artificial intelligence and research ethics. In their webinar on research ethics in the digital age, Panicker and Huh-Yoo (2022) asked, “Is the prevailing ethical framework for protecting the rights and welfare of human research subjects adequate?” There are several aspects encompassed by research ethics: developing a study, collecting data, and writing the results for publication. Ethical considerations include copyright, attribution, plagiarism, and authorship (Liebrenz et al., 2023; Zheng & Zhan, 2023). For human subjects research, issues of informed consent, data privacy, models of human behavior by AI/bots, and research design are relevant in this era of artificial intelligence (AI) growth.

Gottlieb et al. (2023) expressed concern regarding the potential harms of AI in research. These included concerns that AI programs are limited by their training algorithms and that AI cannot accurately analyze data without having designed the study. Another concern is that users of AI programs might see written output as truthful because it reads as factual. The authors noted the risks of copyright

infringement and plagiarism, inaccurate information and sources, and bias through its training (Gottlieb et al., 2023), which is “toward Western, affluent people” (Hutson, 2023, p. 122). There are also potential benefits to the use of AI in research, such as pilot testing without using humans, generating ideas, improving writing, and making processes more efficient, among others. This chapter reviews literature related to these issues, presents some potential benefits of AI in research, and provides implications for researchers, journal editors, and policymakers in the future.

LITERATURE REVIEW

The topic of AI and research ethics encapsulates several topics, including informed consent and data privacy, falsification and other research issues, publication issues, and benefits to AI in research practices. Some of these topics relate to research on human subjects, and others involve humans as knowledge creators.

Informed Consent and Data Privacy

Panicker and Huh-Yoo (2022) cautioned that in daily life, many people click on past terms and conditions on web sites or when using a product; thus, many people do not understand the risks of clicking on an “agree” button. This suggests informed consent may not be truly voluntary, if there is an ambiguity of harm with digital technologies interfering with informed consent (Panicker & Huh-Yoo, 2022). Because daily life involves agreeing to something to continue to another screen or usage level, it may be difficult for people to identify risk before they get involved in research (Panicker & Huh-Yoo, 2022).

There is also a concern highlighted by Gendron et al. (2022) that “we seemingly ‘give information freely’ – yet we have no control over how this information, in turn, controls and governs us” (p. 11). The idea that data can be deidentified is misleading, because data dispersed across technology might lead to identifying research subjects (Panicker & Huh-Yoo, 2022). In her interview with the talent development podcast ATD DEI, Liza Wisner called people “hackable humans” because of the trails of data they produce online and on wearable devices (Thompson, 2023). Another interesting consideration is when research may require participants to use an AI program. Creating an account with ChatGPT or other AI tools requires users to provide data to have access to it (Gurung et al., 2023). It is also possible that when researchers import audio files of interviews and focus groups for transcription, these data may find their way into AI tool training databases and compromise participants’ privacy.

Falsification and Other Research Issues

There are significant concerns that ChatGPT and similar programs might create a study that was never actually conducted or generate fake data (Thorpe, 2023). ChatGPT, according to Graf and Bernardi (2023), “has the potential to help... researchers identify research questions and hypotheses, design studies, and analyze data (including writing code), in addition to its ability to write/edit documents and

correct grammar and syntax” (p. 71). ChatGPT is also able to generate references, often which are fake (Gottlieb et al., 2023; Graf & Bernardi, 2023; Hill-Yardin et al., 2023). ChatGPT may not be able to access a wide range of literature if some articles are behind paywalls, for example (Gottlieb et al., 2023).

There have been efforts by some publishers to remove open access articles, so AI cannot include them, another ethical issue in itself (Lund et al., 2023). Some AI programs use Wikipedia as a training foundation, which is not a scholarly source (Lund et al., 2023). Additionally, many predatory journals are open access, another concern for literature AI may draw from for its training (Kulp, 2023; Vinson, 2023).

Furthermore, another concern mentioned by Lund et al. (2023) is that “the use of AI-driven language models raises concerns about the reproducibility and transparency of research” (p. 570). For researchers and potential human subjects,

it could also degrade the quality and transparency of research and fundamentally alter our autonomy as human researchers. ChatGPT and other LLMs produce text that is convincing but often wrong, so their use can distort scientific facts and spread misinformation. (van Dis et al., 2023, p. 224)

In the legal field, an attorney relied on ChatGPT to prepare a brief on a case for a client who was suing an airline. The brief cited several cases as precedents that did not exist, and ChatGPT responded affirmatively to the attorney’s question about whether the cases were real before including them (Weiser, 2023).

Besides all of the factors that might impact human subjects research, concerns have arisen regarding the use of crowdsourced platforms such as Mechanical Turk (MTurk), which rely on anonymous participants to complete tasks, which could include research surveys, for a fee. There is no certainty that participants on these platforms are actual humans rather than bots (Agle et al., 2022). Other research concerns noted by Agle et al. (2022) included inattentive participants, intentionally dishonest participants, and participants who use VPNs to change the way their location appears to fit within the sampling frame.

To investigate this further, Agle et al. (2022) studied 1,100 participants through MTurk in a randomized, controlled trial by approaching their research in four equal groups: a control group with no quality control procedures, a bot/VPN check with a few procedures to ensure they were human, a truthfulness/attention check with three quality control procedures, and a group that had both a bot/VPN and truthfulness/attention check. They found that “a substantial number of MTurk workers failed to pass basic data quality-control checks” (Agle et al., 2022, p. 893). They found more issues with inattentive or dishonest participants compared to with bots or VPN users (Agle et al., 2022).

Publication Issues

Gendron et al. (2022) suggested a fear of “colonization” by AI in academic publishing (p. 2), and Vinson (2023) noted a lack of guardrails for AI’s place in publishing. Peer reviewers struggle to detect whether manuscripts were written by AI or humans (Thorp, 2023), even though the writing produced is not quite polished

(Graf & Bernardi, 2023). Just like peer review is double-blinded to reduce bias (Rubin et al., 2022), there needs to be a reduction in bias attributed to many AI tools. Very pessimistically, Gendron et al. (2022) cautioned, “the evaluation of academic knowledge...may translate into an erosion and degradation of core academic activities, where the role of human actors historically involved in the evaluation of research becomes less and less tangible and significant” (p. 2). In Zheng and Zhan’s (2023) dialogue with ChatGPT, they received coherent responses that were inaccurate but sounded realistic enough to pass detection from reviewers. Yet, in a short time, AI will continue to improve and may be able to fool almost anyone (Anderson et al., 2023; Graf & Bernardi, 2023; Hill-Yardin et al., 2023; Rahimi & Abadi, 2023). After all, GPT-4 has been shown to have completed a freshman year at Harvard quite successfully (Bodnick, 2023). Thus, Gendron et al.’s (2022) prediction of a human author’s role in decline seems plausible now more than ever. They explained,

Decline may then spread insidiously through academic communities as readers become informed of those reviews of literature, accept their conclusions, and act upon them compliantly – particularly in terms of selecting certain topics, theories or methods. Ultimately, we risk seeing the conduct of research being significantly shaped through AI and the excessive weight it gives to citations—contributing to a kind of deskilling in the author’s ability to craft meaningfully and substantively her objects of study. (Gendron et al., 2022, p. 9)

These concerns suggest AI’s significant potential impact on the future of scholarship. However, AI can assist with peer review and increase the efficiency of the process since it is a time-consuming, voluntary endeavor (Sebai, 2023). Journal editors may also use AI programs to detect whether manuscripts were generated by AI or plagiarized (Sebai, 2023).

Thorp (2023) also argued that ChatGPT is not an author, suggesting that the use of AI for writing research findings is not producing original work and is like plagiarism. However, Graf and Bernardi (2023) suggested that if ChatGPT is utilized for any form of research support, it should be listed as an author. Major publications such as *Nature* announced that AI programs cannot be authors “because they cannot take responsibility for the content and integrity of scientific papers” (Stokel-Walker, 2023, p. 620). Rahimi and Abadi (2023) added that authors have to be legal entities. As explained by Sun (2024, this volume), a creator filing for a patent must legally be a person, not an AI tool. In Hill-Yardin et al.’s (2023) analysis of ChatGPT as a research partner, its language use was considered “shallow” (p. 152). Several authors expressed concern that it might stunt innovation (Hill-Yardin et al., 2023; Lund et al., 2023). Humans have ways of bringing nuances in writing that large language models cannot yet mimic (Gottlieb et al., 2023).

In Anderson et al.’s (2023) differing viewpoints on AI and integrity in publishing, one perspective is that journals must collect data sets and analysis as part of submissions for peer review. Yet, they noted that AI-generated fake data and coding along with a manuscript written by AI is not unrealistic. The role of a journal editor is to “perform an important quality-assurance function” (Rubin et al., 2022, p. 273).

Editors should at the very least require authors to disclose the use of AI, even if AI is not listed as an author. For example, a syllabus statement on AI might require students who use AI for assignments to cite the tool, reflect on its biases, and share why and how they used it (Eaton, 2023).

Beyond ethical issues, there are legal implications for AI usage in publication as well. Some creators have sued OpenAI for copyright infringement (Ramirez, 2023). There is also potential for OpenAI to claim authorship of ideas, text, and images created by ChatGPT (or Microsoft for Bing Chat and so on), thus having the potential leverage to sue users of AI programs for taking ownership of content produced by AI. Before these issues are resolved, researchers and editors will be in a grey area in making sense of AI attribution in scholarship and creative outputs.

Benefits of AI to Ethical Research Practices

There are some positives to the advancements in AI for researchers, such as helping non-native English speakers with scientific writing (Graf & Bernardi, 2023; Lin et al., 2024, this volume). ChatGPT may also benefit the distribution of research and improved indexing for better access to new scholarship (Lund et al., 2023). Although concerns exist for faculty members who seek promotion and/or tenure based on research grants and publications abusing AI for future gain, Lund et al. (2023) indicated the potential for evaluation criteria to change because of ChatGPT. For example, faculty may be rewarded for other activities, such as the scholarship of teaching and learning, mentoring students, and other service, which are not typically valued as much at research institutions.

When considering AI's ability to imitate human subjects, Hutson (2023) suggested that this technology could be useful for pilot studies and enhancing research design at a low cost. AI could "also help with experiments that would be too impractical, unethical, or even dangerous to run with people" (Hutson, 2023, p. 122). He suggested that a model's failure to respond to a survey question, for example, may help the researcher rewrite the item. Thus, just like other technologies that have been introduced over the years, AI can be used to enhance research and writing, and it will become second nature over time, similar to the use of calculators to solve mathematics problems. As mentioned previously, AI programs may be able to make the peer review process more efficient. According to Mittelsteadt (2023), AI has three main benefits: automation, speed, and scale. It can analyze large data sets very quickly. It might also be able to detect plagiarism and even other AI-generated text (Sebai, 2023). ChatGPT and other programs can generate ideas for research projects. It can provide step-by-step instructions on how to study a phenomenon, which shows transparency.

IMPLICATIONS

What does all of this mean for research ethics? Some scholars have argued that the introduction of AI to academic research is not the end of the world. People are already familiar with AI in daily life, as AI-driven predictive text pops up when they

start writing emails and text messages (Hill-Yardin et al., 2023). Yet, ChatGPT may soon have a cost, and free access will be limited (Liebrenz et al., 2023). This could limit its application to research, or just lead to further inequality based on access to it (Liebrenz et al., 2023). Given how important academic research is to advancement in many fields, including medicine, Rahimi and Abadi (2023) insisted on “cautious and conservative consideration of ChatGPT” (p. 273).

Researchers

An optimistic perspective in Anderson et al. (2023) suggested that people have the ability to work together to overcome threats to scholarship by AI, including through transparency in its development and usage. One possible tool is Eto’s (2021) *Artificial Intelligence Human Subjects Research IRB Reviewer Checklist and Determination Decision Tree* to help IRB committee members figure out if the use of AI technology in human subjects research addresses ethical considerations (e.g., respect for persons, justice, beneficence).

Revisiting the question at the beginning of the chapter, it might be time for research with human subjects to be within a new framework for their protection. The training sources of AI cannot necessarily be trusted. It has the potential for biases toward population majorities and those who have more power (Lin et al., 2024, this volume). There is limited access to AI tools for people who are economically disadvantaged, lack the ability to use the internet, or are not able to receive even basic computer training. This is a global concern, especially when AI is dominated by Western thought and purview (Hutson, 2023). Advancements in accessing and reducing biases can be made if AI tools have a broader training base. Without such updates, there is no guarantee that human subjects are protected in research that involves AI as its basis or through its methods and approaches used. Researchers and authors must consider the role ethics play in their studies and how results are represented and communicated. There is also no way to ensure data privacy or that participants are able to read an informed consent form, especially if it is designed like a pop-up window; people are used to clicking to move on to the next window or web page.

Journal Editors and Publishers

Journal editors and publishers must realize the need to adapt to the continued and growing use of AI in research publication. At the very least, publishers must work with editors for all journals within their purview to develop an AI usage policy, whether as averse as *Nature* is or more flexible with AI-aided writing and usage. In addition, journal editors should engage with their editorial boards to discuss whether or not using AI in peer review is favorable and might speed up the process, despite concerns by Gendron et al. (2022) that AI automates peer review and removes human interaction from the process in some cases. Editors can require authors to disclose AI usage—whether or not it is listed as an author—and be transparent with readers about its role in published research. However,

journal editors and publishers need to keep an eye on legal issues that arise from the author attribution of AI-produced content and adjust their policies for AI usage accordingly.

Policymakers

Because there is so much uncertainty legally, policymakers must ensure integrity when setting standards for what is appropriate use of AI in education, research, and the workplace. An editorial in *Nature Machine Intelligence* calls for “regulation at the national and international level is necessary to ensure that technology companies take responsibility and prevent their AI tools from harming society” (p. 1055). Policymakers must seek to find ways to reduce and eventually eliminate biases from how AI programs are trained (Gottlieb et al., 2023, Hutson, 2023; Mittelsteadt, 2023).

There is also a concern that AI might “learn” data that are meant to be private, which could release information to adversary countries or share information between competing corporations (Mittelsteadt, 2023). There also need to be ways to screen AI-produced content for being generated from training by “malicious actors” (Mittelsteadt, 2023, p. 18). Policymakers must also determine how to audit AI programs and how to use AI to conduct audits of research, knowledge, and ownership of creative outputs. AI could also be used to detect cybersecurity vulnerabilities where data are stored (Mittelsteadt, 2023). The challenge for policymakers is to address evolving global legal issues, ethical considerations, rapidly improving technology, and sustainability.

CONCLUSION

The near future is uncertain and potentially turbulent with how researchers and publishers address the use of artificial intelligence in this process of creating new knowledge. These changes impact scholars, research participants, publishers, editors, policymakers, and consumers of knowledge alike. Regardless of the uncertainty, AI is now part of the world in which humans live, and the future of research ethics is directly impacted. Research stakeholders have a responsibility to adjust and adapt to AI’s existence in all aspects of scholarship.

NOTE

AI tools were not used in any way for the preparation of this chapter.

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Chapter 12

ChatGPT on Student Learning Outcomes in Higher Education: A Meta-Analysis of Early Studies

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ABSTRACT

With a focus on teaching and learning, this chapter examines the impact and implications of ChatGPT and AI technologies in higher education. By evaluating strategies and practices for preparing educators and students to effectively utilize ChatGPT and AI technology for academic and professional success, the aim is to offer policy recommendations. Guided by the pedagogical dimensions of the AI Ecological Education Policy Framework (Chan, 2023), this systematic review synthesizes the previous literature in four areas: assessments and examinations, student competencies, the AI-driven workplace, and a balanced approach to AI adoption. By identifying best practices across these areas and offering recommendations to enhance ethical and effective implementations of AI technology, this study contributes to the existing literature on AI technology-related policies in higher education. This chapter intends to assist educators and students in higher education in navigating the challenges and opportunities presented by advanced AI technologies and ChatGPT.

Keywords: AI technology, ChatGPT, higher education, pedagogy, policies, teaching and learning

INTRODUCTION

The application of artificial intelligence (AI) in higher education can be traced back to the 1960s when early computer-assisted instruction (CAI) systems were developed and utilized in universities (Dhawan & Batra, 2021). Many AI-based tools and systems, such as intelligent tutoring systems and virtual assistants, have been developed thereafter. Today, AI technology has significantly advanced and is widely adopted in many industries, bringing advantages and new potential to human life (Anyoha, 2017), among which is the ChatGPT language model.

Developed by OpenAI, ChatGPT was opened to the public in 2022. It is a “large language model” (LLM) artificial intelligence system/tool that is equipped with the potential ability to read and produce course syllabi drafts, to tutor students, to

explain terms and abstract concepts and theories, to find and fix errors or bugs in the source code of computer programs, to write various types of essays, to create consulting reports and new arts, and to provide translation services (Azaria, 2022; D'Agostino, 2023b; Mintz, 2023; University of Michigan, 2022). By functioning as a conversational agent or chatbot, it provides services for generating content while interacting and helping its users with questions in academic study, finance, journalism, publishing, business, coding, marketing, advertising, and consulting (Illinois State University, n.d.). Similar AI-generated content services include Notion, DALL-E, Jasper, YouChat, Cactus ai, and Microsoft Bing, which were developed based on OpenAI (Illinois State University, n.d.; Schroeder, 2023).

Current practices surrounding the use of language models in higher education include automated essay grading, individualized feedback/guidance on assignments, assistance with research, teaching and assessment, language translation, academic skills development, generation of documents, virtual campus tours, meeting and event planning, and assistance with the drafting of institutional policy using appropriate language (Atlas, 2023). The use of AI technology would benefit students and educators through improved efficiency and productivity both academically and professionally. However, related concerns arise, including fair evaluation of students' work and guidance in adopting AI for academic and professional purposes while emphasizing ethics and promoting equality and inclusion (D'Agostino, 2023a, 2023b; Eaton et al., 2021; Mintz, 2023; Weissman, 2023). As such, understanding the impact of AI on teaching and learning is crucial for educators, administrators, and policymakers. This study aims to explore the implications of AI technology for policy in higher education while considering the pedagogical dimensions as outlined in the AI Ecological Education Policy Framework (Chan, 2023): rethinking assessments and examinations, developing student holistic competencies/generic skills, preparing students for the AI-driven workplace, and encouraging a balanced approach to AI adoption.

LITERATURE REVIEW

Research highlights the advantages of ChatGPT for educators and students. Tlili et al. (2023) emphasize its effectiveness in explaining diverse subjects through accessible language. It can reduce intellectual effort and time for different tasks (Chrisinger, 2023), enabling personalized learning tailored to individual needs (Dhawan & Batra, 2021). By analyzing student performance data, it swiftly offers solutions for teaching improvement. For international students, the cross-geographical accessibility and time zone accommodation of AI are especially advantageous. In an efficiency-driven era, AI simplifies tasks with quick input (Else, 2023) and excels at producing sophisticated paragraphs, writing quickly and accurately, correcting errors, and providing explanations (Azaria, 2022; Mollick, 2022). Additionally, it assists language learners by generating authentic language materials (Baskara & Mukarto, 2023).

In contrast to previous concerns surrounding job displacement, present apprehensions about AI in education center on its uncertain implications. Educators

are troubled by issues such as increased surveillance, education about AI use, potential discrimination, academic integrity, creativity, authenticity detection in student work, and the balance of AI benefits and limitations (D'Agostino, 2023b; McMutire, 2022; Mitrano, 2023; Tlili et al., 2023; Weissman, 2023). Ethical aspects in publishing and promotion in academia also require attention (Eaton et al., 2021; Weissman, 2023). To transition from reactive to proactive, educators' assessment values must evolve, and commonplace technologies need enhancement, particularly for academic writing and integrity (Eaton et al., 2021). An approach to AI use that considers potential drawbacks while supporting student learning is advocated (Weissman, 2023; Warner, 2023). Concerns about ChatGPT involve cheating, accuracy, privacy, and ethical considerations (Tlili et al., 2023). Ali et al. (2023) stress accessibility, internet access, infrastructure readiness, user friendliness, privacy, and faculty support as factors influencing AI adoption in higher education. Additionally, the limitations, disadvantages, and ethics of AI technology raise further concerns among educators, students, and policymakers, as summarized in Table 1 (see Appendix A). Finally, research on AI-related teaching and learning and its implications for policies in higher education remains scarce. Therefore, by reviewing the existing literature on pedagogy, this study hopes to address this gap and assist educators and students in higher education in navigating the challenges and opportunities presented by AI technology.

THEORETICAL FRAMEWORK

The theoretical framework that guides this study is Chan's (2023) AI Ecological Education Policy Framework, which provides a holistic approach to integrating AI into higher education. The framework's four pedagogical dimensions provide a structured lens for analyzing the implications of AI in higher education:

- **Rethinking Assessments and Examinations:** Emphasizing the transformation of assessment methods considering AI's capabilities.
- **Developing Student Holistic Competencies/Generic Skills:** Highlighting the need to cultivate skills in students, enabling them to utilize AI technologies effectively and ethically.
- **Preparing Students for the AI-Driven Workplace:** Focusing on preparing students for AI-driven job markets with adaptable skills.
- **Encouraging a Balanced Approach to AI Adoption:** Advocating a balanced AI adoption in education, considering its benefits and limitations.

The pedagogical dimensions of this framework align with the objective of the study: providing a holistic perspective of AI technology in teaching and learning, facilitating comprehensive analysis from the four dimensions, and guiding the synthesis and interpretation of findings within the research scope. By organizing the analysis around these dimensions, this study intends to offer a nuanced understanding of the influence of AI and ChatGPT while acknowledging its broader implications for higher education.

METHODOLOGY

The research question that this study seeks to address is as follows:

- What are the implications of AI technology and ChatGPT for assessment practices, holistic student competencies, the AI-driven workplace, and achieving a balanced approach in higher education?

A systematic review was adopted to achieve the objective of this study. According to Petticrew and Roberts (2006), systematic reviews involve closely adhering to scientific methods to minimize bias by comprehensively identifying, appraising, and synthesizing all relevant studies, regardless of design, to address specific questions. The major literature resource databases included academic databases such as Google Scholar, ERIC, and Scopus, which focus on peer-reviewed scholarly publications from 2022 to 2023. The terms “AI technology”, “ChatGPT”, “teaching and learning”, “higher education”, “pedagogy”, and “policies” were utilized to search the titles, abstracts, and keywords provided by the authors through the three databases. After careful selection from the 40 articles that were filtered, a total of 16 articles were analyzed in this study. Selected studies were required to focus on the pedagogical aspects of AI in education, align with at least one dimension of the framework, and provide empirical insights or theoretical discussions. The data from the selected studies were systematically extracted and analyzed, and the findings from the selected studies were synthesized within the context of the pedagogical dimensions, revealing strategies, challenges, and opportunities related to AI and ChatGPT in teaching and learning in higher education.

FINDINGS

Guided by Chan’s (2023) AI Ecological Education Policy Framework, the findings of this study provide a comprehensive understanding of the impact of AI technology and ChatGPT on teaching and learning in higher education as follows:

Impact of ChatGPT and AI on Assessments

AI-driven technology provides opportunities for educators to rethink assessments and examinations when evaluating students’ learning and growth. Rudolph et al. (2023) stated that assessments should be designed to foster students’ creativity and critical thinking skills through (a) specific in-class assessments, (b) genuine assessments that are meaningful to students and can enhance their learning experiences and skills to solve real problems, (c) assessments that enable students to engage actively such as oral presentations and (d) assessments with topics or activities that interest and are valued by students. Cotton et al. (2023) highlighted the implementation of assessments that not only gauge students’ critical thinking, problem-solving, and communication skills but also underscore the importance of accurate citation and referencing within writing assignments. Additionally, they proposed a preference for

assessments that foster open-ended thinking, prioritizing traits of originality and creativity.

Ryznar (2023) and Crawford et al. (2023) suggest the adoption of (a) online multiple assessments: use multiple assessments to foster skill development, including self-regulation; platforms such as Canvas; quizzes with diverse question types; objective quizzes that offer feedback and tracking; (b) diverse final assessments: alternatives to traditional exams to curb cheating, such as Turnitin for plagiarism detection; online platforms (e.g., Canvas) with anti-plagiarism tools and offer projects, presentations, or participation; and high-tech (video proctoring) and low-tech (time limits, course design) methods. Furthermore, an updated teaching philosophy and the inclusion of varying assessment methods (i.e., group projects and hands-on activities) are recommended. Equally important, exploring efficient human–machine collaboration and attaining collaborative intelligence are also crucial for enhancing student learning outcomes (Tlili et al., 2023). Finally, educators are suggested to utilize AI-powered applications, such as Grammarly, Turnitin, and PaperRater, to detect text-generated materials as a means to encourage originality and creativity (Rudolph et al., 2023; Wang et al., 2023).

Student Competencies and AI Technology

Chan (2023) expressed concerns that the integration of AI technology into teaching and learning may affect the development of student abilities, such as creativity, empathy, collaboration, and leadership. This highlights the importance of focusing on fostering student holistic skills such as communication and critical thinking beyond their technical proficiency. Wang et al. (2023) and Limna et al. (2023) stated that AI has the potential to enhance students' learning experiences by tailoring content to their individual needs and abilities, particularly benefiting language learners and international students who are non-English speakers. AI-powered tools such as translators, writing aids, voice recognition, and language learning tools can assist these students in their studies. Moreover, AI can positively impact students' English communication skills by enriching language exposure and interaction. Additionally, the use of AI can motivate students, boost their self-confidence, and foster an interest in learning while addressing concerns related to discussion skills, understanding lengthy lectures, and managing issues arising from cultural and academic differences. However, a balance must be struck between automated guidance and nurturing students' self-directed learning abilities.

According to Almusaed (2023), the data indicate that AI technology enables the development of various student competencies through diverse learning modes and styles, including hybrid education such as “online learning,” “personalized learning,” “adaptive learning,” “interactive learning,” “learning analytics,” “educational technology,” “blended learning,” “student-centered learning,” “active learning,” “digital learning,” “virtual teaching space,” and “pedagogical interaction” (p. 20). The application of these teaching and learning modes provides students with different learning experiences and possibilities, which can benefit their overall performance and confidence. However, it is important to meticulously contemplate elements such

as infrastructure, proper teacher training, and preemptive mitigation of potential data privacy breaches and ethical issues during the system design phase. Rasul et al. (2023) and Birenbaum (2023) pointed out the significance of improving students' skill sets, such as critical thinking, problem solving, communication, teamwork, leadership, adaptability, digital literacy, cultural awareness, ethics, and professionalism, as vital for both future personal and professional achievements.

AI-Driven Workplace and Higher Education

AI technology and ChatGPT benefit students both for their academic studies at universities but also facilitate their needs at work (Almusaed et al., 2023). However, Chan and Hu (2023) argued that the societal impact of AI, particularly job replacement risks and increased recruitment demands, potentially challenging future graduates' career outcomes. According to Wang et al. (2023) and Sullivan et al. (2023), AI-related education can customize skills based on students' diverse backgrounds, enhancing their information literacy and learning efficiency through intelligent education and data analysis, which ultimately strengthens employability prospects. Additionally, AI adds value to aid international students' career goals by offering technology-related job prospects through overseas education. Future AI applications may include advanced adaptive learning, virtual reality experiences, and educational games, ensuring personalized learning, predictive analytics, and chatbot-driven learning and research. The adaptation and application of these technologies not only enhance students' academic skills but also prepare them for future careers. This also suggests that advanced technology can enhance workforce skills aligned with human-oriented goals, improve students' digital competency essential for the evolving digital economy, and generate new competencies, innovative business ideas, and technologies (Pisica et al., 2023).

Higher education institutions and educators must recognize that technological advancements are now driving and will continue propelling the progress of teaching and learning, especially online learning and e-learning. This involves integrating a variety of online software and platforms, as well as AI, Virtual Reality (VR), and Augmented Reality (AR), to effectively address students' academic needs and motivate their engagement across all academic levels. This educational transformation places a significant responsibility on educators and policymakers to remain well informed and continuously update teaching and learning methodologies. This alignment and adjustment play key roles in supporting students in meeting their current academic demands and preparing them for future career expectations (Ali et al., 2023; Almusaed et al., 2023; Baskara & Mukarto, 2023). Rasul et al. (2023) urged that incorporating AI literacy into graduate skills could improve students' employability and preparedness for dynamic industry demands in the future.

Balanced Approach to AI Adoption in Higher Education

In Cooper's (2023) study, AI technology has the potential to be an asset for educators crafting scientific curricula, assessing criteria, and examining; however,

educators should carefully assess AI-generated materials and tailor them to their specific teaching environments. The adoption of AI involves ethical concerns, including environmental impact, content moderation issues, and copyright concerns. Therefore, it is crucial that educators using ChatGPT prioritize responsible use, encourage critical thinking, and clarify expectations while also considering its value in creating educational resources and adapting them appropriately. Tlili et al. (2023) pointed out using varied assessment techniques in teaching and learning due to the influence of ChatGPT, emphasizing the importance of balancing AI innovation with human interaction.

Crawford et al. (2023) described the potential of AI and ChatGPT in supporting students' basic psychological needs of autonomy, competence, and relatedness to facilitate self-determination and encourage academic motivation and performance. This provides students with a sense of control and psychological autonomy in their writing. By requiring students to carefully construct their prompts and evaluate their results, potentially in the presence of a tutor in the form of formative feedback, ChatGPT can be used to support students and build their confidence. Chan and Hu (2023) raised a major issue related to AI is excessive dependence, which may obstruct individuals' long-term personal growth, skill development, and intellectual advancement. Therefore, Rasul et al., (2023) emphasize the need to balance academic integrity, innovation, and the cultivation of essential skills when integrating ChatGPT into higher education to ensure positive learning outcomes.

Overall, a balanced approach to AI and ChatGPT adaptation involves recognizing both benefits and limitations, embracing technology while prioritizing critical thinking and ethics, and using AI as a complementary tool rather than a sole substitute for traditional methods (Chan, 2023; Farrokhnia et al., 2023; Kooli, 2023; Limna et al., 2023).

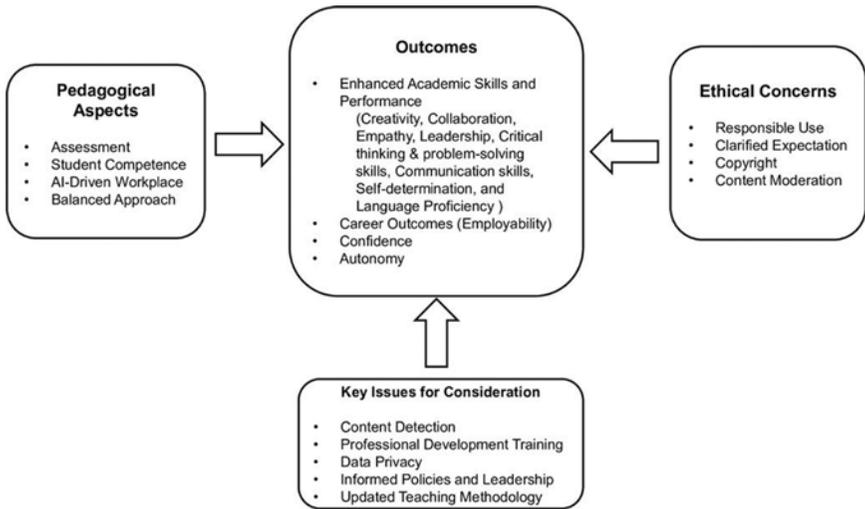
Figure 1 provides an overview of the impact of the findings regarding AI and ChatGPT's impact on teaching and learning in higher education.

DISCUSSION

AI and ChatGPT bring significant potential for teaching and learning in higher education. The findings indicate the transformative potential of AI in teaching and learning, but successful implementation demands a nuanced understanding of its impact on facets, including content and methods, process development, assessment practices, student competencies, workforce readiness, and ethical adoption (Almusaed, 2023; Chan, 2023; Firat, 2023; Pisica et al., 2023). Moreover, establishing learning-centered classrooms through updated teaching and assessment pedagogy involves student participation, diverse tools, and interpretive feedback to enhance learning progress (Birenbaum, 2023). Additionally, the integration of AI-driven technologies has significant implications for student career outcomes, indicating the importance of fostering networks, assessing skills, developing critical thinking abilities, and equipping students with the ability to apply knowledge and solve problems in real-world scenarios (Bowles & Kruger, 2023). This requires institutions to recognize the

practices and opportunities that can enhance student outcomes and to be aware of the key issues and ethical concerns that are involved.

Figure 1: AI and ChatGPT's Impact on Higher Education Teaching and Learning



Continued research on the implications of AI is crucial for ensuring student outcomes and success in the future. The findings in the AI and ChatGPT literature urge the application of strategies and resources that can benefit policies in educators' practice and development, administrative functions, student support, and equity initiatives: (a) Rethink the design of curriculum to engage students in instruction and expectations (D'Agostino, 2023b) and reevaluate course design, enhancing writing experiences (Warner, 2023; Weissman, 2023) while emphasizing authentic assessments and student ownership of learning (McMutire, 2022). (b) Promote academic integrity through policy on syllabi, diverse tasks, and detection software while encouraging responsible and ethical technology use for active learning, skill demonstration, and critical thinking (Eaton et al., 2021; Illinois State University, n.d.; Mitrano, 2023; Weissman, 2023). (c) Detect AI-generated writing using software, i.e., GPTZero, Crossref, Turnitin, and OpenAI's text classifier. Close attention should be given to discrepancies in writing style, proper citations, plagiarism, content enhancement, and copyright (D'Agostino, 2023a; Chechitelli, 2023; Kirchner et al., 2023). (d) Engage students in using AI technologies, facilitate discussion with the results and encourage faculty to incorporate active learning techniques, ensuring that students are proficient in the proper use of technology to develop competencies that meet the evolving demands of the job market. Utilize AI tools to support the digital literacy of marginalized students (McMutire, 2022; D'Agostino, 2023b), and (e) Equity and inclusion considerations. McMutire (2022) and D'Agostino (2023b) emphasize teaching students the critical use of AI technology, understanding its limitations and biases. Remaining mindful of

potential biases in assessing AI-assisted work and considering challenges faced by students with disabilities while being aware of concerns about fairness and potential false positives (D'Agostino, 2023a). In research, AI adoption might exacerbate inequalities, impacting fields with varying access to AI resources (Chrisinger, 2023). Additionally, balancing access and addressing disparities is essential for equitable AI integration in education.

Comprehending the role of AI technology in teaching and learning at the higher education level requires policies to prioritize updated pedagogies and ethics and address related emerging issues. This, in turn, enhances students' learning outcomes in the era of advanced technology.

CONCLUSION

This study provides a systematic review and analysis of the impact and implications of AI technology and ChatGPT in higher education. By synthesizing the previous literature and exploring pedagogical dimensions through the AI Ecological Education Policy Framework, this study adds insights to inform policy recommendations for effectively integrating AI in higher education and an updated pedagogy in teaching and learning.

As revealed, the need for AI to be adopted transparently and fairly is crucial, especially when there is a lack of research, strategies, and regulations that address the concerns of educators and students (Chrisinger, 2023). Higher education institutions are urged to take a proactive approach, offer support to stakeholders, and address the diverse challenges posed by AI in the pedagogical, governance, and operational dimensions (Chan, 2023; Owoc et al., 2021). Instead of enforcing bans or restrictions on AI and ChatGPT, institutions should foster an environment that motivates students to embrace and take advantage of AI technology for exploration and future opportunities while still maintaining academic honesty (Mitrano, 2023; Schroeder, 2023). Conversation about AI in education should center on nurturing values and providing students with resources that enhance their learning experience and long-term career benefits, similar to how Google and Wikipedia contribute to contemporary education.

Through thorough research, deliberate policy formulation, and the development of meaningful pedagogy, educators and students can effectively navigate the opportunities and challenges presented by advanced technology, nurturing greater academic and professional outcomes.

LIMITATIONS

This study is limited by its small sample size. Future research expanding the literature pool to include diverse academic disciplines, countries, research topics, and time frames can provide insights into AI integration in higher education (see Appendix B). Additionally, involving a more varied range of studies from the perspectives of students, faculty, and staff can contribute to a more comprehensive understanding of the implications of AI integration.

NOTE

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Appendix A

Table 1: Advantages, Challenges, and Limitations of ChatGPT in Higher Education

ChatGPT	Summary
Advantages & Benefits	<ul style="list-style-type: none"> • Thorough understanding of diverse subjects using accessible language • Reduced intellectual labor and time consumption for students and educators • Personalized learning with customized instruction and services • Data collection and analysis for quick teaching and learning improvement • Enhanced academic and financial potential for international students • Quick and efficient generation of model answers and responses • Creation of paragraphs in various academic disciplines • Fast and accurate writing, saving time and resources • User corrections and additional details in responses • Explanation provision upon user request • Support for language learners through authentic language materials • Assistance in research and analysis • (Azaria, 2022; Baskara & Mukarto, 2023; Chan & Hu, 2023; Chrisinger, 2023; Dhawan & Batra, 2021; Else, 2023; Tlili et al., 2023)
Challenges & Concerns	<ul style="list-style-type: none"> • Uncertainty about the direction of AI technology in education • Concerns about increased surveillance of students and discrimination • Challenges related to academic integrity, plagiarism, critical thinking, and creativity • Ethical issues in academia (i.e., publishing, hiring practices) • Need for educators to shift from reactive to proactive approaches • Advancement of technologies for academic writing and honesty • Awareness of potential drawbacks and responsible use

ChatGPT	Summary
	<ul style="list-style-type: none"> • Ethical concerns (i.e., plagiarism promotion, reduced critical thinking) • Trustworthiness of ChatGPT's outputs and privacy concerns • Factors affecting AI adoption (i.e., accessibility and internet connectivity) • Extended virtual interactions may lead to addiction, social isolation, reduced empathy and motivation, potential negative impacts on communication and traditional teaching methods. • Concerns on career prospects (i.e., job replacement) • (Ali et al., 2023; Chan & Hu, 2023; D'Agostino, 2023b; Eaton et al., 2021; McMutire, 2022; Mitrano, 2023; Pisica et al., 2023; Tlili et al., 2023; Warner, 2023; Weissman, 2023)
Limitations	<ul style="list-style-type: none"> • Unreliable information on topics with few citations • Inability to use idioms and alter words intelligently • Lack of creativity and accuracy due to information obtained from the internet • Generation of inaccurate or false factual references • Incapability to cite sources correctly and accurately • Diminished response quality after several paragraphs • Lack of ethical considerations, leading to biased (i.e., favoring certain numbers in mathematics, or if data obtained is biased) or inaccurate content • Inability to assess source quality and trustworthiness • Occasional logical errors and incoherent arrangement of claims • Presence of grammatical errors related to adjectives and adverbs • Inability to respond to complex questions (i.e., intricate math problems) or personal inquiries (i.e., when seeking human interaction). • Limited strategic, creative, and analytical capabilities compared to humans • Performance level of grade C to B- in writing and academia • Unawareness of its own knowledge limitations • Incompetence in tasks requiring human expertise (i.e., high-level decision-making in marketing communication)

ChatGPT	Summary
Limitations	<ul style="list-style-type: none"> • Lack of understanding of implications and connections in new research trends for presentations or speeches • Inability to deliver impactful speeches, lacking the charisma and emotional connection of a human speaker • Incapacity to replicate a writer's storytelling, interviewing expertise, and cultural knowledge for original content creation • Production of content with factual errors, reasoning mistakes, or offensive material, posing reputation risks for institutions in terms of equity, diversity, and inclusion (Almusaed et al., 2023; Azaria, 2022; Eaton et al., 2021; Grobe, 2023; Mintz, 2023).

Appendix B

Table 2: Research Topics and Academic Disciplines by Country of Affiliation in 2022-2023

Country of Affiliation	Academic Discipline	Research Topic
Romania	Marketing Management International Business and Economics	Pros and cons of AI
Hong Kong, China	Various disciplines	Students' voices on AI: perceptions, benefits, and challenges
Australia	Diverse disciplines in Australia, New Zealand, the United States, and the United Kingdom	Academic integrity, concerns and opportunities for innovative Assessment design
Australia	business	Benefits, challenges, and future research directions
Turkey	Various disciplines in Turkey, Sweden, Canada and Australia	Perceptions of scholars and students

Country of Affiliation	Academic Discipline	Research Topic
Thailand	Various disciplines	Perceptions of educators and students on the use of ChatGPT in education in the digital era.
Netherland	Education, educational technology	ChatGPT's strength, weakness, opportunities, and threats in education
Hong Kong, China	Educational policy	Teaching and learning
Canada	Management	Ethical implications and solutions
Australia	Science education	Science pedagogy
Australia	Leadership in education	Ethical application: assessment, academic integrity
The United Kingdom	Research, biological and marine sciences	Academic integrity
Switzerland	Education	Challenges of AI and ChatGPT to education
China, Turkey, USA, Australia	Smart learning, distance education, learning science	Concerns of using ChatGPT in education
Singapore	Educational research	Assessments
Bangladesh, Japan	Science, technology, and engineering	Education and research: opportunities, threats, and strategies

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Chapter 13

Rethinking Assessment and Feedback: Adapting Evaluation Methods for the Age of Artificial Intelligence (AI)

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ABSTRACT

Artificial Intelligence (AI) is rapidly transforming the world of higher education, and faculty members play a critical role in enhancing student learning through informed feedback. This chapter explores four key areas related to AI and assessment: 1. The urgency and implications of adopting AI proactively in higher education. 2. Writing comprehensive and adaptable policies to mitigate academic and ethical dilemmas stemming from AI. 3. Reassessing traditional evaluation methods, highlighting AI's potential to personalize learning and support the needs of all students. 4. Developing a framework offering recommendations on how to enhance the positive effects and mitigate the negative effects of AI on assessment and feedback when reviewing student work. By thoughtfully and effectively integrating AI into assessment and feedback, university faculty can harness the technology's potential to improve the educational experience while remaining vigilant against potential pitfalls.

Keywords: Assessment, AI integration, ethical dilemmas, evaluation techniques, faculty, feedback, higher education, neurodiversity

INTRODUCTION

Artificial Intelligence (AI) is revolutionizing the higher education sector, particularly in areas of assessment and feedback. The capability of AI tools to automate tasks, such as grading assignments and data analytics, presents the real possibility of reallocating faculty time toward more creative and strategic teaching activities (Abdous, 2023). However, with innovation comes challenges, such as potential misuse of AI for cheating or its inability to match the personalized feedback given by human educators (Hoffman, 2023). This chapter explores the implications of integrating AI in college and university settings. It balances the undeniable benefits of AI with the potential pitfalls and proposes strategies for its effective adoption. The chapter is structured as follows:

1. Higher education institutions should proactively embrace AI for teaching and learning or risk falling behind. Reactive institutions may face challenges such as

outdated curricula, a lack of skilled faculty, and students who are unprepared for the AI-driven workforce.

2. To address the academic integrity and ethical concerns arising from the use of AI in education, institutions must implement robust and revisable policies. These policies should be developed in collaboration with stakeholders, including students, faculty, and administrators.
3. The far-reaching implications of AI for teaching and learning necessitate a critical examination of evaluation methods for assessment and feedback. Traditional methods may no longer be adequate for assessing students' learning in an AI-enabled world.
4. A framework is needed to enhance the positive effects and mitigate the negative effects of AI on assessment and feedback when reviewing student work. This framework should also address maximizing the additive effects of increased responsiveness to different learning styles and to neurodiverse students. The framework should be based on research and best practices and should be flexible enough to adapt to the evolving landscape of AI in education.

PROACTIVE STANCE ON AI IN HIGHER EDUCATION SETTINGS

The growing presence of AI across many fields and its increased use in the workplace underscore its emerging significance in higher education (Shiohira, 2021). Tools such as Grammarly and plagiarism detectors have long aided academia. However, with the rapid evolution and surge of academic prominence of AI, highlighted by systems such as ChatGPT and Bard, its role in higher education is intensely debated (Fuchs, 2023). Colleges and universities now face a pivotal choice: adopt a proactive or reactive stance? Being reactive risks missed opportunities for enhancing student learning in needed skill sets and the prospect of falling behind in educational advancements. Conversely, a proactive strategy, particularly when focused on enriching learning experiences, can position institutions as pioneers of educational innovation. Some possible benefits of incorporating AI technologies in college classes are outlined below.

Table 1: Benefits of AI for Higher Education

Benefit	Explanation
Personalized Feedback	Tailored performance analysis paves the way for individualized feedback and study paths, promoting superior learning outcomes.
Real-time Feedback & Faculty Engagement	Immediate AI feedback allows students to address errors quickly. Automating certain grading tasks lets instructors dedicate more time to innovative instruction and individual student interaction.

Benefit	Explanation
Data-Driven Instruction	AI-driven data analytics enable faculty to refine their teaching strategies based on student performance patterns.
Assistive Technologies	AI tools can provide significant advantages for students with disabilities, potentially bridging learning disparities.
Scalability & Efficiency	AI offers a solution for delivering personalized feedback in large enrollment courses.
Objective Assessment	AI ensures evaluations based on pre-set criteria, ensuring consistent and unbiased grading.
Continuous Improvement	Over time, AI tools refine their feedback, benefiting both educators and students (Cardona, Rodriquez, & Ishmael, 2023).

While there are clear advantages to embracing AI in higher education settings, integrating AI does present some challenges. Concerns over data privacy, potential over-reliance on technology, and the loss of human nuance are valid (Fourtane, 2022). These worries highlight the pitfalls of a purely reactive approach, either in conversation or via actions when institutions scramble to address unforeseen problems only after they have manifested. However, it is important to note that these concerns, while valid, can be mitigated when the integration of AI is approached with foresight. For instance, a well-thought-out AI implementation strategy can safeguard data and ensure that technology does not overshadow the human element in education. It should be viewed simply as a tool to highlight teaching and learning. Additionally, discussions about AI in academia should not frame it as faculty vs. AI. Rather, it should be viewed as a collaborative effort where AI serves as an ally to human educators rather than a rival (Times Higher Education, 2023). The union of AI's analytical prowess with human insight has the potential to offer a comprehensive learning experience for students.

For post-secondary institutions, adopting a proactive stance toward AI is a necessity. Institutions that lead in AI's adoption effectively set themselves apart in offering top-tier educational experiences. This forward-thinking mindset prepares institutions and their students for success in an ever-evolving, digitized world.

IMPORTANCE OF EFFECTIVE POLICIES

With the launch of ChatGPT on November 30, 2022 (Marr, 2023), and the subsequent introduction of similar AI programs, colleges and universities are forced to discuss how to respond to the rapid advancements of AI in the academic setting. The main concern centers on plagiarism and cheating (Bailey, 2022). Institutions that

are more proactive will take time to discuss, learn, and develop workable policies to address fears over academic integrity.

When considering traditional assessments, such as college essays or online discussion boards, AI tools can easily generate text sourced from various references without citation. If students utilize this information out of context, this blurs the distinction between originality and plagiarism. Such misrepresentation not only violates academic ethics but also diminishes the true essence of learning, potentially stifling critical thinking and genuine ideas. There is also concern about cheating on assessments, as AI systems can readily provide answers to questions. Although challenges around academic integrity have always existed in higher education, the advent of AI has spotlighted a new dimension of these concerns. Like any tool, AI has its pros and cons. As such, it is essential for educational institutions to address its implications head-on.

Amidst heightened concerns about academic integrity in the age of AI, it is important to return to a foundational question: What is the purpose of education? Central to this discourse is the imperative to instill, address, and maintain ethical standards for both learners and the wider educational system (Torres & Mayo, 2023). Such discussions should also engage learners and address academic integrity beyond just AI-related contexts, as academic misconduct can manifest in various forms.

Once college and university communities reach a consensus on the goal of education and the ethical standards to uphold, they can begin to revisit, revise, or develop policies related to academic integrity and AI. These policies should reflect the community's philosophy and stance on AI within higher education and address specific academic integrity concerns. It is essential that these policies are comprehensive and adaptable, keeping pace with the dynamic and changing landscape of AI. Below is a breakdown of the key elements that such policies should entail.

Table 2: Towards an AI-Informed Approach to Academic Integrity Policies

Policy Area	Explanation
Definition & Scope	<ul style="list-style-type: none"> - Clearly, define what constitutes AI and provide examples of commonly used AI tools. - Outline the policy's scope and specify the permissible and restricted uses of AI in assignments, research, and classroom activities.
Purpose of Education	<ul style="list-style-type: none"> - Reiterate the institution's commitment to fostering original thought, critical thinking, and genuine learning. - Emphasize that the purpose of the policy is to prevent cheating and ensure a meaningful educational experience.

Policy Area	Explanation
Acceptable vs. Unacceptable Use of AI	<ul style="list-style-type: none"> - List specific scenarios where AI can be applied, such as assisting with data visualization in college research or improving literature review efficiency in academic writing, in addition to applications like data analysis and simulations. - List prohibited uses of AI, such as auto-generating essays or solving tasks without comprehension.
Training & Awareness	<ul style="list-style-type: none"> - Emphasize the importance of training faculty, staff, and students about the ethical implications and potential pitfalls of AI. - Conduct regular workshops, seminars, or classes to keep the academic community updated.
Equity & Access	<ul style="list-style-type: none"> - Address disparities in access to AI tools, ensuring that no student is disadvantaged. - Consider offering institution-provided AI resources to ensure everyone has equal footing (D'Agostino, 2023).
Data Privacy & Protection	<ul style="list-style-type: none"> - Detail how AI tools, especially those provided by third parties, handle student data. - Mandate stringent data protection measures and ensure compliance with privacy regulations.
Addressing Bias	<ul style="list-style-type: none"> - Recognize and acknowledge that AI tools have the potential to reinforce existing biases. - Offer guidance on identifying, addressing, and reporting biases in AI-generated content
Procedure for Violations	<ul style="list-style-type: none"> - Establish a clear process for reporting suspected misuse of AI. - Outline potential consequences for violations, ensuring they are consistent and proportionate.
Review & Revision	<ul style="list-style-type: none"> - Recognize that AI and technology, in general, evolve rapidly. - Commit to a periodic review of the policy, inviting feedback from stakeholders, and ensuring it remains current.
Resources & Support	<ul style="list-style-type: none"> - Provide faculty and learners with a variety of resources, such as tutorials, expert consultations, online courses, books and articles, software tools, simulations, and hands-on workshops, to help them understand the complexities and subtleties of AI.

Policy Area	Explanation
Collaborate with AI Providers	<ul style="list-style-type: none"> - Ensure that there is a support system in place for those who have questions or need guidance on using AI ethically (Chan, 2023). - Foster relationships with AI tool providers to understand capabilities, limitations, and future developments. - Seek opportunities to customize AI tools to better align with academic needs and values.

By incorporating these elements, academic institutions could strike a balance between leveraging the benefits of AI and upholding the principles of academic integrity. It is not merely about setting boundaries but nurturing an environment where technology enhances, rather than diminishes, the value of education.

RE-EVALUATING ASSESSMENT & FEEDBACK IN THE AGE OF AI

As the world changes, colleges and universities must adapt or risk falling behind. AI is rapidly transforming both the workplace and daily life, and higher education institutions stand at a juncture. They can be innovative in how they approach and utilize AI or risk falling behind. We saw this play out with online learning. Early adopters thrived, while skeptics and detractors struggled. Today, online learning is an essential pillar of education, which was beneficial during the COVID-19 pandemic. As AI has begun to weave into the fabric of higher education, the following question arises again: Will colleges and universities pave the way forward or play catch-up? One of the most important areas where they can be proactive is in reconsidering evaluation methods for assessment and feedback, given the far-reaching implications of AI for teaching and learning (Swiecki et al., 2022).

Traditional methods of assessment and feedback have strengths and weaknesses. On the one hand, they can be standardized and objective, which makes them useful for comparing learners' performance and identifying areas for improvement. On the other hand, they can be limited in their ability to capture the full range of students' learning and development. AI offers new possibilities for assessment and feedback that can overcome some of the limitations of traditional methods. For example, AI-powered tools can instantly provide personalized feedback to students on their writing, coding, and other skills. AI can also be used to create more authentic and engaging assessments, such as simulations and games, based on the strengths and weaknesses of individual learners. In addition, AI can be used as a partner to improve traditional methods of assessment and feedback. For example, AI can be used to automate the grading of essays and exams, freeing up time for faculty to provide more personalized feedback or developing innovative teaching strategies. AI can also be used to develop new assessment formats that are more aligned with

the way students learn and apply their knowledge (Balla, 2023). At its genesis, the reevaluation of assessments and feedback in the age of AI should start with focusing on using AI to enhance the strengths of traditional methods, while also addressing their limitations. By working together, AI and human educators can create a more effective and equitable system of assessment and feedback for all students.

Once administrators and instructors establish frameworks for AI in assessment and feedback and as their expertise grows, we can expect a consistent evaluation of assessment methods in higher education. AI will continue to revolutionize education by unlocking opportunities for personalized learning, advanced data analytics, and interactive learning environments. AI can design learning experiences to be tailored to student strengths, weaknesses, interests, and pace. Through advanced data analytics, AI can quickly produce reports that highlight areas where learners face challenges, their study habits, and other relevant data points. This information can provide faculty with deeper insight into student needs, enabling them to refine their feedback and teaching methods accordingly (Spector, 2023). Furthermore, AI's capability to craft virtual labs, simulations, and virtual reality experiences tailored to students' needs enriches the teaching resources available to professors.

Another reason why continuous evaluation of assessment and feedback in college and university courses should occur is because AI can support students with learning differences, such as by providing personalized feedback and adapting learning materials to individual needs. For example, a student with dyslexia might benefit from text with enhanced font and background colors (Readability, 2022), while a student with ADHD could receive content interspersed with interactive activities to maintain focus. For those facing processing delays, AI could moderate the pace of lessons or tests, ensuring comprehension without time pressures (Clark, n.d.).

Predictive analytics also enable AI to identify potential challenges for students with learning disabilities and proactively offer resources or alternate assessments. For instance, students on the Autism Spectrum might find certain abstract themes or figurative language challenging. AI could modify questions to resonate with these students' cognitive processing or rephrase abstract concepts into tangible ideas. The transformative power of AI would extend to supporting learners with sensory impairments. For example, cutting-edge speech recognition can transcribe lectures in real time for the hearing impaired, while those with vision impairments may benefit from AI-driven descriptive audio for visual content or advanced text-to-speech features for an enriched learning experience (Innocaption, n.d.).

Leveraging AI in higher education settings does not have to detract from essential learning objectives set by educators and institutions. Rather, if utilized effectively, AI could enhance learning outcomes, paving a unique path for students to achieve and demonstrate college-level proficiency. While there is value in traditional assessment methods, the evolving landscape necessitates change. With the rising influence of AI, the imperative is clear. It is time to reassess and continuously update traditional assessment methods in higher education. However, amidst this innovation, one element remains constant. The human voice is central to teaching, learning, assessment, and feedback processes. In this context, AI is not a replacement but

rather a tool that strengthens the influence of faculty members in assessment and feedback.

A FRAMEWORK FOR AI-DRIVEN ASSESSMENT & FEEDBACK

Integrating AI into higher education assessments and feedback is a complex but necessary endeavor. Before deep learning into this integration, educational stakeholders, ranging from administrators and professors to instructional designers, must root their understanding in foundational educational values. This involves reaffirming core academic objectives, formulating dynamic academic integrity policies that address AI’s nuances, and fostering a shared vision of the role of AI both institutionally and within individual classrooms. Establishing this foundation mandates continuous dialogue and comprehensive training about the implications and applications of AI.

The distinct characteristics of each higher education institution dictate that there is no one-size-fits-all approach. Indeed, colleges and universities must craft systems that resonate with their unique ethos and cater to their student population’s diverse needs. Nevertheless, there exists a common thread that can guide these institutions: a generalized framework. This suggested framework, detailed below, offers a structured approach, covering critical aspects such as research and committee structure, core AI principles, benefits and challenges of AI, considerations for neurodiversity, recommendations for seamless implementation, and strategies for periodic evaluation and review.

Table 3: Key Considerations for Evaluating Feedback and Assessment in the Age of AI

Committee Establishment & Research	
Committee Establishment	A dedicated committee should be formed to monitor AI developments, ensuring representation from all major academic and administrative departments. This committee should establish a clear protocol for reporting findings and recommending implementations.
Research	A comprehensive overview of AI’s role in higher education assessment is essential for all learners, placing special emphasis on its impact on diverse learning styles and neurodiverse students.
Evaluation and Implementation	The committee needs to critically evaluate AI’s overarching impact and its specific relevance to the institution. It is important to address emerging trends, embracing the technology’s benefits, and mitigating its shortcomings.

Committee Establishment & Research

Framework Principles

Diversity, Equity, & Inclusion	Every measure should be taken to ensure that all students, irrespective of their background or learning needs, are provided with equal learning opportunities.
Transparency	All stakeholders, from faculty to students, need to be educated and informed about how AI-driven assessments operate.
Validity & Reliability	The AI systems employed should produce results that are not only accurate but also consistent.
Ethical & Privacy Concerns	Prioritizing data security is non-negotiable. It is equally important to address ethical considerations. Regular training sessions should be held to educate stakeholders about ethical implications of AI systems (Chan, 2023).
Student Voice	It is essential to include the perspectives, experiences, and concerns of learners in the decision-making process.

Positive Aspects of AI

Feedback	AI systems can offer students immediate, consistent, and personalized feedback, which is benchmarked against predetermined course outcomes and individual learning profiles.
Objective Grading	By using AI, grading can be made more objective, potentially minimizing human biases and errors.
Adaptive Learning Paths	AI can customize learning materials and assessments based on individual student performance and preferences, ensuring a more tailored learning experience.
Diversity of Assessments	To cater to individual learning needs, a variety of assessment methods can be deployed using AI.
Faculty Training	It is essential for faculty to receive thorough training on AI systems. Faculty need to understand how to interpret analytics and improve both feedback mechanisms and instructional methodologies.

Negative Aspects of AI

Reducing Bias	It is important to recognize and rectify inherent biases in AI algorithms.
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Committee Establishment & Research

Transparency & Decision Making	The decision-making processes involving AI should be transparent and comprehensible for all stakeholders.
Human Oversight	Machines are fallible. Therefore, a human touch is essential to verify and validate AI decisions.
Continuous Improvement	Regularly update AI models and policies to ensure their accuracy, fairness, and relevance.
Faculty Training	Faculty should be made aware of the potential pitfalls and drawbacks of AI in assessment, along with strategies to mitigate these issues.

Addressing Neurodiversity

Personalization	AI can be expertly calibrated to tweak assessment methodologies in line with each student's unique learning requirements.
Accessibility	All tools and platforms should be user-friendly and accessible to all learners, including those with disabilities.
Cultural Sensitivity	AI must be fine-tuned to ensure it does not inadvertently penalize students due to cultural communication gradations.
Flexibility	Offering diverse formats and scheduling options for assessments can accommodate varied learner needs.

Recommendations for Effective Implementation

Student Voice	Students' feedback and perspectives should be at the forefront of any AI-related initiative.
Student Onboarding	Students' concerns should be addressed proactively, and they should be trained to use AI tools effectively.
Faculty Training	Regular training and professional development opportunities are essential for faculty to utilize AI tools effectively.
Interactive Feedback Loop	Establish a feedback mechanism involving educators, students, administrators, and other stakeholders to continually refine the AI-driven system.
Pilot Testing	Before large-scale implementation, pilot testing in smaller settings can help identify potential issues and areas for improvement.

Committee Establishment & Research

Evaluation and Review

Performance Metrics	Establish metrics to measure the success and effectiveness of AI-driven systems based on academic outcomes and faculty input.
Ethical Considerations	On a regular basis, the ethical ramifications of AI tools should be reviewed and addressed.
Feedback Collection	Clear protocols should be in place to gather and consider feedback from faculty, students, and other stakeholders (Chan, 2023).
Permanent Committee	The committee should continually offer improvements for AI in assessment based on performance metrics, ethical considerations, and collective feedback.

CONCLUSION

As we have explored, the rapid evolution of AI is poised to transform not only the workplace but also the broader societal landscape. To remain relevant, learners must develop the capabilities required to thrive in this AI-driven world. Higher education institutions, therefore, have a difficult task to navigate. Colleges and universities can either be proactive in embracing the positive aspects of AI in teaching and learning, including assessment and feedback, or be caught in its undertow. A proactive stance towards AI adoption in higher education is not simply about incorporating the technology but doing so thoughtfully. Central to this task is instituting robust and revisable academic integrity policies that adapt over time. The potential of AI to facilitate or even unintentionally promote plagiarism and cheating necessitates these policies. Yet, in an era where technology is continuously evolving, these policies cannot be static. They need regular reviews and timely revisions.

Furthermore, the integration of AI into educational practices should not be misconstrued as a contest of technology versus academia. Instead, it should be perceived as a balanced alliance of technology with human intelligence. Traditional assessment methodologies need introspection, not just because AI is here, but because AI can augment them. This collaboration between human touch and the power of AI can lead to enhanced feedback mechanisms, which can be especially beneficial for all learners, including those who are neurodiverse. By being proactive and embracing AI, educators can dive deeper into data analytics and free up valuable time, paving the way for more innovative and inclusive teaching methods.

To round it off, while there is no universal blueprint for the adoption of AI in higher education, institutions must develop a structured framework. This framework should summarize unique institutional needs but also draw upon core principles

such as in-depth research, an understanding of AI's strengths and limitations, and considerations for neurodiversity. It is not just about implementation but also about continuous evaluation, ensuring that the institution remains at the cutting edge of both technology and pedagogical excellence.

In conclusion, the proactive adoption of AI in higher education is essential for preparing learners for the AI-driven world ahead. By thoughtfully integrating AI into teaching and learning, including assessment and feedback, institutions can enhance academic integrity, improve feedback mechanisms, and foster more innovative and inclusive teaching methods.

NOTE

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Chapter 14

Artificial Intelligence in Undergraduate Assignments: An Exploration of the Effectiveness and Ethics of ChatGPT in Academic Work

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ABSTRACT

Since its public release in 2023, ChatGPT has sent ripples of excitement and fear throughout the internet and halls of higher education. The prospect of ChatGPT, and AI in general, revolutionizing education has sparked fervent discussions in classrooms, scholarly journals, and conferences (Parker et al., 2023). While the urge to ban ChatGPT outright in college classrooms is tempting, educational institutions must conduct research before enacting such sweeping and consequential changes. This mixed-methods study adds to this burgeoning, imperative area of research. In this study, undergraduate students completed an existing pre-set assignment and undertook a subsequent survey. Graduate Teaching Assistants (GTAs) graded the work blindly and then attempted to differentiate work completed by students from ChatGPT-generated work. Results show that ChatGPT-generated responses consistently outperformed student grades (by an average of 13.5%) in this near first-of-its-kind study, indicating its potential impact on academic tasks. GTAs correctly identified 50% of ChatGPT AI-generated assignments, whereas Turnitin's new AI-detecting feature demonstrated 100% detection accuracy. Turnitin evaluated all student assignments as a routine aspect of class assessment and identified 16 out of 118 submissions that contained more than 20% AI-generated content. The investigation of the prevalent use of AI among undergraduate students revealed higher-than-researchers-expected usage; 65% of the surveyed students self-reported using ChatGPT to perform academic tasks across all their classes. The ethical perceptions of AI in academia amongst these students were uncertain, suggesting the need for additional conversation and exploration. Despite some limitations, this research lays an early yet solid foundation for future studies to examine the use and impact of ChatGPT in higher education assessment practices and in schools' codes of conduct and plagiarism policies.

Keywords: AI detection, Artificial Intelligence (AI), ChatGPT, Effectiveness of AI, Ethical Perceptions, Higher Education, Prevalence of AI usage

INTRODUCTION

When Arthur C. Clarke (1962) wrote, “Any sufficiently advanced technology is indistinguishable from magic” (p.39), he may have been envisioning a future set in the next century, where a new tool, known as ChatGPT, becomes so advanced that it does in fact appear to be magical. This decade’s new Pandora’s box is posed to bring towards Clark’s proclamation to fruition. ChatGPT is poised to bridge the gap between human and machine communication while presenting a tantalizing glimpse into the boundless possibilities that lay ahead in the realm of artificial intelligence (AI).

Since its public release in 2023, ChatGPT has sent ripples of excitement and fear throughout the internet and halls of higher education. The prospect of ChatGPT artificial intelligence (AI) revolutionizing education sparked fervent discussions in classrooms, scholarly journals, and conferences (Parker et al., 2023). Its potential implications for education have created chaos and havoc, leading to emergency faculty meetings across campuses globally (Young, 2023). Educators and administrators found themselves confronted with profound questions such as the following: How will this AI impact individual classrooms? Should its use be embraced or restricted? Regardless of the individual school’s or faculty’s opinions, ChatGPT is here; students are using it. Now that this knowledge is known, the broader question remains: how does education adapt to this new “magic?”

While the urge to comprehensively ban the use of ChatGPT in college classrooms is tempting, schools must conduct or become familiar with timely research before making such sweeping and consequential changes (Ubel, 2002). Investigation has now become paramount. Thorough research must examine the efficacy of ChatGPT as an educational tool within classrooms and for assignments, thus delving into the ethical considerations of AI implementation. Moreover, understanding how higher education can adapt to an AI-driven world has become an urgent and pivotal aspect of this conversation. Commencing the exploration of ChatGPT’s effectiveness, this chapter addresses one of the most pressing concerns among higher education faculty—assignments. ChatGPT’s potential impact can be illuminated by comparing AI performance in ten diverse classroom assignments to that of human students. This study explored the perspectives of preservice students, who represent the potential use of ChatGPT for studying and assignments.

This study utilized a mixed-methods approach (Creswell and Clark, 2017) to comprehensively explore the effectiveness of ChatGPT in higher education. Through qualitative and quantitative analyses, this research provides rich insights from the perspective of higher education instructors and undergraduate students. The significance of this exploration lies in gaining a deeper understanding of how ChatGPT can supplement or challenge traditional assessment practices. Furthermore, this study explores the ethical considerations surrounding the use of AI in education and its potential impact on teaching and learning experience. By elucidating these key discussions, this chapter contributes to the broader scholarship discourse on AI’s presence in higher education, lays the groundwork for future research, and provides insight for decision-making in the domain of educational technology.

LITERATURE REVIEW

The emergence of ChatGPT in 2023 was a pivotal development, attracting widespread attention for its potential to transform the educational landscape. Its applicability spans all levels of higher education, encompassing undergraduate and graduate students, as well as academic staff, as noted by Parker et al. (2024a, 2024b). However, despite the burgeoning interest and enthusiasm surrounding this technology, the formal research literature on its application in education remains limited. Thus, this literature review thoroughly explores sources from other areas of AI usage research. This review endeavors to construct a coherent and insightful overview that illuminates the multifaceted implications of ChatGPT for education.

Evolution of AI and ChatGPT

Almost instantly, ChatGPT revolutionized human-computer interactions by generating detailed responses that closely resemble human conversations (Sok & Heng, 2023; Xiao et al., 2023). Its quick evolution has been noteworthy. Beginning with GPT-1 in June 2018, comprising 117 million parameters, the subsequent releases of GPT-2 in February 2019 (with 1.5 billion parameters) and GPT-3 in June 2020 (with a staggering 175 billion parameters) showcased AI's capacity for generating increasingly sophisticated text. A significant stride came with GPT-3.5 in March 2022, which, despite sharing the parameter count with GPT-3, exhibited enhanced efficiency through streamlined features (Chatterjee & Dethlefs, 2023). ChatGPT, powered by GPT-3.5, emerged as a groundbreaking achievement and enabled direct and engaging conversations with AI (Mollman, 2022). Subsequent releases, such as GPT-4 and the forthcoming GPT-5, continue to underscore the dynamic evolution of AI technology (Terwiesch, 2023).

While ChatGPT has captured the public's attention, it was not the original tool used to assist with educational tasks. Before the advent of ChatGPT, educational tools such as QuillBot, Duolingo, and offerings from Carnegie Learning had integrated artificial intelligence into their functionalities, often unbeknownst to their users. However, with the significant update and public interest in ChatGPT in 2023, the landscape has seen an influx of new AI offerings, such as Google Bard, Claude 2, and Grok, which have potential applications in higher educational settings. Despite the array of available AI tools, this chapter focuses on ChatGPT and its academic relevance.

The Role of AI in Higher Education

Only a small percentage of universities have established ChatGPT-related policies, with varying stances on embracing or restricting its use (Xiao et al., 2023). Although formal research on ChatGPT's role in education is still in its infancy, additional research is necessary to address the practical and ethical issues surrounding its use in education as more colleges work to establish their own policies. This software's application spans various education topics, including automated essay scoring, personalized tutoring, research assistance, and language translation (Atlas, 2023).

GPT-4's assessment performance often surpasses that of human test takers, and case studies such as Talan and Kalinkara's (2023) anatomy course demonstrate ChatGPT's efficacy in academia; however, this proficiency is not uniform across all domains. A few studies have also illuminated various limitations, such as ChatGPT's challenges in mathematics and selecting assessment tasks (Chia & Theo, 2023; Suchman et al., 2023).

ChatGPT's integration into higher education has also ushered in discussions about ethical considerations (Sok & Heng, 2023; Yu, 2023). As perceptions of ChatGPT's impact vary among students, educators seem to struggle to balance the benefits and potential ethical pitfalls of this software. Concerns about students' overreliance on AI and possible implications for building critical thinking skills have been raised. Is ChatGPT a new positive tool to embrace? Is this merely another way for students to avoid doing homework? Where is the middle ground? This ethical discourse also mirrors broader public sentiment, oscillating between embracing AI-driven innovation and fearing dystopian outcomes (Penalvo, 2023).

Balancing Opportunities and Ethical Considerations

Potentially, ChatGPT could influence education research by promoting discussions, aiding in drafting articles, and enhancing the organization of ideas (Kasneji et al., 2023; Zhai, 2022). This landscape is not without its ethical complexities. Easily accessible student AI usage raises concerns about the preservation of academic integrity and the potential diminishment of critical thinking skills (Cotton et al., 2023; Sok & Heng, 2023). As ChatGPT grows in prevalence, a nuanced equilibrium in educational institutions must be struck between harnessing advantages and addressing inherent challenges (Duan et al., 2019).

The introduction of AI, particularly ChatGPT, in educational environments has prompted an exploration of the perspectives held by students and educators. Early perspectives span a diverse spectrum, ranging from recognizing ChatGPT's value as a potent study tool to reservations regarding its ethical implications and potential impacts on academic integrity (Cotton et al., 2023; Parker et al., 2024c, Xiao et al., 2023). This topic has given rise to pivotal inquiries surrounding established assessment methods, evolving learning paradigms, and the overarching ethical underpinnings that govern educational technology (Pavlik, 2023; Sok & Heng, 2023).

This intersection of opportunities and ethical considerations demands a holistic examination that delves into the intricate dynamics of AI's role in education. The potential for enhanced learning experiences and efficiencies is juxtaposed with the need to preserve academic rigor and cultivate essential skills. As the dialog surrounding AI's integration in education evolves, it becomes imperative to navigate the intricate balance between leveraging artificial intelligence for educational enrichment and upholding the ethical integrity of the learning process. However, the quickly evolving AI landscape has and will continue to outrun the slower pace of institutional discourse and change.

In sum, the integration of ChatGPT in higher education holds transformative potential yet simultaneous ethical challenges. This literature review underscores the need for higher education institutions to carefully approach this issue to be mindful of both the benefits and drawbacks of AI-driven education. Ongoing ethical discussions and the rapid evolution of AI necessitate continued research and the research-informed creation of guidelines to ensure the responsible and effective integration of AI tools such as ChatGPT in educational settings. It is imperative to explore its impact, limitations, and implications for pedagogy to ensure a holistic understanding of its role in shaping the future of education.

RESEARCH METHOD

This study is centered on seven research questions. Institutional Review Board (IRB) human subject approval was successfully obtained to answer these questions. These seven questions were divided into three phases.

Phase 1

Research Question 1: Can artificial intelligence (ChatGPT) produce work that receives a mark equivalent to the top 25% of undergraduate students within the selected classes?

Research Question 2: Can graduate teaching assistants (GTAs) accurately identify AI-generated assignments embedded within a cohort of student-created assignments?

Research Question 3: What is the impact of GTA characteristics on patients' ability to correctly identify and assess AI-generated assignments?

To address the initial phase of our research inquiries, five Graduate Teaching Assistants (GTAs), also referred to as 'Instructors' throughout this chapter, were involved in the Department of Curriculum and Teaching at the University of Kansas; these individuals volunteered themselves and their undergraduate course sections for the study. The seven sections of courses taken during the spring semester of 2023 spanned a wide range of subjects, including English pedagogy, STEM pedagogy, classroom technology, teacher preparation, and TESOL.

In each course, an upcoming assignment was identified for the research study. The prompts for each assignment were shared with the researchers, and one or more responses created by ChatGPT were made by the research team (minus the GTA) for each assignment. The first AI response (introductory level) used only the basic input/output functions of ChatGPT, with ChatGPT providing one singular answer to the assignment prompt, averaging less than 5 minutes of time to generate and submit. The second AI-generated assignment, classified as "Advanced", encompassed tasks of ChatGPT engaging in self-assessment, enhancement, and error correction carried out across multiple iterations, consuming an average of nearly 40 minutes before submission.

The AI-written responses were kept anonymous from the course instructor. Coresearchers provided those responses to the course instructor and the deidentified student-completed assignments. The course instructor then graded all the assignments (both ChatGPT and student-generated). After grading was completed, the instructor was asked to identify which assignments they believed to be written by ChatGPT. Finally, the course instructor submitted information about their background, including age, years of grading experience, comfort with technology, and experience using ChatGPT.

Phase 2

Research Question 4: Can Turnitin accurately identify all assignments as AI-generated?

To address the second phase of the research, all the assignments used in Phase 1, including the ten ChatGPT-generated assignments, were uploaded to Turnitin, a widely used plagiarism detection software in higher education institutions worldwide (Mphahlele and McKenna, 2019). After uploading each assessment, Turnitin provided a score of 0 to 100, indicating the probability that an AI rather than a human wrote the submitted work. This scoring system was utilized to evaluate the effectiveness and accuracy of Turnitin in distinguishing AI-generated content from human-authored content.

Phase 3

Research Question 5: How prevalent is the use of AI (ChatGPT) by undergraduate students when completing academic tasks?

Research Question 6: Do undergraduate students believe that using AI (ChatGPT) to complete academic tasks is ethical?

Research Question 7: Is there a relationship between the ethical perception of AI (ChatGPT) and its use in completing academic work?

To answer the final three research questions, a survey was presented to the undergraduate students in the same seven sections of courses used for Phases 1 and 2 of the study. All 118 undergraduate students were invited to complete the survey. The convenience sampling method utilized for this survey may limit the generalizability of subsequent findings. Students were able to complete the survey anonymously. Qualtrics software was used to perform the survey, and Jamovi software was used to analyze the data.

Research Hypothesis

Phase 1 Hypothesis: Graduate Teaching Assistants at the University of Kansas will not accurately detect which assignments in various undergraduate classes were

created by the artificial intelligence model ChatGPT, and the subsequent AI grades will rank within the top 25% of all student grades across all classes.

Phase 2 Hypothesis: Turnitin will be able to correctly distinguish between the assignments created by ChatGPT and those created by students.

Phase 3 Hypothesis: Less than half of undergraduate students use ChatGPT to perform academic work. Students who actively engage with ChatGPT for academic work will perceive fewer ethical concerns about its use than students who do not utilize ChatGPT for their academic tasks.

Participants

The participants in this study were drawn from the Department of Curriculum and Teaching at the University of Kansas, encompassing both undergraduate students and graduate teaching assistants (GTAs). A total of 65 out of 118 enrolled undergraduate students from seven diverse course sections participated; these students represented a range of academic disciplines, including English pedagogy, STEM pedagogy, classroom technology, teacher preparation, and TESOL.

The undergraduate student participants completed an assignment task and completed a survey at the conclusion of the semester. Their responses provided valuable insights into the prevalence of AI, ethical concerns, and the extent to which they utilized AI-driven tools for their academic work. Simultaneously, the study involved five GTAs who played a pivotal role in facilitating the research. These GTAs, responsible for guiding the course sections, oversaw assignment administration and assessed AI-generated content. With their diverse backgrounds, experience levels, and technological comfort, the GTAs contributed to understanding the factors influencing their ability to distinguish between human- and AI-generated work. This comprehensive approach sheds light on the multifaceted implications of integrating AI, particularly ChatGPT, within higher education.

RESULTS AND DISCUSSION

This section comprehensively discusses the findings pertaining to the seven core research questions. Each phase of the study has its own section.

Phase One

Research Question 1: Can artificial intelligence (ChatGPT) produce work that receives a mark equivalent to the top 25% of undergraduate students within the selected classes?

The study included 10 AI-generated assignments across seven undergraduate classes. Both Introductory and Advanced AI consistently outperformed the average student marks in each class, with the AI-generated assignment receiving the highest mark in 70% of the classes.

Table 1: Average Student and Artificial Intelligence Marks

Variable	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Overall
Student Year of Study	Mixed	Mixed	Mixed	Mixed	Juniors	Mixed	Mixed	
Average Student Mark	7.7/10	8.6/10	8.85/10	9.8/10	13.6/20	15.36/20	13.6/20	77%
AI Introductory Mark	10/10	NA*	10/10	9/10	20/20	NA*	14/20	90%
AI Advanced Mark	NA*	10/10	10/10	10/10	14/20	20/20	NA*	91%
AI Rank Within Class	1/20	1/18	1/23**	15/36**	1/9	1/10	1/8	
			15/23**	1/36**	3/9			

*= This symbol indicates scenarios where a GTA was responsible for two distinct classes, with each class incorporating a single type of AI-generated assessment. Consequently, these instructors administered a total of two AI-related assignments across their two classes, consistent with the methodology employed by their counterparts.

**= This symbol indicates instances where both AI-generated assessments in a class attained the highest mark, signifying equal top performance within that class.

In the three cases where the AI assessment fell short of securing the top rank, it garnered the 3rd position out of 9, 15th position out of 36 and 15th position out of 23. Despite the fact that two AI-generated assessments ranked 15th out of 23 and 36, the AI received a commendable score of 9/10, impacted by 14 students in both classes achieving a perfect score of 10/10.

The findings strongly support the research question concerning ChatGPT's ability to attain marks equivalent to those of the top 25% of students. Across the seven classes, the AI-generated assignments not only landed in the top quarter of all the results but also received marks corresponding to the top 15% of all the students in one class and the top 7% of the students in the remaining six classes. Notably, the cumulative marks of the 10 AI-generated assignments totaled 127 out of 140 possible points, achieving 90% of all available points.

A discernible disparity of one-letter grade on average was observed between introductory and advanced submissions. The AI-generated introductory assignments demonstrated superior performance, with an average attainment of 90%, encompassing three out of five perfect scores, and constituted the highest-ranked assessment in 80% of the classes.

The advanced AI assignments also performed above the student average, with a 91% average score. Three of those five assignments received perfect scores and attained the highest rank within their respective classes. These findings highlight the strong performance of both the introductory and advanced AI-generated ChatGPT assignments while demonstrating the need for further research to explore the factors that contribute to this disparity, albeit small.

Research Question 2: Can graduate teaching assistants (GTAs) accurately identify AI-generated assignments embedded within a cohort of student-created assignments?

Table 2: Overview of Class Details as Coordinated by each Graduate Teaching Assistant (GTA)

	GTA One	GTA Two	GTA Three	GTA Four	GTA Five
Accurately Identify Introductory Paper	Yes	No	No	No	Yes
Accurately Identify Advanced Paper	Yes	Yes	No	Yes	No
Assessment Type	Blog Post	Teaching Philosophy	Dispositions Reflection	Thematic Units Discussion	Changes in Education Reflection
Number of Students Enrolled in the Class and consented to participate in this aspect of the study	20 10 (Out of 38 enrolled students)	18 (Out of 23 enrolled students)	21 (Out of 36 enrolled students)	6 (Out of 9 enrolled students)	10 8 (Out of 18 enrolled students)
What each instructor was looking for to identify an assessment as AI-generated	Phrases and sentence structure Referring to concepts not covered	Observing how closely aligned to the rubric Coherence and harmony of writing	Formatting mistakes	Phrases and sentence structure	Phrases and Grammar Incorporation of course vocabulary

This study incorporated ten AI-generated ChatGPT assignment submissions across seven classes taught by five graduate instructors. Notably, the instructors received no specific information or guidance on identifying ChatGPT assignments;

thus, the study simulated real-world scenarios in which educators assess student work without access to details about AI-generated content.

Each instructor received two AI-generated assignments regardless of their class load. If they taught one class, both AI assignments were embedded in that class; if they taught two classes, one AI assessment was assigned per class. Instructors accurately identified five of the ten ChatGPT-generated assignments, but five did not.

The findings indicated that 40% of the introductory assignments were correctly identified, while 60% of the advanced assignments were recognizable. The increased time and effort spent using ChatGPT and refining the responses made advanced assignments more distinguishable. Instructors who identified advanced assignments credited this recognition to the higher level of writing exhibited, surpassing the content covered explicitly in the course. They observed that these assignments discussed related concepts in a more advanced manner. In contrast, the introductory assignments proved harder to identify, as they closely resembled other students' work, often containing minor grammatical errors and blending in with the cohort's submissions. This study also considered class size's potential influence on instructors' ability to perform AI-generated work. The instructors who accurately identified AI-generated assignments had an average class size of 14; those who failed to identify the AI work had a slightly larger average class size of 16 students. This finding suggested a potential correlation between class size and an instructor's ability to identify AI-generated assignments. Larger classes (>40) might pose more significant challenges in the accurate identification and use of ChatGPT by students; however, further research is needed to establish a conclusive relationship between these two factors. Furthermore, an analysis of the word count disparities between introductory and advanced AI assignments revealed interesting observations. The introductory assignments averaged approximately 394 words, totaling 1,970 words across five assessment tasks. The advanced assignments averaged approximately 1,105 words, totaling 5,528 words. Although the instructors did not explicitly cite word count as a determining factor in their grading, prolonged interaction and iterative refinement with ChatGPT resulted in an average response length increase of 180%. This warrants further investigation into the potential correlation between prolonged interaction, refined ChatGPT responses, and instructors' ability to identify AI assignments accurately.

Research Question 3: What is the impact of GTAs' characteristics on their ability to correctly identify and assess AI-generated assignments?

The data above revealed notable patterns: GTA age, ability level with technology, and experience with ChatGPT seemed to play a role in accurate identification. For instance, younger instructors with extensive technological experience and prior usage of ChatGPT demonstrated higher accuracy in detecting AI-generated assignments. In contrast, instructors with limited use of technology and no experience with ChatGPT showed lower accuracy in identifying AI-generated assignments. Although

these findings offer initial insights, the small sample size calls for further research to establish a more conclusive relationship between GTA characteristics and individuals' proficiency in identifying AI-generated work.

Table 3: Comparative analysis of the Graduate Teaching Assistants' Profiles and Technological Proficiencies

	GTA One	GTA Two	GTA Three	GTA Four	GTA Five
AGE	32	40	41	42	32
Use of Technology	Extensive use of technology	Extensive use of technology	Limited use of technology	Somewhat in every date and teaching life	Extensive use of technology
Use of ChatGPT	Extensively used ChatGPT	Extensively used ChatGPT	No use of ChatGPT	Minimal usage of ChatGPT	Moderate usage of ChatGPT
Years of grading experience	10+ Years of grading experience	15+ Years of grading experience	10+ Years of grading experience	10+ Years of grading experience	10+ Years of grading experience
Accurately Identified Introductory Paper	Yes	No	No	No	Yes
Accurately Identified Advanced Paper	Yes	Yes	No	Yes	No

Phase Two

Research Question 4: Can Turnitin accurately identify all assignments as AI-generated?

In 2023, significant emphasis was placed on the ability to detect AI-generated work (Neumann, 2023; Cotton et al., 2023) to discern between AI-generated and human-generated assignments accurately. During the course of this 2023 study, Turnitin (a commonly used academic software) unveiled an innovative feature aimed at detecting AI-generated text, a development they contextualize by stating, "Over the years, academic integrity has been both supported and tested by technology. Today, educators are facing a new frontier with AI writing and ChatGPT" (Turnitin, 2023a, para. 1). However, the emergent nature of this technology means that its efficacy and implementation within higher education remain undocumented within peer-reviewed scholarship. Alternative detection systems are beginning to surface, but Turnitin's widespread adoption across global educational institutions (Meo and Talha, 2019) provided a compelling rationale for its exclusive examination in

this study. As this feature continues to be integrated within Turnitin's established framework, it affords a unique opportunity to assess its effectiveness within the existing academic infrastructure.

Ten AI-generated assignments were crafted for the purpose of this investigation and subsequently subjected to Turnitin's new AI detector. The results indicated that eight of the ten assignments were correctly identified as 100% AI-generated. The remaining two assignments, however, received scores of 41% and 79%, respectively.

Turnitin acknowledges the possibility of false positives, particularly when the AI content constitutes a smaller percentage of the overall submission (1-20%) (Turnitin, 2023a). Consequently, any score less than 20 is denoted with an asterisk, drawing attention to its lower reliability. Since all ten submissions in this study received scores exceeding 20%, we can assert that the AI writing detection tool achieved a 100% accuracy in identifying the ten AI-generated submissions that were purposely embedded into the marking. Notably, the tool accurately gauged the exact percentage of AI content in each submission, which was approximately 80%.

Curiously, the two assignments that did not achieve a 100% AI score (41% and 79%) were advanced assignments that required the AI to refine its output. Intriguingly, these advanced assignments also exhibited the highest word counts among the ten AI-generated assignments. This raises the possibility of a correlation between increased interaction and refinement in assignments and a potential decrease in Turnitin's capacity to definitively label them as 100% AI-generated. Conversely, all five introductory assignments received a 100% AI-written score from Turnitin, demonstrating Turnitin's overall accuracy in detecting AI-generated content. Crucially, it must be emphasized that AI writing detection represents an emerging field. Turnitin discloses, "While Turnitin has confidence in its model, Turnitin does not make a determination of misconduct; rather, it provides data for the educators to make an informed decision based on their academic and institutional policies" (Turnitin, 2023a, para. 3). Exploration is warranted to investigate whether the accuracy of Turnitin diminishes with longer assignments involving substantial interactions and refinement processes. Examining this aspect could facilitate a comprehensive comprehension of the factors influencing Turnitin's performance in accurately detecting AI-generated content.

Expanding the investigation, an analysis of Turnitin's AI results across all the classes involving 118 student submissions across the seven classes was conducted. The findings revealed that 16 student-submitted assignments were flagged as AI-generated, with an average AI content usage of 89% among these 16 cases. Of these, 11 received a score of 100%. This finding underscores that students who engage with ChatGPT for assignments often use it for nearly 90% of their submission content, frequently adding an introductory and concluding paragraph while relying on AI-generated content for the main body. Moreover, this analysis indicated that approximately 12.5% of the students enrolled across the five instructors employed ChatGPT to either aid or entirely compose their assessment submissions.

Table 4: Comparative Analysis of AI-Generated Submission Detection Across Instructors by Turnitin

	GTA One	GTA Two	GTA Three	GTA Four	GTA Five
Number of all student submissions identified as AI generated (above 20%)	13/38	3/23	0/36	0/9	0/18
Use of Technology					
Percentage of Assessments Identified as AI-Written Among Those Deemed Written by AI	93%	92%	0%	0%	0%

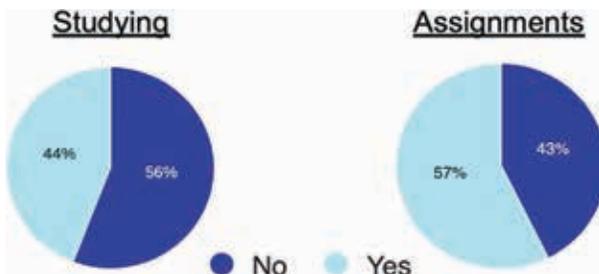
As evident from the data above, three instructors appear to have had no student engagement with ChatGPT as part of undertaking their class assignments. Conversely, Instructors 1 and 2 reported engagement from 13 out of 28 and 3 out of 23 students, respectively. This observation might be attributed to Instructors 1 and 2 sharing a common student cohort, particularly within Instructor 1’s technology introduction class. Here, students were introduced to ChatGPT’s utility within the context of teaching and were encouraged to use the tool to learn its capabilities. The data suggest that heightened engagement and interaction with the tool in a pedagogical setting could be positively associated with greater adoption of the tool in class assignments within these specific classes.

Phase Three

Research Question 5: How prevalent is the use of AI (ChatGPT) by undergraduate students when completing academic tasks?

The following pie graphs show the survey results (n=68) for questions regarding using ChatGPT in academic work.

Figure 1: Distribution of ChatGPT Usage Among Undergraduate Students for Studying and Assignment Completion



Based on the survey results, the prevalence of ChatGPT was higher than initially expected. Forty-four percent of the surveyed undergraduate students used ChatGPT while studying, while 57% of the undergraduate students used ChatGPT to help complete assignments. The following table further shows these values, separating students based on their use of ChatGPT in studying and assignments.

Table 5: Use of ChatGPT by Undergraduate Students

		Use Of ChatGPT for Studying	
		Yes	No
Use of ChatGPT for Assignments	Yes	37%	21%
	No	7%	35%

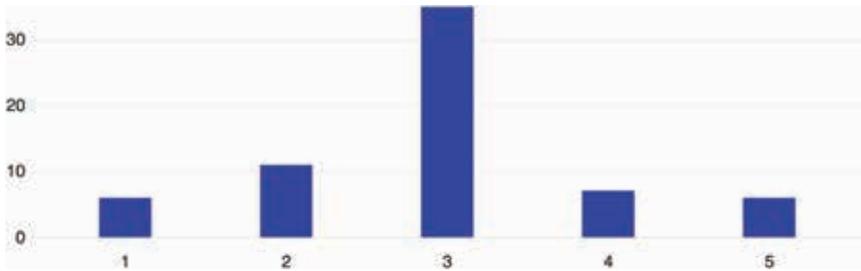
This table allows for additional clarity on the prevalence of the use of ChatGPT in academic work. Based on the survey results, we can conclude that 65% of the undergraduate students included in this study use ChatGPT in some manner to complete academic work across their various classes.

Although the small sample size and convenience sampling method discouraged large-scale extrapolation, the sample used in this study fairly represents undergraduate students taking courses in the School of Education and Human Sciences (SOEHS) at a large Midwest University. In the spring of 2023, 2,850 undergraduate students were enrolled in a course offered by the SOEHS. By extrapolating these survey results, we can estimate that approximately 1,850 undergraduate students in the SOEHS courses were using ChatGPT to perform academic work. The particular characteristics of each student were not solicited in this study due to the anonymity preserved when addressing the choice of employing or abstaining from using ChatGPT in assignments. Concurrent with this study's execution, the University of Kansas had not yet instituted any policies, guidelines, or frameworks concerning using ChatGPT within its higher education programs. This stands in contrast to a number of other American institutions of higher education that have taken such steps. Examples include the University of California, Berkeley (2023), Harvard University (2023), and Stanford University (2023).

Research Question 6: Do undergraduate students believe that using AI (ChatGPT) to complete academic tasks is ethical?

According to the survey results below, it is clear that undergraduate students are unsure how to view the ethics of artificial intelligence in academic tasks. The following bar graph shows the survey results ($n=65$) for participants who were asked about the ethics of using AI in academic work (1=very unethical, 3=unsure, 5= very ethical).

Figure 2: Undergraduate Students' Perceptions of the Ethics of Using AI (ChatGPT) in Academic Tasks

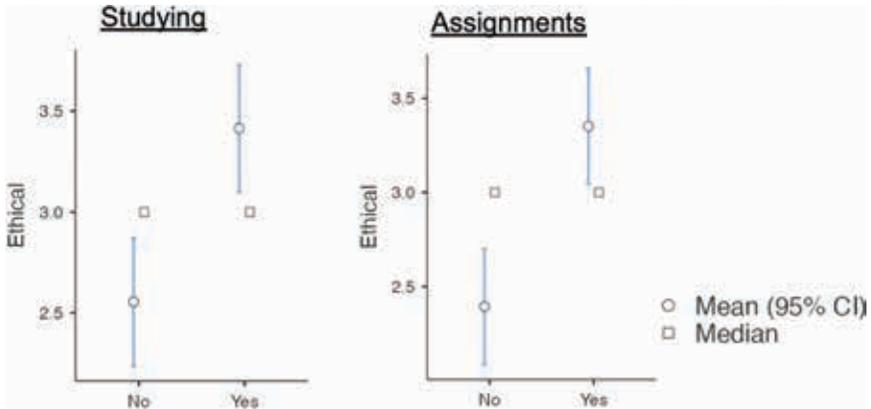


The conversation regarding ethics and AI is clearly one that needs to occur in classrooms, as more than half of the students answered “unsure.” Discussing the ethical impact of new technologies in education should remain an ongoing dialog between students and teachers due to the ever-changing landscape of education and the constant evolution of new technologies.

The desire for these conversations is not a novel finding. Even before the widespread emergence of ChatGPT, conversations regarding AI in academia were ongoing (see Borenstein & Howard, 2021; Holmes et al., 2021). These crucial conversations are needed in research journals and at education conferences but, most importantly, in the classroom. Mhlanga (2023) explained a conversation model that can be used with students; this model helps to dissect the responsible and ethical use of ChatGPT in academic work because it incorporates a variety of factors that influence the ethical perception of AI in academics, such as “fairness,” “accuracy of information,” and artificial intelligence being unable to fully grasp the “context.” To make an informed decision regarding the ethics of ChatGPT and academic work, students must be presented with these ideas and given the opportunity to critically examine and discuss their own perspectives, experiences, and biases.

Research Question 7: Is there a relationship between the ethical perception of AI (ChatGPT) and its use in completing academic work?

Analysis of the survey data demonstrated a statistically significant relationship between students' use of artificial intelligence to complete academic work and their ethical perception of artificial intelligence in academia. As shown in Figure 3, those who used AI for studying ($M = 3.414$, $SD = 0.867$) believed it was more ethical than those who did not ($M = 2.556$, $SD = 0.969$), $t(63) = -3.718$, $p < .001$. Additionally, those who used AI for assignments ($M = 3.351$, $SD = 0.949$) believed it was more ethical than those who did not ($M = 2.393$, $SD = 0.832$), $t(63) = -4.248$, $p < .001$.

Figure 3: Ethical considerations and students' use of AI for studying and assignments.

These statistically significant findings demonstrate the impact that ethics have on decision-making. Those who view the use of artificial intelligence in academic work as ethical use ChatGPT to perform academic work, while those who do not view it as ethical abstain from its use.

These data provide a roadmap for reigning in or unleashing the widespread use of artificial intelligence for academic tasks. If an instructor wants to limit their students' use of ChatGPT, it is likely necessary to first convince their students that its use is unethical. Conversely, if an instructor wants to encourage their students' use of ChatGPT, it is likely necessary to first assure their students that its use is ethical in their course. Per Research Question #6, most students have not yet made this decision; therefore, conversations regarding the ethicality of ChatGPT in academic work could have a lasting impact on any extensive use of the topic.

CONCLUSION

Artificial Intelligence will forevermore be a part of the education landscape. As such, educators and students must acknowledge the potential provided by AI while continuously questioning its ethical use. This study demonstrated that academic work completed by ChatGPT has the potential to supersede the work of undergraduate students and that graduate instructors cannot consistently tell the difference between work created by ChatGPT and work created by their students. This study also demonstrated confidence in AI detection software with Turnitin's new feature, which demonstrated 100% accuracy in detecting AI-generated submissions, in addition to highlighting 16% of the total student assignments, which, based on the word probability of AI detectors, were deemed to be written by AI as opposed to students.

The ethical conversation regarding the use of ChatGPT in academic work must be at the center of ongoing discussions regarding the presence of AI in education. This study concluded that the use of this new AI technology was more prevalent than expected, even though many students were unsure of how they felt about it ethically. Moreover, the findings of this study suggest that classroom conversations regarding

the ethicality of ChatGPT in academic work may significantly impact its future use by those in academia.

The decisions made in the design of this research study may have potentially adverse consequences. These decisions include limited sample size, the use of convenience sampling, and the lack of content field diversity among the undergraduate students surveyed. The findings and conclusions drawn from this study vastly outweigh these limitations. In conclusion, emphasizing the development of aspiring educators is of paramount importance, as these students will emerge as the decision makers who shape the integration of AI in classrooms in the decades to come.

FUTURE STUDIES

Given the recent emergence of artificial intelligence's integration into mainstream academia through the new ChatGPT, this initial investigation serves as a catalyst for extensive subsequent research. Ethical considerations remain at the forefront of such further investigations. Future scholarly endeavors may entail a rigorous examination of the influence of students' ethical stances on their utilization of AI technologies. Additionally, comparative analyses across diverse academic disciplines could highlight the propensity for ChatGPT use in specific areas of study. Evaluating the academic integrity frameworks within higher education institutions may also prove insightful, as would a longitudinal study examining shifts in the use of AI and the reliance on AI detection tools as ChatGPT becomes more entrenched in educational settings. Expanding the scope to larger student cohorts, potentially exceeding 100 individuals, could significantly enhance the robustness of the data and the generalizability of the findings.

IMPLICATIONS

The exploration of the impact of ChatGPT and emergent technologies on education presents a spectrum of far-reaching implications that intersect various dimensions of the educational landscape. The study's findings illuminate the transformative potential of AI-driven tools such as ChatGPT in higher education. The consistent outperformance of student-generated work highlights how AI has the capacity to redefine traditional educational paradigms. This places educators at the cusp of a paradigm shift, where they must reconsider their pedagogical approaches to effectively integrate AI-driven assignments within curricula.

Additionally, the study underlines the importance of instructor preparedness in the era of AI. The challenges that graduate teaching assistants face in identifying AI-generated content underscore the need for comprehensive training programs that empower educators to navigate the nuanced landscape of AI-assisted learning. Moreover, the ethical ambiguity students express toward AI's role in academia prompts the imperative need for dynamic classroom dialogues that grapple with the ethical dimensions of AI integration. This study underscores the significance of Turnitin's AI detection capabilities, as it offers a robust mechanism to safeguard academic integrity in the face of AI-generated content.

This book chapter acts as a navigational beacon, marking a significant juncture in education history. This moment demands the active engagement of students, educators, and academic institutions in a thoughtful discourse that will define the trajectory of AI, ethics, and pedagogy. The implications presented within these pages serve as a call to action, urging educators to wholeheartedly embrace AI's transformative capacities while steering the course toward educational landscapes that are not only technologically adept but also underpinned by a steadfast commitment to ethical considerations.

NOTE

AI tools were not used in any way for the preparation of this chapter.

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UNIT 4:
CURRENT ISSUES AND FUTURE
CONCERNS ABOUT TEACHING
AND LEARNING

Chapter 15

Communities of Practice and Preservice Teachers in the Rise of Artificial Intelligence Era: ChatGPT as a Method of Inquiry and Reflection

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ABSTRACT

This study presents the findings of a narrative research study that investigated preservice teachers' experiences using the ChatGPT as a method of inquiry and reflection on a taught lesson in lieu of relying on a community of practice for reflection and insights. Ten preservice teachers participated in the study, and their experiences were gathered through narrative frames. The findings highlight the potential benefits and limitations of the ChatGPT as a tool for inquiry and reflection, emphasizing the need for a balanced approach that combines both AI-based interactions and engagement in communities of practice in teacher education programs.

Keywords: artificial intelligence, ChatGPT, communities of practice, education, preservice teachers, teacher education programs

INTRODUCTION

During the last few months, higher education has been promoted by the increasing use of artificial intelligence (AI) tools by students, particularly ChatGPT. The main concerns revolved around students' academic misconduct and possible ways to stop students from using it. Although AI is recognized as a new field, ancient people dream about intelligent machines that would revolutionize the world. The world has benefited from technological innovations throughout centuries, enjoying the advantages that have significantly improved our lives. AI continues to evolve at an increasing speed, and researchers continue exploring new frontiers in various fields.

Previous research has highlighted the benefits of AI for teachers, especially regarding time (Bryant et al. 2020; Miao & Holmes 2021). While the fear of using AI tools has been noted previously (Schlögl et al., 2019), recent studies (Alam, 2021; Pedro et al., 2019; Giles et al., 2020) have shown that fundamentally, there is a lack of understanding of what AI is and how it works. Teachers must constantly develop and learn new pedagogies and adopt curricula to navigate the challenges of today's classroom (Hursen, 2014; Köksal, & Çöğmen, 2013). Considering the

economic climate in which we live, as well as the disheartening number of teachers who leave the profession (Lortie, 2002), AI might actually serve as a powerful tool for preservice and current teachers.

While Seldon and Abidoye (2018) claimed that AI will make teachers redundant since technology will replace them, the idea of the teaching profession becoming obsolete is farfetched. The fear of AI taking over the profession is anchored in the erroneous belief that teachers are the sole source of knowledge. Freire (1968) cautioned us against this belief when he introduced the “banking” concept of education in which students are viewed as empty vessels and teachers have the role of filling up the empty vessel with the knowledge they possess. This type of thinking denies the humanity of our students and their ability to create knowledge (Dewey, 1906; Lillard, 2013). As Felix (2020) emphasized, AI should not replace teachers because of the inherent values and norms that cannot be transferred from AI to students, as is the case with teachers. As a result, what is there to do with AI technology, which seems to have taken us by surprise? Do we resist it, find ways to fight against it, or do we embrace it?

Progress can be slow at times; however, there are benefits to intelligent systems that can further enhance and support individuals’ work. Considering that the world has been taken by surprise and while many appreciate the advantages that AI brings to conducting work, there is still resistance to it and overall fear. The use of the ChatGPT, an AI-based language model, as a reflection and inquiry tool by preservice teachers poses a significant challenge and raises important concerns in the field of education. While reflection and inquiry are critical components of teacher development (Han, 1995; Marcos et al., 2009), integrating AI technology into these processes can lead to potential complexities and ethical considerations. The problem lies in the lack of comprehensive understanding regarding the implications of using the ChatGPT as a tool for preservice teachers’ reflective practices and professional growth, which often derive from their communities of practice. Thus, a thorough investigation of the benefits and challenges of preservice teachers using the ChatGPT as a reflection and inquiry tool is essential for informing educational policies, curriculum design, and professional development practices in the context of teacher preparation programmes and the engagement of preservice teachers in communities of practice. Moreover, the concept of participant legitimacy in a community of practice has been extensively explored in the theoretical literature (Kim & Cavas, 2013) as a crucial factor for determining the success or risk of such communities. Legitimacy attainment is understood as the process of gaining credibility among peers, gaining social recognition, and expanding responsibilities within a social setting (Kim & Cavas, 2013); thus, this study investigated whether the ChatGPT could be used as a method for reflection and inquiry among preservice teachers.

LITERATURE REVIEW

There is a general understanding among researchers in the field that improvements in teacher preparation programs are needed because teacher education students are

able to use and apply theoretical coursework to practical classroom practice (Darling-Hammond, 2006; McDonald et al., 2013; Zeichner, 2010).

Teacher preparation programmes have historically focused on presenting theories in education without providing preservice educators with tangible tools to implement in their classes after graduation (Darling-Hammond, 2006). Educational theory courses and field-based experiences are often taught disjointedly, with tenure-track university faculty sharing their knowledge of the former and adjunct faculty, doctoral students, or retired K-12 teachers supervising the latter (Zeichner, 2010). Experiencing theory and practice in disconnect is detrimental to the overall development of preservice teachers and hinders their ability to understand how to become successful educators. Coherence between coursework and clinical work is necessary for developing strong teacher preparation programs (Darling-Hammond, 2006; Zeichner, 2010).

Porayska-Pomsta (2016) examined the role of AI as a methodology for enhancing educational practices and supporting teacher metacognition. The author emphasized the potential of AI technologies in providing personalized learning experiences and facilitating teachers' reflective thinking and decision-making processes. Furthermore, the study explored various AI-based tools and approaches, such as intelligent tutoring systems, learning analytics, and adaptive learning platforms, and explored their potential to support teachers in understanding and improving their instructional strategies. This highlights the importance of integrating AI technologies with pedagogical knowledge and fostering a collaborative relationship between teachers and AI systems to maximize the benefits of educational praxis. Moreover, the literature on preservice teachers' technology-related knowledge has extensively outlined the importance of teachers' digital competence in today's technology-driven educational landscape (Seufert et al., 2021).

As novice teachers journey to become proficient members of a community, they engage in legitimate peripheral participation (Lave & Wenger, 1991). In the context of teaching, Lave and Wenger argue that new teachers require "modified forms of participation" (p. 1661), akin to apprenticeships, to develop mastery and become expert educators. Building upon Wenger's work, Lambson (2010) further explained that two essential modifications, peripherality and legitimacy, are necessary for meaningful participation. Peripherality involves new learners being actively engaged in the community, gaining exposure to all aspects, even those that occur behind the scenes. Lave and Wenger acknowledge that legitimate peripherality is intricate due to power dynamics within communities. If the newcomer is embraced by the community and provided with relevant knowledge, they will be empowered. Conversely, if the newcomer faces exclusion or essential information is withheld, he or she may disengage, leading to a disempowering experience. For successful integration, the newcomer must feel fully integrated and accepted within the community. Any disconnection hinders the learning process and impedes progress toward full participation.

Research suggests that there are several reasons for which preservice teachers may be restricted from participating in communities of practice. Some of these reasons

include lack of confidence and self-efficacy (Tschannen-Moran & Woolfolk, 2007; Ronfeldt et al., 2015); fear of judgment and evaluation (Vescio et al., 2008); time constraints and heavy workload (Heibert et al., 2002; Ingersoll & Strong, 2011); perceived irrelevance and incompatibility (Dennen et al., 2007); and limited exposure to professional communities (Villegas-Reimers, 2003; Feiman-Nemser & Buchmann, 1985). This category of teachers in training goes through a process of becoming experienced in the practices of the community, which Lave and Wenger (1991) defined as legitimate peripheral participation.

Therefore, in the case of teachers, novices are seen as needing modified forms or participation before they master the necessary skills to become experienced teachers in this context. Recent research shows a number of ways new and preservice teachers can be engaged in communities of practice “that entails learning as an integral constituent” (Lave & Wenger, 1991, p. 35). Daniel et al. (2013) sought feedback about the process of engaging in critical dialog and teacher practice from preservice teachers engaged in a small cohort that evolved into a community of practice. The students were meant to engage in skills they would use during teaching. They learned about a teaching practice, tried it out within their cohort, and then gave and received critical feedback. Over time, the students learned to adopt the language of teaching and critique as ways to support their conceptual development of teaching. Students in this setting experienced breaking down myths developed during their apprenticeship of observation (Lortie, 2002).

Students and new teachers enrolled in social learning situations exhibited the ability to reflect on their own practices. In developing communities of practice, new and preservice teachers coproduce knowledge, adopt the language of teaching, and begin to develop their teaching identities (Lave & Wenger, 1991). Through instruction in cohorts and support in developing thinking, speaking, and practicing like a teacher, preparation programs can encourage membership in the teaching community, which might promote retention and teacher quality.

These previous studies prompted the current investigation to identify whether AI tools, such as the Chat GPT, can serve as valuable tools for preservice teachers and whether they can provide support that communities of practice usually do. Therefore, this study is anchored in the assumption that the ChatGPT may facilitate the engagement, reflection, and skills development of preservice teachers by enhancing their learning experiences, thus fostering their professional growth.

RESEARCH METHOD

This study reports on preservice teachers’ experiences using the ChatGPT as a method of inquiry and reflection. The focus of the article is not so much on the type of content or questions that preservice teachers asked about ChatGPT, as it is on the students’ experiences using this AI tool. Considering that the focus of the study was preservice teachers’ experiences using the ChatGPT, this prompted the use of narrative inquiry as a method of study. Although there is no agreed-upon definition of narrative research, with Lieblich et al. (1998) indicating that “qualitative

studies freely use the terms narrative and narrative research” (p. 2), this study is anchored in Connelly and Clandinin’s (1990) definition of narrative as stories of lived experiences.

Context and Participants

A qualitative research design was used to gain an in-depth understanding of preservice teachers’ experiences using the ChatGPT as an inquiry and reflection tool. Ten participants from a teacher education program in a math methods course at a rural university in northeast Iowa represented the participants in this study. In addition to taking the Math Methods course, the students were simultaneously taking a Field Experience class, which enabled them to teach a Math lesson in an elementary classroom.

Data collection

Upon developing their math lesson plans and then teaching that lesson in an elementary classroom, preservice teachers were asked to use the ChatGPT as a tool for inquiry and reflection. Students were instructed to “converse” to the ChatGPT and ask questions related to their lesson to obtain feedback and improve their practice. Afterwards, they were given a writing frame or a narrative frame as a “skeleton to scaffold writing” (Warwick & Maloch, 2003, p. 59). This narrative frame consisted of a template inspired by Barkhuizen and Wette (2008) with sentence starters and connectives (see Fig. 1) to give participants a structure so that they can communicate their thoughts, therefore giving them support and guidance. The template was designed to focus on participants’ experiences but also not to overwhelm them with a more open-ended type of writing. The participants were instructed to write about their experiences and reflections in the narrative frame.

Data analysis

The data analysis involved utilizing the qualitative content analysis procedures outlined by Miles and Huberman (1994) and Strauss and Corbin (1998). This included coding and categorizing the identified themes, recognizing patterns within the themes, and offering interpretation of these patterns throughout the process (Creswell, 2012).

RESULTS

The data analysis revealed a range of opinions and experiences regarding the use of the ChatGPT as an inquiry and reflection method instead of an old discussion and interaction with cooperating teachers, mentors, and university supervisors. In the next section, I report on what the preservice teachers said about using the ChatGPT as an inquiry and reflection tool to highlight the results of the analysis. The findings can be categorized into three main themes: valuable tool, impersonal aspect, and complementary nature.

Figure 1: Narrative frame

Using ChatGPT to reflect on my Math lesson was _____

_____ because _____

ChatGPT _____

_____ but _____

ChatGPT as a valuable tool and a “safe space”

Several participants expressed positive experiences with the Chat GPT, as it is considered a valuable tool for generating ideas and receiving feedback on their teaching practices. The authors highlighted the ability of AI to provide immediate responses, explore different strategies and deepen the understanding of certain topics.

Using the ChatGPT to reflect on my math lesson was an interesting experience because I find it to be a valuable tool for reflecting on my practice when I do not receive feedback from my cooperating teacher. It allowed me to get immediate feedback on my ideas and questions. ChatGPT provided detailed explanations that helped me better understand classroom management, but the suggestions were similar to those of many textbooks. (Student S)

Using the ChatGPT to reflect on my math lesson was considered mind-blowing because it was able to give me specific feedback on my questions, and it gave me ideas for the lesson that I did not think about before. ChatGPT may be the next best thing, but I think we should all use it with caution. (Student L).

Using ChatGPT to reflect on my math lesson was like having a knowledgeable mentor available 24/7 because it gave me so much information and insight into my classroom practice. ChatGPT is an amazing resource that I can access anytime, anywhere. (Student J)

The participants appreciated the anonymity that the ChatGPT offered, allowing them to explore ideas without fear of judgment and fostering creativity in their inquiry process.

Using ChatGPT to reflect on my math lesson was a game changer for future teachers like me because it offered me a safe space to ask dumb questions; questions I would be too scared to ask a real teacher or my university supervisor. The ChatGPT is anonymous and allows me to explore ideas without fear of judgment. (Student D)

Impersonal Aspects of the ChatGPT

While recognizing the benefits, some preservice teachers expressed reservations about relying solely on the ChatGPT for inquiry and reflection.

Using ChatGPT to reflect on my math lesson was impersonal because I prefer engaging in face-to-face discussions with my peers and instructors. It's in these interactions that I can truly express my thoughts and build relationships with other peers and teachers. ChatGPT offers immediate feedback when real humans may not be able to participate, but it can never replace the richness of real human interaction. (Student R)

Using the ChatGPT to reflect on my math lesson was useful because it is right there. ChatGPTs can be good at generating new ideas or responding to questions; however, engaging in conversations with real teachers and mentors should still be a priority and should be used carefully. (Student B)

Participants emphasized the importance of human interactions in their professional growth, stating that ChatGPT lacks the human element crucial for building relationships, engaging in critical discussions, and understanding the contextual nuances of teaching. Participants raised concerns about the reliability and accuracy of the information provided by the CHatGPT, emphasizing the need for discernment and critical thinking while using AI tools.

Using the ChatGPT to reflect on my math lesson was a useful tool because it answered all my initial questions. ChatGPT gave me quick answers, but it lacked the ability to understand context and nuance. I think it is important for preservice teachers to think critically about themselves and engage with different perspectives, which CHatGPT may not be able to do fully. (Student Q)

Using the ChatGPT to reflect on my math lesson was an exciting addition to my technological tools because I was able to engage in a conversation, and it helped me to understand certain things better. ChatGPT helped me develop a better understanding of my teaching practice, but it does not know the students I teach and their individual needs. (Student N)

Complementary Nature of ChatGPT

Some of the participants indicated that the ChatGPT has the potential to complement human interactions and engagement in communities of practice. The findings

indicated that ChatGPT should not replace real-life discussions and experiences but may instead serve as a supplemental resource.

Using the ChatGPT to reflect on my math lesson was intriguing because while it can be helpful in generating ideas and providing information, it lacks the human element. ChatGPT gave me good answers and feedback, but I believe that interacting with real teachers and mentors is crucial for my growth as a future educator. It can definitely supplement my learning, but it cannot and should not replace real-life discussions and experiences. (Student N)

Using ChatGPT to reflect on my math lesson was unusual because I had some reservations. It gave me very quick answers, but I am not sure how accurate the information was; it looked like it was copied from the internet. ChatGPT may be a quick tool, but I prefer relying on my instructors, teachers and other experienced professionals in my field. (Student T)

Preservice teachers believe that the combination of AI-based interactions and human interactions could provide a comprehensive and well-rounded approach to inquiry and reflection. Participants highlighted the convenience and accessibility of the Chat GPT, particularly in providing instant feedback, but stressed the need for ongoing mentorship and face-to-face discussions.

The findings of this study contribute to the understanding of preservice teachers' experiences using the ChatGPT as an inquiry and reflection method. While ChatGPT offers benefits such as immediate feedback, it cannot replace the human element and the contextual understanding that real-life interactions provide. Preservice teacher education programmes should consider integrating the ChatGPT as a supplementary tool, ensuring that it is used mindfully and in conjunction with human interactions.

DISCUSSION AND CONCLUSIONS

There are both potential benefits and limitations to using the ChatGPT as a method of inquiry and reflection in preservice teacher education. While it offers convenience and immediate feedback, it cannot replace the value of human interactions and contextual understanding, as previously highlighted by Felix (2020). A balanced approach that combines AI-based tools such as the ChatGPT with real-life discussions and experiences is crucial for fostering comprehensive professional development among preservice teachers. Future research should explore effective strategies for integrating ChatGPT into teacher education programs, ensuring its optimal use and supporting preservice teachers in their journey toward becoming effective educators.

Consistent with the literature, this research showed that participants experience fear of judgment (Vescio et al., 2008) when participating in communities of practice; however, the anonymity ChatGPT provides made them feel more empowered and open to asking questions about their practice. Although this represents a positive outcome in preservice teachers' development of self-efficacy and agency, this result must be interpreted with caution, as participants also indicated that the ChatGPT cannot fully replace communities of practice. The rationale behind this statement is anchored in the findings of this study, as ChatGPT cannot provide the same level of support and collaboration as a community of practice. As evidenced in the literature

(Lave & Wenger, 1991), a community of practice represents a group of teachers who come together to share their experiences, knowledge and expertise. This can be a valuable resource for teachers, as it allows them to receive support from their peers and learn from each other's experiences. ChatGPT, on the other hand, is a tool that can be used to automate tasks and/or provide information. It cannot generate the same level of support and collaboration as a community of practice.

As far as we know, ChatGPT is not able to understand the nuances of teaching and learning, which is a complex process that involves human relationships, emotions, and creativity. The claim here is not that ChatGPT may lack creativity; however, it cannot fully grasp emotions in the same way that humans can. Thus, ChatGPT cannot provide the same level of support and guidance to teachers as a community of practice. In the same vein, the ChatGPT cannot replace human touch in education. Education is much more than just providing information (Freire, 2018); education is also about building relationships, fostering creativity, and inspiring students (Dewey, 1906; Lillard, 2013); thus, developing a well-rounded understanding of its role and the role of teachers is essential. AI tools such as ChatGPT can be valuable tools, but they cannot replace the human element of teaching and learning. While technology competency is required of teachers in today's world (Seufert et al., 2021), collaboration and sharing of practices among teachers can enhance their technology-related competence in the field of AI.

In conclusion, ChatGPT cannot replace communities of practice among teachers, as these communities provide valuable space for teachers to share their experiences, knowledge, and expertise. While AI tools can provide some level of support and collaboration, much-needed mentorship and conversations are essential elements to becoming a teacher. Issues such as the authenticity and depth of reflection, the potential biases and limitations of the AI model, and the impact on the development of critical thinking skills and pedagogical decision-making need to be further examined. Moreover, there is a need to further explore the full potential and limitations of AI in supporting educational praxis and teacher metacognition.

Nevertheless, in our attempts as educators to keep up with the rise and development of technology, we must familiarize ourselves with the concepts and technologies associated with AI and ultimately try to embrace them. After all, it was not too long ago that educators worldwide had to reimagine and redesign their practices and utilize technology to teach them during the COVID-19 pandemic (Trust & Whalen, 2021; Rahayu et al., 2022; Oliviera et al., 2021). By addressing the concerns preservice teachers encounter in their journey of using AI tools, they may feel less resistant and intimidated by perceived complexity or ethical dilemmas, thus developing confidence in their possibilities and use. Continued efforts are needed to support preservice educators and novice teachers in adopting AI technology to further harness the power that technology can have on education.

IMPLICATIONS

Research exploring the intersection of artificial intelligence tools such as ChatGPT and communities of practice for preservice teachers holds significant importance

in the field of education. As AI continues to advance and permeate various aspects of society, it is crucial to understand its potential impact on the professional development and learning experiences of future educators. Communities of practice, characterized by collaborative learning and knowledge sharing among individuals with shared professional interests (Lave & Wenger, 1991), play a vital role in shaping teachers' identities, pedagogical practices, and ongoing growth (Lambson, 2010).

By examining how AI can be integrated into these communities, researchers can explore innovative ways to enhance preservice teachers' learning, provide them with opportunities for meaningful engagement with AI technologies and support their transition into effective and adaptable educators in the digital age. Furthermore, understanding the dynamics between AI and communities of practice can inform the design of relevant and contextually appropriate professional development programs that empower preservice teachers to harness the potential of AI while upholding educational value and addressing potential challenges. Ultimately, this research can contribute to the preparation of competent and technologically savvy educators who are equipped to navigate the evolving landscape of AI in educational settings.

NOTE

AI tools were not used in any way for the preparation of this chapter.

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Chapter 16

Unlocking the Promise of AI: Exploring the Crucial Role of Faculty Members' Growth Mindset, Self-Efficacy, and University AI Policies: A Study at Vietnam National University, Hanoi

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ABSTRACT

This study explores how faculty members' attitudes, behaviors, and university regulations influence student outcomes with AI integration at Vietnam National University Hanoi (the VNU Hanoi). A survey of 559 faculty members revealed that a growth mindset had a stronger positive relationship with AI instructional behaviors than self-efficacy. However, university policies had a greater impact on student performance than did faculty members' instructional behaviors. These findings imply that cultivating a growth mindset among faculty members should be a top priority. Furthermore, supportive policies and an enabling environment are critical enablers for teachers to fully leverage AI capabilities for the benefit of students. The VNU Hanoi should focus its efforts on creating AI-facilitative policies and resources and developing a flexible ecosystem. The benefits for students can be maximized by prioritizing the development of a growth-oriented mindset among faculty members, as well as creating policies and an environment conducive to AI adoption. This empirical study lays the groundwork for improving the VNU Hanoi's AI integration to improve teaching and academic performance.

Keywords: Artificial Intelligence, faculty members, higher education, instructional behaviors

INTRODUCTION

The Vietnam National University in Hanoi (the VNU Hanoi) has recently taken significant steps to integrate artificial intelligence (AI) into its academic environment and curriculum. As a prominent educational national institution, the VNU Hanoi aims to equip its students with the knowledge and skills necessary to excel in a world increasingly driven by AI technology.

In recent years, VNU Hanoi has implemented several innovative initiatives. One notable initiative is the revision of the university's curricula to include interdisciplinary foundations in AI alongside traditional, subject-specific courseworks. This holistic approach to AI education is designed to foster both specialized knowledge in students' chosen fields and adaptable AI skills that can be applied across diverse contexts. To facilitate practical learning and experimentation, the VNU Hanoi has established innovation and creativity spaces equipped with the latest technologies, including artificial intelligence (AI). These universities' creative spaces provide students with opportunities to work on real-world AI projects, develop new AI applications, and participate in technologies-related competitions. By engaging in hands-on learning, students can bridge the gap between academic theory and practical application and develop the skills and confidence they need to succeed in the AI-driven workplace.

In addition to emphasizing experiential learning, the VNU Hanoi encourages faculty members to incorporate AI into their teaching strategies. These initiatives include financial support for AI research and development, reduced teaching loads for faculty members who develop AI-powered teaching materials, and recognition for faculty members who demonstrate excellence in AI education. By incentivizing faculty members to adopt AI in their teaching and research, the VNU Hanoi ensures that students have access to the most up-to-date and innovative AI learning experiences.

The purpose of this research is to analyze the impact of AI integration in faculty members' class instruction on student learning outcomes at the VNU Hanoi. Faculty members from nine universities and two schools under the VNU completed questionnaires on their growth mindset, self-efficacy, instructional practices related to AI, university's AI policies and environment, and student performance. Furthermore, this study clarifies the impact of faculty members' growth mindset and self-efficacy on their instructional behaviors related to AI. Therefore,, this study emphasizes the significance of AI-supported policies and environments at universities, as well as its impact on student performance. This study addresses the following research questions:

Q1: How do faculty members' growth mindsets and self-efficacy affect their instructional behaviors with AI at VNU Hanoi?

Q2: How do AI policies and environment influence faculty members' instructional behaviors and student outcomes at VNU Hanoi?

Q2: What is the impact of faculty members' instructional behaviors with AI on student engagement and academic performance at VNU Hanoi?

Through an in-depth exploration of the connections between faculty members' attributes, institutional policies, and student outcomes resulting from AI-based instruction at the VNU Hanoi, this study aims to provide valuable insights that can guide the development of effective AI policies and practices for harnessing AI's potential to enhance student outcomes.

LITERATURE REVIEW

Artificial Intelligence in the Higher Education Context

Artificial Intelligence (AI) has the potential to transform the educational environment, ushering in a new era of individualized instruction and improved pedagogical techniques (Xia & Li, 2022). However, the realization of this transformation depends on a shared commitment to justice and ethics. A set of policies encompassing collaborative creation, digital proficiency, exemplary practices, and originality must be established to ensure that AI's benefits are truly all encompassing and reach even marginalized communities (Kim, 2021). To fully realize AI's potential, faculty members must be given access to the AI latest technologies. As recommended by Berendt et al. (2020), providing faculty members access to AI related materials and collaborative platforms makes it easier to integrate AI into teaching practices. Faculty members are empowered to create tailored learning experiences that cater to the diverse needs of students and minimize administrative workloads (Kannan & Munday, 2018).

With the support of AI, faculty members can improve their lesson plans, pinpoint problem areas, and quickly propose solutions to improve student learning. Through intelligent tutoring systems that adjust instructional materials to individual student needs and allow them to advance at students' own pace. The incorporation of AI offers an opportunity for personalized learning experiences for students (Thu et al., 2023). AI can also support collaborative learning initiatives by promoting interactions and knowledge sharing between students from different backgrounds, thereby improving educational experience (Andersen et al., 2022).

A key aspect of implementing AI in education is giving top priority to initiatives that promote student agency, curiosity, and active engagement (Kumar, 2022). A shift from passive learning to active participation can be sparked by demonstrating how faculty members use AI to amplify student voice and agency. This finding is in line with the recommendations of Berendt et al. (2020), who underline the need to enable students to take responsibility for their own learning in creative ways. In addition, another important benefit of AI in education is its ability to increase learning process transparency (Khosravi et al., 2022). Both traditional and AI-based education will significantly advance as a result of the insights generated by AI that shed light on student engagement and progress.

Realizing AI's potential in education is a complex process that necessitates an ecosystem for innovation, aligned incentives, and institutional integration. Cooperation among technologists, faculty members, and policymakers is critical for successful AI application and fostering an environment in which AI can thrive and meet educational needs (Luckin et al., 2022). However, a careful examination of pedagogical and ethical issues is required as AI's role in education evolves. Besides, differentiating between knowledge-centric and data-driven approaches is essential to prevent objectives like individuation and socialization from being overshadowed. Despite its enticing potential, there is not enough evidence that artificial intelligence

increases educational effectiveness, so more research needs to be conducted. (Bates et al., 2020).

Meanwhile, as the impact of AI on education grows, issues of bias, transparency, and privacy become more prominent (Holmes et al., 2021). Strong ethical frameworks are required to avoid reinforcing injustices and unintended consequences of AI-driven education. Without ethical oversight, AI tutors and chatbots risk exacerbating inequity. Therefore, higher education institutions must prioritize AI ethics. Transparency, data security, and appropriate use ensure that chatbots adhere to educational and moral standards. (Mohamed, 2023). A careful balance of AI benefits and risks is required for an ethical, equitable integration process. Berendt et al. (2020) emphasized providing students with data access and control while addressing biases in AI systems. A thorough critical examination of AI systems can lower the risk of perpetuating injustice and impeding creative teaching. By carefully navigating this balance, faculty members and stakeholders can enable AI to seamlessly empower students and foster holistic development (Chan, 2023).

Faculty Members' Instructional Behaviors with AI

The term “artificial intelligence” (AI) refers to computer programmes or technologies that perform tasks that would otherwise require human intelligence (Bawack et al., 2021). Artificial Intelligence allows computer systems to mimic human cognition and behavior by performing tasks and responding predictably (Wang, 2019). Artificial Intelligence-enabled computers can detect, interpret, act, and learn on their own. AI technology advancements have made them valuable educational partners for faculty members (Luckin & Cukurova, 2019).

Faculty members can use AI discoveries to create personalized learning paths that ensure that students receive knowledge that is appropriate for their pace and learning style (Bhutoria, 2022). To tailor learning materials and activities to individual needs, AI systems examine students' learning patterns, preferences, and performance data (Chen et al., 2020). AI-enabled technologies generate analytics and reports that provide faculty members with insights into overall class performance as well as individual students' conceptual comprehension. For example, automated grading systems can quickly evaluate assignments and tests, freeing up faculty members' time to provide student-specific feedback and interact with them (Darvishi et al., 2022). AI-enabled chatbots may respond quickly to student questions, allowing easier access to guidance and information (Chen et al., 2023).

More importantly, faculty members must utilize AI to develop an effective curriculum and create instructional materials that support student learning and achievement. Faculty members can use AI to create not only lectures and assignments but also supplementary materials such as study guides, summaries, and quizzes. Besides, faculty members can simulate the peer review process using AI, allowing for iterative revision of student projects and assignments through simulated feedback (Darvishi et al., 2022). Therefore, faculty members can use AI tools to provide more comprehensive educational experience than traditional classrooms (Chan, 2023).

The relationship between faculty members' growth mindset and self-efficacy, and the relationship between their instructional behaviors and artificial intelligence.

A growth mindset is the belief that abilities can be developed through hard work and learning (Richardson et al., 2021). This concept contrasts with a fixed mindset, which states that talent is innate and unchangeable (Dweck, 2010). Faculty members with a growth mindset are more likely to experiment with new pedagogies, adapt to educational technologies, and persevere in the face of adversity. When faculty members model growth mindset thinking, students adopt a similar learning approach and persistence (Smith, 2023). Therefore, faculty members with a growth mindset have a larger influence on students' perspectives and experiences.

Cultivating growth mindsets among faculty members thus has significant potential benefits. Faculty members can establish more encouraging and successful learning environments in the classroom by implementing the growth mindset concepts. Faculty members can boost students' motivation, resilience, and engagement by putting an emphasis on effort and persistence, giving clear instruction that abilities can be developed, using materials that are appropriately challenging, having high expectations for all learners, and fostering a culture that sees challenges as opportunities (Darling-Hammond et al., 2020). Growth mindsets emerge as the foundation for effective teaching, enriching experiences, and academic achievement in dynamic higher education.

Faculty members with a growth mindset are more likely to be open and positive about technologies applications including AI (Seaton, 2018). Faculty members see these tools as additional opportunities to learn, grow, and promote student development, not as assessments of their teaching abilities or threats to their roles. Because faculty members with growth mindsets value long-term progress, they are eager to incorporate promising innovations and see classroom AI as an ally rather than a threat. Even when faced with challenges in implementing new technology tools, growth-minded faculty remain motivated to master the process in order to provide better learning experiences. Faculty members' open-mindedness also makes them more focused on evaluating and improving AI tools to maximize student benefits. In addition, AI provides professional and personal growth opportunities for faculty members with a growth mindset to better provide quality education for students (Luckin et al., 2022).

H1: Faculty members' growth mindset is positively related to their instructional behaviors with AI.

Shortridge-Baggett (2000) defines self-efficacy as confidence in one's ability to succeed in a given situation. This concept refers to faculty members' perceived capability in the core duties of teaching, research, and service (Landino & Owen, 1988). Faculty members with strong self-efficacy are confident in their capacity to educate, research, and serve effectively. Influencing factors include mastery and vicarious experiences, verbal persuasion, and emotional state. Increased self-efficacy is correlated with increased achievement in the classroom, research, and

community involvement (Meng & Zhang, 2023). Moreover, faculty members with high self-efficacy embrace innovation, stick with struggling students, and have a strong sense of institutional commitment. Developmental opportunities, feedback, and a supportive environment can all boost faculty members' self-efficacy, as can collegial support, resources, and a positive climate (Ismayilova & Klassen, 2019). Faculty members with high self-efficacy are confident in learning new skills and adapting to emerging AI technologies. Faculty members with self-efficacy see it as a means of improving performance rather than seeing AI as a threat, (Chan, 2023).

H2: Faculty members' self-efficacy is positively related to their instructional behaviors related to AI.

Relationships between faculty members' instructional behaviors and AI, university policies and the academic environment and between students' engagement and academic performance

Faculty members are more likely to use AI if they have access to AI teaching materials (Mohamed, 2023). University policies have a significant impact on AI integration in education. University policies that promote and support AI as instructional tools make essential resources and support available to faculty members. Policies that offer AI training incentives also help faculty members develop integration skills (Chan, 2023). Academic cultures and policies that encourage collaboration allow faculty members to advance AI expertise together. The value of open idea exchange enables the integration of AI insights (Andersen et al., 2022). Regular forums for sharing experiences enable the exchange of best practices and lessons learned when using AI to improve outcomes. Faculty members can improve their AI leveraging skills through collective reflection.

H3: University policies and the academic environment are positively related to faculty members' instructional behaviors related to AI.

Students tend to be more engaged in class at universities that encourage the use of technologies including AI. Learning is more interactive and tailored to the needs of each student thanks to tools such as AI tutors, personalized learning platforms, and intelligent course assistants (Alam, 2022). Students become more engaged in their courses because AI allows them to study at their own pace. When faculty members are assisted in developing AI-enhanced courses, students can use cutting-edge technologies for projects, labs, and assignments. These firsthand experiences develop valuable skills while encouraging further AI research (Chen et al., 2019). As universities implement AI, students will find courses more engaging. Customized and self-directed learning, as well as access to advanced technologies, encourage active participation and skill development for future careers.

Furthermore, having access to AI resources in educational settings improves students' learning outcomes (Chan, 2023). Students can receive individualized and

interactive support outside of the classroom at universities that have invested in AI courseware, adaptive learning systems, and teaching assistants. The accessibility of these AI tools allows students to fill knowledge gaps, tackle difficult concepts, and gain a deeper understanding (Kong et al., 2021). Students are more likely to study effectively when faculty members are skilled at using AI to support their instruction. Faculty members create well-thought-out AI applications that improve critical thinking, teamwork, creativity, and other advanced skills (Wang et al., 2023).

H4: University policies and academic environment are positively related to student engagement and academic performance.

When faculty members expertly integrate AI into their lessons, students learn more actively. Tools such as AI-driven student response systems, intelligent tutoring apps, and adaptive learning platforms make classes more interactive (Darvishi et al., 2022). When students actively participate in the course materials, they remain attentive and fully engaged in learning. Because of the careful use of AI, faculty members are also better able to offer personalized comments and support. For example, AI teaching assistants can provide personalized tips and suggestions to each student to improve their understanding of key concepts. Individualized learning paths encourage students to take greater ownership of their understanding of course materials (Holmes et al., 2023).

Additionally, faculty members who incorporate AI into their curriculum design create more engaging learning opportunities (Kasneji et al., 2023). Students can apply their knowledge in replicated real-world scenarios thanks to augmented reality, smart textbooks, and AI-powered virtual simulations (Dai & Ke, 2022). When used responsibly, AI enables faculty members to increase their educational support for students (Seo et al., 2021). Because of intelligent tutoring technologies, faculty members can now assist more students outside of the classroom (Alam, 2022). Chatbots answer common questions, freeing up faculty members for more in-depth conversations with students who need them. Faculty members can help students develop their critical thinking, communication, and creative thinking skills by carefully integrating AI into their lessons (Kooli, 2023). When faculty members carefully integrate AI, they can create accessible, stimulating learning that targets and develops core competencies in their students.

H5: Faculty members' instructional behaviors related to AI are positively related to students' engagement and academic performance.

RESEARCH METHODS AND DATA COLLECTION

The SEM in Figure 1 is well suited for this study because it focuses on understanding the relationships between faculty members' growth mindset, self-efficacy, and instructional behaviors. Most importantly, the model explores the impact of faculty members' instructional behaviors, as well as university policies and environments, on student engagement and academic performance. Surveys were sent to 2,125 faculty members across 9 universities and 2 schools under Vietnam National University

Hanoi. These included VNU-HUS, VNU-USSH, VNU-ULIS, VNU-UET, VNU-UEB, VNU-UEd, VNU-VJU, VNU-UMP, VNU-UL, VNU-HSB, and VNU-IS. There were 559 valid responses received, equivalent to a 26.3% response rate. Descriptive statistics of the valid responses are provided in Table 1.

Figure 1: Research Model and Hypotheses

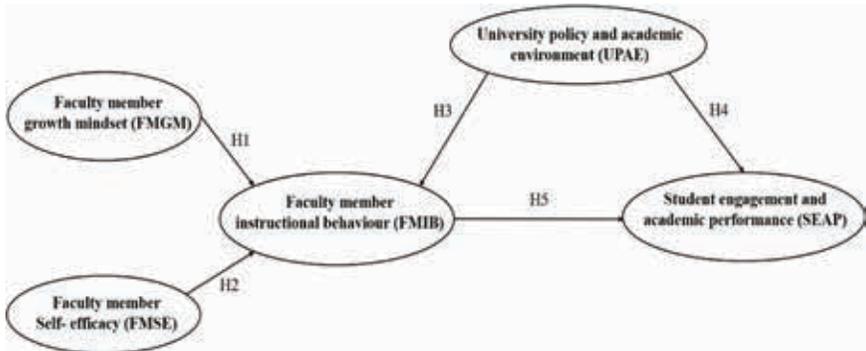


Table 1: Descriptive statistics of the valid responses

Variables/Items	Types	Frequency	Percentage
Gender	Female	262	46.87
	Male	297	53.13
University/School	VNU-Hanoi School of Business & Management (VNU-HSB)	35	06.26
	VNU-International Schools (VNU-IS)	29	05.19
	VNU-Hanoi University of Science (VNU-HUS)	33	05.90
	VNU-University of Social Sciences and Humanities Hanoi (VNU-USSH)	61	10.91
	VNU-University of Languages & International Studies (VNU-ULIS)	51	09.12
	VNU-University of Engineering and Technology (VNU-UET)	54	09.66
	VNU-University of Economics & Business (VNU-UEB)	63	11.27
	VNU-University of Education (VNU-UEd)	56	10.02

Variables/Items	Types	Frequency	Percentage
Age	<i>Under 30</i>	46	08.23
	<i>From 30 to under 40</i>	224	40.07
	<i>From 40 to under 50</i>	179	32.02
	<i>From 50 to under 60</i>	84	15.03
	<i>Aged 60 and above</i>	26	4.65

Table 1 shows that respondents' gender distributions are roughly even, with 53.13% being men and 46.87% being women. Table 1 delineates the respondents' affiliations with their respective universities and schools. There are 51 to 63 faculty members from universities affiliated with VNU Hanoi. The fact that three VNU Hanoi schools—VNU-HSB, VNU-IS, and VNU-HUS—had the fewest respondents was understandable, given that those institutions had fewer faculty members than other VNU Hanoi universities. The majority of respondents (40.07% of all) were aged between 30 and 40 years. The distribution narrows as age increases, with the “aged 60 and above” group having the fewest respondents (4.65%). This suggests that the respondents are relatively young, but there is still a mix of ages represented. The study was carried out on faculty members from August 2022 to June 2023. Table 2 illustrates how the research questionnaire was created by adapting items from previous studies. A total of 23 items were rated on a 5-point Likert scale, with response options ranging from 1 to 5, where 1 indicates strongly disagree, 2 indicates disagree, 3 indicates neutral, 4 indicates agree, and 5 indicates strongly agree.

Table 2: Questionnaire Research Items

Variable	Item	Constructs	Previous studies
Faculty member growth mindset (FMGM)	GM1	I believe that intelligence can be developed through effort rather than being fixed.	Dweck (2010)
	GM2	I am constantly looking for ways to improve my teaching abilities.	Hartka (2019)
	GM3	I am not afraid to make mistakes in front of my students, and they can learn from them.	Hartka (2019)
	GM4	I am constantly looking for new ways to push my students.	Mireles-Rios & Becchio (2018)
Faculty member self-efficacy (FMSE)	SE1	I am confident in my ability to effectively instruct my students.	Mireles-Rios & Becchio (2018)

Variable	Item	Constructs	Previous studies
Faculty member instructional behaviors (FMIB)	SE2	I am confident in my ability to effectively connect with my students through an array of instructional approaches..	Haddad & Taleb (2016)
	SE3	I am confident in my ability to use technology to enhance my teaching.	Giles & Kent (2016)
	SE4	I am confident that I can work with other faculty members to improve my teaching.	Ismayilova & Klassen (2019)
	IB1	I use AI-powered tools to personalize and differentiate my instruction	Zhai (2022).
	IB2	I use AI-powered tools to provide feedback to my students.	Kumar, R. (2023).
	IB3	I use AI-powered tools to track student progress	Kumar, R. (2023).
	IB4	I use AI-powered tools to create interactive learning experiences	Chiu et al., (2023).
	IB5	I use AI-powered tools to automate some of my teaching tasks, allowing me to focus on more creative and engaging activities.	Zhai (2022).
	University policies and academic environment (UPAE)	PAE1	The university has a clear vision for how artificial intelligence (AI) can be used to improve teaching and learning.
PAE2		The university offers financial assistance to faculty members who develop and use AI-powered tools.	Tanveer et al., (2020).
PAE3		The university trains faculty members on how to use AI-powered tools.	Nazaretsky et al., (2022).
PAE4		The university has a culture that encourages AI experimentation and innovation.	Yams et al., (2020).

Variable	Item	Constructs	Previous studies
Student engagement and academic performance (SEAP)	PAE5	The university has policies in place to ensure that artificial intelligence is used in an ethical and responsible manner.	Chan (2023)
	EAP1	AI used in the classrooms helped me to attract more students in the educational activities that I organized in the class.	Wang et al., (2020).
	EAP2	AI supported me in personalizing instruction to improve students' academic performance.	Chan (2023)
	EAP3	AI supported me in providing timely feedback and helped my students learn more effectively.	Seo et al., (2021).
	EAP4	AI assisted me in developing interactive learning experiences that are more engaging for students.	Chen et al., (2023).
	EAP5	AI assisted me in understanding students who were struggling and providing them with additional support that drives better academic outcomes for each of my students	Gupta & Chen (2022).

DATA ANALYSIS

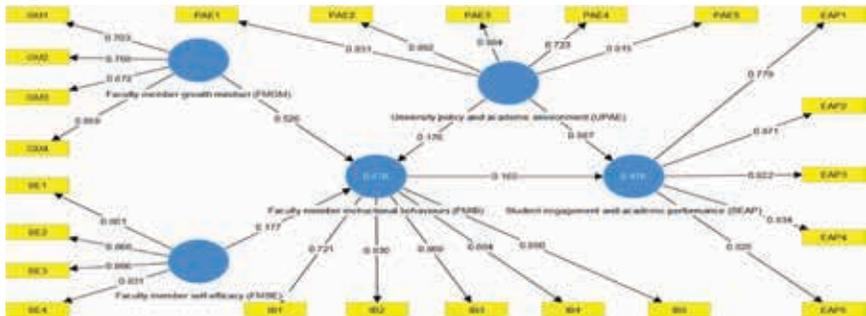
In this study, the quantitative structural equation modeling (SEM) approach was used to analyze the complex interrelationships between multiple variables (Sarstedt et al., 2021). SEM analysis was performed using SmartPLS software. The analysis required a maximum of 300 iterations and a stopping criterion of 7 to achieve accurate calculations using the partial least squares (PLS) algorithm.

Following the completion of the estimation process, the obtained results were thoroughly evaluated in two stages. The first stage involved evaluating the measurement model, which entailed examining the validity and reliability of the observed indicators or variables within the developed model. This evaluation was critical in determining the robustness of the measurement instruments and elucidating the quality of the measurement procedure. The second stage was dedicated to evaluating the structural model. At this stage, the research hypotheses

were rigorously tested, and the interactions and effects of the model's variables were carefully examined. The causal links and effects between the variables in the larger research framework were clearly revealed.

The division of the evaluation procedure into these two stages facilitated a thorough understanding of the model's veracity and the significance of the variables in the context of the study. This method ensured a methodical and thorough evaluation of the research framework from structural and measurement perspectives. The results of the analysis within the measurement model shed light on how the path model was created. This path model also includes loading factors, which are critical for understanding the relationships between latent variables and observed indicators. Figure 2 depicts the visualization of these results, illustrating the established connections and their respective strengths.

Figure 2: Results of the Path Model



The outer loading of each variable ranged from 0.703 to 0.892, exceeding the recommended threshold of 0.700 (Hair et al., 2012; Wijaya et al., 2022). This indicates that all variables in the instrument have outer loadings greater than 0.700, meeting the previously-mentioned requirement.

Table 3: Results for the Loading Factors, Validity, and Reliability

Latent Variables	Indicators	Outer loadings	Cronbach's Alpha	Composite Reliability (rho_a)	AVE
Faculty member growth mindset (FMGM)	GM1	0.703	0.814	0.823	0.645
	GM2	0.768			
	GM3	0.872			
	GM4	0.859			
Faculty member self-efficacy (FMSE)	SE1	0.801	0.888	0.894	0.693
	SE2	0.866			
	SE3	0.866			

Latent Variables	Indicators	Outer loadings	Cronbach's Alpha	Composite Reliability (rho_a)	AVE
	SE4	0.831			
Faculty member instructional behaviors (FMIB)	IB1	0.721	0.862	0.865	0.708
	IB2	0.830			
	IB3	0.869			
	IB4	0.884			
	IB5	0.850			
University policies and academic environment (UPAE)	PAE1	0.831	0.884	0.887	0.684
	PAE2	0.892			
	PAE3	0.884			
	PAE4	0.723			
	PAE5	0.815			
Student engagement and academic performance (SEAP)	EAP1	0.779	0.886	0.892	0.691
	EAP2	0.871			
	EAP3	0.822			
	EAP4	0.834			
	EAP5	0.825			

Tavakol and Dennick (2011) established a standard for internal consistency by stating that a Cronbach's alpha value greater than 0.700 indicates adequate reliability. Furthermore, according to Netemeyer et al. (2003), a composite reliability value greater than 0.700 indicates robustness. The calculated Cronbach's alpha and composite reliability values for all variables exceeded 0.700, meeting the recommended thresholds, as shown in Table 3. This demonstrates that the variables under consideration are appropriate for further study.

The authors utilized the average variance extracted (AVE) as an indicator for assessing convergent validity, following Hock and Ringle's (2010) recommendation that an AVE of 0.5 or higher signifies strong convergence. LAs must explain at least 50% of the variance in their corresponding observable variables. The obtained AVE values for the latent variables surpass 0.5, signifying a robust level of convergence (Hock & Ringle, 2010). Simultaneously, discriminant validity was scrutinized using both the Heterotrait-Monotrait Ratio (HTMT) technique and the Fornell-Larcker criterion. The results of the Fornell-Larcker analysis, presented in Table 4, feature the square roots of the AVEs diagonally from the top left to the bottom right. Following Henseler et al.'s (2015) guideline, these diagonal elements should be less than 0.9 to meet the criterion for discriminant validity.

Table 4: Results of Discriminant Validity Based on Fornell–Larcker Criterion Results

	Faculty member growth mindset (FMGM)	Faculty member instructional behaviors (FMIB)	Faculty member self-efficacy (FMSE)	Student engagement and academic performance (SEAP)	University policy and academic environment (UPAE)
Faculty member growth mindset (FMGM)	0.803				
Faculty member instructional behaviors (FMIB)	0.723	0.833			
Faculty member self-efficacy (FMSE)	0.593	0.572	0.842		
Student engagement and academic performance (SEAP)	0.522	0.480	0.528	0.827	
University policy and academic environment (UPAE)	0.525	0.536	0.471	0.676	0.831

As shown in Table 5, the Heterotrait-Monotrait Ratio (HTMT) of correlations was also used to assess discriminant validity. This method compares correlations between different constructs to correlations within the same construct (Henseler et al., 2015). According to Henseler et al. (2015), an HTMT ratio less than 0.85 indicates that the discriminant validity requirements have been met. The HTMT ratios in Table 5 are all less than 0.85, indicating that the constructs have adequate discriminant validity based on these criteria. As a result, the HTMT method analysis supported the distinctness of the variables measured in this study.

Table 5: Additional Validity Discriminant Measurement Results Based On HTMT

	Faculty member growth mindset (FMGM)	Faculty member instructional behaviors (FMIB)	Faculty member self-efficacy (FMSE)	Student engagement and academic performance (SEAP)
Faculty member instructional behaviors (FMIB)	0.850			
Faculty member self-efficacy (FMSE)	0.708	0.654		
Student engagement and academic performance (SEAP)	0.609	0.540	0.604	
University policy and academic environment (UPAE)	0.614	0.602	0.540	0.761

Figure 3 depicts the significance of each relationship, demonstrating that the variables in the constructed model have a strong relationship with one another.

Table 5 shows that all effect relationships in the model have a P value less than 0.05. This result suggested that the effect within the structural model was statistically significant. Furthermore, having a growth mindset outperforms self-efficacy in terms of its impact on faculty members' instructional behaviors with AI. Moreover, university policy and the academic environment are more positively related to student engagement and academic performance than faculty instructional behaviors are, demonstrating the importance of implementing policies and developing a learning environment that supports AI. University policies and the academic environment have a positive influence on faculty members' instructional behaviors related to AI.

Table 5: Bootstrapping Results of Hypothesis Testing

Hypothesis	Effects	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Conclusions
H1	Faculty member growth mindset (FMGM) -> Faculty member instructional behaviors (FMIB)	0.526	0.525	0.064	8.188	0.000	Accepted
H2	Faculty member self-efficacy (FMSE) -> Faculty member instructional behaviors (FMIB)	0.177	0.179	0.065	2.716	0.007	Accepted
H3	University policy and academic environment (UPAE) -> Faculty member instructional behaviors (FMIB)	0.176	0.177	0.053	3.338	0.001	Accepted
H4	University policy and academic environment (UPAE) -> Student engagement and academic performance (SEAP)	0.587	0.587	0.065	9.095	0.000	Accepted
H5	Faculty member instructional behaviors (FMIB) -> Student engagement and academic performance (SEAP)	0.165	0.167	0.065	2.549	0.011	Accepted

Figure 3: Evaluation of the proposed measurement model

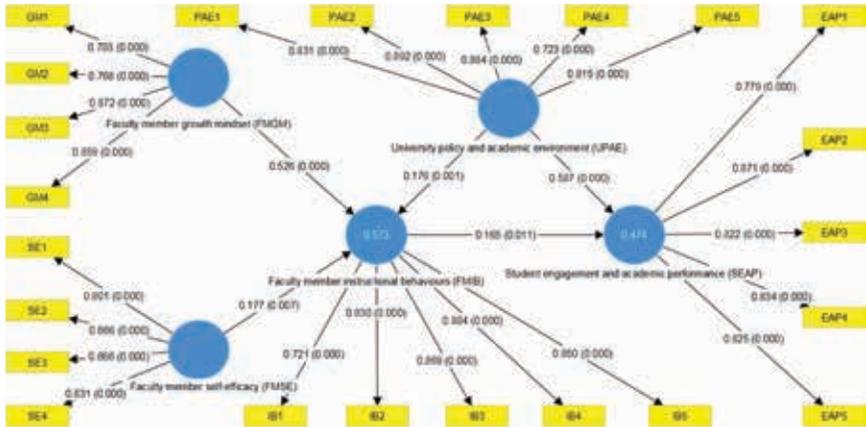


Table 6: Coefficients of determination

Dependent variables	R Square	R Square Adjusted
Faculty member instructional behaviors (FMIB)	0.576	0.573
Student engagement and academic performance (SEAP)	0.476	0.474

The coefficient of determination, also known as the R-squared, is commonly used to assess the strength and accuracy of structural models. As shown in Table 6, the model explained 47.4% of the variation in student involvement and academic achievement and 57.3% of the variation in faculty members’ instructional behavior.

DISCUSSION

The findings of this study indicate that a growth mindset has a stronger relationship with faculty members’ instructional behaviors related to AI than self-efficacy. According to Lin et al. (2022), self-efficacy is concerned with one’s confidence in one’s current skills, whereas a growth mindset is more explicitly concerned with beliefs about one’s ability to progress and develop talent. Faculty members who strongly emphasize development are more likely to use teaching strategies that gradually improve students’ competencies. Moreover, Haddad and Taleb (2016) discovered that self-efficacy has a positive influence on faculty members’ teaching performance, implying that faculty members should be more self-efficacious, organized, and effective at dealing with obstacles to improve their teaching performance.

In addition, university policy and the academic environment are more positively related to student engagement and academic success than faculty members’ instructional practices are, demonstrating the importance of enacting policies

and creating a learning environment that supports AI, which is consistent with the findings of Yu et al. (2022). This study suggested that while faculty members' instructional behaviors are important, students may spend more time interacting with their surroundings and peers than they do in class. Faculty behaviors are the most important for specific classroom outcomes. The environment may have a greater impact on overall student development. Furthermore, the academic environment and institutional policies have a positive impact on faculty members' AI-based teaching habits. This finding is consistent with the findings of Chan (2023), who discovered a positive impact of the academic environment and institutional policies on faculty members' instructional quality related to AI.

Therefore, fostering a growth mindset in faculty members should be prioritized because it has a strong positive association with the use of AI-enhanced instructional behaviors. Professional development centered on the growth mindset has the potential to improve teaching practices. While faculty members' instructional behaviors are important, AI-friendly policies and the environment may be even more important in determining student success. Higher education institutions should concentrate their efforts on developing policies, resources, and an environment that will allow faculty members to fully realize the potential of AI.

CONCLUSIONS

This study explored how faculty members' growth mindset and self-efficacy relate to their instructional behaviors with AI and how such behaviors, along with university policies, affect student outcomes. According to the findings, a growth mindset has a stronger positive relationship with instructional behavior than self-efficacy. Furthermore, university policies and atmosphere had greater impacts on student involvement and performance than faculty members' instructional behaviors alone. The model explained 57.3% of the variation in faculty instructional behaviors and 47.4% of the variation in student outcomes. The implications are that cultivating faculty growth mindsets and providing enabling AI policies are critical to realizing AI's potential.

Furthermore, institutional support is required to ensure that faculty members have access to and knowledge of AI tools. It is also critical to foster an intellectual environment of collaboration, sharing, and invention. In such an environment, faculty members can share best practices for AI integration.

Faculty members play a crucial role in unlocking the benefits of AI for personalized, flexible learning. Proper training empowers faculty members to harness AI's potential, creating an enhanced curriculum and revolutionizing the learning experience. As AI becomes more common, it is critical to maintain a focus on strong educational goals and ethical application. AI should supplement, not replace, high-quality education.

NOTE

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Chapter 17

Creating Context-Specific Critical Incidents with ChatGPT for Effective Soft Skill Training

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ABSTRACT

This paper explores the potential of generative AI text models, specifically ChatGPT, to create case studies/ critical incidents for soft skill training sessions. While educators and trainers often use critical incidents to provide practical examples of course content, existing language models struggle to produce high-quality outputs due to a lack of contextual understanding and inability to mimic specific writing styles. The proposed approach involves training a generative AI text model, such as ChatGPT, with existing case studies to replicate the writing style of a particular author and generate complex and specific prompts for critical incidents. This process allows for the creation of highly personalized and tailored critical incidents that align with the target group's industry and real-life challenges. This paper will emphasize the potential benefits of using the ChatGPT in soft skill training sessions, including increased efficiency and personalization of context-specific critical incidents. It will also address the limitations and problems related to the use of AI in educational settings. By utilizing this approach, educators and trainers can provide their students with a variety of practical examples that enhance their learning experience and improve their overall skill development.

Keywords: Case Studies, Critical Incidents, Training

INTRODUCTION

Storytelling is a fantastic way to transport knowledge in a vivid way that sticks in students' minds, but not every scholar is a naturally born storyteller. In this article, we use the example of critical incidents (CIs) to explore how ChatGPT, with its strong linguistic and creative writing abilities (Atlas, 2023), can help to write highly personalized training materials that lift training sessions to a new level. The traditional method of crafting CIs in intercultural training relies on human intuition, personal experiences, and cultural insights. The findings suggest that while AI, in this case, ChatGPT, cannot create highly specific CIs without a detailed context, it has the remarkable capability to adapt, refine, and customize based on inputs. As such, the primary research question arises: Can AI truly replace human knowledge and intuition in crafting these CIs?

Critical incidents have emerged as pivotal tools in soft skill training sessions, especially in intercultural courses, serving to amplify our comprehension of human behaviors, attitudes, and interactions (Apedaile & Schill, 2008.). Rooted in the cross-cultural work of Triandis in the 1960s, they have been integral in cultivating cross-cultural competence by presenting situations where cultural nuances lead to misunderstandings or conflicts (Apedaile & Schill, 2008). Critical incidents are tools for increasing our awareness and understanding of human attitudes, expectations, behaviors, and interactions and for engaging participants at a meaningful, personal level. These incidents, grounded in everyday scenarios, often unravel surprising, enigmatic, or even conflicting outcomes, urging training participants or students to reflect on the cultural foundations and norms that might be the reason for such outcomes. Because of its clarity, Critical Incident Analysis was developed into a classic training method for intercultural training sessions (Hiller, 2009).

Often, the Critical Incidents used in training sessions are located in contexts that are unfamiliar to the participants and thus hinder the relation or connection of students to the incidents. The personalization of critical incidents fosters the connection of students and thus the learning outcome but requires much work, which can be minimized with generative AI tools. When using creative training formats, such as showing different perspectives on critical incidents or exploring the emotions of different protagonists, the ChatGPT can help to create fantastic training materials.

While AI tools can aid in drafting, personalizing, and even analyzing such incidents, they also have the potential to perpetuate harmful biases or stereotypes, as outlined by OpenAI in their OpenAI's "Educator considerations for ChatGPT," thus reinforcing biased or stereotypical portrayals of groups of people. These models are trained on large amounts of data, and if that data are biased, the model will reflect and amplify that bias in its output (Atlas, 2023).

This article discusses the enormous benefits of using the ChatGPT to write and adapt critical incidents as well as the risks of relying on AI, all of which involve biases and limitations.

FINDINGS AND DISCUSSION

The integration of AI models such as the ChatGPT into intercultural training, specifically the creation of critical incidents (CIs), opens new avenues for both groundbreaking possibilities and inherent challenges. It brings to the fore unparalleled advantages in terms of efficiency, customization, and diversity of perspectives. The aim of this study was to craft a comprehensive prompt that would allow ChatGPT to generate very specific CIs in a well-defined and reproducible structure and tonality based on minimal additional instructions such as the cultural dimension, industry context, and involved cultures.

While ChatGPT-4 is highly effective at producing creative texts, it produces very random results when not provided with sufficient context. The way information is fed to the ChatGPT significantly influences the quality and accuracy of its output.

Approach

To guide the ChatGPT, 10 critical incidents were uploaded, and the ChatGPT was asked to extract guidelines for writing great critical incidents and internalize the core elements and desired tone from these tangible examples. The examples can either be copy-pasted into the Chat window or uploaded as a text file. This was further enhanced by integrating supplementary background materials, enriching the understanding of the overarching context.

The key elements, which ChatGPT extracted from the uploaded Critical incidence and the background theory were:

- **Authentic, Everyday Encounter:** The incident should depict a believable, day-to-day scenario where at least two individuals from different cultural backgrounds interact.
- **Cultural Misunderstandings or Conflicts:** At the heart of the incident should be a cultural misunderstanding or conflict.
- **Unexpected outcome:** The incident should deviate from what is typically expected. It might be seen as surprising, hard to grasp, or as resulting in conflict for one or more persons involved.
- **Detailed Description:** The narrative should provide a thorough depiction of the situation, the characters, and the setting. The story should focus primarily on the sentiments and perceptions of the individuals involved, showing their exact spoken words.
- **Ambiguity:** The root cause of the problem should be subtly woven into the narrative, presenting a bit of a challenge for the reader or participant to pinpoint the exact issue.
- **The incident:** Layout the event or sequence of events where cultural differences lead to misunderstandings or conflicts. The behaviors, interactions, or decisions that underline the cultural contrasts are described.
- **Consequences:** Describe the repercussions of the incident on the professional relationship, the progress of projects, or the work atmosphere.
- **Simplicity and Language:** The narrative should be simple, akin to storytelling, and should steer clear any specialized terminology from the intercultural or cross-cultural domain.

It became evident that creating an efficient prompt for the ChatGPT was an iterative process. Starting with a base, testing its efficiency and refining it based on the outcomes led to the generation of more refined and accurate incidents. However, even with meticulous refinement, stylistic or content-based corrections, such as reminding the AI to employ direct speech or ensuring cultural nuances, were occasionally necessary.

Example

This is an example of a critical incident that was created with ChatGPT 4 (default mode) by asking for a CI for high-context communication:

Background and Context:

Anna, a marketing manager from Sweden, has recently joined a multinational corporation based in Japan. She works closely with Taro, a Japanese senior marketing executive, on a project to launch a new product in the international market. Anna has been assigned to create a marketing plan to present to the board of directors. This is her first project with the company, and she wanted to make a good impression.

The Incident:

Anna works diligently on the marketing plan, taking care to include innovative ideas and strategies. She feels confident in her work and is eager to receive feedback from Taro before presenting it to the board. After she emails her proposal to Taro, they schedule a meeting to discuss it. During the meeting, Taro listens attentively, as Anna explains her ideas. Taro responded with vague comments such as “This is interesting,” and “I see what you’re trying to do here.” Anna becomes increasingly frustrated, as she feels that Taro is not providing any concrete feedback or suggestions for improvement. Anna asks Taro directly, “Is there anything you think I should change or improve in the marketing plan?” Taro hesitates for a moment before saying, “Well, perhaps you could consider the impact of the local market on this strategy.” Anna is still unsatisfied with the response, as it does not offer specific guidance.

Consequences:

As a result of the unclear feedback, Anna is left feeling unsupported and uncertain about her work. She begins to question her abilities and whether she is a good fit for the company. The marketing plan she presents to the board is ultimately well received, but her confidence is shaken. Taro, on the other hand, feels that he has been respectful and supportive by not pointing out any glaring flaws in Anna’s plan. He is puzzled by her frustration and believes he has provided helpful guidance.

The example illustrates how well ChatGPT was able to choose appropriate cultures, write a story that illustrates cultural misunderstanding and illustrate the consequences of intercultural misunderstanding.

Benefits

One of ChatGPT’s significant strengths lies in its adaptability. Not only could incidents be generated across various cultural frameworks, but proficiency in tailoring incidents to specific target groups, such as age groups, industries, professions, etc., was also shown. This adaptability was further manifested in the ability to creatively present incidents, such as recounting the same event from the viewpoint of different protagonists, offering readers multifaceted perspectives on a single incident.

The key advantages and potentials of AI in writing about critical incidents are as follows:

Customization and Flexibility: The first, and perhaps the most potent, advantage of AI lies in its unparalleled adaptability. Given the diverse student bodies in higher education, each with their unique experiences, backgrounds, and learning needs, educators have always faced the challenge of ensuring content relevance. With

AI, there is the ability to mold CIs tailored to specific contexts, industries, or even intricate cultural nuances. This inherent flexibility ensures that the content remains pertinent across courses, departments, or varying cohorts of students.

Speed and Efficiency: In academia, where time is often a limited commodity, efficiency in content creation becomes pivotal. While manual crafting of CIs provides depth and authenticity, it is an undeniably time-consuming process. Enter AI, and we witness a paradigm shift. Once fed with a detailed and appropriate prompt, AI tools such as ChatGPT can generate comprehensive CIs a fraction of the time, ensuring that educators can focus on pedagogical aspects rather than content generation.

Enriched Analysis and Diverse Perspectives: An essential component of intercultural training involves fostering empathy and understanding. In its algorithmic nature, AI can reinterpret and rewrite CIs from various perspectives. By presenting students with a situation analyzed from multiple viewpoints, educators can cultivate a more profound sense of empathy and comprehension among them.

The Novelty of Approach and Integration: AI offers a fresh perspective that is devoid of human prejudice. When combined with traditional methods, this approach can result in a harmonious blend of accuracy and innovation. For instance, while AI can craft a CI skeleton, human educators can imbue it with depth, emotions, and real-world relevance. Such a collaborative approach promises CIs that are both accurate and relatable.

Challenges

Incorporating the ChatGPT in the development of critical incidents for intercultural training brings forth both innovative prospects and notable challenges. A recurring concern was the AI's potential to inadvertently introduce or perpetuate cultural stereotypes, a concern rooted in its training on vast datasets that might contain biased information. Consequently, there was a reiterated emphasis on the necessity of human oversight, especially from experienced intercultural trainers, to vet and ensure the cultural validity and appropriateness of the generated incidents.

The extensive reliance of AI on data predominantly shaped by the Western, Educated, Industrialized, Rich, Democratic (WEIRD) perspective often leads to an underrepresentation of diverse global viewpoints, especially from regions such as India, Africa, and Asia. Consequently, this skewness may inadvertently perpetuate cultural stereotypes and oversimplify complex cultural behaviors, potentially overlooking subtle nuances that are essential in intercultural understanding. Additionally, given that cultures are dynamic and constantly evolving, there is a risk that ChatGPT, which relies on its training data, might not fully capture the latest cultural shifts and developments.

One of the primary research questions focused on the cultural intuition embedded within these CIs. These findings indicate that while ChatGPT can craft scenarios, these nuances often require human oversight. For instance, while AI can ensure algorithmic neutrality, reducing inherent biases or stereotypes, it sometimes lacks the depth of understanding of cultural intricacies that humans inherently possess.

Therefore, while ChatGPT can significantly aid in creating case studies, it is crucial to supplement its outputs with current insights, a critical perspective and the strategic integration of human expertise to ensure a more accurate and comprehensive depiction of the diverse cultural landscape.

Acceptance by training participants/students

In my exploration of ChatGPT's role in crafting critical incidents, I have also considered the perceptual differences between human-created and AI-generated case studies in educational settings. Interestingly, my experience reveals that when ChatGPT-generated critical incidents are utilized in training sessions, participant reception is positive, irrespective of whether AI involvement was disclosed. This suggests that learners tend to prioritize the relevance and quality of the content over its origin. Notably, ChatGPT's ability to tailor critical incidents to specific roles, industries, and unique challenges presents a significant advantage. It facilitates the creation of highly contextual and relatable scenarios, enhancing the learning experience. This adaptability of AI, aligning case studies with the immediate professional environment of the participants, seems to overshadow any concerns about the artificial nature of their creation. However, it is crucial to recognize that this acceptance might vary across different educational contexts and cultures, necessitating ongoing evaluation to ensure the effectiveness of AI-integrated learning experiences.

Concluding Thoughts

The integration of AI in crafting critical incidents in higher education intercultural training is not merely a technological feat; it is a pedagogical evolution. While the adaptability, neutrality, and efficiency of AI are undeniable, its true potential lies in its collaboration with human educators. Together, they can ensure that CIs are timely, relevant, and profoundly resonant, bridging cultural divides and fostering genuine understanding in an increasingly interconnected world.

CONCLUSION

AI, particularly ChatGPT, is emerging as a valuable tool in the creation, adaptation, and analysis of critical incidents for intercultural training. Its capacity to rapidly generate tailored scenarios, its adaptability across various frameworks, and its versatility in content formats make it a powerful asset.

However, like any tool, its efficacy lies in its usage. A combination of strategic prompt creation, iterative refinement, and human oversight ensures that the critical incidents produced are relevant, accurate, and free from stereotypes. In the realm of intercultural training, where nuances matter, a synergistic approach that combines AI capabilities with human expertise promises the best outcomes.

NOTE

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Chapter 18

Applications of the ChatGPT in Work-Based Learning Programs: Opportunities, Challenges, and Ethical Considerations

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ABSTRACT

As artificial intelligence (AI) technology rapidly advances, concerns have been growing regarding its potential impact on employment in the blue-collar and vocational industries. It is essential to consider how Career and Technical Education (CTE) will adjust to this new reality, particularly through work-based learning (WBL) programs. This chapter discusses the implications of the increasing use of ChatGPT, a generative AI language model proficient in comprehending and generating human-like text, for WBL programs and for the roles of WBL coordinators. The focus of the examination is on understanding the opportunities, challenges, and ethical considerations associated with this technological advancement. Additionally, the chapter emphasizes the imperative for WBL coordinator preparation programs to ensure that future WBL coordinators are prepared to leverage ChatGPT to support their students' progression across the stages of the WBL continuum: career awareness, exploration, and preparation.

Keywords: Career and Technical Education, ChatGPT, Work-Based Learning

INTRODUCTION

Artificial Intelligence (AI), a topic of considerable debate and exploration, holds significant potential to profoundly influence the trajectory and future of teacher education (Ma et al., 2014; Zhang & Aslan, 2021; Zhai et al., 2021). The extensive potential of AI in education is manifested in applications encompassing myriad educational technologies, including chatbots, expert systems, intelligent tutors, learning analytics, gamification, personalized learning environments, and real-time visualizations (Department of Education, 2023; Fidan & Gencil, 2022; Luterbach, 2024). Each of these technologies offers distinct features and capabilities in and beyond the classroom, collectively demonstrating the versatility that AI brings to the realm of teaching, assessment and learning. The recent emergence of generative AI, exemplified as OpenAI's ChatGPT, showcases the vast potential to enhance all the facets essential to effective teaching, including instructional planning, assessment, culturally responsive instruction, student motivation, differentiation, and managing

the learning environment (Su & Yang, 2023; Zhang & Aslan, 2021). There is increasing consensus that educational technology powered by AI, particularly generative AI such as ChatGPT, presents unique opportunities for teacher candidates to develop pedagogical content knowledge, classroom management skills, and subject-specific expertise (Rahman & Watanobe, 2023; Zhai et al., 2021).

As demonstrated by Fidan and Gencil (2022), AI-based chatbots exhibit the potential to provide personalized feedback, support, and instruction to preservice teachers in pedagogical and content coursework. Related research involving the use of chatbots in schools shows that chatbots are capable of assisting teachers in administrative and communicative tasks through real-time guidance, answers to frequently asked questions, refining communication content, and facilitating interactive conversations (Mendoza et al., 2022). Similarly, additional research underscores the advantages of AI-driven chatbots in facilitating reflective practices, facilitating learning, and providing actionable feedback while also recognizing the need for further investigations into the long-term impact, outcomes, and efficacy of their deployment (Alneyadi & Wardat, 2023; Jauhainen & Guerra, 2023). Notwithstanding the benefits, there are intrinsic challenges when implementing chatbots in learning environments, such as designing effective conversational interfaces, ensuring data privacy and security, and addressing ethical concerns related to the use of AI in education (Zhang & Aslan, 2021; Zhai et al., 2021). Overall, a review of related research underscores the potential of generative AI as a valuable educational tool, particularly within subject areas that have historically received limited resources and emphasis.

WORK-BASED LEARNING PROGRAMS

In the United States, Career and Technical Education (CTE) courses are prominent, with 88% of high school graduates earning a minimum of 2 CTE credits annually (Liu et al., 2020). The most popular CTE course clusters were Arts, Audio-Visual Technology, and Communication with 420,000 students, followed by Business Management and Administration with 410,000 students and Health Science with 390,000 students (Carneval et al, 2018). The widespread popularity of CTE programs can be largely attributed to the advantages of work-based learning (WBL) programs, which blend classroom learning with real-world work experience and facilitate the practical application of academic knowledge. WBL programs can take various forms, including internships, apprenticeships, cooperative education, job shadowing, and mentorship programs (Alfred et al., 2013). WBL prides itself on providing opportunities for students to actively engage in hands-on experiences, apply theoretical knowledge, and refine practical skills under the mentorship of industry professionals and the support of CTE educators.

WBL programs provide opportunities for students to engage in career awareness and exploration activities, including investigating career options, developing a network of professional contacts, and gaining a better understanding of the expectations of the workforce (Stone, 2017). Indeed, the central objective of WBL

is to narrow the gap between classroom instruction and the practical requirements of the workforce to prepare students for meaningful transitions from high school to postsecondary education, employment, or additional career training (Bae & Darche, 2019). WBL serves to enhance students' preparedness for employability, support career exploration and decision-making, and equip them with the skills and experiences needed to thrive in their chosen fields. Another feature of WBL is that it empowers students to self-awarley construct their career decisions and understand the industries they elect to serve (Liu et al., 2020; Rooney-Kroon & Dymond, 2021).

Another pivotal characteristic of WBL programs is the presence of a network of partnerships between educational institutions, including CTE schools and vocational training centers, and stakeholders from industry and local communities (Carneval et al, 2018; Liu et al., 2020). These partnerships form the basis for successful student placement and support the structured transition from academic to work environments (Stone, 2017). Embedded within WBL programmes is the fundamental provision of authentic work experiences, designed to align with the demands and expectations of students' chosen career paths (Bae & Darche, 2019). The comprehensive range of WBL experiences includes internships, apprenticeships, cooperative education, and various forms of experiential learning, all of which are designed with the overarching objective of facilitating the practical application of theoretical knowledge, development of industry-specific competencies, and professional work habits. For instance, Information Technology in CTE describes industry-specific competencies such as technical skills in networking, professional work habits such as awareness of best practices for safety, environmental impacts, and communication and professionalism (CompTIA, 2023). Such competencies and work habits are emphasized not only in the learning activities laid out in the WBL programs for Information Technology but also within the interactions and feedback from their industrial mentors.

WBL is also distinguished by the integration of classroom instruction with workplace experiences (Crease-Cook et al., 2015). Curriculum and instructional activities are meticulously designed to forge connections between theoretical concepts taught within the classroom and their real-world applications in professional environments. The cohesive integration of knowledge enhances students' comprehension of subject matter while promoting the seamless transfer of skills and insights between the workplace and the educational setting (Rooney-Kroon & Dymond, 2021). Furthermore, WBL programs prioritize active engagement and student-centered learning. Students are encouraged to assume ownership of their learning by setting goals and engaging in reflective practices. This approach empowers students to explore various career pathways, foster self-awareness, and make well-informed decisions regarding their future career choices (Liu et al., 2020). To facilitate a successful transition into the workplace, WBL coordinators develop structured activities such as professional development workshops, mentor-mentee matching and coaching activities. WBL coordinators are central figures in the orchestration of experiential learning, with responsibilities encompassing partnership development, student placement, curriculum integration, program coordination, student support,

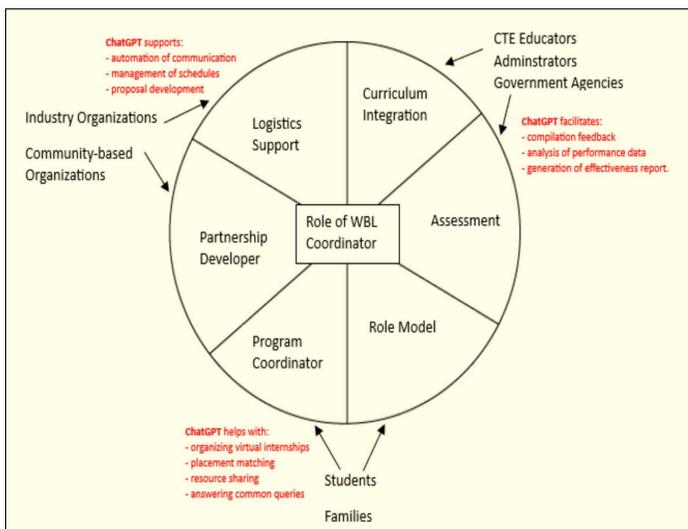
and program assessment, all of which are pivotal in shaping the quality of WBL experiences for students.

OPPORTUNITIES

The multifaceted WBL coordinator role (see Fig. 1) presents significant potential for enhancement and supplementation through the technical capabilities of ChatGPT: processing volumes of data, automating complex workflows, providing real-time analytics, and integrating with digital platforms. First, the ChatGPT holds the potential to enhance the role of WBL coordinators by automating routine tasks, supporting the cultivation of relationships with stakeholders, and streamlining the communication activities of WBL programs. Second, the ChatGPT can assist the WBL coordinator through the creation of personalized learning plans and the selection of suitable placements based on students' career aspirations and skillsets. Third, WBL coordinators serve as student support specialists, and ChatGPT can enhance this role by providing additional resources, answering common queries, and offering guidance anytime and anywhere. Fourth, WBL coordinators play a vital role in curriculum integration and program evaluation, and the ChatGPT could support these tasks by assisting with the generation of learning materials, analyzing feedback, and providing evidence-informed insights for continuous improvement.

Opportunities for WBL Coordinators

Figure 1: Potential enhancements of the WBL coordinator role by ChatGPT



ChatGPT provides several ways to enhance the efficiency of the WBL coordinator, who plays a multifaceted role within communities and has to collaborate with multiple stakeholders to develop student experiences in career awareness, exploration and preparation. For example, coordinators often serve as facilitators of relationships

between educational institutions and employers. They establish and maintain crucial partnerships with diverse stakeholders, including employers, industry experts, and community organizations. ChatGPT can significantly aid in this capacity by automating routine communication tasks. For example, ChatGPT can assist with scheduling meetings, reporting updates, and drafting initial partnership proposals (Sabzalieva, & Valentini, 2023). This not only enhances efficiency but also allows coordinators to concentrate on more strategic aspects of their role, such as fostering meaningful relationships with employers. Furthermore, coordinators function as program coordinators, overseeing the logistical aspects of WBL programs in local educational institutions. ChatGPT can assist in automated scheduling, handling routine communications, and providing resources for students. For example, it can create schedules for students and employers, send automated reminders for important program dates, and offer a library of resources for students to access when needed. These capabilities reduce administrative burdens and allow coordinators to focus on enhancing the educational aspects of WBL programs.

Another essential role of WBL coordinators involves the placement of students in industrial and community positions, made possible by collaborating with students, caregivers, and industry partners to match students with suitable WBL opportunities. ChatGPT can assist in creating personalized learning plans based on students' goals and skills to tailor the WBL experience (Department of Education, 2023). For instance, ChatGPT can be used by students to analyze their profiles based on identified career aspirations and skillsets before they are matched with available placements and industrial opportunities (Rahman & Watanabe, 2023; Su & Yang, 2023). Such a practice has been studied by researchers who developed a career-guidance chatbot to aid high school seniors in navigating pivotal decisions in studies and careers (Assayed et al., 2023). Furthermore, ChatGPT can also facilitate collaboration between students and industry professionals. Virtual industry expert chats can be arranged where professionals from various fields share their expertise with aspiring CTE students (Bozkurt et al., 2023; Rasul et al., 2023). For instance, a teacher preparation program in engineering could organize a virtual chat session with experienced engineers who provide insights into the latest industry trends and technological advancements. ChatGPT can act as a conversational mediator, ensuring that pertinent questions are posed and that valuable knowledge is exchanged during these interactions.

WBL coordinators also serve as student support specialists, as indicated by their role in establishing student support processes while ensuring their access to coaching, advice, and mentorship. ChatGPT can enhance student support by supporting the generation of relevant resources, answering common queries, and offering guidance throughout hours (Department of Education, 2023; Pesonen, 2021; Qadir, 2023). For instance, ChatGPT is capable of generating a knowledge base that includes FAQs, resources for addressing common challenges, and recommendations for optimizing WBL experiences (Department of Education, 2023; Sabzalieva & Valentini, 2023). The relative ease of accessing ChatGPT across various online means ensures that students receive timely and comprehensive support without the need to expend

additional resources. Furthermore, WBL coordinators can utilize ChatGPT to create virtual internship simulations, offering firsthand experience for CTE students in WBL scenarios. These simulations can emulate real-world workplace interactions, responsibilities, and decision-making scenarios. For example, WBL coordinators could engage culinary students with a virtual kitchen simulation powered by ChatGPT. Within this virtual setting, they interact with AI-driven “students” and “mentors,” simulating the dynamics of a culinary classroom.

The WBL coordinator is responsible for aligning practical hands-on learning opportunities in WBL with the academic content and learning objectives of the existing CTE curriculum (Bae & Darche, 2019; Liu et al., 2020). ChatGPT can facilitate this process by aiding in resource recommendations, crafting plans for WBL activities across the WBL continuum, offering strategies aligned with identified state standards, and articulating clear expectations and benefits for stakeholders. (Ausat et al., 2023; Sabzalieva, & Valentini, 2023). For instance, ChatGPT can provide educators with current industry-specific content that complements classroom instruction, ensuring that students gain both theoretical knowledge and practical skills in their WBL experiences. This streamlined approach benefits both educators and students by improving overall curriculum integration and the learning experience. Assessment and evaluation of WBL programmes are essential for continuous programme improvement and form a part of curriculum integration. To this end, the ChatGPT can aid in the development of evaluation instruments and support the analysis of feedback from students, employers, and academic faculty to identify trends and areas for improvement. Additionally, it can generate statistical reports that provide insights into program effectiveness and student performance, helping coordinators make data-driven decisions to enhance the WBL experience.

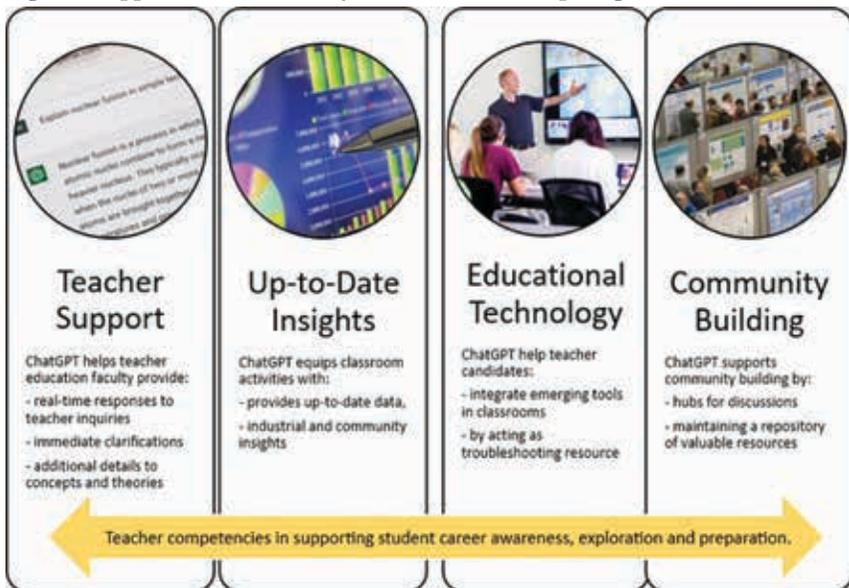
Opportunities for Preparing Work-Based Learning Coordinators

ChatGPTs present a multitude of opportunities to transform the way we prepare WBL coordinators in teacher preparation programs (see Fig. 2). First, ChatGPT’s interactive capabilities can revolutionize WBL coordinator preparation programs by enhancing real-time responses, aiding curriculum development, supporting professional development, and fostering collaboration. Second, ChatGPT can be utilized to enhance the coordinator training process by developing specialized online learning modules, augmenting pedagogical training, and creating comprehensive credential preparation guides. Third, WBL coordinators can be trained to utilize ChatGPT in their daily tasks, workflow and development of programmatic activities. Fourth, ChatGPT can facilitate the creation of online community forums to be used as hubs for discussions, resource sharing, and collaboration while ensuring peer support and professional bonding.

The interactive capabilities of ChatGPT play a pivotal role in providing real-time responses to teacher inquiries, thereby ensuring that educators receive immediate clarifications, comprehensive explanations, and tailored advice (Neumann et al., 2023; Rahman & Watanabe, 2023). This approach may allow the preservice WBL coordinator to navigate the intricacies of creating a structured WBL curriculum that

aligns with both academic requirements and industry expectations. This AI-driven approach supports teachers through the development of pedagogical knowledge and instructional practices to create industry-relevant WBL opportunities for their students. Teacher preparation programs should underscore the significance of lifelong learning and provide avenues for WBL coordinator candidates to engage in relevant professional development activities. These can include attendance at conferences, participation in workshops, and enrollment in online courses, all of which are geared toward keeping educators abreast of industry updates, technological advancements, and effective teaching methodologies. Here, ChatGPT can serve as a supplementary resource, offering pre- and post-workshop materials, facilitating discussion forums, and providing access to expert insights. Collaboration is an integral component of teacher preparation, and ChatGPT can contribute substantially to these initiatives by acting as a virtual mentorship coordinator, matching industry mentors with student mentees, and providing an interactive platform for online collaboration and knowledge sharing. This approach fosters innovation and continuous improvement among CTE teachers as they collaborate with experienced educators and industry professionals.

Figure 2: Opportunities offered by the ChatGPT in Preparing WBL Coordinators



ChatGPT can be leveraged to develop online learning modules focused on a range of in-demand and emerging topics in WBL coordination, including strategies for integrating WBL into the curriculum, designing authentic workplace experiences, fostering partnerships with local businesses, and implementing effective assessment methods for evaluating student learning in work-based settings (Bozkurt et al., 2023; Rasul et al., 2023). Furthermore, the ChatGPT can function as a valuable

augmentation tool in the realm of pedagogical training for WBL coordinators. It provides teacher education faculty with a comprehensive repository of best practices, real-world case studies, and interactive scenarios. What is more, WBL coordinators can be trained to use the ChatGPT to create industrial credentialing guides for CTE students in their specific vocational areas. These guides can cover various aspects of industry-recognized certifications, offering a roadmap for students to follow. For instance, a guide in the field of healthcare education could outline the steps required to obtain industry-recognized certifications in nursing. ChatGPT can provide detailed explanations of credential requirements, suggest study resources and strategies, and even generate sample test questions that align with industry credential exams.

ChatGPT offers numerous feasible ways to assist WBL coordinators in building technological skills for seamless integration of emerging tools and technologies into their classrooms (Rahman & Watanabe, Rasul et al., 2023). First, it can provide practical guidance on software integration, offering step-by-step instructions for incorporating specific applications into the learning environment (Department of Education, 2023; Sabzalieva & Valentini, 2023). Additionally, the ChatGPT can serve as a troubleshooting tool, helping coordinators address common technical issues promptly. Furthermore, the ChatGPT can offer the best practices in educational technology and keep WBL coordinators updated on high-impact practices, ensuring that they remain well informed about emerging technologies. Moreover, it can aid in adapting to remote or hybrid learning scenarios by advising on the selection and use of virtual classroom platforms and collaboration tools. These tangible avenues demonstrate how ChatGPT can practically support WBL coordinators in acquiring the technological expertise necessary to enhance the learning experiences of their students. This ensures that CTE educators are well versed in not only the subject matter but also the tools that are transforming the workforce.

Finally, the ChatGPT can facilitate the creation and maintenance of online community forums that allow CTE educators and WBL coordinators to connect and share resources from anywhere any time (Department of Education, 2023). These platforms, supported by ChatGPT, can serve as hubs for discussions on innovative teaching methods, the exchange of research findings related to WBL, and the sharing of successful implementation strategies (Su & Yang, 2023). ChatGPT can be customized to function as a forum moderator, guide discussions, offer expertise, and maintain a repository of valuable resources (Sabzalieva & Valentini, 2023; Su & Yang, 2023). For instance, educators in the automotive industry can convene in a virtual forum to discuss how to incorporate the latest automotive technologies into their programs effectively. By fostering collaboration and resource sharing, these forums empower educators to learn from each other's experiences and gain fresh insights into how to enhance their WBL programs.

CHALLENGES

The integration of the ChatGPT into WBL programs and CTE teacher education programs brings uncharted risks and challenges of varying complexities. One substantial challenge lies in ensuring equitable access and addressing disparities

among CTE teachers and WBL student participants. Variations in internet accessibility, device availability, and digital literacy levels can limit the effectiveness of ChatGPT-powered resources in and beyond the classroom (Floridi, 2023; Su & Yang, 2023). For instance, students in rural areas may lack reliable high-speed internet access, hindering their ability to utilize ChatGPT for homework or research. Another significant challenge pertains to the quality and accuracy of content generated by ChatGPT (Kocoń et al., 2023, Department of Education, 2023). For example, if ChatGPT generates inaccurate information about industry practices, it might lead students to develop incorrect skills and adopt unexpected dispositions.

Data privacy and security represent another challenge, where the utilization of ChatGPT involves the collection and storage of data, which raises privacy concerns (Lin et al., 2024). Protecting sensitive information is paramount, especially concerning student and evaluation data (Dwivedi et al., 2023). Compliance with data protection regulations, such as the HIPAA for healthcare-related programs in CTE and the FERPA for all educational programs, is a legal requirement. Furthermore, effective teacher training and readiness constitute another challenge in integrating ChatGPT into CTE classrooms, and educators may be resistant or unresponsive to technology integration without additional incentives or training, posing potential barriers to the successful adoption of these tools (Rahman & Watanabe, 2023; Su & Yang, 2023).

Finally, the use of the ChatGPT to meet the diverse needs of students from various CTEs in WBL programs presents a challenge. Ensuring that ChatGPT can provide context-specific information and adapt to different learning environments is vital for its effectiveness. For example, ChatGPT models developed for healthcare-related CTE programs should deliver industry-specific insights, while those designed for engineering programs should focus on engineering concepts. In conclusion, the integration of the ChatGPT into WBL programs holds significant promise but demands meticulous attention given these multifaceted challenges. A comprehensive approach that encompasses technological solutions, policy development, professional development, and ethical considerations is required to harness the potential of AI-driven tools while simultaneously ensuring equitable access, content quality, data security, teacher readiness, and adaptability.

ETHICAL CONSIDERATIONS

The integration of AI technologies, exemplified by ChatGPT, within WBL programs and WBL coordinator preparation programs necessitates a thorough exploration of ethical considerations. One primary concern is the susceptibility of ChatGPT to perpetuate biases or errors inherently embedded within its corpora and training data, particularly in the context of gender, race, and socioeconomic factors (Cotton et al., 2023; Crawford et al., 2023). The training data, drawn from various sources, may inadvertently capture and reinforce existing societal biases, posing a considerable ethical challenge that could contribute to the dissemination of prejudiced or discriminatory information that marginalizes certain racial and ethnic groups. Addressing this concern requires a meticulous examination of the training data and the implementation of rigorous strategies to identify and rectify

biases, emphasizing the importance of ethical considerations in the development and deployment of AI models in educational settings. In the current educational landscape, which prioritizes fairness, equality, and equity, educational institutions are responsible for developing comprehensive measures to mitigate biases in content generated by the ChatGPT.

Transparency and accountability stand out as crucial ethical considerations in the context of AI integration. ChatGPT, a form of generative AI, operates opaquely and conceals processes prior to text generation from end-users (Floridi, 2023; Mijwil et al., 2023). In educational settings, particularly where clarity is vital for understanding learning outcomes, it is ethically important to explain the processes underlying AI-generated content to foster confidence and acceptance among educators and students alike (Dwivedi et al., 2023). Another critical ethical consideration centers on privacy and data security, as the operation of the ChatGPT inevitably involves collecting and retaining student data (Huallpa, 2023). Ethical principles necessitate the careful handling of these data, requiring the establishment of stringent protective measures and communication of data usage protocols (Floridi, 2023; Dwivedi et al., 2023). These measures not only uphold students' privacy rights but also reinforce trust within AI-supported learning environments. Informed consent is of ethical importance due to its emphasis on fully informing users about the role of the ChatGPT, including its role in data collection, monitoring, and content creation. In other words, user autonomy is affirmed by providing the option to opt in or out of AI-integrated learning.

Finally, another notable ethical concern is the potential for education and learning to become depersonalized due to over-reliance on AI-generated content (Crawford et al., 2023; Kocoń et al., 2023). Striking a balance between AI-enhanced resources and human interaction is of ethical importance. Instructors offer the essential and irreplaceable human touch, manifesting through emotional support, mentorship, and guidance—qualities that ChatGPT cannot currently comprehensively replace. Thus, the ethical imperative is to preserve the personal and humane aspects of education by prioritizing transparent, fair, and responsible AI integration. Clearly defined implementation policies, guidelines, and continuous assessments of AI's pedagogical impacts are imperative. To harness ChatGPT's potential while upholding ethical standards in education, it is essential to ensure that ChatGPT serves as an enhancer rather than a replacement for the educator's role and that ChatGPT promotes meaning construction rather than rote learning.

NOTE

AI tools were not used in any way for the preparation of this chapter.

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About the book

This book provide a comprehensive, research-driven analysis of AI chat-bots' roles in shaping institutions of higher education around the world. By exploring the transformative potential of ChatGPT in academic settings, this timely book aims to bridge the gap between technological innovation and its practical applications.

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