Leveraging AI to Enhance Critical Thinking Skills

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The perils and possibilities of artificial intelligence present educators in the 21st century with challenges incorporating new forms of technology into the learning environment. Technology's ever-evolving nature has not only given educators more means to teach in general but has also enhanced the demand for critical thinking abilities (Halpern, 1999). Personalized learning, access, innovation, and efficiency present unprecedented opportunities to incorporate emerging technologies into the classroom environment both online and in person. Concerns regarding bias, privacy interests, lack of transparency and inaccurate information give many educators pause in embracing new technologies. Because it is now so simple to obtain enormous volumes of information, the ability to evaluate and assess its quality is paramount (Walton, 2017). Much of the information available online is unreliable (Flanagan, 2010). As a result, one of the most important critical thinking skills that should be openly and frequently taught starting in college is the ability to assess the dependability of an information source (Goldman & Brand-Gruwel, 2018). Artificial intelligence has the potential to revolutionize teaching and learning, but it must be implemented thoughtfully, with careful consideration of ethics, privacy, and accuracy to maximize its benefits and minimize its risks. This paper discusses three case studies, from three different disciplines at a regional college of a research university, illustrating the use of artificial intelligence in the classroom to enhance critical thinking skills.

Critical Thinking and Academic Success

Critical thinking is the kind of thinking about any topic in which a person improves the quality of his or her thought processes by elevating the caliber of their reasoning by deftly controlling the thought processes that are inherent in thinking and applying intellectual standards to them (Paul & Elder, 2004). It is the intellectual process of ''conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication" (Scriven & Paul, 1987, para. 2). Higher-order thinking from

Bloom's taxonomy is synonymous with critical thinking in the realm of education (Anderson et al., 2001). Cognitive abilities can be categorized based on their complexity level using Bloom's taxonomy (Anderson, et al., 2001). Therefore, the levels of analysis, synthesis, and assessment correspond to higher-order thinking abilities (Anderson, et al., 2001). The goal of critical thinking is to find a way to consider information in a more complex fashion, to enhance problem solving skills, to communicate more effectively, increasing collaboration and innovation (Roth, 2013). The benefits of critical thinking inure to the enrichment of personal development as well as organizations and the community (Roth, 2013).

Researchers and practitioners have encouraged a focus on critical thinking to equip students with the skills needed for academic success and twenty-first citizenship (Crane et al., 2003). Research has shown that when critical thinking skills are developed in the classroom, not only are students more thoughtful in the learning environment, but they continue to practice those skills in their lives (Murawski, 2014). Moreover, studies have suggested that acquiring critical thinking skills is a better predictor of making sound judgments than IQ (Butler et al., 2017). While a historical focus on critical thinking has permeated academic circles, developing students' critical thinking skills is also now necessary to assist in evaluating the legitimacy of information from among the volume of material available on the internet (Yang et al., 2008). It is not enough to acquire knowledge. The ability to analyze, weigh, evaluate, contextualize, and assess that knowledge is what makes it valuable (Debono, 2004).

Given the importance of critical thinking skills for individuals, academic success and society, the fact that such thinking is a skill set that can be developed is good news for all. Educators are then faced with the task of how to effectively develop critical thinking skills for learners in the 21st century. Research reveals the emergence of two approaches to developing critical thinking skills in the classroom. Some educators prefer a definitive and overt teaching of critical thinking as a separate subject (Abrami et al., 2008). The predominant approach is to endeavor to nurture their students' critical thinking abilities by incorporating them within the framework of their respective subjects (Caceres et al., 2020). This is achieved by emphasizing the fundamental principles of each academic domain, selecting topics that facilitate students' comprehension of the world through the lens of the subject matter, and acquainting them with discipline-specific methodologies (Caceres et al., 2020). Through this

approach, students are encouraged to cultivate solutions by applying the essential skills inherent to each field of study (Jones, 2015). The authors of the current case studies have chosen the latter approach to integrate artificial intelligence technology and the development of critical thinking skills.

AI in Higher Education

While artificial intelligence has been in the lexicon and components of AI have been at the fingertips of many for several years, the last few years have witnessed unprecedented growth in this field. Artificial intelligence refers to machines that can examine data, make inferences and act accordingly (Roschelle et al., 2020). Numerous definitions also characterize machines as learning entities due to their capacity to adjust to fresh challenges and draw conclusions from engagements with other data-providing entities, in addition to interactions with humans (Niemi, 2021). Current artificial intelligence technology is designed to build a computer network that resembles the "neural networks of the human brain (Niemi, 2021, para. 7)." With this capability has come widespread optimism about the potential for artificial intelligence to enhance classroom learning. For example, researchers have discussed the promise of AI bringing the possibility of more personalized learning for students (Hwang et al., 2020), as an analytical tool for understanding student functioning and needs (Seo et al., 2021), as a resource for automating routine tasks (Popenici & Kerr, 2017) and as a method for increasing access to educational resources (Roll et al., 2018). The pervasive nature of the technology has led commentators to conclude that "there is little doubt that the [AI] technology is inexorably linked to the future of higher education" (Olaf et al., 2019, p. 39).

However, many have also urged caution in the rush to embrace the new technology. Concerns have been raised about the ethical impact of artificial intelligence. Many observers have discussed the problem of AI generated writing assignments including the academic integrity issues presented as well as the impediment to student development in both writing and critical thinking skills (Marche, 2022). Educators have communicated worries that too much dependence on AI systems might hamper students' capacity for self-learning, creative problem solving, and critical thinking (Wogu et al., 2018). Others have noted that AI generated content is frequently incorrect and misleading (Perkins, 2023). Perkins

recently published an observational study of ChatGPT, a popular and publicly available, large language model AI tool, which is capable of producing large amounts of text in response to short input requests (Perkins, 2023). Perkins prompted ChatGPT to respond to a question explaining ChatGPT's own capability. The prompt requested the response to be written in an academic style with citations in APA format. ChatGPT responded with valid information about its own capabilities, but all the references provided were fictitious (Perkins, 2023). Others have noted the risks of gender, ethnic and political bias embedded in AI models and the output generated (Rozado, 2023).

Although AI poses risks to academic integrity, it also opens doors to various opportunities. AI has the capacity to enhance users' capabilities, both positively and negatively (Foltynek et al., 2023). Thus, it is important to educate students about the advantages and constraints of AI tools (Seo et al., 2021). This knowledge equips them to use AI ethically and effectively (Foltynek, et al., 2023). As contemporary societies become more automated, individuals will likely also employ AI tools professionally (Foltynek et al., 2023). Consequently, integrating AI education into their learning experience becomes imperative, offering them the chance to acquire and utilize these essential skills ethically and effectively.

Current Case Studies

The current case studies involve observational and qualitative data collective from three separate courses, each delivered in a different course modality, in three separate disciplines at a regional campus of a research institution. The college attracts a high percentage of minority and first-generation students. The particular courses involved in this case study consisted of first- second- and third-year college students from a variety of different majors. The purpose of this paper is to explain the strategies used by the authors to attempt to integrate AI learning into the classroom setting, discuss the pedagogical impact and implications for the future. Each author aimed to integrate critical thinking with the utilization of AI in the form of ChatGPT, tailoring the application to their respective academic field.

Case Study 1

The first assignment involved a face-to-face course in an information systems class and unfolded over a series of three class sessions. The introduction to ChatGPT was centered around the midterm examination. First, students were given a midterm exam involving short

answer questions. In the second class meeting, the course instructor provided an overview of ChatGPT, its origins, objectives, and functional mechanisms. The instructor initiated a discussion with the class conversing about their prior knowledge and experience with ChatGPT and their expectations for how it can be used in various academic, social and workplace settings. The instructor then conducted a demonstration by posing a question to ChatGPT and allowing students to see the response. Students were then divided into groups and asked to set up a free version account with ChatGPT and then invited to interact with the technology posing questions and prompts and reviewing the answers generated. From the small group experiential exercise students were asked to come back into the larger class discussion to discuss their experiences. The instructor discussed the capabilities and limitations of the technology. The instructor then guided the class in a discussion of the ethical parameters of using AI responsibility. Students discussed positive aspects of the technology, the possible downsides of machine learning and the future development of AI.

In the next class setting, students were asked to reform their small groups and retake the midterm examination with AI assistance. The instructor then handed back the original graded midterms and asked students to compare their answers to the AI generated answers. Students were asked to reflect on the similarities and disparities between the exams completed by students and the exams completed by AI. The discussion groups were asked to review how closely the AI responses aligned with the correct exam answers. The small groups were then asked to discuss the insights the group gained in this comparison with the larger class. The larger class discussed the ways in which the AI generated answers varied widely in their accuracy.

There were several learning objectives for this activity. First, it was designed to assist students in describing and evaluating the circumstances where AI may furnish inaccurate information. This involves critically assessing the reliability and precision of AI-generated content. Additionally, the activity encouraged students to contemplate the notion that AI's output often hinges on the quality of input data and the context it operates within. It prompts students to consider how AI-generated materials, although occasionally accurate, may not always align perfectly with the specific learning material covered in a particular course. Furthermore, the activity sought to foster an investigation into the limitations of AI. It underscored the importance of recognizing these limitations and highlighted the

necessity of acquiring foundational knowledge before relying on AI as a learning tool.

Before launching this assignment, the instructor opened a dialogue with students about their experience with and impressions of AI technology like ChatGPT. Most students had heard of ChatGPT but had not interacted with it. Students expressed fears that platforms like ChatGPT could be abused in the classroom. Most recognized that relying on AI technology like this to complete assignments felt like a violation of the directive that students submit their own work. Students also expressed a desire to use the technology to help complete complex tasks or work they did not fully understand but did not want to become dependent on it or have it negatively impact their learning. Qualitative feedback was solicited from students regarding the assignment and was overwhelmingly positive. Some students expressed excitement over the chance to interact with ChatGPT – something they had heard about but not yet experienced. Other students admitted to having used the technology in other courses without understanding the implications of doing so. Several students talked about the ways that their analytical ability had been expanded by having the tools to know when and how to employ the technology.

Table 1. Qualitative responses collected from student survey question in case one: What are the ethical aspects of using AI in the classroom? (N=6 of 25 student responses)

- *I've heard some mixed things. I've heard it's this super smart AI that can help with homework and stuff, which sounds cool. But I've also heard that it might make us lazy, like relying too much on it could be a bad thing.*

- *I mean, it's incredibly smart, and that's what's scary. It can answer almost any question which can make it tempting to use all the time. But, I've seen some friends become overly dependent on it, and it feels like it might be making us lose our ability to think on our own.*

- *I gotta say, I love ChatGPT! It's like having a magic homework genie. I can ask it anything, and it helps me breeze through assignments. I've got more free time to hang out with friends and enjoy my freshman year of college. People say it will make us lazy, but I'm not*

complaining, your first year is like a refresher of high school. Like none of these classes are about the things I came to college to learn about.

- *Not gonna lie, I imagine it being like the terminator. It's eventually going to be the end of civilization.*
- *I don't feel like I know enough about it to have an opinion. I mean I've heard about it, but like it doesn't sound legal.*
- *This sounds like that social media documentary we watched in class. There is some sort of catch because nothing is free!*

Case Study 2

The second case was an assignment in a fully online business law course, which involved an experiential exercise requiring the creation of a legal contract. Prior to the introduction of this assignment students worked on a role-playing exercise where they assumed the role of an attorney representing a limited liability company ("LLC") with the objective to protect that LLC's intellectual property. The instructor provided background information on the creation of common legal documents and the historical use of templates in the creation of contracts. Students were first asked to draft a legal contract incorporating the terms required by their fictional clients from a either a template provided by the instructor or utilizing an AI tool (ChatGPT or similar) to produce a legal document that satisfied an assigned fact pattern. Students were then required to reflect on their experiences and discuss the ways that using AI helped in the creation of the document and the ways that AI was limited in producing a viable contract. The instructor asked students to reflect on the unique ethical issues of providing AI technology with protected client information and related privacy concerns.

After the assignment the instructor elicited qualitative responses from students about the project. Students expressed concerns about using AI in this context. The survey question was "Based on your experience with your Final Project, would you use AI for future assignments (where allowed) to help you think critically? Please explain why or why not." Of the 11 students (out of 25) who completed the survey questions, six responded they would use AI on future assignments and five responded they would not

use AI on future assignments. Students were apprehensive about divulging information to ChatGPT and losing control over how that information might be used in the future. The use of templates with basic contract language and provisions from which students could pick and choose and modify to fit their fictional client's needs seemed to be of greater benefit to students than giving ChatGPT the information they possessed to create the entire contract. Student feedback did reflect finding value in the ability to use ChatGPT to gain understanding of legal vocabulary and concepts and for help with ideas to get started on a project. Students also commented on the ability of AI to do the work for the student in an academic setting and the negative impact of missing out on learning opportunities as a result.

Table 2. Qualitative responses collected from case two student survey question: Based on your experience with your Final Project, would you use AI for future assignments (where allowed) to help you think critically? Please explain why or why not (n=11 of 25 students responded to survey).

- *Yes, I would use AI if allowed. The reasoning for this is allows me to better understand while also conducting the research on my end which would allow me to learn more about the information that I am learning. With the Cognitive Computing I do think AI will have better wording and terms than I would personally use while also teaching me.*

- *I think AI could be helpful, but I think it is a very fine line between it helping with assignments and actually doing the work for you … I think that in some ways it would be helpful to make things easier to understand, but I think it can take away a student's ability to have to learn the material and put in the effort.*

- *I would one hundred percent use AI to help me come up with some sort of template to follow. We always talk about ChatGPT for machine learning at work, I just did not think to use that resource for a school assignment …*
  The reason I would use AI for this assignment would be it can resemble a conversation I am having with a human. I have even seen videos where Chat GPT has prompted to "dumb down" an article for

the end user. This could've been useful to copy and paste then ask AI to simplify the reading.

- *I do not have much experience with AI, but from the information coming out in the news about AI, I would have to say probably not. I enjoyed using the templates because I was able to take out and add what I needed that related specifically to my documents. I also feel that the templates give a greater understanding of the legal terms for the documents. Using the templates that I found, I was able to take out many sections that did not apply to my documents and add in sections that I believed would give my documents more legal power.*

- *Overall, I would not use AI for future assignments. Do I think it could make it easier on the student? yes. However, I believe that if most of the work is done for the student, then they don't have the traditional learning experience. They could find it hard to understand the assignment or be able to come up with certain things on their own without it.*

- *No. I've never used AI before, but I think I would wait a few more years for it to improve.*

Case Study 3

The third case study involved a fully online criminal justice course and asked students review a news article (Weiser and Schweber, 2023) about a lawyer who asked ChatGPT to write a legal brief. The lawyer submitted the brief to the court. However, the opposing party raised objections when the legal citations used in the brief could not be located. It was later learned that ChatGPT fabricated the legal citations. The attorney had not checked any of the ChatGPT citations before filing the brief. Students were asked to read the article and draft an essay reflecting on what happened in this case, why the attorney used ChatGPT to write the brief and the lessons they learned from this story. Students discussed the danger of relying on internet to conduct legal research, expressed their surprise that an attorney would fail to check the legal citations and expressed surprise that ChatGPT would generate false responses. Information literacy with regard to misinformation on the internet came up

repeatedly in student responses as did the acknowledgment that it is important to seek out reliable sources when completing academic assignments as well as real world projects.

Table 3. Qualitative responses collected as part of the extra credit assignment in case study three: What is your experience with ChatGPT? What concerns do you have about this technology? (N=5 of 23)

- *I do not have much of an experience with ChatGPT, since I am very against its usage in the classroom setting, and a very large amount of students are now currently able to complete all of their work with it, and get good grades by putting in no effort. I have logged onto ChatGPT one time to see what it was about, but after I used it for a couple of minutes I started to better understand exactly how powerful this technology could be.*

- *I personally have only used Chatgpt for the sake of an assignment our teacher told us to use it for. I know for we had to use Chatgpt to prove a point our professor was trying to make. We had to type in our topic for a project and see what It could come up with. I personally did not like It because I felt like It was not giving me what I was asking/looking for, which made it even more difficult and frustrating for me to use.*

- *My experience with ChatGPT is that I have heard of it but I have not ever used it. All I know is that it is a artificial intelligence that kids use to complete assignment. Which I believe is wrong because how are you supposed to learn what you are going into if you take a short cut in life.*

- *My experience with ChatGPT is that to my knowledge I don't think I have ever heard of it before. What concerns I do have about this technology is the human rights and business aspect of ChatGPT. Its AI a machine it does not feel anything. It could spread stuff like hate speech.*

- *My experience with ChatGPT was interesting because it is a great source to learn and understand information, however further*

research is needed in order to back up information. My concerns with this technology is misleading people with information that could leave them astray and then them thinking they know what they need to know when they may not.

- *My experience with ChatGPT is minimal, but I have utilized it for social aspects. For one of my courses, we had to write a paper about AI, and the professor encouraged us to use any type of AI generator that could assist in constructing our project. I used ChatGPT for the first time and was shocked at how it constructed an entire essay within seconds.*

Considerations for the Future

The growing prevalence of AI in our society requires engagement from the academic community. This paper illustrates three examples of how AI can be used to foster critical thinking skills in the classroom. When evaluating the insights derived from the examined case studies, it is important to highlight several noteworthy observations. Many students exhibit curiosity regarding AI, with a significant portion already incorporating it into their activities. Lack of exposure to ethical AI education for students can increase the likelihood of them resorting to improper AI utilization, potentially leading to academic misconduct. These case study observations thus confirm prior commentary by others (Foltynek, 2023). Leveraging AI for pedagogical purposes has the potential to enhance students' critical thinking abilities. Classroom activities such as those described here are beneficial in assisting students with information literacy skills, recognition of the limits of artificial intelligence, increasing student confidence in their own abilities to comprehend and apply their knowledge, and in thinking with more nuance and complexity about the ethical use of information.

The case studies presented here warrant further investigation, including the collection of quantitative data to explore the impact of incorporating AI assignments on overall student performance. Additional qualitative data should also be collected in broader surveys evaluating students' impressions of interacting with this technology. Survey data that includes both students who complete AI course activities and those who do not may be helpful to elicit a more robust response from feedback for comparative purposes. One goal is to better understand the current

openness to AI as an educational tool and to explore options for developing more effective assignments. Additionally, future research should explore how students' viewpoints change over time. These initial studies illustrate the caution with which many students approach the new technology. As students become more comfortable with the use of this AI, reticence on using these tools will most likely dissipate over time if, as predicted by the experts discussed above, AI becomes incorporated into greater aspects of daily life.

Future research should also focus on the experience of faculty in interacting with AI technology and its use in the classroom. While not specifically the focus of this study, the faculty engaged in these case studies were accustomed to using technology and exploring new technological advances in the courtroom. It is imperative that faculty who choose to explore activities such as those described in this paper first become familiar themselves with the concept of artificial intelligence, what it is capable of, how it works and the implications of its use. The novel experience of using this technology may be outside the comfort zone and experience of many. Given the broad reach and complicated repercussions of artificial intelligence discussed above, faculty must take time to gain competence in uses and limitations of the technology before bringing it into the classroom. These case studies and student adaptability to this technology suggests that faculty cannot afford to ignore the emergence of this technology and its impact of students whether faculty ultimately decide to employ activities involving AI or not. It is imperative that faculty consider this technology and provide clear parameters for the use of AI to help guide the student to address ethical concerns and to meet educational competencies.

There is still much work to be done to consider the risks and benefits of this technology in the academic setting and beyond. For example, colleges and universities should consider adopting policies around the use of AI, outlining the parameters within which use is considered acceptable and where it would violate principles of academic integrity. Researchers should investigate the ways in which students and faculty currently use AI and the level of understanding around the technology. Professional development explaining the technology, how it works, its capabilities and ideas for pedagogical integration should be implemented. In order for educators to actively engage in discussions about the proficient utilization of AI, they must possess a comprehensive understanding of the technology. Artificial intelligence in education holds the promise of

ushering in significant advancements in the learning process (Niemi, 2021). However, realizing this potential requires substantial investments in research that bridges the realms of human learning and intelligent machine learning. There is a pressing need for an increased focus on fundamental and practical research in the field of AI, particularly with regards to utilizing multimodal data (Niemi, 2021).

While the scope of artificial intelligence and its rapid expansion can be intimidating, pedagogical interventions such as those described here illustrate the possibilities the technology holds to support, rather than detract from student learning. If, as Francis Bacon famously said, "knowledge is power" (Vickers, 1992, p. 512), then educators have a responsibility to assist students in harnessing that power and wielding it ethically and effectively. The assignments outlined here provide examples of mechanisms by which this can be done with AI in a way that enhances critical thinking skills while integrating this new technology into the toolkit of student learning.

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