

DOI: https://doi.org/10.48009/4_iis_2024_105

Generative artificial intelligence: student learning, anxiety, and legality perceptions

Barbara Jo White, *Western Carolina University, whiteb@wcu.edu*

Heidi Dent, *Western Carolina University, hdent@wcu.edu*

H. Kevin Fulk, *Western Carolina University, hfulk@wcu.edu*

Abstract

Before higher education instructors design learning activities that help students use AI to find and thrive in future jobs, instructors first need to gauge the level of student understanding of AI, especially generative AI that uses large language models to create new content. Students are mixed in their perceptions of AI. After completing a prompting activity, some student comments were optimistic, with some expressing a desire to use generative AI tools in the future and showing interest in learning how generative AI works. Other students viewed generative AI negatively with little future need for what they considered a ‘creepy’ tool. Also, some students noted the inauthentic manner of speech the generative AI provided while others described their beliefs that using generative AI constituted cheating. To better understand student beliefs about AI, a survey measured student anxiety regarding generative AI, anxiety with respect to various AI applications, understanding of legality and AI, as well as perceptions concerning a prompting exercise designed to teach the value of refining prompts. Activities designed to expand student use and knowledge of AI and prompting are described.

Keywords: generative AI, artificial intelligence, ChatGPT, legality

Introduction

Helping students understand technology in an ever-changing business environment requires that professors both stay current in their technology knowledge and stay current in their understanding of students including how they learn new technologies, technology-related knowledge, and their impact. One of the biggest technologies to impact business in recent times is artificial intelligence (AI), with companies developing drones and robots, implementing service automation, and creating content at a rapid pace. AI has been used heavily in human resources, especially in the hiring process as well as many other functional areas in business. A key area of AI impacting organizations is generative AI, such as ChatGPT, Claude 2, or Google Gemini. These AI applications, based on large language models, can generate new data such as text or images in response to prompts (Hacker et al., 2023). How generative AI responds to prompts is based, in part, on its learning patterns from being trained on very large data sets that encompass billions of parameters (Hacker et al., 2023).

Business and higher ed are both interested in AI education. The COVID pandemic, though, had a big impact on education and students. One of the biggest issues facing students, especially since the COVID pandemic, is the rise of student anxiety and their willingness to both seek therapy and talk about it. Technology is a

major driver of student mental health issues. Both hardware and the applications on them contribute to student anxiety. Students report that smartphones and social media applications on them contribute to their anxiety issues. Not only does using social media contribute to anxiety but learning to use new technology can also impact anxiety.

This study explores how students gauge their anxiety with learning to use new technologies, such as AI, and their understanding of the use of AI and its implications for their interactions with businesses and other organizations. A key area where these implications, as well as stakeholders' understandings of them, are in flux, is the legality of generative AI.

Literature Review

AI is increasingly discussed by academics and practitioners alike. The continual growth of its applications has increasingly impacted human lives and business organizations. The growing attention on AI in business organizations can be attributed to the technological maturity achieved in computational calculation, access to large quantities of data, and the ability to analyze that data in real-time (Sestino & De Mauro, 2022). AI is increasingly being used in business as a strategic tool to increase performance, competitive advantage, and value delivery. AI technology can mimic human-like capabilities and can perform tasks that normally involve human intelligence.

There are multiple AI applications that businesses are increasingly adopting. Chatbots trained using machine learning algorithms continue to learn and evolve with more data inputs (Castillo et al., 2021). AI can be used for automation, to replace human work, and augmentation, to enhance human intelligence to assist in decision-making (Enholm, et al., 2022). AI can be found and is impactful in operations, finance, marketing, e-commerce, innovation, and sustainability (Pallathadka, et al., 2023). One challenge noted is the mixed reviews concerning the use of AI in hiring practices. Research suggests that leveraging AI to augment rather than automate hiring practices can prevent undermining the candidate experience (Gonzalez et al., 2022). Indeed, when using generative AI selectively to support human resources processes, organizations have been able to create more efficient and engaging hiring processes for both applicants and recruiters (Aguinis, et al., 2024). Increasingly AI-empowered robots are being adopted in business for service and manufacturing in what's referred to as the 'Dawn of the Service Revolution' (Wirtz et al., 2021). Alternatively, the tight incorporation of AI into industrial functions, forming a highly connected ecosystem has been characterized as being part of the fifth industrial revolution, or I-5.0 (Sai et al., 2024).

Legal approaches to addressing harms caused by AI

While applications, such as those described above, have made business decision-makers and other stakeholders optimistic about AI's impacts, others have shown good cause for anxiety about these technologies' effects. Researchers have identified instances of AI applications producing, or having the potential to produce, serious harm to individuals and groups. An example is producing biased judgments against particular groups of people (Qian et al. 2024), such as unfairly considering age in hiring decisions (Harris, 2024). While the underlying causes of some of these harms are poorly understood, others are likely the result of actions of those bent on harm such as hackers' use of prompt injection attacks (Cheong et al., 2024).

Approaches intended to prevent or mitigate AI-based harms can be categorized as technical or legal in nature. Technical approaches are based on the concept of alignment, by which the organization that owns the AI incorporates protective mechanisms such as refusing unethical prompts (Cheong et al., 2024;

Humphreys et al., 2024). However, due to the voluntary nature of technical approaches and the costs of implementing them, profit-focused organizations may not sufficiently prioritize reducing these potential harms to users. In contrast, legal approaches focus on transforming more abstract values, such as human autonomy, into rights that can be legally enforced through criminal and civil penalties (Cheong et al., 2024).

While some have questioned the applicability of existing legal systems to protect against AI-based harms (Cheong et al., 2024), governments have moved forward with implementing new laws. Most recently, the European Union (EU) decision-makers voted to adopt the Artificial Intelligence Act (Novelli et al., 2024). Its drafters intended the AI Act to be a comprehensive measure, aimed at reducing the harms from AI applications, categorized based on their levels of risk, through bans or stipulated legal requirements (Novelli et al., 2024). A caveat about the AI Act is the anticipated challenges of enforcing its provisions. In sum, this discussion about the potential positive and negative impacts of AI suggests the need to focus on how college students do and will use these AI applications. In addition to focusing on students' learning to use these technologies, we contend that students need to gain an appreciation for these technologies' potential for both positive and negative impacts.

Student learning, technology, and anxiety

As AI continues to develop and integrate into student learning environments, students increasingly need to not only understand the technology but also be able to learn AI-related skills that will serve them post-graduation. Students are increasingly being exposed to information communication technology (newer and older) in their learning environments, especially since the onset of COVID in the last five years. Research has shown that while the Internet offers students the benefits of communication and access to new information in secondary school, it hurts concentration in class and is time-consuming (Shatri, 2020).

Students are entering higher education where the use of ICT is prevalent for automating academic processes and enhancing instruction and student learning. Learning management systems, digital-based assessments, and online learning require students to develop technology skills. However, research has found that student usage of technology has increased technostress or the inability to cope with new technologies and can adversely impact productivity, performance, and burnout (Upadhyaya & Vrinda, 2021). Unfortunately, while higher education institutions are focused on preparing students for post-graduation, technostress has resulted in a decrease in productivity, retention, and a departure from academic work (Upadhyaya & Vrinda, 2021).

When it comes to educational performance, motivation is one of the most important predictors (Donnermann et al., 2021). Academics use a combination of both intrinsic and extrinsic motivators in pedagogy. However, the increased prevalence of AI in the student experience can result in anxiety. Besides technostress, students are experiencing AI anxiety. AI anxiety is embedded in computer anxiety (Wang & Wang, 2022). Students' motivation to learn is negatively impacted by AI-anxiety but at the same time, students' fear of AI job replacement results in positive motivation due to external influences (Wang & Wang, 2022). Different generational students experience different levels of comfort and anxiety when using technology for learning (Culp-Roche et al., 2020). In today's environment where smartphones, computers, and AI are part of everyday lives, the students' uncomfortable experiences of using technology are easy to forget. However, student perspectives about the use of technology are important because they influence student engagement which in turn impacts learning outcomes. Faculty are tasked with balancing student levels of 'technostress' and anxiety while preparing them for the workforce.

Methodology

Given the level of student anxiety following the COVID pandemic, as well as its use in the business world, including the evolving legal landscape regarding AI, our research questions were the following:

1. To what degree do students have anxiety about AI?
2. To what degree are students familiar with the business implications and legality of AI?
3. What are student perceptions of the Student Introduction Generative AI Prompting Activity?

Introductory activity using generative AI

The introductory activity, called “Get ChatGPT to Write Your Student Introduction For You!” was designed to teach students the importance of writing good prompts, evaluating the prompt according to the results, and refining them as needed to achieve desired results using the Prompt Development Life Cycle (Willey et al., 2023). Students were instructed to use generative AI to create a student introduction that they deemed suitable to paste “as is” in a discussion board for a typical learning management system.

To complete the activity, students were to fill out their information in a four-line form asking for their name, major, software they use at work, and an interesting hobby or interest. They were instructed to paste the five lines of text into the prompt window of a generative AI tool such as ChatGPT, Claude 2, Bing with Chat or Gemini by Google. Most students used ChatGPT for the assignment. Students were to use the Prompt Development Life Cycle with its planning, development, testing, and evaluation phases to help them reach their goal of getting generative AI to create a student introduction for them.

Once they ran and evaluated their initial prompt, they could refine their prompt as needed. When they were finished, they pasted their introduction directly into the learning management system discussion board, which in this case was on their Canvas course site and ended with writing a short paragraph about their experience using their chosen generative AI tool to write their introduction.

Survey

Several items were used to measure student reaction to the introductory generative AI activity (see Table 1). To measure AI anxiety, a 21-item scale was used (Wang & Wang, 2022) which is comprised of 4 factors: learning (see Table 2), job replacement (see Table 3), sociotechnical blindness (see Table 4) characterized by a more abstract view of AI and “an exclusive focus on AI programs ... [and a] blindness to the human contexts in which programs are used (pg. 2268, Johnson & Verdicchio, 2017),” and AI configuration (see Table 5), which refers to AI configured in the form of a robot, for example. To measure AI understanding, a two-item scale (Diab et al., 2011) was used (see Table 6). Additional items covered additional AI applications and demographic questions covering age and gender.

After the generative AI introduction activity, students completed the survey at one of two time periods. Approximately 30 students completed the survey within a few days after the generative AI activity while 34 students completed the survey at the end of the semester, 14 weeks after the initial generative AI student introduction activity.

Surveys were completed by students in five sections of an introductory information systems class required by all business students, including CIS majors. Students in four sections were in online versions of the

course while students in the remaining section met in a face-to-face setting. Regardless of course modality, before completing the survey, students first completed an introductory activity using generative AI such as ChatGPT, Claude 2, Bing with Chat, or Gemini.

Students who completed the survey at the end of the semester also had a chance to experience other AI activities. For example, when students sent emails, often late at night asking about Excel issues like ##### signs in cells, a response was posted in the Announcements area of the learning management system course site showing students how ChatGPT could be a late-night tutor to answer questions about Excel (see Appendix A).

A purposefully poorly worded prompt was entered into the ChatGPT prompt window such as “I’m a college student working on my Excel lab, and I got number signs. What do I do?” along with the output generated to encourage students to phrase their questions the best they could but also not to worry about having it perfectly worded if they weren’t familiar with the right vocabulary to use. In addition, students used Big Interview’s AI tool to review short one- to two-minute videos they created in response to four questions (Fulk et al., 2022). They then wrote a short reflection about their experience with Big Interview and its AI review tool.

Results

Demographics (see Table 1 below), show there were more females (73.4%) compared to males (26.6%). In addition, more participants were 25 and over (70.3%) compared to younger participants 18-24 (29.7%).

Table 1: Study Participant Demographics

Gender	Female		Male		Full Sample	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Age						
18 to 24 Years Old	12	25.5%	7	41.2%	17	29.7%
25 and Over	35	74.5%	10	58.8%	45	70.3%
Total	47	73.4%	17	26.6%	62	100.0%

Student Perceptions of Classroom Activities Involving Generative AI Products

Students were asked to identify how much they agreed or disagreed with the statements (see Table 2 below) and rated each on a 7-point Likert scale with “1” = “Strongly Disagree” and “7” = “Strongly Agree”. One sample t-tests were conducted to determine the student perceptions of the generative AI student introduction activity. All items were significant, and all were positive, except that students did not feel like they spent more time on the ChatGPT activity than they would have on a typical student introduction discussion board assignment.

Table 2: Results of Student Perception of “Get ChatGPT to Write Your Student Introduction For You”

Item	<i>n</i>	Mean	Std. Dev.	<i>t</i>	<i>p</i>	Cohen’s <i>d</i>
I think professors should include the ChatGPT student introduction activity in future semesters	60	5.30	1.598	6.303	<.001	.814
I liked the ChatGPT student introduction assignment better than completing a typical student introduction discussion board assignments	64	5.39	1.865	5.964	<.001	.745
I learned about the importance of refining prompts in generative AI like ChatGPT to get the output you want	64	5.97	1.403	11.229	<.001	1.404
I spent more time working on the ChatGPT student introduction assignment than completing a typical student introduction discussion board assignments	64	3.58	1.934	-1.745	0.43	-.218
I liked the ChatGPT student introduction assignment	64	5.63	1.750	7.427	<.001	.928

Independent samples t-tests showed no significant differences for older versus younger students except that older students, who were generally in distance courses, liked the activity even more than younger students. Independent samples t-tests also showed that neither student gender nor whether they took the survey immediately after the introductory activity or at the end of the semester, contributed to significant differences with perceptions of the introductory activity. Anecdotally though, more women seemed to mention it was their first time using generative AI like ChatGPT compared to men.

Student anxiety with generative AI products, like ChatGPT

Students were asked to identify how much they agreed or disagreed with the statements regarding Learning and AI (see Table 3), Jobs and AI (see Table 4), AI Configuration (see Table 5), and Sociotechnical Blindness (see Table 6). Students rated all statements, modified from the original instrument (Wang & Wang, 2022) to specifically relate to AI products like ChatGPT, on a seven-point Likert scale with 1 = “Strongly Disagree” to 7 = “Strongly Agree”.

Student anxiety related to learning and generative AI products like ChatGPT

One sample t-tests were conducted to determine whether student anxiety regarding learning and generative AI like ChatGPT differed from the neutral value of 4 (see Table 3 below). Results showed that students were not anxious about any of the statements that covered learning about AI like ChatGPT.

Table 3: Results of Student Anxiety Related to Learning and ChatGPT

Item	<i>n</i>	Mean	Std. Dev.	<i>t</i>	<i>p</i>	Cohen’s <i>d</i>
Taking a class about the development of AI products like ChatGPT, makes me anxious	63	2.56	1.457	-7.871	<.001	-.992
Learning to use AI products like ChatGPT, makes me anxious	63	2.44	1.423	-8.676	<.001	-1.093
Learning to understand all the special functions associated with an AI product like ChatGPT, makes me anxious	63	2.62	1.570	-6.981	<.001	-.879
Learning how an AI product like ChatGPT works, makes me anxious	63	2.48	1.413	-8.562	<.001	-1.079

Item	<i>n</i>	Mean	Std. Dev.	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
Learning to use specific functions of an AI product like ChatGPT, makes me anxious	63	2.37	1.371	-9.463	<.001	-1.192
Learning to interact with AI products like ChatGPT, makes me anxious	63	2.43	1.434	-8.700	<.001	-1.096
Being unable to keep up with the advances associated with AI products like ChatGPT, makes me anxious	63	3.21	1.797	-3.505	<.001	-.442
Reading an AI product like ChatGPT, manual makes me anxious	63	2.65	1.567	-6.832	<.001	-.436

Independent samples t-tests showed no significant differences for gender or whether students took the survey immediately after the initial generative AI activity or at the end of the semester. Also, while all students showed no anxiety with respect to reading AI product manuals, younger students were significantly less anxious about reading an AI product manual compared to older students.

Student anxiety related to learning and job replacement and AI products like ChatGPT

One sample t-tests were conducted to determine whether student anxiety regarding job replacement and generative AI like ChatGPT differed from the neutral value of 4 (see Table 4 on the following page). Results showed that, except for one statement, students were not overly anxious about any of the job-related statements about AI like ChatGPT, and that no statements reached a level of significance. The exception that reached the level of significance, was that students were not anxious about becoming dependent on AI and losing some of their reasoning skills.

Independent samples t-tests concerning gender, students' age, or whether students took the survey just after the initial generative AI student introduction activity or at the end of the semester showed no significant differences.

Table 4: Results of Student Anxiety Related to Job Replacement and ChatGPT

Item	<i>n</i>	Mean	Std. Dev.	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
I am afraid that if I begin to use AI products, like ChatGPT, I will become dependent upon them and lose some of my reasoning skills	63	3.51	1.925	-2.029	.023	-.256
I am afraid that AI products, like ChatGPT, will replace someone's job	63	4.21	1.797	.911	.183	.115
I am afraid that widespread use of AI products, like ChatGPT, will take jobs away from people	63	4.43	1.890	1.800	.038	.227
I am afraid that an AI product, like ChatGPT, may make use dependent	63	4.22	1.755	1.005	.159	.127
I am afraid that an AI product, like ChatGPT, may make us even lazier	63	4.27	1.885	1.136	.130	.143
I am afraid that an AI product, like ChatGPT, may replace humans	63	3.70	1.863	-1.285	.102	-.162

Student anxiety related to AI configuration and generative AI products like ChatGPT

One sample t-tests were conducted to determine whether student anxiety regarding AI configuration and generative AI like ChatGPT differed from the neutral value of 4 (see Table 5 below). Statistically significant results showed that, except for one statement, students were not anxious about humanoid robots being intimidating, and humanoid robots didn't scare them. Students were also not anxious about finding humanoid robots scary though results were not statistically significant.

Table 5: Results of Student Anxiety Related to AI Configuration

Item	<i>n</i>	Mean	Std. Dev.	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
I find humanoid AI products (for example humanoid robots) intimidating	63	3.38	1.611	-3.050	.002	-.384
I don't know why but I humanoid AI products (for example humanoid robots) scare me	63	3.35	1.715	-2.761	.002	-.380
I find humanoid AI products (for example humanoid robots) scary	63	3.63	1.763	-1.644	.053	-.207

Independent samples t-tests showed that for AI configuration, with respect to gender, older versus younger students or whether students took the survey just after the initial generative AI student introduction activity or at the end of the semester, showed no significant differences.

Student anxiety related to sociotechnical blindness and generative AI products like ChatGPT

One sample t-tests were conducted to determine whether student anxiety regarding sociotechnical blindness and generative AI like ChatGPT differed from the neutral value of 4 (see Table 6 on the following page). Statistically significant results showed that students were anxious that AI products like ChatGPT could be misused. While students were afraid of potential problems with AI products like ChatGPT, the results were not statistically significant. Students were not anxious about AI getting out of control or that it could lead to robot autonomy, but the results were not statistically significant.

Independent samples t-tests showed no significant differences for older students versus younger students or whether students took the survey immediately after the initial generative AI activity or at the end of the

Table 6: Results of Student Anxiety Related to Sociotechnical Blindness and ChatGPT

Item	<i>n</i>	Mean	Std. Dev.	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
I am afraid that an AI product, like ChatGPT, may get out of control and malfunction	63	3.83	1.718	-.806	.212	-.102
I am afraid that an AI product, like ChatGPT, may be misused	63	5.14	1.595	5.688	<.001	.717
I am afraid of various problems potentially associated with an AI product, like ChatGPT	63	4.33	1.646	1.607	.057	.202
I am afraid that an AI product, like ChatGPT, may lead to robot autonomy	63	3.87	1.862	-.541	.295	-.068

semester. Also, with respect to gender, there were no significant differences with the exception that male students were significantly more anxious ($n=16$, $m=4.56$) than female students ($n=47$, $m=3.57$) in terms of a fear over an AI product like ChatGPT getting out of control and malfunctioning ($t=2.036$, $p=.046$).

Student Perceptions of Perceived Legality for Generative AI products, like ChatGPT

Students were asked to identify how much they agreed or disagreed with the statements below (see Table 7 below) and rated each on a 7-point Likert scale with “1” = “Strongly Disagree” and “7” = “Strongly Agree”. One sample t-tests were conducted to determine whether student perceptions of the perceived legality of generative AI products, like ChatGPT differed from the neutral value of 4. Statistically significant results showed that while students believed ChatGPT itself was legal, they also doubted the legality of generative AI used in the hiring process.

Table 7: Results of Student Perception of Legality of AI Like ChatGPT

Item	<i>n</i>	Mean	Std. Dev.	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
I am not sure an AI product, like ChatGPT, is legal	63	3.40	1.530	-3.130	.001	-.394
I have doubts about the legality of an AI product, like ChatGPT, in hiring procedures	63	4.52	1.605	2.590	.006	.326

Independent samples t-tests showed that for student perception of legality and AI, for gender, older versus younger students, or whether students took the survey just after the initial generative AI student introduction activity or at the end of the semester, results showed no significant differences.

Student anxiety with different types of AI applications

Students were asked to identify how much they agreed or disagreed with the statements (see Table 8 on the following page) and rated each on a 7-point Likert scale with “1” = “It Does Not Make Me Very Anxious At All” to “7” = “It Makes Me Very Anxious”. One sample t-tests were used to show whether student anxiety over different types of AI applications differed from the neutral value of 4. The only types of AI that students were significantly anxious about included AI in military uses, AI used in deep fakes, and AI for companionship or caregiving.

Independent samples t-tests showed no significant differences for gender and older versus younger students, with one exception. While students, in general, were not anxious about facial recognition AI applications, younger students were significantly less anxious compared to older students. Also, students who took the survey within a few days after the initial student introduction activity were significantly less anxious about AI in music recognition compared to students who took the survey at the end of the semester.

Table 8: Results of Student Anxiety Related to Different AI Applications

Item	<i>n</i>	Mean	Std. Dev.	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
Deep fakes (AI which creates fictitious characters, brings dead people back to life, etc.)	60	5.03	1.983	4.307	<.001	.521
AI in military drones	60	4.55	1.899	2.243	.014	.290
AI in military equipment, such as robots	60	4.80	1.929	3.212	.001	.415

Item	<i>n</i>	Mean	Std. Dev.	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
AI robots (people or pet-like) for caregiving	60	5.15	1.716	5.192	<.001	.670
AI robots (people or pet-like) for companionship	60	4.62	1.932	2.473	.008	.319
AI that seeks to learn human knowledge	60	4.37	1.939	1.464	.074	.189
AI facial recognition technology (photograph	60	3.58	2.036	-1.585	.059	-.205
AI in software to suggest health diagnosis based on past symptoms	60	3.97	1.877	-.138	.466	-.018
AI in music recommendation (Spotify, Pandora) suggestions for similar music based on your genre and engagement with other artists	60	1.68	1.157	-15.509	<.001	-2.002
AI in entertainment recommendation (Netflix, Amazon, etc.) based on past selections or friend selections	60	2.28	1.678	-7.923	<.001	-1.023
AI in recommendation systems to suggest products (for example, grocery items) based on past searching or purchases	60	2.42	1.660	-7.388	<.001	-.954
AI to create paintings that are like those of other artists who have died	60	3.27	2.098	-2.707	.004	-.350
AI in hotel concierge robots to recommend restaurants or entertainment based on input of likes and dislikes	60	2.47	1.799	-6.602	<.001	-.852
AI in hotel concierge robots to recommend restaurants or entertainment based on credit card restaurant spending over the last year or two	60	3.58	2.196	-1.470	.073	-.190
AI metaverse (community, friends) so you can interact with friends and people in your network	60	3.15	1.964	-3.352	<.001	-.433
AI/AR gamification (community, friends) so you can interact with people	60	3.25	2.104	-2,761	.004	-.356
AI in social media (community) so you can interact with others in your network	60	3.25	1.919	-3.027	.002	-.391
AR in the metaverse – building virtual worlds	60	3.45	2.182	-1.953	.028	-.252
AR in reality – placing furniture, paint, landscaping, tile, etc. – designing virtually before you buy (Google/Meta/SNAP glasses, mobile apps)	60	2.62	1.805	-5.937	<.001	-.766
AR in retail consumption (fashion – clothing, eyewear, makeup, haircuts) try-on virtually before you buy	60	2.70	1.835	-5.489	<.001	-.709
AI personal assistant (Echo, Home, Alexa, Siri)	60	3.05	2.037	-3.612	<.001	-.466

Students who took the survey at the end of the semester were also not anxious about AI in the metaverse used to build virtual worlds compared to students who took the survey within days of the initial ChatGPT student introduction activity (who were anxious).

Discussion

This study's results raise interesting questions about student anxiety with using generative AI. For example, why were students only somewhat anxious about caregiving robots and robot AI applications? Students may have increased anxiety with AI displaying human-like qualities. Another possible explanation may be

that the media paints a picture of a dystopian future with AI in control with an abundance of questionable ethics (Karnouskos, 2020). Plenty of movies, from *I Robot* to *2001: A Space Odyssey* to *Ex Machina* to the *Matrix* and *Terminator* series paint a similar picture of robots taking over society or malfunctioning in some way. Recent research (Nader et al., 2022) showed that people were more likely to see AI as society-destroying robots or emotional support robots if they thought those were realistic portrayals of AI in media entertainment sources like movies. Many movies tend to appeal to specific genders. For example, the *Terminator Genesys* movie, with more male audience appeal came out at the same time as *Magic Mike XXL*, which attracted more women. With more males attending movies like the *I Robot*, *Terminator*, and *Matrix* movies, males may have been exposed to more entertainment media where robots are in control and malfunctioning.

In contrast to students being somewhat anxious about AI and robots, students were decidedly not anxious when it came to learning about AI like ChatGPT. Perhaps this is because learning is one of the central activities of the university. Since students had completed an AI class activity at the beginning of the semester that they liked, that could explain why they were not anxious about learning about AI. It is also possible that students wanted to learn about AI because it could make them more productive, thereby saving them time, easing their workload, and reducing related stress (Li & Jan, 2023).

Not only might using ChatGPT in a student introduction learning activity have reduced student anxiety about ChatGPT, but it also might have contributed to student beliefs that ChatGPT is legal. It may be likely that students believe any software used in class or appearing in various news articles is legal. However, students had significant doubts about the legality of ChatGPT used in hiring procedures.

This is in keeping with a survey of people more in line with U.S. Census statistics (Li & Jan, 2023) which showed that people believed that AI could replace human jobs. While AI, in general, may replace jobs (Li & Jan, 2023), and while students were also more anxious about AI like ChatGPT replacing jobs, results here did not reach a level of significance. However, students were anxious about the possibility of misuse of AI products like ChatGPT. Perhaps students were anxious about the misuse of ChatGPT in hiring processes.

Overall, though, students either showed reduced anxiety or were not overly anxious with the majority of the items in the AI Anxiety Scale, which we modified to specifically refer to generative AI tools like ChatGPT. It could be that easy-to-use tools mask the complexity of the AI behind them (Karnouskos, 2020).

Perhaps students find the interface for ChatGPT overly like a search engine like Google. Some student comments suggest they see few differences. For example, input boxes are shaped like an emery board with space for a single line of text. Research has shown that with traditional search engines, users enter an average of 2.35 terms used per search phrase and generally examine just the first ten result links (Silverstein et al., 1999).

Other research pointed out that while users enter few terms for initial search phrases, users near the end of the search for items, for example, may use more long tail keyword terms (Jansen et al., 2009), which includes target item details indicating users have done prior research on the topic at hand. With generative AI like ChatGPT, called GutGPT, there were about 11-15 words per prompt (Rajashekar et al., 2024) depending on whether it was used for content versus risk assessment. With generative AI used for software engineering, there were 17.6 words per prompt (Rasnayaka et al., 2024). Considering that generative AI can accept input from up to 6,000 words to about 75,000 words, students appear to be using generative AI more like a traditional search engine.

Conclusion, Limitations, and Future Research

The prevalence of AI in academia and industry is everywhere, especially since OpenAI just released its education version of ChatGPT Edu geared toward educational institutions. Faculty are tasked with preparing students for employment, while also balancing the changing environment post-COVID and student technostress (Upadhyaya & Vrinda, 2021) and AI anxiety (Wang & Wang, 2022). This study explored student anxiety and perspectives on learning new technology.

After an initial prompting activity, which students were quite positive about, survey results found that students were not very anxious about artificial intelligence. However, male students were significantly more anxious about AI technology like ChatGPT getting out of control or malfunctioning.

Additionally, students believed the technology was legal but were doubtful of the legal use of the technology such as in job hiring practices. Existing research supports the idea that perceptions, rather than factual knowledge, influence how people act (Dijksterhuis & Van Knippenberg, 1998; Pruijssers et al., 2020). In addition, individuals are often mistaken about what is legal (Rowell, 2019; Van Rooij & Fine, 2021). Hence, it is important to pay attention to students' beliefs about the legality of using AI technology, regardless of their level of actual legal understanding.

Overall, students expressed a lack of anxiety about learning AI or AI applications and technologies. Gender and age did not show significant differences other than facial recognition where younger students had even lower anxiety than older students. This study adds to current research on AI anxiety. Finally, this study also provides practical examples that can be used in higher education courses that educators can introduce to promote AI learning behavior and not add to student technostress or increase student AI anxiety.

While the small sample size, especially the low number of male students, is a limitation to the study, results aid in our understanding of students and generative AI as well as generative AI course activities. Student interaction with generative AI provides a wide variety of areas for future research from student prompting techniques to understanding nuances of anxiety associated with generative AI, to ideas concerning how user interfaces, that are remarkably similar to familiar, traditional search engines, impact student anxiety.

References

- Aguinis, H., Beltran, J. R., & Cope, A. (2024). How to use generative AI as a human resource management assistant. *Organizational Dynamics*, 101029.
- Castillo, D., Canhoto, A. I., & Said, E. (2021). The dark side of AI-powered service interactions: exploring the process of co-destruction from the customer perspective. *The Service Industries Journal*, 41(13-14), 900-925.
- Cheong, I., Caliskan, A., & Kohno, T. (2024). Safeguarding human values: rethinking US law for generative AI's societal impacts. *AI and Ethics*, 1-27.
- Culp-Roche, A., Hampton, D., Hensley, A., Wilson, J., Thaxton-Wiggins, A., Otis, J. A., & Moser, D. K. (2020). Generational differences in faculty and student comfort with technology use. *Sage open nursing*, 6, 2377960820941394.

- Diab, D. L., Pui, S. Y., Yankelevich, M., & Highhouse, S. (2011). Lay perceptions of selection decision aids in US and non-US samples. *International Journal of Selection and Assessment*, 19(2), 209-216.
- Dijksterhuis, A., & Van Knippenberg, A. (1998). The relation between perception and behavior, or how to win a game of trivial pursuit. *Journal of Personality and Social Psychology*, 74(4), 865-877.
- Donnermann, M., Lein, M., Messingschlager, T., Riedmann, A., Schaper, P., Steinhäusser, S., & Lugin, B. (2021). Social robots and gamification for technology-supported learning: An empirical study on engagement and motivation, *Computers in Human Behavior*, 121, 106792.
- Enholm, I. M., Papagiannidis, E., Mikalef, P., & Krogstie, J. (2022). Artificial intelligence and business value: A literature review. *Information Systems Frontiers*, 24(5), 1709-1734.
- Fulk, H. K., Dent, H. L., Kapakos, W. A., & White, B. J. (2022). Doing more with less: Using AI-based Big Interview to combine exam preparation and interview practice. *Issues in Information Systems*, 23(4), 204-217.
- Gonzalez, M. F., Liu, W., Shirase, L., Tomczak, D. L., Lobbe, C. E., Jusenhoven, R., & Martin, N. R. (2022). Allying with AI? Reactions toward human-based, AI/ML-based, and augmented hiring processes. *Computers in Human Behavior*, 130, 107179.
- Hacker, P., Engel, A., & Mauer, M. (2023, June). Regulating ChatGPT and other large generative AI models. In *Proceedings of the 2023 ACM Conference on Fairness, Accountability, and Transparency* (pp. 1112-1123).
- Harris, C. G. (2024, February). Combining Human-in-the-Loop Systems and AI Fairness Toolkits to Reduce Age Bias in AI Job Hiring Algorithms. In *2024 IEEE International Conference on Big Data and Smart Computing (BigComp)* (pp. 60-66). IEEE.
- Humphreys, D., Koay, A., Desmond, D., & Mealy, E. (2024). AI hype as a cyber security risk: The moral responsibility of implementing generative AI in business. *AI and Ethics*, 1-14.
- Jansen, B., Zhang, M., Booth, D., Park, D., Zhang, Y., Kathuria, A., & Bonner, P. (2009). To what degree can log data profile a web searcher? *Proceedings of the American society for information science and technology*, 46(1), 1-19.
- Johnson, D. G., & Verdicchio, M. (2017). AI anxiety. *Journal of the Association for Information Science and Technology*, 68(9), 2267-2270.
- Karnouskos, S. (2020). Artificial intelligence in digital media: The era of deepfakes. *IEEE Transactions on Technology and Society*, 1(3), 138-147.
- Li, E. Y. & Jan, A., (2023). Impact of artificial intelligence (AI) in enhancing productivity and reducing stress among students. *ICEB 2023 Proceedings* (Chiayi, Taiwan). 33.
- MPAA. (March 14, 2022). Distribution of the audiences of the highest-grossing movies in the United States and Canada in 2021, by gender [Graph]. In *Statista*. Retrieved May 27, 2024, from <https://www.statista.com/statistics/696186/movie-audience-distribution-gender/>

- Nader, K., Toprac, P., Scott, S., & Baker, S. (2022). Public understanding of artificial intelligence through entertainment media. *AI & society*, 1-14.
- Naneva, S., Sarda Gou, M., Webb, T. L., & Prescott, T. J. (2020). A systematic review of attitudes, anxiety, acceptance, and trust towards social robots. *International Journal of Social Robotics*, 12(6), 1179-1201.
- Novelli, C., Hacker, P., Morley, J., Trondal, J., & Floridi, L. (2024). A Robust Governance for the AI Act: AI Office, AI Board, Scientific Panel, and National Authorities. *AI Board, Scientific Panel, and National Authorities (May 5, 2024)*.
- OpenAI. (2023) [Large language model]. <https://chat.openai.com/chat>
- Pallathadka, H., Ramirez-Asis, E. H., Loli-Poma, T. P., Kaliyaperumai, K., Ventayen, R. J. M., \$ Naved, M. (2023). Applications of artificial intelligence in business management, e-commerce and finance. *Materials Today: Proceedings*, 80, 2610-2613.
- Pruijssers, J. L., Heugens, P. P., & Van Oosterhout, J. (2020). Winning at a losing game? Side-effects of perceived tournament promotion incentives in audit firms. *Journal of Business Ethics*, 162, 149-167.
- Rajashekar, N. C., Shin, Y. E., Pu, Y., Chung, S., You, K., Giuffre, M., ... & Shung, D. (2024, May). Human-Algorithmic Interaction Using a Large Language Model-Augmented Artificial Intelligence Clinical Decision Support System. In *Proceedings of the CHI Conference on Human Factors in Computing Systems* (pp. 1-20).
- Rowell, A. (2019). Legal knowledge, belief, and aspiration. *Arizona State Law Journal*, 51, 225.
- Qian, Y., Siau, K. L., & Nah, F. F. (2024). Societal impacts of artificial intelligence: Ethical, legal, and governance issues. *Societal Impacts*, 3, 100040.
- Rasnayaka, S., Wang, G., Shariffdeen, R., & Iyer, G. N. (2024). An empirical study on usage and perceptions of llms in a software engineering project. *arXiv preprint arXiv:2401.16186*.
- Sai, S., Sai, R., & Chamola, V. (2024). Generative AI for Industry 5.0: Analyzing the impact of ChatGPT, DALLE, and Other Models. *IEEE Open Journal of the Communications Society*.
- Sestino, A., & DeMauro, A. (2022). Leveraging artificial intelligence in business: Implications, applications and methods. *Technology Analysis & Strategic Management*, 34(1), 16-29.
- Shatri, Z. G. (2020). Advantages and disadvantages of using information technology in learning process of students. *Journal of Turkish Science Education*, 17(3), 420-428.
- Silverstein, C., Marais, H., Henzinger, M., & Moricz, M. (1999, September). Analysis of a very large web search engine query log. In *Acm sigir forum* (Vol. 33, No. 1, pp. 6-12). New York, NY, USA: ACM.

- Smith, E. R., Sherrin, S., Fraune, M. R., & Šabanović, S. (2020). Positive emotions, more than anxiety or other negative emotions, predict willingness to interact with robots. *Personality and Social Psychology Bulletin*, 46(8), 1270-1283.
- Upadhyaya, P., & Vrinda. (2021). Impact of technostress on academic productivity of university students. *Education and Information Technologies*, 26(2), 1647-1664.
- Van Rooij, B., & Fine, A. (2021). Do people know the law? Empirical evidence about legal knowledge and its implications for compliance. In B. Van Rooij & D. D. Sokol (Eds.), *Cambridge handbook on Compliance* (pp. 467-488). Cambridge University Press.
- Wang, Y. M., Wei, C. L., Lin, H. H., Wang, S. C., & Wang, Y. S. (2022). What drives students' AI learning behavior: A perspective of AI anxiety. *Interactive Learning Environments*, 1-17.
- Wang, Y. Y., & Wang, Y. S. (2022). Development and validation of an artificial intelligence anxiety scale: An initial application in predicting motivated learning behavior. *Interactive learning Environments*, 30(4), 619-634.
- Willey, L., White., B. J., & Deale, C. S. (2023). Teaching AI in the college course: Introducing the AI prompt development life cycle (PDLC). *Issues in Information Systems*, 24(2), 123-138.
- Wirtz, J., Kunz, W., & Paluch, S. (2021). The service revolution, intelligent automation and service robots. *European Business Review*, 29(5), 909.

Appendix A: Announcement: Get ChatGPT to be Your Excel Tutor! (OpenAI, 2023)

ChatGPT: What if you needed a private tutor who was ready to help exactly when you had an Excel question?

Hi All--I know many of you were blown away with the way ChatGPT could handle your student introduction. I have had students in both my classes wonder what ##### was (and we did discuss it in class but maybe not everyone was there to hear it). Here is another idea: have a chat with ChatGPT about it! My Prompt (that I don't think is actually a very well-written, good one, by the way!):

I'm in a college course and have to do an Excel lab about a budget but when I write my formula, what I get in the cells is #####. Can you help me with that?

ChatGPT's Answer (what do you think of it? Asterisks, by the way, seem to indicate spaces so don't worry about them)

“Certainly, the “#####” error in Excel cells usually occurs when the content of a cell is too wide to fit within the column width. It's Excel's way of indicating that the cell content is not fully visible. This often happens with numbers or dates that are too long to display within the column width.

To fix this issue, you can follow these steps:

1. ****Adjust Column Width:**** Increase the width of the column that contains the cells showing “#####”. To do this, move your mouse pointer to the boundary between the column letters at the top of the column and double-click. Excel will automatically adjust the column width to fit the content.

2. ****Format Cells:**** If adjusting the column width doesn't resolve the issue, it's possible that the format of the cell might be causing the problem, especially if you're dealing with dates or numbers. Try the following:

- Select the cell(s) displaying “#####”.
- Right-click and choose “Format Cells.”
- In the “Format Cells” dialog box, go to the “Number” tab.
- Choose an appropriate number format that fits your content, such as “General” or a specific number/date format.

3. ****Check Content:**** If the above steps don't work, verify that the content you've entered in the cell is valid. For example, make sure you've entered numbers or dates correctly. If you're using formulas, ensure that your formulas are accurate and properly structured.

4. ****Reduce Decimal Places:**** If you're dealing with numbers that have many decimal places, it could also cause the “#####” error. Try reducing the decimal places or using scientific notation to make the number fit within the cell.

5. **Text Wrapping:** If you have long text in the cell, consider enabling text wrapping. This will allow the text to be displayed on multiple lines within the cell.”

So...there are some words of advice from your ChatGPT tutor. Again, remember that "#####" is just an indication that the content is too wide for the cell. It's not an error per se. Adjusting the column width and formatting should help you display the content properly. If you're still facing issues, please provide more details about the content and formulas you're using so I can offer more specific guidance.