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Generative artificial intelligence integrations and applications

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Abstract

Generative artificial intelligence (AI) systems are changing the landscape of communication in every capacity. This is seen in written, oral, and visual methods of communication. For educational degree programs such as graphic communication programs, like those found at Clemson and Cal Poly, this is a difficult technology advancement to navigate. Previously, these programs have been a home for creative students' hopeful to pursue a career in a science and creative communication field within the printing or digital media industries. New technology integrating into the classroom daily such as Chat GPT, Adobe Firefly, and Midjourney are quickly changing the education landscape. This leaves students and educators left to answer the questions of how to adapt these new technologies into the classroom and if it should be part of a formal education program. The first step in making these informed decisions is to better understand the attitudes, apprehensions, and level of comfort of students in Clemson and Cal Poly degree programs toward generative AI systems. To collect metrics on these attitudes, a five-point Likert Scale survey that was distributed to students enrolled in Clemson and Cal Poly graphic communication programs has been formulated. The data collected provided clarity that students have a high level of ethical apprehension toward generative AI systems despite adopting the technology in their everyday lives. In addition, the data results provided clarity that students, regardless of class standing, have a high level of fear surrounding job security and the impact that generative Artificial Intelligence will have on the communication job market post-graduation.

Keywords: generative artificial intelligence, graphic communication, education

1. Introduction

Artificial intelligence (AI) is an emerging technology that has the ability to change the methods of communication visually, written, and auditory. According to IBM "(Generative) AI refers to deep-learning models that can generate high-quality text, images, and other content based on the data they were trained on" (Martineau, 2021). While the history of AI technology has been developing over the last 50 years there have been significant advances over the past five years that have been adopted by industries in multiple different disciplines. While there are many application usages for AI software, many fail to understand that conceptually AI systems are inherently different. While AI follows a decision-making model process that has been well established, new AI actually creates something new and unique to each user by searching through data sets. Thus, the job market and the way that colleges instructors prepare students for the job market will inevitably have to change and adapt over time. This poses a unique threat for majors such as

graphic communication degrees that specialize in visual and multimodal methods of communication that has traditionally been a degree that combines craftsmanship, artistry, business models, and scientific data applied to printing and communication processes. This type of degree is unique in that it still largely relies on traditional print methods for core courses but has recently branched into web and digital media design. There are two large programs in the United States that offer Bachelor of Science graphic communication degrees: Cal Poly and Clemson University. The fast adoption of this technology with the emergence of platforms like ChatGPT and Adobe Firefly has left these two programs unsure how to move forward as instructors navigating the changing industry. One important lens to identify a way to move forward is to gather research on current graphic communication major attitudes and beliefs surround generative AI. This study will discuss the Likert Scale survey research addressing attitudes and beliefs toward AI distributed and completed by Cal Poly and Clemson University graphic communication students in November 2023.

According to the Clemson University webpage the graphic communication program can be best described by their vision and mission statement: “Our mission is to develop effective and engaged problem-solving people grounded in the printing, packaging, and visual communications fields in order to advance and strengthen businesses globally. We strive to be the preeminent graphic communications program known for innovative educational experiences driven by strategic partnerships and applied research” (Clemson University, 2023).

The students receive an education that covers graphic design, color science, brand management, digital media, and traditional print systems. The degree program at Cal Poly has a similar structure in form and content to Clemson and both have long standing roots in the traditional print field and attract design student who wish to receive a degree that includes business and brand management courses. The emergence of AI is changing the previously craft or skilled aspects of this degree program into a tool that can be accessible and used by most of the job market regardless of design skills or print production knowledge.

Artificial intelligence is not a relatively new system of machine learning and automated systems utilizing databases and feedback loops to solve problems. In 1983 Wilson encouraged visual artists to adopt and accept AI as a creative model, “I am here to stress to visual artists the importance of AI research and the need for more of them to participate in it, since at present AI research is dominated by those concerned with scientific, engineering, commercial and military application” (Wilson, 1983). In many ways, this research continued to be dominated by scientific, commercial, and scientific researchers for applications. That is why AI systems in the written and visual landscapes recently have changed future forecast and applications within the communication industries. Therefore, while AI is not a new system of machine learning it has the ability to “generate new outputs based on the data they have been trained on. Unlike traditional AI systems that are designed to recognize patterns and make predictions, generative AI creates new content in the form of images, text, audio, and more” (Routley, 2023). However, the way that these AI systems generate new content is by sourcing and pulling from already existing content within a particular dataset. This is what leads to some of the ethical grey areas for design and visual communication career fields. The continual question of where is the line between copyright infringement and generative content generation based on sourced data to points is leading mixed attitudes and emotions throughout faculty and student demographics alike.

2. Methods

This study focuses on Clemson and Cal Poly students currently enrolled in graphic communication degree programs. The sample was a voluntary response group as all students in the degree programs were sent the survey but did not have a formal incentive to respond to the survey. The choice to remove an incentive resulted in a smaller response pool but was deemed appropriate in an effort to maintain internal study validity.

First the study was approved through Clemson University Institutional Review Board to ensure the safety of all student participants in the study, and an informed consent was deemed appropriate to be added to the beginning of the survey. This consent explained the scope of the study as well as the potential advantages or harm that could result in voluntary participation. The decision to utilize a Likert scale survey to collect data was because Likert scale surveys, “have the advantage that they do not expect a simple yes / no answer from the respondent but rather allow for degrees of opinion and even no opinion at all” (McLeod, 2023). In addition, they have fixed answers that allow for a clear quantitative value to be assigned to an abstract attitude and therefore, allow for a consensus to be inferred from a group of results by completing statistical analysis to find the median and mode of the data set collected.

The survey was distributed via email to students at both universities and was left open for 14 days before the data was closed and analyzed for the study. Once the response period closed, the data was analyzed using Excel charts and graph systems to create visual and numerical statistical analysis. The median, mode, and standard deviation of each question were found. In addition, charts and graphs were created to visualize the data set for specific questions in an effort to provide a clear way to express complex data.

3. Results

3.1 Student demographics

There was a total of 23 respondents to the survey across both universities. The voluntary respondents overwhelmingly identified as female (69.6 %); 26.1 % identified as male and 4.3 % of respondents identified as non-binary. In addition, there was an almost fully equal distribution of respondents between both university degree programs. Clemson University students accounted for 56.5 % of the respondents while Cal Poly students accounted for 43.5 %. This equal distribution allows for the dataset to be inferred equally across

both student body demographics instead of a majority respondents would imply that the attitude could be regional or based on faculty, social, or cultural influence. In addition, the respondents were consistent across class standing as shown in Figure 1.

This data is largely representative of the student body demographics at large for both universities with a slightly larger female representation across enrollment than male. In addition, the equality in respondents between both universities allows for the responses to remain unbiased from one program to another. While the sample size is small the degree programs are a smaller subset and due to the variety in the data set and the reflectance it has upon the student body demographics at large this data set should yield results that would be applicable to the larger student body population. A larger sample size may have been collected if an incentive to respond was attached or if the study was sent to run for a second time. However, the incentive could have potentially increased the bias and reliability of the study. In addition, when the survey answers were collected and demonstrated variance and captured the larger subset the need to reopen the survey was not necessary at the time.

3.2 Current student usage of generative ai systems

Questions 1–9 were designed to collect data on how students are currently using generative AI and to access their level of comfort toward the new systems as shown in Appendix A. On the Likert scale the responses could range from strongly disagree to strongly agree. These responses were coded to a corresponding 1–5 scale with 1 corresponding to strongly disagree and 5 corresponding to strongly agree and with 3 being the neutral response. Students who responded with a 1 or 2 demonstrated a low level of comfort or current usage of generative AI systems while students who responded with 4 or 5 expressed a high level of comfort and current usage of AI systems.

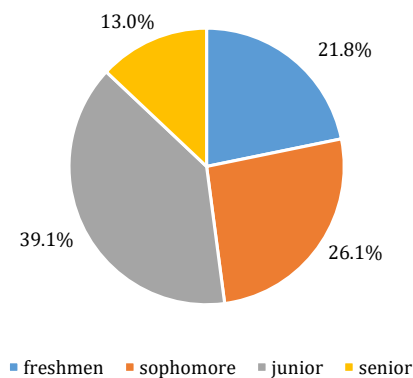


Figure 1: Student self-identifying information

The numerical statistical analysis for questions 1–8 is included in Table 1; the results for question 9 are provided in Figure 2.

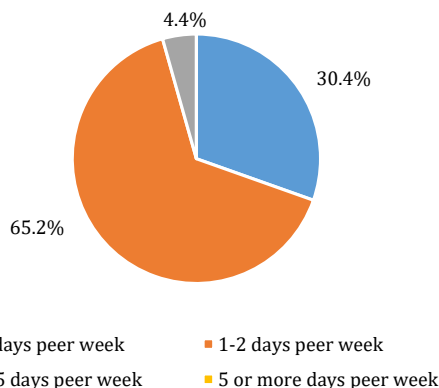


Figure 2: Response to question #9 “On average, how many days per week would you say you use AI outside of school?”

Table 1: Statistical analysis questions 1–8

Question #	Standard Deviation	Percent	Mode
1	1.07	2.39	2
2	1.58	3.39	5
3	0.83	1.65	1
4	1.49	3.34	4
5	1.30	2.82	2
6	1.49	2.69	2
7	0.97	3.69	4
8	1.01	3.86	4

Questions 1–3 were specifically intended to gain understanding about current student usage with AI application such as Chat GPT. Question one was left in a generic state and left the answer open for students. However, one risk to this is it assumes the students fully understand all applications that are fully generative AI and not traditional decision modeling AI. The average response was 2.39 indicating that students typically either do not utilize AI in their daily lives or they are unsure or unclear about what is and is not a generative AI application. Question 2 was then designed to name a well-known generative AI application when asking about current usage applications. The average was one point higher than question 1 coming in at 3.39. There are multiple reasons this could be higher. The first is that the question was not limited to daily lives and students may utilize this software for academic purposes unlike question 1. The second reason could be that students were unclear about what generative artificial intelligence platforms were and the name association with a known software caused the response to increase. Shifting to question 3,

this question was specifically to see if students were yet using a new Adobe platform that is a text to vector generative AI. This software is newer emerging technology that changes a lot about the design process for traditional print runs. It makes utilizing the pen tool in Adobe Illustrator a threatened taught skill. However, based on student response this is not something they are either aware of or are not currently utilizing. Questions 4–6 were intended to assess how students are currently engaging with the software. These questions did not specifically limit students to academic or personal usage for the scope of these 3 questions. Question 4 asked if students were using generative AI to learn about a topic. This engagement would be an acknowledgement that generative AI serves as a reference source and contains reliable information. The average was 3.34 indicating a medium to high amount of usage in this capacity with a mode of 4. However, the standard deviation was very large at 1.49 demonstrating that responses were divided. The answers to this question directly correlated to the responses to question 7. Students who were very comfortable with technology trended on the 3–4 scale side for question 4 whereas students who were uncomfortable fell closer to a 1. This demonstrates student comfort has a direct relation to software usage. Question 5 was a more targeted usage question asking specifically about productivity. The mode was a 2 and most students indicated they did not currently use generative AI for productivity; however, the large standard deviation represents that yet again there was division between student respondents. Like question 4, this question also corresponded to question 7 answers and students who were more comfortable with technology had a higher response. At this point, neither degree program is currently teaching generative AI in the classroom for core courses in the curriculum. Therefore, student usage is mostly defined by a personal level of comfort to engage with the software. If generative AI were being taught in the classroom it could be possible for comfort and overall usage inside and outside the classroom to rise. Question 6 was to gain insight on if students were utilizing AI as a means to source information much like a search engine. The mode for this question was a 2 indicating this is not currently a way students are engaging with the software. This could be because they do not realize that the data set is capable or that there is still a heavy reliance on Google as the search engine source of information. In addition, students may feel a distrust with generative AI or have doubts about the reliability. In addition, both schools have implemented ChatGPT policies that students may be afraid of repercussions for using the software as a search engine.

Questions 7 and 8 were to gain insight on student comfort with new technologies overall as well as how

receptive they would be to integrating AI in the classroom. Based on the responses, most students, even those who are not comfortable with technology would be excited to see the technology taught in the classroom. This explicit instruction could ease uncertainty about applications as well as help with comfort levels with the technology. Both of these questions had a mode of 4 indicating that most students are fairly comfortable with technology and would be excited to see this in the classroom.

Question 9 was designed to quantify the frequency of usage of AI outside the classroom. One thing that could have caused these answers to be lower is that there was a limitation in the question to only personal usage levels. Students could have responded much more frequent had the question allowed for personal and academic usage. Overall, most students use generative AI outside the classroom in their personal lives but not as a daily resource. This could be due to the lack of information students have about how to use generative AI and the ways that it can be productive. In addition, there was a correlation between students who used AI to increase productivity and those students who selected 1–2 times per week usage. This suggests that the main reason for non-academic generative AI usage is to increase productivity.

3.3 Attitudes and apprehension toward generative ai systems

Questions 10–13 were designed to collect data on student fears, apprehensions, and uncertainty toward generative AI systems. These questions varied from ethical concerns, future job implications, and cheating as shown in Appendix B. The data set from Appendix B had a much lower standard deviation (Table 2) and demonstrated that student responses were much closer to the average when compared to the data set collected from Appendix A.

Table 2: Statistical analysis questions 10–13

Question #	Standard Deviation	Percent	Mode
10	0.83	4.17	4
11	1.06	3.30	4
12	0.97	4.04	5
13	0.86	2.73	3

Question 10 was specially added to the survey in order to quantify student attitudes toward how generative AI software will change the job market in which they are currently studying to enter after graduation. This question could vary in response depending on if a student's interest is in digital media or traditional print. Student study area was not identified during the survey so there

is no way to see a correlation. However, the average was 4.17 with a low standard deviation indicating that all students regardless of school or emphasis feel that general communication job markets will change due to this. This could be an explanation for why students would be receptive to seeing the software taught in the classroom. They see it as a useful skill to add to their toolkit before entering the job market.

Questions 11–13 were to assess students ethical thoughts toward generative AI software. These answers could have been largely skewed due to both universities having a formal Chat GPT policy that outlines a well-known generative AI platform as cheating. The survey being distributed in an academic setting, students could have feared repercussion for answers. Due to this and the lack of formal training and education on the software students were overwhelmingly clear that they have concerns about ethics. This demonstrates a strong need for ethical discussions to occur in formal settings and for a better and more comprehensive understanding of how generative artificial intelligence software work. The misinformation, academic repercussion policies, and lack of formal education adoption have led to high levels of student apprehension and uncertainty toward ethics surrounding generative artificial intelligence.

3.4 Analysis of student responses

In the data set collected from Appendix A questions the median fell around the neutral response for all except question 3. This question was specific to a text to vector application that was released in early Fall 2023 and has widespread applications within Adobe Illustrator vector artwork preparation. However, the responses from this data set also had a high standard deviation showing that student responses were much farther apart. After observation, this set of questions proved to be very polarizing to student responses. Thus, it is inferring that at this stage student usage and adoption of AI systems varies widely from student to student. In addition, the mode for questions 7 and 8 was 4 which correlates to a strong excitement in this technology being adopted into a classroom and a high level of student comfort with the technology. The data set collected from Appendix B questions had a median that fell in an agreeing response correspondence except for question 13 demonstrating a high level of uncertainty regarding ethics and job implications regarding AI systems.

4. Discussion and future research

The initial question at hand was to better understand student attitudes, usages, and apprehensions

in regard to generative AI systems. The questions designed were formulated and placed into a Likert scale survey to give quantitative data points to help visualize these responses. In the first set of questions, a large variation between responses can be observed shown through a high standard deviation which infers that usage is a personal choice despite all students demonstrating a high level of comfort in the second set of data questions. In addition, the results revealed that the majority of students would be happy to learn about generative AI in a formalized education setting. Thus, the results suggest that implementation of the new technology in the classroom would be an accepted practice by the enrolled students at both universities surveyed. However, additional research would need to be conducted to test how integration of this technology would be best applied in the classroom for student retention and comprehension of information. In addition, the second set of data reveals that students have a high level of apprehension in a post degree job market since this technology has impacted industry. In addition, students revealed that they are concerned about the ethics surrounding generative AI generation and how this could impact designers. These answers were consistent throughout different class standing, university of enrollment, and gender. If educators wish to implement this technology in the classroom it could be a potential way to help students gain clarity and reduce uncertainty.

In the future, further research in this area is planned on student comfort after a guided activity. This would help to further understand how formal education training increases comfort with technology and if this has any correlation to how students view ethics. This research could be completed by conducting a pretest to assess student ethical concerns and comfort with the technology. Then each student would complete a module that provides information on what is generative AI, how does it work, its current applications, an ethical discussion, and a short practice activity to learn how to better engage the software. At the end a post test could be delivered to measure student differences or changes after being exposed to the stimulus.

5. Conclusion

Through this study, it is demonstrated that students have a high level of variability in their attitudes and usage of generative AI and all generally agree in their levels of apprehension and ethical uncertainty. These results were consistent regardless of gender, university of enrollment, or current class standing. This study also showed that students are aware of the impact that generative AI will have in their professional and personal lives. Despite the small sample

size, the data set is reliable for the scope of study as there are very few existing Bachelor of Science graphic communication degree programs in the United States. This data is important for consideration of both insti-

tutions on how to navigate new generative AI technology advancements and will serve as a baseline for student attitudes and applications of these systems in the future.

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Appendix

A: Questions 1-8 in likert scale survey

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
I use artificial intelligence in my everyday life outside of school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have used generative text Artificial intelligence such as Chat GPT to complete a task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have used the text to vector artificial intelligence application to create vector images.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use artificial intelligence in my everyday life outside of school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use Artificial intelligence to learn more about a topic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use artificial intelligence to improve productivity in my everyday life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use artificial intelligence to find answers to complex questions that other search engines do not provide comprehensive answers to.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am very comfortable using new and emerging technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would be excited to see my instructors integrate new technology into the classroom.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix

B: Questions 10-13 in Likert scale survey

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
I believe generative Artificial intelligence will change the communication job market.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am apprehensive about using artificial intelligence.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am concerned about the ethics surrounding the use of generative artificial intelligence.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think using Generative Artificial Intelligence is cheating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>