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Generative AI and College Students: Use and Perceptions

Jonathan M. Golding[1], Anne Lippert[2], Jeffrey S. Neuschatz[3], Ilyssa Salomon[4], and Kelly Burke[5]

Abstract

Background: The advent of generative-artificial intelligence (AI) applications introduces new challenges for colleges. Importantly, the growth of these applications requires faculty to adjust their pedagogy to account for the changing technological landscape.
Objective: As colleges wrestle with the implications of these applications, it is important to understand college students' perceptions and use of generative-AI.
Method: Undergraduate college students' (in psychology courses) were surveyed about their use and perception of these applications. The sample was from five U.S. universities; primarily made up of women, and included White, Hispanic, and Black participants.
Results: Most students were familiar with these applications, yet less than half had used them in college, primarily to receive help with assignments. Those not using these applications gave "getting caught" and "cheating" as responses for not using them. Finally, most students perceived using these applications as cheating.
Conclusions: Students were familiar with these applications and were most likely to use them in humanities courses. Furthermore, these applications were used most often in writing tasks.
Teaching Implications: The increased use of these applications has led to educators debating whether these applications should be incorporated into the college classroom. Do these applications have pedological value or are they just another means for cheating?

Keywords

generative-AI, ChatGPT, artificial intelligence, education, college, cheating, academic dis/honesty

Generative AI and College Students: Use and Perceptions

It is hard to believe that it has been less than 2 years since OpenAI (backed by Microsoft) released an early demo of ChatGPT on November 30, 2022 (Blitchok, 2023). The public response to ChatGPT was immediate and overwhelming. It took less than a month for the application to surpass one million users, and 4 months later it had reached more than 100 million users (Blitchok, 2023). ChatGPT and other generative-AI applications are natural language processing models that can generate human-like text (e.g., writing letters and essays, composing music) in response to conversational text questions/prompts (Blitchok, 2023; Rudra, 2023). These applications provide answers based on books, websites, and other text-based materials (Rudra, 2023). Moreover, generative-AI applications have flooded the Internet and changed the way individuals approach all facets of life, including work and school. The purpose of the present study was to investigate the use and perception of generative-AI applications by college students.

Prevalence and Perception of Generative-AI Use

The increasing use of generative-AI applications has led to a spike in survey research over the past 2 years investigating the use of these applications. For instance, Delello et al. (2023) conducted a peer-reviewed study in the United States with 165 undergraduate and graduate students. Their online survey study included both rating questions and open-ended questions (e.g., "Does AI use in education have associated risks?") that were scored and used to generate themes. Results showed that most respondents were familiar with the term "*ChatGPT*." In addition, participants reported concerns about generative-AI applications leading to misconduct (e.g., plagiarism).

In another peer-reviewed study, Chan and Hu (2023) surveyed 399 undergraduate and postgraduate students in Hong Kong. There were 26 rating questions and three open-ended questions (not included in the article) on both knowledge of generative-AI applications and the use of these applications in

[1] Department of Psychology, University of Kentucky, Lexington, KY, USA
[2] Department of Psychology, Prairie View A&M, Prairie View, TX, USA
[3] Department of Psychology, University of Alabama in Huntsville, Huntsville, AL, USA
[4] Department of Psychology, Elon University, Elon, NC, USA
[5] Department of Psychology, University of Texas at El Paso, El Paso, TX, USA

Corresponding Author:
Jonathan M. Golding, Department of Psychology, University of Kentucky, Kastle Hall 40506-0044, Lexington, KY, USA.
Email: golding@uky.edu

college. Most respondents reported using these applications. Answers to open-ended questions (some examples were provided) showed that students had positive feelings about using these applications for writing and brainstorming support, but they also had various concerns including accuracy and ethical issues.

Finally, Stohr et al. (2024) recruited the largest number of respondents ($N = 5{,}894$) yet to investigate generative-AI applications. Although a published research study, little information was provided about participant recruitment, other than the participants (undergraduate and graduate students) were from universities and academic disciplines in Sweden. Responses to their survey, which included only single-item measures, revealed that students were most aware of the ChatGPT application, expressed positive attitudes toward these applications regarding education, but had concerns about cheating. This study also examined gender differences (e.g., women were more negative about the impact of AI on learning than men) and disciplinary difference (e.g., engineering students used these applications more than other disciplines).

The peer-reviewed research investigating generative-AI applications has been outnumbered thus far by several nonpeer-reviewed surveys conducted in conjunction with websites. Regarding the latter, although some information was presented about data collection, limited information was provided about the questions presented to participants or analytic techniques. In addition, open-ended questions were sometimes asked, but the full corpus of answers was not presented. These website surveys (Intelligent.com, 2023a, 2023b; Study.com, 2023; Tangerman, 2023; Welding, 2023) all included about 1,000 college students (often a mix of U.S. undergraduate and graduate students) and showed that these applications are being used in large numbers, and many students think using these applications constitute cheating.

The Generative-AI Controversy on College and University Campuses

The availability of generative-AI applications and their increasing use has led to soul-searching on college campuses as administrators and faculty wrestle with the question of how these applications fit into higher education. Some propose these applications be incorporated into curricula or used as feedback tools (*Wall Street Journal*, 2024). Others believe these applications should be banned outright (Sullivan et al., 2023). It is a vexing issue that continues to reverberate across campuses, with no clear resolution in sight (Verma, 2023a). At many colleges and universities (e.g., Harvard University, 2024), the use of generative-AI in a particular class is determined by each faculty member (Mock, 2023). However, at other schools, use of these applications for classwork is explicitly prohibited due to cheating concerns (Rudra, 2023).

In the debate concerning the use of generative-AI applications in colleges and universities, proponents feel these applications can aid in learning (see Stohr et al., 2024; Sullivan et al., 2023), especially helping non-English speaking students (see Chan & Hu, 2023). They have argued that educators should leverage these applications to prepare students for a new reality (Belkin, 2023). On a related point (Intelligent.com, 2023a), some faculty feel that certain disciplines can use these applications as a catalyst to greater engagement with material. Thus, the argument is that these applications can be used for generating ideas, drafting, and editing.

On a practical level, survey respondents (e.g., Intelligent.com, 2023b) argue that generative-AI applications offer organizational skills by producing clear outlines, are easy to use, are free, and save time (see Tossell et al., 2024). Interestingly, some of these points have been raised in a recent article addressing the use of these applications for scientists writing external grant proposals (Parrilla, 2023). Finally, these applications can be seen as a valuable resource for students (Thorbecke, 2022) as a starter tool (e.g., generating ideas for an essay; Chan & Hu, 2023; Spector, 2023), to explain new concepts (see Rudra, 2023; Spector, 2023), and aid those who have communication difficulties (Hemsley et al., 2023; Starcevic, 2023), and/or need additional resources typically available to college students (e.g., tutoring; Intelligent.com, 2023c).

Generative-AI detractors believe these applications could be a looming disaster for colleges. A major worry is that they could become another means for cheating (Chan & Hu, 2023; Gecker, 2023; Intelligent.com, 2023a, Stohr et al., 2024; Sullivan et al., 2023; but see Spector, 2023), because they allow students to submit work that is not their own original content. In fact, some faculty are so concerned about the use of generative-AI applications they have deemed it necessary to "ChatGPT proof" exam questions and assignments (Gecker, 2023). Faculty discuss the possibility of having students complete essay drafts in class, only distributing in-person exams, and ending traditional homework (Blitchok, 2023). We should also note that attempts to detect whether text was generated by a generative AI application are not 100% effective (Gecker, 2023; Gewirtz, 2023). Indeed, Ghaffary (2023) noted that Vanderbilt, Michigan State, Northwestern University, and the University of Texas at Austin, have stopped using the well-known Turnitin AI detection software because of accuracy concerns. Moreover, at least one case at a Texas A&M branch campus led to accusations of cheating, but most students were exonerated (Verma, 2023b).

There are other concerns about the use of generative-AI applications. First, these applications may allow students to complete various tasks but are ineffective in helping students to learn (Belkin, 2023). Second, some warn that the technology behind these applications is more limited than people may think (Thorbecke, 2022). Although the text produced by these applications may be "human-like," the text is typically generic, which is not surprising given that it is produced by a machine. Third, the use of generative-AI applications to complete work can be viewed as a liability, as one can become too reliant on these applications to finish tasks (Intelligent.com, 2023b). Finally, given the proliferation of inaccurate information on the Internet, some note (Intelligent.com, 2023b) that these

applications are leading to a "garbage-in-garbage-out" situation (i.e., incorrect answers that sound authoritative; see Blitchok, 2023), as there are no fact-checkers for the output produced.

The Present Study

In the present study, we administered a self-designed online survey to undergraduates at five U.S. universities examining their familiarity with, use of, motivation for using or not using, and perceptions of generative-AI applications. Some of these questions were like those asked in prior surveys (e.g., use of these applications). However, the present exploratory study, beyond offering new data, extended prior surveys in several important ways. First, the present survey offered greater control over the recruitment of students attending 4-year universities by using participant pools associated with psychology courses. Second, the number of respondents was larger than that of prior surveys investigating the use of generative-AI applications in U.S. colleges, increasing generalizability and reliability of results. Third, the nature of the sample allowed us to investigate participant factors that have not been examined in prior surveys—age, ethnicity, and year in school. Fourth, given the dearth of published research on AI use among high schoolers, our survey allowed us the opportunity to compare AI use across high school and college. Finally, although understanding one's motivation to use or not use generative-AI applications is critical, prior research has largely not investigated motivational factors.

Method

Transparency and Openness

All data, and material for this study can be found at Golding et al. (2024) or by request from the corresponding author. The study was approved by the Internal Review Board at each university where data were collected. Below, we report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

Participants

Participants were undergraduate students at five U.S. universities: public institutions University of Kentucky ($n = 658$), University of Alabama at Huntsville ($n = 125$), University of Texas at El Paso ($n = 398$), Prairie View A & M University ($n = 235$), and the private institution Elon University ($n = 168$). These universities were selected primarily because they allowed for a diverse sample. The schools included both public and private institutions, land-grant and regional universities, large and small schools, and schools that included many minority students.

Participants completed the survey for psychology course credit. Of the sample, 35 were not U.S. citizens and for 215 English was not their first language. These respondents were not excluded because these factors do not prohibit them from using generative-AI applications. The sample included 1,358 women, 179 men, 19 transgender students and 23 students who listed "other" for their gender. The average age of participants was 19.82 ($SD = 2.76$), and participants' average year in school was 1.90 ($SD = 1.15$). Regarding ethnicity, of those who answered this question, 771 participants identified as White, 392 as Hispanic, 283 as Black, 50 as Asian, 48 as mixed-race, seven as Native American, four as Pacific Islanders, and 22 who selected "Other." Across the universities, ethnicity varied regarding the number of White, Black, and Hispanic participants consistent with the overall distribution of race at these schools.

We should note that three of the five universities had a primarily White sample (University of Kentucky: 531 [89%] White, 24 Black [4%], 41 Hispanic [7%]; University of Alabama in Huntsville: 80 [78%] White, six Black [6%], 17 Hispanic [16%]; and Elon University: 135 [88%] White, eight Black [5%], 10 Hispanic [6%]). One university had a primarily Black sample (Prairie View A&M University: four [2%] White, 206 Black [94%], 10 Hispanic [4%]), and one university had a primarily Hispanic sample (University of Texas at El Paso: 21 [6%] White, seven Black [2%], 346 Hispanic [92%]).

Finally, there was a great deal of variability in participants' majors. Regarding frequency (first major listed was counted), the five majors with the highest frequencies were: psychology ($n = 573$), biology ($n = 86$), business ($n = 75$), kinesiology ($n = 70$), and education ($n = 61$). In addition, the data indicated that majors were most likely in the social sciences ($n = 987$, 62%) then the natural sciences ($n = 418$, 26%), humanities ($n = 59$, 4%), and undeclared ($n = 32$, 2%). There were 87 participants (5%) who did not answer this question.

Materials

The Generative AI Survey began with demographic questions about age, citizenship, English as first language, gender (male, female, transgender, other), ethnicity (African American, Caucasian, Latino, or Hispanic American, Native American, Pacific Islander, Asian, Mixed Ethnicity, Native Hawaiian, Other), year in college, and disciplinary major. Next, questions were presented about generative-AI applications. Participants were informed that generative/Chat AI applications involve machine learning systems that can generate text, images, code or other types of content. This content is typically generated in response to a prompt entered by a user (Aydin & Karaarslan, 2023). Participants were asked: (a) how familiar they were with generative-AI applications on a 1 (*extremely unfamiliar*) to 10 (*extremely familiar*) scale (a 10-point scale was used because it offered a much broader spread of options and because scales with more vs. fewer response categories are more sensitive and reliable, Alwin, 1997); (b) if they had at least one Chat AI app on an electronic device; (c) a series of questions about using these applications in college (use at all, which subjects, type of work, reason for using or not using) followed by questions about using these applications in high school[1]; and (d) if participants felt that using these applications was cheating and why or why not. Participant data from all the above questions are presented in the results.

Procedure

The self-paced survey was administered between October 25 and December 15, 2023. Participants were presented the survey via Qualtrics.com and took approximately 20 min to complete. First, participants were presented with a consent form. Next, they received the generative-AI Survey. Each question was presented on a screen by itself, and participants were prevented from returning to previous questions. Once the survey was completed, participants were debriefed, provided with a copy of the consent form, and given the researchers' contact information.

Results

Note that all data analyses were exploratory. Also, because participants were nested within schools, we computed the intraclass correlation (ICC) for intercept-only multilevel regression models corresponding to each of our primary outcome variables (Lee, 2000). The ICC measures the proportion (from 0 to 1) of the total variance in the dependent variable that lies systematically between schools. In other words, it provides a measure of the degree to which observations within schools are more similar than observations from different schools. Only when the ICC is more than trivial (i.e., greater than .10 of the total variances in the outcome variable) are multilevel regression models needed (Lee, 2000). ICC values for each of our dependent variables were all less than .10 (use in high school = .02; use in college = .07; is AI cheating = .04; have app = .02; familiarity with AI = .01). Thus, we analyzed our data using single-level regression models.

Third, because of the relatively low number of participants who were not U.S. citizens, and/or indicated English was not their first language, these factors were not analyzed separately, and all data from these participants were included in analyses. Fourth, there were a relatively low number of participants who did not indicate being a woman or a man (42 out of 1583). When examining gender as a predictor in regression analyses, these participants were excluded, and a comparison was only made of women versus men. Fifth, because most participants indicated being White, Black, or Hispanic, we only examined the differences (using dummy coding) between these three groups. Finally, only results significant at $p < .05$ were presented.

Familiarity With Generative-AI Applications

The overall mean familiarity with generative-AI applications was 5.63 ($N = 1{,}575$, $SD = 2.41$). These data (and all other analyses involving rating dependent variables) were entered into a linear regression analysis to examine participants' familiarity concerning generative-AI applications. On Step 1, we entered age, the dichotomous gender variable (0 = *female participant* and 1 = *male participant*), and the dichotomous year in school variable (0 = *Year 1 or 2* and 1 = *Year 3 and beyond*). In addition, we entered the dummy coded variable for race.

The linear regression for this dependent variable showed that familiarity with generative-AI applications was higher for men ($M = 6.13$, $SD = 2.32$) than women ($M = 5.48$, $SD = 2.40$), $b = .92$, $\beta = .12$, $t = 4.43$, $p < .001$, for younger students than older students, $b = -.08$, $\beta = -.09$, $t = 3.20$, $p = .001$, and for Hispanic ($M = 5.82$, $SD = 2.61$) compared to White students ($M = 5.46$, $SD = 2.29$), $b = .44$, $\beta = .07$, $t = 2.55$, $p = .011$.

Prevalence of Using Generative-AI Applications

Responses to several questions dealing with prevalence of use were analyzed in two ways. First, logistic regression was used on binary-choice questions: "Do you have a generative-AI application?"; "Have you used a generative-AI application in college?"; and "Have you used a generative-AI application in high school?" Second, chi-square analyses were conducted to examine the use of generative-AI applications in college versus high school.

Logistic regressions were conducted on three questions. First, the analysis on having a generative-AI application did not yield significant differences for any of the predictors (overall $M = 0.45$, $N = 1{,}583$). Next, an analysis was conducted on using a generative-AI application in college. Overall, less than half of respondents ($M = 0.36$, $N = 1{,}574$) acknowledged using a generative-AI application in college. The logistic regression showed that: (a) more men ($M = 0.45$) had used these applications than women ($M = 0.35$), $b = .62$, *Wald's* $\chi^2 = 11.94$, $OR = 1.86$, $p < .001$; (b) the use of these applications was higher for younger respondents than older respondents, $b = -.04$, *Wald's* $\chi^2 = 2.89$, $OR = .96$, $p = .001$; (c) White students used these applications more than Black students, $b = .45$, *Wald's* $\chi^2 = 9.99$, $OR = 1.56$, $p = .002$; and (d) Hispanic students used these applications more than Black students, $b = 44$, *Wald's* $\chi^2 = 5.92$, $OR = 1.58$, $p = .002$. Finally, regarding the use of generative-AI applications in high school, overall, the proportion of respondents who had used a generative-AI application in high school was .19 ($N = 1{,}570$). Younger college students used these applications in high school more than older college students, $b = -.65$, *Wald's* $\chi^2 = 52.20$, $OR = .52$, $p < .002$, and college students in their first and second year of college used these applications in high school more than college students beyond their second year, $b = -.92$, *Wald's* $\chi^2 = 7.95$, $OR = .40$, $p = .005$.

Chi-square analysis examined the use of generative-AI applications in college versus high school and was significant, $\chi^2(1) = 20.16$, $p < .001$, Cramer's $V = .114$. The highest percentage of students had not used a generative-AI application in college and had also not used one in high school ($N = 847$, 54.2%). The number of students who had used a generative-AI application in both college and high school was the lowest ($N = 139$, 8.9%). Also relatively low was the number of students who had not used these applications in college but had used one in high school ($N = 156$, 10.2%), and the number of students who had used these applications in college but not in high school ($N = 421$, 26.9%).

Generative-AI Use as a Function of Type of Course and Task

To determine whether there were differences in the type of college course AI was used, we scored each participant for the number of social sciences, natural sciences, and humanities courses they listed. For example, a participant listing "Math" and "English" had one class in the natural sciences, one in the humanities, and zero in the social sciences. We found that 13.00% of courses were in the social sciences, 16.10% in the natural sciences, and 17.20% in the humanities—note the total percentage is below 100% because there were many scores of zero. We analyzed the data using a generalized linear mixed model (accounting for repeated measures) with a Poisson distribution and log link function (accounting for frequency data). The relationship of course type frequency of AI use was significant, $X^2(2) = 8.95$, $p = .011$. Pairwise comparisons of estimated marginal means using Bonferroni corrections showed that the only significant difference was that AI was used more humanities courses than social sciences courses (mean difference = 0.13, $SE = 0.044$, $p = .012$, 95% CI: [0.211, 2.887]). The same analyses were conducted on high school classes. AI use was 0.03% in social science courses, 16.17% for the natural sciences, and 24.94% for the humanities. The mixed model was significant, $X^2(2) = 152.34$, $p < .001$. AI was used more in humanities courses than in social sciences courses (mean difference = 0.65, $SE = 0.056$, $p < .001$, 95% CI: [0.540, 0.761]), more in natural science courses versus social science courses (mean difference = 0.39, $SE = 0.047$, $p < .001$, 95% CI: [0.295, 0.479]), and more in humanities courses compared to natural science courses (mean difference = 0.03, $SE = 0.046$, $p < .001$, 95% CI: [0.130, 0.397]).

There were a wide variety of tasks for which students used generative AI applications. Frequency counts revealed the six most prevalent tasks were similar for college (total of top six: 77.0%; writing: 32.0%; obtaining information: 16.2%; homework/assignments: 13.8%; generate idea: 9.1%; work on problem: 5.9%; and math problems: 5.9%) and high school (total of top five: 87.2%; writing: 40.2%; obtaining information: 11.3%; homework/assignments: 18.4%; generate idea: 5.3%; and math problems: 12.0%).

Motivation for Using/Not Using Generative-AI

We examined responses to open-ended questions that assessed motivation for using or not using generative-AI applications (e.g., "Why did you use/not use generative-AI applications in college? and "Why are these applications cheating?") The reasons provided allowed us to generate specific representations of these reasons. To create these networks, we used a combination of text analysis and Pathfinder data scaling (Schvaneveldt, 1990). Networks constructed using the Pathfinder algorithm consist of nodes and links, where nodes represent key concepts in text and links represent semantic distances between these concepts. To derive a network, responses were first modeled as vectors within a "term-by-response" matrix using the bag-of-words model (Salton et al., 1975). Each row in the matrix represented a unique term, each column represented an individual participant's response, and each cell gave the term's frequency in each response. Next, the cosine similarity between pairs of rows (terms) in the term-by-response matrix was computed, yielding a term-by-term matrix whose entries provided a measure of similarity between terms. Finally, the Pathfinder algorithm (Schvaneveldt, 1990) scaled this similarity matrix, retaining only the most salient connections for the final network representation.

After constructing each network, we employed the Girvan-Newman Community Detection algorithm (Newman & Girvan, 2004) to isolate clusters of nodes in each network. This algorithm assigns nodes into communities (clusters) so that within-community connections are enhanced while between-community connections are minimized. We conducted network construction and community finding using MATLAB (2022) computing software.

Figure 1a shows the networks derived from reasons for the question, "Why did you use generative-AI applications in college?" The network consisted of seven nodes which represented common answers generated to this question. Two communities represented this network. The left community reflected respondents' use of these applications to help with work (e.g., assignments), especially those involving math. The right community included responses that were more associated with writing, including specific tasks (e.g., essays) and generating ideas for class. The network for using generative-AI applications in high school (Figure 1b) was similar (including the communities) and is available from the corresponding author.

The next figure (Figure 2a) shows the networks for those who have not used these applications in college. This network revealed that the reasons for not using a generative-AI application in college (Figure 2a) contained two major communities. The left community focused primarily on the concerns of students getting caught using these applications, along with a node reflecting not needing these applications. The right community included nodes about cheating, the applications generating work that was not one's own, and that the respondent's integrity led them to not use these applications. Figure 2b showed the reasons for not using a generative-AI application in high school. The nodes in this network were like Figure 2a, but the communities were structured somewhat differently. For example, nodes about cheating and getting caught were in the same community. However, notice *cheat* acted as a bridge node (Cherifi et al., 2019) and connected the distinct themes of the network through the common concept of cheating.

Perception of Cheating Using Generative-AI Applications

These perceptions were initially examined through a binary-choice question that asked whether participants thought the use of generative-AI applications was cheating. The overall proportion of respondents who thought using these applications was cheating was .56 ($SD = 0.50$, $N = 1565$). The logistic regression showed that women ($M = 0.58$, $SD = 0.49$) perceived these applications as cheating more than men ($M = 0.48$, $SD = 0.50$), $b = -.41$, *Wald's* $\chi^2 = 5.46$, $OR = .66$, $p = .019$. Regarding race, White students ($M = 0.61$, $SD = 0.49$)

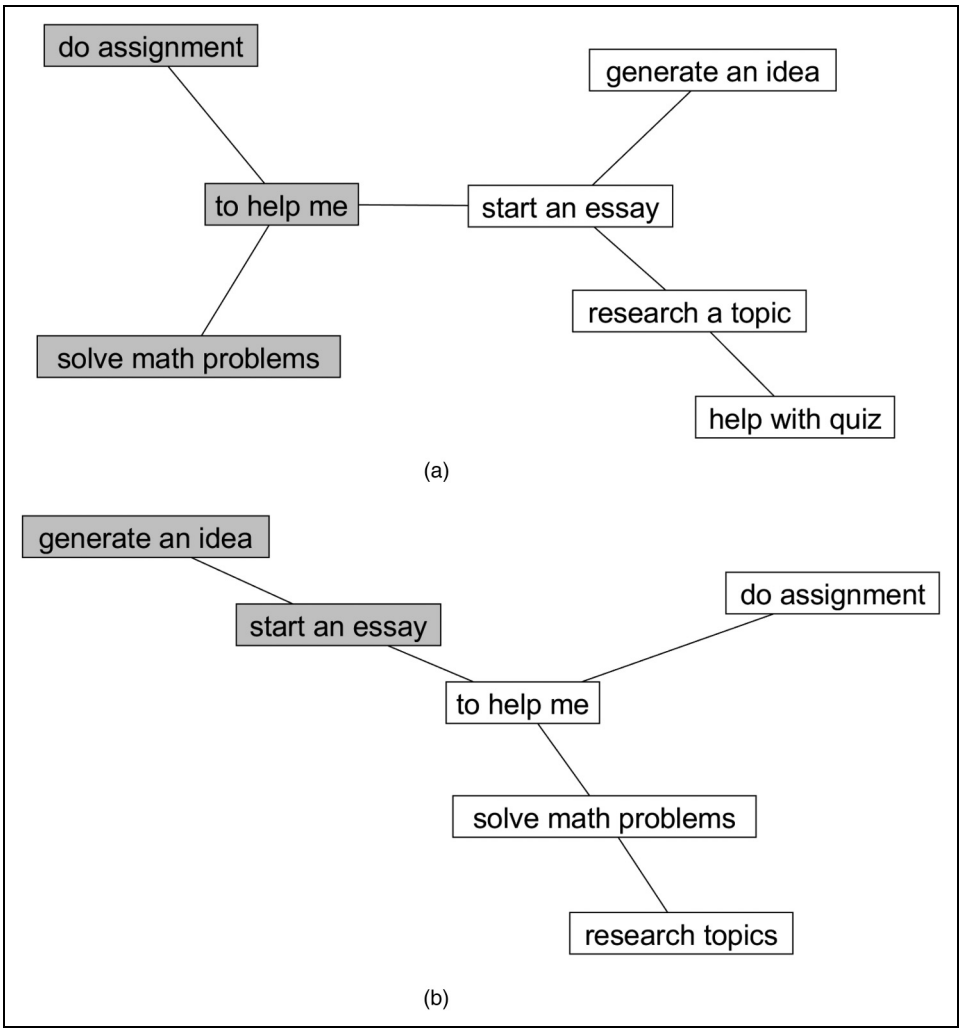

Figure 1. (a) Network reflecting reasons for using generative-AI application in college. (b). Network reflecting reasons for using generative-AI application in high school.
AI = artificial intelligence.

perceived generative-AI applications as cheating more than Hispanic students ($M = 0.47$, $SD = 0.50$), $b = -.54$, *Wald's* $\chi^2 = 13.50$, $OR = .58$, $p = .001$. Regarding perceptions of cheating and behavior, a chi-square analysis examined the correspondence between perceiving generative-AI applications as cheating and using these applications in college. This enabled us to identify respondents who used these applications, despite considering it cheating. For use of these applications in college, the chi square was significant, $\chi^2(1) = 261.05$, $p < .001$, Cramer's V $= .165$. Participants who thought the use of these applications was cheating were least likely to use them ($N = 719$, 46%), followed by those who perceived generative-AI as cheating but still used them ($N = 395$, 25%), those who perceived the applications as not cheating and did not use them ($N = 288$, 18%), and then those who perceived the applications as not cheating and used them ($N = 162$, 10%).

The chi-square analysis that examined the correspondence between perceiving generative-AI applications as cheating and using these applications in high school was significant, $\chi^2(1) = 31.71$, $p < .001$. The pattern of results was somewhat different than for use of these applications in college. The number of students who perceived these applications as cheating were again least likely to use them ($N = 759$, 50%). The next highest cell was the number of students who perceived generative-AI as not cheating and did not use them ($N = 513$, 34%). The lowest numbers were in the cells for students who perceived the applications as not cheating and used them ($N = 171$, 11%), and then those who perceived the applications as cheating and still used them ($N = 122$, 8%).

Reasons for Thinking Generative-AI Applications Are Cheating or Not Cheating

A final open-ended question asked why respondents thought the use of generative-AI applications was cheating or not. These

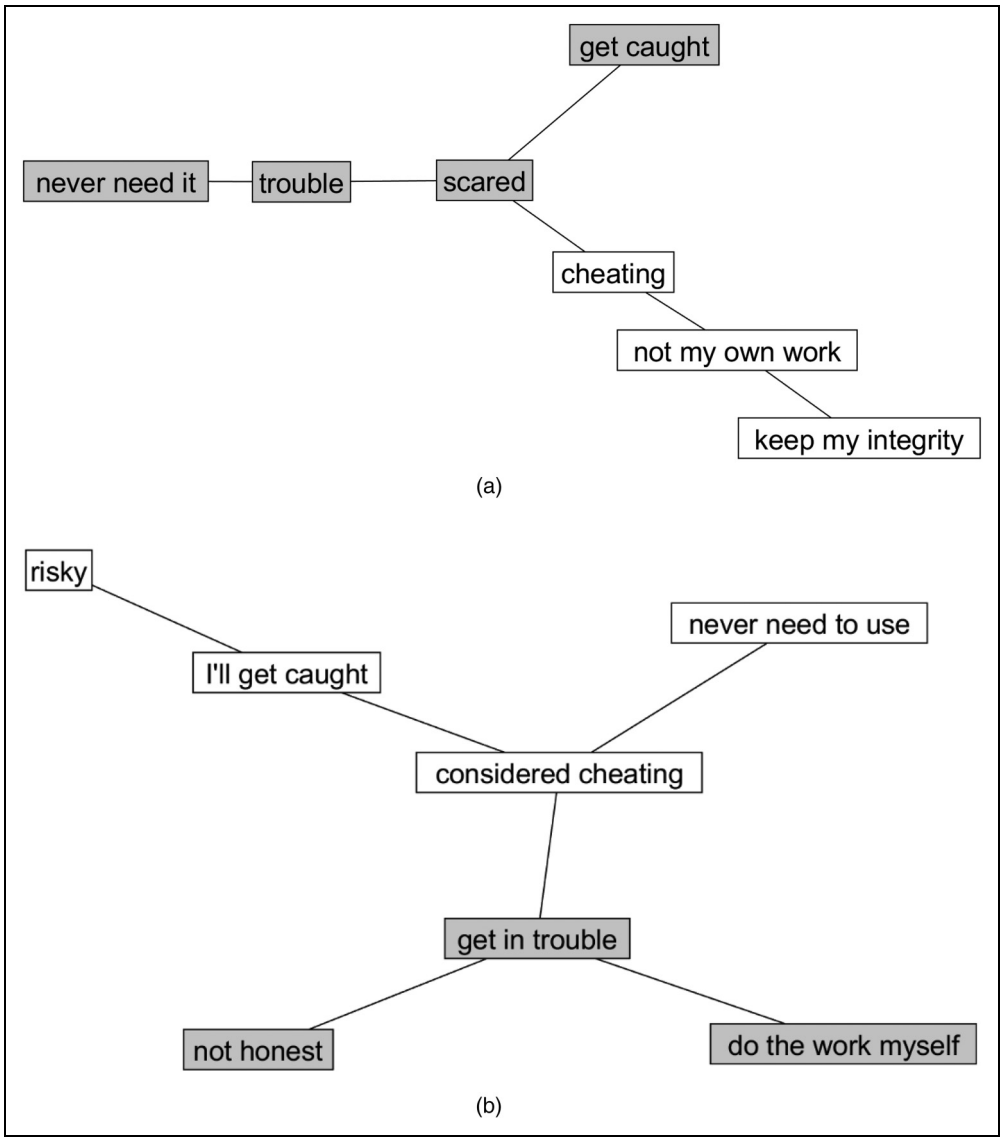

Figure 2. (a) Network reflecting reasons for not using generative-AI application in college. (b). Network reflecting reasons for not using generative-AI application in high school.
AI = artificial intelligence.

responses were analyzed in the same manner as the answers to the open-ended questions above. The network (Figure 3a) for reasons for thinking these applications involved cheating showed that *cheating* had the highest number of connections which is a measure of node centrality or importance within a network (Newman, 2010). This central node connected the two communities represented in the network. The left community viewed generative-AI applications as cheating because the information generated was not one's own work but noted that AI applications were not always cheating (*depends*). The other, smaller community to the right focused on information being generated about the applications and that it was not original.

Figure 3b presents the network and communities for responses concerning generative-AI not being cheating. In this case, the network consisted of two communities. The left community indicated participants felt these applications were like copying from the Internet (*copy*) and simply generated ideas, and the right community suggested that (although acknowledging whether it involved cheating, *depends*) these applications helped students and provided a useful tool.

Discussion

The present study offered important data concerning the use and perception of generative-AI applications by college students. These data extended prior survey research on this issue by offering, to date: (a) an explicit description of survey methodology; (b) the most recent and largest sample of U.S. college students; (c) the most demographically varied sample; (d) an explicit

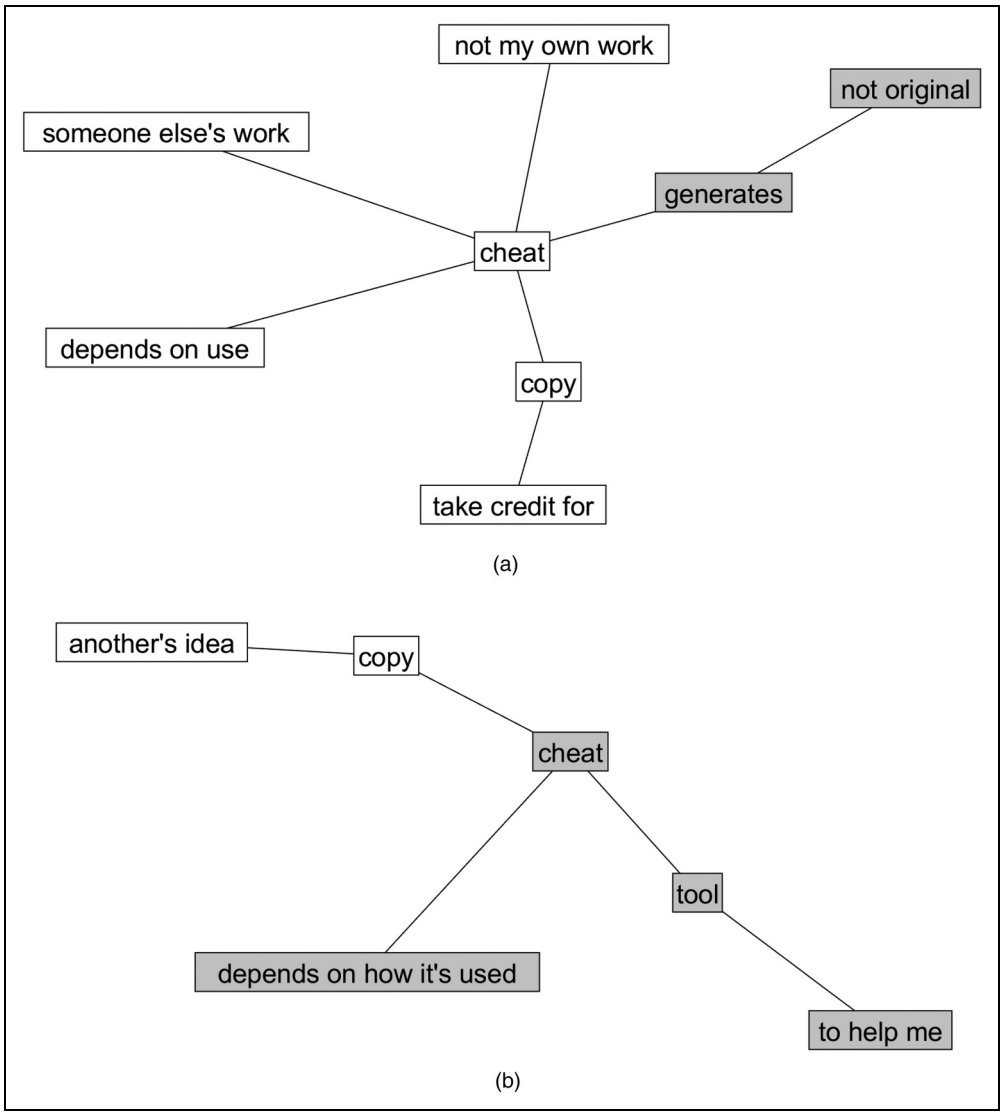

Figure 3. (a). Network reflecting reasons for why generative-AI application is cheating. (b). Network reflecting reasons for why generative-AI application is not cheating.
AI = artificial intelligence.

description of analyses and the use of both quantitative and qualitative data; and (e) clearer insight on the motivations for using *and* not using these applications. Regarding the primary results, most college students are familiar with these applications yet only about half have one of these applications and fewer than half have used these applications for their college studies. The reasons for using these applications varied from getting help on assignments to assistance with writing essays. Our data, however, make clear that there is a large subset of students who have not used these applications, because they think such use constitutes cheating, and they have concerns about getting caught using an application.

As stated above, college students are familiar with generative-AI applications. However, we found that familiarity is impacted by demographic factors. For example, men were more familiar with these applications than women (see Stohr et al., 2024). This finding was not surprising, given that women and men differ in technological savviness. For instance, women often perceive themselves as less technologically capable than men although this does not always translate into actual skill differences (Hargittai & Shafer, 2006). Other explanations may also account for these gender differences such as women being more anxious about the implications of AI or women having a stronger belief in the importance of doing one's own work. This is an area ripe for future research. Our results also indicated that younger students were more familiar with these applications than older students. However, given the age difference between young and old students was relatively small, this difference may simply indicate that the use of generative-AI applications is more mainstream for students in their first 2 years of college.

Finally, it was interesting to find that Hispanic students were more familiar with these applications than White students, and

that Hispanic and White students used generative-AI applications more than Black students. Regarding the former, this is consistent with research showing that Hispanic people and technology have a "close relationship" (Cruz, 2019). For example, most Hispanic people prefer products that offer the latest in new technology (Nielson, 2018). In addition, Hispanic students may rely on AI more frequently to assist with potential language barriers (e.g., English as a second language). Perhaps Hispanic students used AI more frequently as a means of helping them with college-level coursework in English, which requires knowledge of specialized vocabulary. Zhou et al. (in press) found a similar result with Chinese students studying English. Regarding the relatively low use of generative-AI applications by Black students compared to White and Hispanic students, this may be the result of (among other factors): Black students using the Internet less (Smith, 2014), Internet costs (Community Tech Network, 2023), having less access to computers (Digital Planet, 2020); and/or Black students fearing being punished for using AI more than White and Hispanic students (Young & Butler, 2018).

College students' familiarity with generative-AI applications appears consistent with their use of these applications. Moreover, our findings are generally consistent with the results of prior surveys that asked about the use of these applications by college students (e.g., Delello et al., 2023). Will the use of generative-AI applications continue to increase? The answer to this question is unknown, although one could argue that an increase is possible given that in the present study, younger respondents were more likely to use these applications than older students, and usage increased from high school to college. Tempering the likelihood of an increase in generative-AI application use, the present data showed that the highest percentage of students had not used a generative-AI application in college or high school. Of course, future research will be necessary to further gauge the use of these applications at all educational levels.

Regarding how generative-AI applications were used, the present data showed that these applications were used more often in humanities courses than in social science and natural science courses (see also Intelligent.com, 2023b). Consistent with this pattern of use in types of courses, these applications were used most often in tasks that involved writing. We should note that the present data indicated that generative-AI applications were used much less often for homework/assignments, counter to the findings of some prior surveys (Intelligent.com, 2023b; Study.com, 2023; Tangerman, 2023). This discrepancy might reflect the present study not explicitly asking if one's writing involved homework. We cannot be sure of the nature of questions asked in many prior surveys, because (as noted earlier) the exact questions in some of these surveys were not provided.

The use of open-ended questions in the present study was an initial attempt to explore the underlying representation for why respondents used/did not use generative-AI applications, and their thoughts about these applications and cheating. Participants' answers to open-ended questions were presented as Pathfinder networks to illustrate students' underlying cognitive structure when considering generative-AI use (see Collins & Loftus, 1975; Collins & Quillian, 1969). This novel approach to investigating participants' conceptualization of generative-AI applications has been utilized in other research domains (e.g., legal decision-making; see Levi & Golding, in press). In the past, examining responses to open-ended questions about generative-AI applications failed to provide much more than a handful of quotes. In contrast, our networks offered a visual representation of concepts (nodes) regarding generative-AI that were important to participants, and revealed how these concepts grouped into major themes (communities). Because network construction and community identification were based on computational text analysis methods and mathematical algorithms, we avoided human interpretation at the level of each response. Thus, considering the large number of responses, using networks significantly reduced the time and effort required to identify latent themes within the qualitative data as compared to the use of human coders (Miner et al., 2023).

The issue of cheating was a major point of concern for many respondents, most of whom regard the use of these applications as a form of cheating. This is consistent with prior surveys, even to the point that some surveys found that most respondents believed that these applications should be banned from college campuses (Study.com, 2023). As reported earlier, the network representing thinking about cheating showed that *cheating* was the central node, indicating that most responses included the word "cheating." The communities in this network highlighted respondents viewing generative-AI applications as cheating because the information generated was not one's own work (i.e., not original). There was, however, a community that indicated that "it depends" if these applications should be considered cheating. Those who did not perceive the use of generative-AI applications as cheating led to a network with a community with responses that indicated the use of these applications was like copying from the Internet and a community that also acknowledged that it depends whether these applications involve cheating.

One point to note about perceptions of cheating and the use of generative-AI applications is that perceiving the use of these applications as cheating does not deter all students from using them (see also Intelligent.com, 2023a). This should not be surprising, given that research on cheating in college has consistently shown that most college students cheat (up to 75%; see Bowers, 1964; Jenkins et al., 2023; McCabe et al., 2012), despite attempts to deter this behavior. However, in the case of generative-AI applications and cheating, one might wonder why more students are not using these applications, given that their use is generally not codified as cheating, at least not at most institutions (Harvard University, 2024). Instead, it appears that the perception of these applications as a form of cheating is causing college students to think twice before they use them.

Limitations

There are some limitations that should be acknowledged regarding the present study. First, the sample included students taking

psychology classes. This resulted in a distribution of women and men different than that for the overall women and men in college (statista, 2023). It is unclear how this might have impacted the findings, but we hope that future researchers will examine students taking a variety of classes across college campuses. Second, the survey was a self-report measure involving retrospective memory, and thus is subject to the various criticisms of these measures (e.g., Dang et al., 2020). It would be beneficial for researchers to move away from self-report methodology, and potentially investigate the use of generative-AI applications in a more controlled laboratory setting. This might include offering students the opportunity to use these applications in real-time and see if they opt to do so. Additionally, we only included five universities in the present sample. Even though this is the largest U.S. sample investigating this topic to date, it is still a limited examination of college students and generative-AI applications. It will be very important to replicate the current findings and investigate other issues related to these applications (e.g., amount of time spent using them, possibly using a diary study). Finally, although there were no differences between the public and private universities in this study, only one private university was included. Some research suggests that frequency of cheating may differ among students from private versus public universities (e.g., Bucciol et al., 2020), and universities themselves may differ in how they handle incidences of cheating. Public schools also have greater representation of students from diverse socioeconomic backgrounds, which could impact access to technology. Given the relevance to AI, future studies should further explore potential differences between private and public institutions.

Implications

The implications of the present research investigating college students and generative-AI applications are vast with regards to psychology. These findings make clear that those who teach college courses must better understand the nature of generative-AI applications (i.e., how they can be used), and acknowledge that their students have used these applications and will continue to do so on tasks related to classroom instruction. The degree to which their use increases or decreases will likely be a function of how educators approach these applications in the future. Important in this regard is whether educators can come to a consensus on whether these applications constitute cheating. This is easier said than done, as illustrated by our earlier discussion of the controversy about these applications. Ultimately, colleges and universities may allow individual educators to decide the latitude they want to give their students regarding these applications. Some will likely decide not to allow the use of generative-AI applications (e.g., because they believe it is cheating), whereas others may decide that these applications are a tool that, like the Internet, should be used by students as needed. It will be interesting to see whether these decisions will hinge on data (yet uncollected) that show these applications have educational value beyond simply obtaining information.

Beyond the classroom, the field of psychology must reckon with the use of generative-AI applications in other domains. We will highlight just three. First, there is the use of generative-AI applications in publishing. This discussion has already started, with APA (2023) guidelines stating, "When a generative AI model is used in the drafting of a manuscript for an APA publication, the use of AI must be disclosed in the methods section and cited." Other publishers of peer-reviewed work have followed suit (e.g., Sage Publishing, n.d.). Second, some have argued that these applications should be used in "writing" grants, because they make the process of requesting funds much easier (Parrilla, 2023). However, while some granting agencies (e.g., NSF, 2023) are "encouraging proposers to indicate in the project description the extent to which generative AI technology was used and how it was used to develop their proposal," other agencies (e.g., NIH, 2023) are yet to be willing to accept AI-generated grant material. Finally, for some, the use of generative-AI applications brings back memories of using AI in a clinical context. It was in 1966 that Weizenbaum developed ELIZA, the first autonomous computer chat program. ELIZA could have a conversation with a human, although the answers provided basically repeated words and rephrased statements in the form of a question (Rossen, 2023). Are we prepared for new ELIZA-like programs that will be more refined in "conversing" with those in need of psychological counseling? There are already numerous mobile applications utilizing AI-driven chat therapy on the market, one out of Dartmouth College is even undergoing a clinical trial (Weir et al., 2024).

As the world of generative-AI technology moves faster than ever, and the population becomes more accepting of such technology, it is critical that psychology continues to discuss, conduct research on, and make critical decisions that will impact the field in the future. This is especially true regarding the focus of this paper—education. Like other pedagogical advances in the past, be it moving from the chalkboard to overhead slides to PowerPoint slides or going from physical visits to the library to accessing material on the Internet, psychologists must prepare to forge a path for teaching that will benefit both educators and students. This path must likely be developed with greater caution than some advancements in the past, given the concerns raised (even by students themselves) about cheating and plagiarism, and perhaps most importantly, whether it will lead students to bypass learning opportunities and skill development that are imperative to successfully navigating the 21st century (e.g., critical thinking, communication, information seeking skills). However, like changes in the past, the future of using generative-AI applications in an educational context appears inevitable. With this in mind, we must also consider whether *not* integrating these applications into our classrooms will lead to students missing out on earning certain technological skills which may be critical in the future workplace.

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ORCID iDs

Jonathan M. Golding https://orcid.org/0000-0003-1126-1882
Anne Lippert https://orcid.org/0000-0003-3920-1582
Kelly Burke https://orcid.org/0000-0001-5584-3740

Note

1. Given that the present survey was administered in late Fall 2023 and generative-AI applications only appeared about a year earlier, only first-year college students would have had the opportunity to use a generative-AI application in high school.

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