Generative Artificial Intelligence in Undergraduate Research at the US Military Academy

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Abstract

The United States Military Academy at West Point is an accredited undergraduate institution of higher learning, offering 36 academic majors to a graduating class of approximately 1000 cadets. Most of these academic majors require a senior thesis or capstone research project as part of their degree requirements. Moreover, many underclass cadets begin pursuing research prior to their senior year, so every year, there is a large pool of undergraduate researchers at West Point. The advent of free, publicly available large language models and generative artificial intelligence (AI) has the potential to disrupt higher education. Most educators first think of the risks associated with generative AI truncating the learning process. However, in the context of undergraduate research, generative AI has the potential to both aid and abet research progress as well as undermine the learning that should be occurring within a research project. Faculty from four departments have joined together to pursue a multi-year study focused on the role of generative AI in undergraduate research. We intend to learn how cadets use generative AI and what the impact of this technology is on their education, their scholarship, and their development as professionals. The primary goal of our research is to understand student perspectives and use cases for generative AI across multiple academic disciplines. A secondary goal is to help inform instructors how best to advise, teach, and demonstrate generative AI. This paper outlines our survey methodology and describes initial student responses.

I. Introduction

A. Background

The release of ChatGPT in November 2022 thrust generative artificial intelligence (AI) into mainstream conversation and appeared poised to disrupt higher education and many professions. A variety of generative AI tools have rapidly proliferated including text generators based on large language models (LLMs), coding assistants, meeting assistants, and generative AI capable of producing graphical art, music, videos, and other media (Cao et al., 2023). The emergence of widely available free and low-cost tools to boost productivity and human creativity seems poised to impact most areas of society and industry (Eapen et al., 2023). Examples that demonstrate generative AI's ability to undermine public trust in institutions (Ritchie, 2023) include the Colorado artist who won a State Fair digital arts competition with the help of Midjourney (Kuta, 2022), and deepfake videos which pose a threat to the journalistic integrity of news media (Scott, 2024). In less than two years, humans have used popular AI generators such as DALL-E, Stable Diffusion, Adobe Firefly, and Midjourney to create over 15 billion images, the same number of images created in the first 150 years of traditional photography from 1826-1975 (Sukhanova, 2024; Valyaeva, 2023). The scope and magnitude of impacts from generative AI seem to vary between disciplines, institutions, and subject matter, with leaders in the AI development community, such as OpenAI, responding by contributing research and new technologies to address potentially harmful uses such as forgeries (Metz & Hsu, 2024).

In a recent survey by the Chronicle for Higher Education, 404 leaders in higher education acknowledged both the positive and negative potential impacts that generative AI will have on the way that colleges operate and educate ("Perspectives on Generative AI", 2023). Survey respondents were at times even self-contradictory on the potential ramifications of the technology.

Consequentially, there have been a wide variety of responses to generative AI including outright bans (Nolan, 2023), attempts to ignore the technology (*UNESCO Survey*, 2023), and other attempts to embrace and integrate it (Coffey, 2024). Universities began to formalize policies alongside professional societies such as the Association for Computing Machinery (*ACM Policy on Authorship*, 2023) and the American Psychological Association (APA Journals Policy on Generative AI, 2023) to clarify academic integrity concerns, questions of authorship, and to provide general pedagogical advice. For example, the ACM and APA both allow generative AI to assist in the generation of text for academic, peer-reviewed scholarship to appear in their journals, as long as the use is properly disclosed and attributed in domain-specific ways. The American Association of Colleges and Universities announced that it will launch a new Institute on AI, Pedagogy, and the Curriculum to help schools "respond effectively to the challenges and opportunities artificial intelligence (AI) presents for courses and curricula" (*Institute on AI, Pedagogy, and the Curriculum*, n.d.), especially from the standpoint of pedagogical innovation. On the other hand, some pedagogical experts such as James Lang have cautioned that such powerful tools, like other technologies that enhance human efficiency, can short-circuit the human learning process (2023; 2024).

Many universities have been proactive in providing guidelines for student use of generative AI, while others have been slower to issue concrete policies. For example, Harvard University provided early guidance which focused on protecting confidential data and placing the onus on generative AI users to verify the accuracy of any material that students obtain from AI. Harvard did not issue a university-wide policy on when and how generative could be used or how its use should be documented, deferring to individual schools, departments, and professors to promulgate their own discipline and course-specific guidelines (*Generative Artificial Intelligence (AI)*

Guidelines, n.d.). On the other hand, Purdue University has taken a deliberative approach and did not publish university-wide guidance until January 2024, but it was comprehensive guidance focused on multiple topics: academic integrity, syllabus language (to include draft language that professors could use), AI-enabled grading aids, the use of AI detection software, and how to handle copyrighted material (*Purdue Guidance on AI Use*, 2024). Purdue further commits to providing updated guidance each semester since generative AI evolves so rapidly. Other schools have responded by providing their own custom versions of generative AI including the University of Michigan, Washington University, and UC San Diego among others (Coffey, 2024). These custom text generators are designed to provide more privacy, better access, and better equity than other generative AI products available online. One concern is that paid versions of generative AI are noticeably better than free versions, which can introduce disparity in student outcomes based on their ability to procure such services. For example, as of the writing of this paper, GPT 4.0 requires a $20 per month subscription, and most users consider its output to be better than ChatGPT. The University of Michigan reports that their suite of generative AI tools have an average of 15,000 users per day (O'Connell, 2024). In spite of all of the activity and though surrounding the use of generative AI in higher education, the authors were unable to find university-provided guidelines on the use of generative AI within the context of research.

The United States Military Academy at West Point adopted a deliberate approach to the technology as it gained a broader user base in the spring of 2023 and issued guidance to students and faculty prior to the fall semester of 2023 ("DAAW," 2023). The guidance underscored the need for academic integrity and acknowledging the assistance of generative AI, while emphasizing the need for faculty to provide specific guidance to students on the use of generative AI in each

course. It also discouraged the blanket use of generative AI detection tools based on the impact to trust in the classroom from a high rate of false positive detections.

In addition to examining administration and faculty approaches to AI, several studies explore the extent of adoption of artificial intelligence tools among undergraduate students as well as student attitudes toward the use of generative AI technologies in higher education. One report from Tyton Partners, which surveyed 1,600 students across 600 institutions in fall 2023, found that nearly half of students (49%) report using generative AI writing tools, with 12% of students identifying as daily users. The report noted that most uses are "relatively unsophisticated" except among daily users. Common use cases for non-daily users include summarizing or paraphrasing text, assisting with writing assignments, answering homework questions, and analyzing or interpreting data. (Shaw et al., 2023). Another study published in the *International Journal for Educational Integrity* also focused on student attitudes toward generative AI. The study surveyed 2,500 students at the University of Liverpool in spring 2023. It found that the majority of students were supportive or somewhat supportive of using tools like Grammarly, but 70% were unsupportive or somewhat unsupportive of using tools like ChatGPT to write entire essays, and more confident writers were less likely to use or consider using generative AI for academic purposes. (Johnston et al., 2024).

B. Motivation

As students at the United States Military Academy entered the 2023-2024 academic year with the initial broad guidance on generative AI, its use appeared, anecdotally, to vary widely between students and between disciplines. We wanted to begin a structured process of gathering information about its use in a way that would allow us to compare academic majors and students over time. While generative AI is used on class assignments, instructor guidance can dramatically

shape how it is used, and the assignments themselves are rarely open-ended. On the other hand, undergraduate research and independent study courses typically place the greatest demands on students' critical and creative thinking. They are also the courses that typically require the largest amount of sustained scholarly output such as code or summative papers like technical reports and theses. These are the places where generative AI can enhance creativity and productivity if properly used, and we wanted to determine whether students were taking advantage of this new technology, and if so, how.

Moreover, multiple studies have shown that young people are more likely to adopt technological innovations across several different fields and cultures (Eisma et al., 2004; Kusuma et al., 2020; Lam & Lee, 2006; Morris & Venkatesh, 2000; Rogers et al., 2017; Venkatesh et al., 2003; Zhang, 2023). It is reasonable to expect the use of generative AI by undergraduate students to outpace the use of the same tools by instructors and research advisors who are typically 10 to 40 years older than the typical undergraduate (Coffey, 2023).

ChatGPT was released publicly in November 2022, while the Class of 2023 was in their senior year of college. West Point published its updated academic integrity policy in the summer of 2023, such that the policy was in place for the Class of 2024, which will be reported upon in this study, as well as juniors and sophomores who are also performing research. Over the next four years, we will be able to capture trends from the graduating classes of 2024 through 2029, shown in Table 1. We view this as a unique opportunity to capture some trends and lessons learned in near-real time as this technology will doubtlessly continue to evolve quickly in the next five years.

The opportunity to capture trends over time from different disciplines in a setting that drives creative thinking motivated multiple faculty members from four departments at West Point

(Mathematical Sciences, English and Philosophy, Electrical Engineering and Computer Science, and Social Science) to collaborate on this effort.

Table 1

Number of years of generative AI exposure by graduation year of West Point cadets

Class year (college graduation)	Nov 22* - 2023	Jun 2024	Jun 2025	Jun 2026	Jun 2027	Jun 2028	Exposure years by graduation
2024	junior	senior					1.5
2025	soph.	junior	senior				2.5
2026	freshman	soph.	junior	senior			3.5
2027	HS senior	freshman	soph.	junior	senior		4.5
2028	HS junior	HS senior	freshman	soph.	junior	senior	5.5
2029	HS soph.	HS junior	HS senior	freshman	soph.	junior	6.5

** month when ChatGPT was launched to the public*

We focused our attention on undergraduate research, which typically demands both productivity and creativity, where the practitioners are at the youngest age to be involved in research and to measure how it is used across multiple disciplines and over several years. This is a unique opportunity to capture how young humans, with a specific yet diverse set of tasks (undergraduate research), embrace and adjust to this ground-breaking technology in near-real time.

C. Research Questions

The primary goal of our research is to understand student perspectives and use cases for generative AI across multiple academic disciplines, with a secondary goal of using that understanding to inform instructors on how to best advise, teach, and demonstrate generative AI. In our academic setting, the most open-ended work that students conduct is research, and so we focus our efforts on undergraduate research considering the accessibility of generative AI. We have initiated a multi-year survey intended to answer these questions:

1. How are students using generative artificial intelligence in their undergraduate research?

2. How does student usage differ across different subject areas?

3. How does student use change over time, both as individuals (since individual responses will be tracked) and in the aggregate?

This paper describes the research design initiated in January 2024 and provides a snapshot of early results from one semester of research.

II. Methodology

A. Research Design

For this multiyear study, with results from the first six months reported here, we field a retrospective Qualtrics survey to gather responses from undergraduate students regarding their use of generative AI in research. Survey questions are focused on initial information gathering. Within this new area of research, we want to understand qualitative and quantitative factors that drive cadets to leverage or abstain from generative AI. Questions have a multi-disciplinary flavor, resembling our student population – those with major fields of study in Mathematical Sciences, Electrical Engineering and Computer Science, Social Sciences, or English and Philosophy.

We plan for our study to be longitudinal, spanning more than three years. Our survey questions are phrased to reflect how students' attitudes toward generative AI change over time and as they progress in their individual research. Since some second-year cadets are completing the survey in 2024, we can analyze how their responses change when they are seniors. Furthermore, we ask free-response questions that allow for the changing landscape of AI. As new generative AI tools emerge in academia, our survey will capture their relative impact on our undergraduate researchers.

B. Research Setting

This research takes place at the United States Military Academy (USMA) at West Point. USMA is an undergraduate-only institution of approximately 4,400 students with the unique mission of educating leaders of character who will commission as officers in the United States Army. The curriculum includes a broad core set of courses along with majors from 13 academic departments with 27 research centers. The Academy has an Honor Code that serves as a foundation for academic integrity. This is operationalized in the Documentation and Acknowledgement of Academic Work (DAAW), a Dean-level publication that provides guidance on citing sources and acknowledging peer assistance. The update to the DAAW following the Academy's initial generative AI guidance focused on describing generative AI assistance as similar to receiving assistance from a peer. There exists no Academy-wide ban on generative AI – instructors are granted course-level discretion to allow or prohibit use by cadets. From an academic integrity perspective, its use must be acknowledged if it substantially impacts the work, but it isn't cited in the same way as a book or article. An example of a course policy memo is provided in Appendix A, which is applicable to cadets completing a thesis as majors in Data Science, Operations Research, or Mathematical Sciences.

We mention here that while the authors hold all cadets accountable for academic integrity, the survey responses in this study are not linked to students. Their responses have no punitive effect, which is clearly noted in our consent statement.

C. Data Collection and Analysis

The survey will be fielded to cadets twice each semester – once within the first half of the semester, and a second time after final presentations or papers are submitted. Collecting information twice allows us to examine the changes in generative AI usage within a single course,

especially when pressure mounts to finish the final deliverable, and we intend to continue this during future semesters.

Each collection interval, we send out a link via email to a Qualtrics survey. Our survey consists of a mixture of multiple choice, free-response, and numerical questions. After consenting, providing basic demographic information, and selecting their major(s), students are prompted with a series of branching questions tailored to their responses. The following is a sample of questions.

- Does your research include any computer coding? Y/N
- What percentage of your code was generated using AI? Scale: 0-100%
- What percentage of your code was fixed/troubleshot using AI? Scale: 0-100%
- If you used a coding co-pilot, please describe how you employed it.
- When comparing the extent to which you trust the information, how would you compare GenAI tools to other web sources (Stack Exchange, articles, papers, etc.)?
- Did you use GenAI in a way that you regret? If so, how?

After collecting responses, the OIR at USMA combines participant survey data with other institutional information: course grade in the research class and course grades in major-required courses. The OIR also de-identifies the data.

Once we have anonymized data, we will use descriptive analytics to identify trends on our primary axes of comparison:

1. Changes in generative AI usage for an individual cadet over time
2. Difference in usage between cadets from different graduating class years
3. Variations between responses between different disciplines of study

Beyond observing numerical trends, we plan to apply rudimentary natural language processing (NLP) techniques. In our free text responses, we will use bigrams and trigrams – groups of two or

three words that appear sequentially – for trends in how cadets are interacting with generative AI. We can also perform sentiment analysis on the aggregated responses to see if there is a generally positive or negative attitude toward generative AI.

For our three-year study, we build in room for adaptations. The first year focuses on exploratory data analysis. We will determine if we need to update our survey distribution and the wording of questions. In the second and third years, we will compare student responses to previous years, as well as to individual cadets' personal changes. We plan to include a series of faculty questions to determine if their views toward generative AI change and see how they are using the results of student feedback regarding generative AI.

III. Results & Discussion

D. Initial Participants

Our initial work on this study began with surveys in the spring of 2024. From January to May 2024, we fielded the survey to 243 students in 12 different courses across 4 departments. Table 2 provides a detailed breakdown of students who accessed the survey. These students are all enrolled in an undergraduate research course. Most cadets are enrolled in a senior thesis or capstone course, with the remainder participating in research through an independent study. The departmental breakdown is representative of our intended survey population in subsequent years.

All participants consented to this voluntary survey before they were allowed to continue. Although students are prompted to fill out their name and identification number, the data is de-identified by the Office of Institutional Research (OIR) before analysis. The analysis of student responses to survey questions was approved by USMA IRB #CA-2024-73.

Table 2

Student Population Sent GenAI Survey in Spring 2024 as the Initial Survey Population

Course Number	Course Name	Students Enrolled
EN300	Literary Methodologies	16
EN400	Seminar in Advanced Literary Study	9
PY300	Philosophical Methods	24
PY400	Senior Seminar in Philosophy	8
XE402	Integrative System Design II	70
CS387/8/9/489	Independent Study in Computer Science	10
SS498B	Senior Thesis in International Affairs	5
SS498A	Senior Thesis in American Politics	8
SS491	Senior Project in Social Sciences	16
MA289/389/489	Independent Study in Mathematics	47
MA498/499	Senior Thesis in Mathematics (3 Credit Hours each semester)	19
MA491	Research Seminar in Applied Mathematics (3 Credit Hours, Spring semester)	4

Note. There are 12 distinct courses with 243 students total.

E. Survey Respondent Demographics

Of those 243 students who received the survey during its first available semester, 71 students completed the survey. Table 3 provides the class year of each survey participant. Almost a half (46.55%) of the participants are the class of 2024 as most seniors are required to complete a research project as part of their coursework. Table 4 shows the academic major of each survey participant. Notably, 52.86% (37/70) of participants are STEM majors and 47.14% (33/70) of participants are non-STEM majors. In summary, our survey participants include a representative sample of all class years and types of majors that provides insight to a variety of GenAI use cases.

Table 3

Class Year of Survey Participants

Class Year	Count	Percent
2024	27	46.55%
2025	11	18.97%
2026	15	25.86%
2027	5	8.62%

Note. n = 58. There were 71 total participants who completed the survey. Only 58 of the participants completed this specific question.

Table 4

Academic Major of Survey Participants

Academic Major	Count
Applied Statistics & Data Science	14
International Affairs	11
Philosophy	10
Mathematical Science	9
Operations Research	6
Computer Science	5
English	5
Chinese	2
Law & Legal Studies	2
Systems Engineering	2
Economics	1
Electrical Engineering	1
Life Science	1

Academic Major	Count
Spanish	1

Note. n = 70. There were 71 total participants who completed the survey. Only 70 of the participants completed this specific question.

F. Selected Survey Results

This section includes the initial results after one semester of the survey being active. Table 5 shows the results specific to GenAI use in coding. Based on the 51 cadets who answered the question, an average of 25.10% of code was generated from GenAI. For both STEM and non-STEM majors, the initial survey results indicate that GenAI use is pervasive to assist with coding.

Table 5

Results of Survey Question: "What percentage of your code was generated using AI?"

Field	Minimum	Maximum	Mean	Std Deviation	Count
Applied Statistics & Data Science	0	80	26.43	22.87	14
International Affairs	0	90	36.67	29.06	9
Mathematical Science	0	20	11.11	7.37	9
Operations Research	0	60	36.67	20.55	6
Computer Science	0	60	18	22.27	5
Chinese	0	40	20	20	2
Systems Engineering	0	0	0	0	2
Economics	50	50	50	0	1
Electrical Engineering	10	10	10	0	1
Life Science	30	30	30	0	1
Spanish	40	40	40	0	1

Note. n = 51. There were 71 total participants who completed the survey. Only 51 of the participants completed this specific question.

Table 6 shows the responses for cadets using GenAI in written products. For those cadets who answered the question, GenAI is used for idea generation, text generation, and proofing. Our initial results suggest that GenAI has significant applications to written research.

Table 6

Results of Survey Question: "Select all that apply [regarding GenAI uses]"

Answer	Count
I used AI to generate some text and used it as inspiration or to overcome writer's block.	17
I uploaded my text to check for spelling and/or grammar errors.	16
I uploaded my text and asked AI to rewrite it.	7
I used AI to generate text and used it in my written reports.	5
I uploaded my text and asked AI to generate additional similar content.	5

Note. n = 28. There were 71 total participants who completed the survey. There were 28 responses to this question. Survey respondents could select all answers that applied.

Table 7 shows the responses for which specific GenAI cadets use in his or her research. Of the cadets who answered the question, ChatGPT is the most prominent use for both coding and written research.

Table 7

Results of Survey Question: "Which AI did you use (select all that apply):"

Answer	Count
ChatGPT - GPT3.5	36

Answer	Count
ChatGPT - GPT4.0	16
Google Gemini (formerly Bard)	7
Other	5
Microsoft Copilot (formerly Bing Chat)	4
Google Colab’s embedded GPT	2
ChatPDF	1
Scite	0

Note. n = 51. There were 71 total participants who completed the survey. There were 51 responses to this question. Survey respondents could select multiple answers that applied.

Table 8 shows the responses to how much perceived productivity cadets gained in their research by using GenAI. The average response was that GenAI improves their research productivity 2.57, or 2.57 times more productive compared to not using GenAI.

Table 8

Results of Survey Question: "What factor of productivity have you gained in your research progress by using AI?"

Minimum	Maximum	Mean	Std Deviation	Count
0	5	2.57	1.19	46

Note. n = 46. There were 71 total participants who completed the survey. There were 46 responses to this question. The possible response options were: 0 = AI use was unproductive, 1 = no boost in productivity, 2 = twice as productive, 3 = three times as productive, 4 = four times as productive, or 5 = five+ times as productive.

Table 9 shows the responses to how using GenAI in research has helped cadets gain confidence in other professional contexts. 67.27% (37/55) of cadets agreed or strongly agreed that using GenAI in research gave them confidence to use in other areas.

Table 9

Results of Survey Question: "My use of generative AI in research gives me more confidence and proficiency in using generative AI in other professional contexts."

Answer	Count	%
Strongly Agree	13	23.64%
Agree	24	43.64%
Neutral	12	21.82%
Disagree	3	5.45%
Strongly Disagree	3	5.45%

Note. n = 55. There were 71 total respondents who completed the survey.

G. Discussion

The initial results from one semester show a clear student-perceived positive response to the use of generative AI. These are initial results and might be heavily swayed by a selection bias where students more likely to enjoy using generative AI completed our survey. But the results do indicate that some students, from a variety of academic disciplines, get a perceived large boost in productivity from using generative AI to write and code.

IV. Conclusion

This research serves a launch point for understanding the use of generative AI across subject areas and time. We focus on undergraduate research because of the open-ended types of problems that students encounter, and the need for creative and sustained scholarly work. We will continue gathering data about the use of generative AI for multiple years in this setting so that we can learn more about its use.

A. Appendix:

We provide an example of course-level guidance on the use of Generative AI within undergraduate research, issued to students in November 2023.

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