# Impact of Infusing Artificial Intelligence in the Curriculum Across Disciplines

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**ABSTRACT**

The rapid integration of artificial intelligence (AI) tools into higher education offers transformative potential but also presents challenges for student engagement and academic performance. This study investigates student attitudes and outcomes associated with the use of AI tools across disciplines, including psychology, biological sciences, mathematics, and modern foreign languages at an historically Black institution. Data were collected from 277 undergraduate students using the ATTARI-12 scale to measure attitudes, trust, and perceptions of AI utility, supplemented with targeted questions to explore ethical concerns and comfort levels. Faculty-designed interventions incorporated AI tools into course activities for data acquisition, problem-solving, and conceptual reinforcement. Results revealed that direct engagement with AI tools positively influenced academic outcomes, yet over trust in AI and limited critical engagement persisted as challenges. These findings emphasize the need for faculty expertise to remain central throughout the learning process, ensuring that AI-generated content is critically assessed rather than uncritically accepted. By addressing both the benefits and limitations of AI adoption, this study provides actionable insights for optimizing AI's role in education while safeguarding against its pitfalls.

Keywords: artificial intelligence, academic, attitudes, across disciplines, historical black university

**Impact of Infusing Artificial Intelligence in the Curriculum Across Disciplines**

Artificial Intelligence (AI) is sweeping the landscapes of science, technology, and education. This rapid incorporation of AI in the mainstream is associated with concern, need for understanding how AI works, and if used in an informed manner, as a tool to create learning experiences and enhance positive social change (Erduran & Levrini, 2024; Roscoe et al., 2022; Ho et al., 2022). In the field of education, although AI can free teachers and students from redundant tasks (Ouyang et al., 2022), a primary concern is its impact on student performance and ethical issues regarding ownership of information. Understanding student attitudes towards the utility of AI and a guided use of AI in the academic setting, is important to increase our understanding of AI utility and also keep abreast of the dynamic AI landscape. This study intended to gauge the AI attitudes of students, while introducing AI in the classroom to enhance academic performance.

The following section summarizes current research on the utility of artificial intelligence in academic settings, while discussing various contexts and methodologies in past studies. Research questions are presented, followed by an overview of the methodologies employed by each instructor.

## LITERATURE REVIEW

### Student Perspectives about Using AI

Concordance among most students entails the significant impact associated with AI on the perceived effectiveness and the benefits it has on their learning process and transition into employment opportunities (Bisdas et al., 2021). Today, most students are willing and continue to use AI in separate ways and across various stages of their education (Bisdas et al., 2021). Consequently, awareness on how to use and integrate AI among some students is associated with less anxiety (Caucheteux et al. 2024). Nonetheless, variations regarding the perceptions of its use remain prevalent among different students due to distinct reasons. As an elaborate example, a study by Idroes et al. (2023) determined the existence of a belief that it can offer personalized benefits to students with an elevated level of comprehension and awareness. Conversely, a different group of students expressed concerns that increased use and integration of AI could lead to adverse effects. Given the contrasting views and perspectives, several researchers have evaluated students' perspective on using AI by assessing its benefits and potential drawbacks in higher education (Owoc et al, 2021, Singh & Hiran, 2022).

Based on the evaluation of the perspectives of university students on using generative AI, Johnston et al. (2024) revealed that they consider it as a vital tool that offers personalized support and efficiency in completing different tasks. Specifically, by surveying 2,500 students, the authors realized that utilization of AI served as a platform for exploring various approaches and to develop solutions to different problems. As such, the findings indicated that by using AI, the students learned how to streamline routine tasks (Johnston et al., 2024). In a different study, Mulaudzi and Hamilton (2024) highlighted similar sentiments through heightened satisfaction expressed by students due to the personalized experiences and responses obtained from using AI. These findings facilitated the determination that the students perceived AI utilization as engagement with a tool that boosts their comprehension and academic performance (Mulaudzi & Hamilton, 2024).

In another study, Grájeda et al. (2023) complemented these sentiments through findings from their assessment of the impact of using AI in coursework based on the perception of the students from several universities across South-East Asia. The findings from this study accentuated the learners' appreciation for AI's facilitation of rapid access to vast information and the convenience of obtaining preliminary drafts. At the same time, by optimizing and exploring the effects of integrating AI into higher education teaching and learning practices, Al-Zahrani and Alasmari (2024) determined that its adoption as a supplementary tool played an integral role in boosting students' in-depth comprehension of complex subjects through the iterative delivery of content. Thus, the findings align with those obtained from a study by Lin and Chen (2024) that investigated the influence of AI-integrated educational applications on students' academic capacity and creativity. Specifically, Lin and Chen (2024) determined that the integration and utilization of AI as the starting point for conducting iterative research and writing alleviate academic stress for students by offering on-demand assistance and fostering creative thinking. Besides, a study by Ravšelj et al. (2025) involving the determination of ChatGPT utilization in higher education globally revealed students' perception of the technology as an insightful virtual tutor that provides increased clarity on various concepts and enhances efficiency in the learning process.

In a study by Kim and Danilina (2025), students' perception of the effectiveness of using AI is exemplified across different learning levels through findings associating it with fostering inclusive assessment practices for multilingual learners and the provision of customized feedback that incorporates learners with diverse linguistic backgrounds. A rapid scoring review by Moya et al. (2024) reinforces similar points of view by concluding that the appropriate implementation and utilization of assessment tools that use AI facilitate the maintenance of academic rigor while simultaneously supporting equitable learning environments. Additionally, a study by Song et al. (2024) set out to examine real-world experiences of ChatGPT integration into educational courses at the college level, leading to the determination of most students' expression of improved efficiency in their research and creative output. Nevertheless, the results obtained from this study indicated the condition that AI should be used to assist the conventional methods of learning. Therefore, the studies reviewed herein highlight students' perspective of AI utilization as the incorporation of a tool that enhances personalized learning and the acquisition of cognitive skills. Its utilization has been associated with benefits such as the improved academic performance of most students, indicating its effectiveness and time efficiency in higher learning.

Even though most students perceive using AI as beneficial, a substantial portion of them feel that it is associated with significant challenges, including limitations over human interaction, impending leakage of data, and the inadequacy of emotional connection. Specifically, a select group of students contend that the increased utilization of AI may lead to the violation of ethical principles, significantly reduce employment opportunities, and intensify the demand across several job practices. Subsequently, various researchers have critiqued the perceived effectiveness of using AI by focusing on the cautionary issues highlighted from the students' points of view. On the one hand, a study by Doğan et al. (2024) determined that despite its potential for streamlining routine tasks, extensive use of AI can significantly reduce students' incentive and capacity of critical thinking and deep learning due to overreliance on machine-generated responses.

Most fundamentally, findings from a study by Wang et al. (2023) caution that increased use of AI by students can lead to the emergence of ethical and reliability issues. Thus, Ravšelj et

al. (2025) encapsulated the increased likelihood of AI to generate inaccurate information, culminating in the naive acceptance by students as factual insight. These concerns were echoed by Al-Zahrani and Alasmari (2024) through cautionary findings that due to the inadequacy of sufficient oversight by educators, the increased use and reliance on content generated by AI can adversely compromise the quality and integrity of students' academic acquisition and performance.

Although most students have expressed their appreciation of AI assistance, findings from the study by Lin and Chen (2024) warn that the prevalence of increased reliance on such tools will culminate in superficial learning and diminished originality. Moreover, findings from the study by Moya et al. (2024) indicate that following the inadequacy of alignment between increased AI usage in assessment practices and frameworks that guarantee ethical use, its convenience may inadvertently encourage academic dishonesty or lead to a dilution of academic standards. Therefore, Doğan et al. (2024) point out that failure to attain rigorous control may lead to the risks associated with data privacy and biased algorithmic outputs outweighing the benefits, necessitating extensive research into long-term effects. Moreover, Kim and Danilina (2025) caution that despite the capacity of AI-driven feedback to enhance learning for some students, it does not present equal effectiveness for all student populations. The researchers point out that due to the variations in the levels of AI literacy among students, alongside the existing digital divide, unequal outcomes may persist, raising the question on whether AI utilization is truly effective and equal across the various education levels (Peres et al., 2023).

**The Limitations of Artificial Intelligence**

It is clear that AI is here to stay. Its rapid growth, widespread popularity and undeniable utility, serve to silence the concerns of many, who find its unchecked challenges problematic. Despite many voices of dissent, particularly among the professoriate, the usage of AI for coursework continues to soar. Frequently, faculty members feel that student usage of AI is inappropriate and problematic in multiple ways. Among them are: (1) ethical challenges; (2) issues of racism and bias in AI; (3) problems of accountability, and (4) the circumvention of fundamental skills that AI should build upon instead of replacing.

**Ethics and Accountability in Artificial Intelligence Usage**

Some of the primary challenges brought about by the existence of AI are ethical. Since AI has the capacity to imitate human intelligence, many students simply use it to generate assignments instead of doing the work that is required of them. One task assigned by this professor is demonstrative of such issues. At the end of the semester, students were asked to write their reflections on their psychology course. The course, which was taught from an Afrikan-centered perspective, emphasized the cultural perspective on various psychological phenomenon. Despite the cultural specificity of the course content, several students submitted essays that were written from a Eurocentric perspective and omitted any cultural analysis. Some essays also went far beyond the required word count, included information that was never presented, and attached references that were obscure. It was soon discovered that those essays were generated by AI, and not written by the student as required. Turnitin and other plagiarism detection tools were often able to determine the percentage of AI usage, and distinguish generative AI from other forms.

In a subsequent semester, this professor used AI as a teaching tool to demonstrate its biases and lack of cultural competence for a similar assignment. Students were asked to use AI to explore the prevalence of racism and culture in their psychology textbook and then compare it to the pedagogy in this professor's course. The responses indicated AI's cultural bias, reflection of attempts to sanitize the internet, historical inaccuracy and ineptitude for psycho-spiritual material.

Conversely, students expressed the importance of the culturally relevant learning experience provided by this professor. The following student reflection on the course support the aforementioned limitations of AI:

> Through the exercise assigned by this professor, students learned some of the limitations of artificial intelligence. While AI sometimes acknowledges the history of racism in Psychology, it often suggests that the contemporary discipline is devoid of the biases that students are still taught. Even AI's definition of racism typically distorts the relevant issues and absolves the actual racists of responsibility for their legacy. While AI vaguely suggests that racism is an elevated level of prejudice, it negates the theories of Afrikana psychologists who define racism as a system of oppression perpetuated by non-myelinated people (Cress-Welsing, 1991); or as a psychological disorder (Pine & Hilliard, 1990) or as a spiritual limitation (Ani, 1994). In addition, it minimizes the degree to which racism exists in the current curriculum and it lacks specificity in that regard. For example, one of the most notoriously racist psychologists was Jean Piaget who said that Afrikana people are cognitively inferior to whites (Orbell, 1981). His theory is one of the most common in contemporary psychology. Chat GPT says that Piaget was not a racist, and that his theory is unbiased. Similarly, Lawrence Kohlberg described himself as a disciple of Piaget. He said that Afrikana people are morally under-developed compared to whites (King & Mitchell, 1995). Nonetheless, Chat GTP said that Lawrence Kohlberg's theory is universal despite some minimal critiques of cultural bias. Both Piaget, and Kohlberg referred to Afrikana people as savages in their work. In fact, most of the psychologists presented in the typical textbook espoused racist views. Chat GPT's ignorance about that makes it problematic as a culturally competent tool for students.

**The Utility of Artificial Intelligence**

In summary, there is a consensus among researchers that artificial intelligence (AI) tools are being used in academic settings and their utility is associated with various views and outcomes. There have been no attempts to test the impact of infusing the AI tools in the context of teaching, especially at our historical black institution. This study fills this gap, includes quantitative indices to evaluate the attitudes and tests the infusion of the tools in the curriculum, across subjects. All instructors used the ATTARI-12 scale (Stein et al., 2024) to assess student attitudes toward AI. This scale is unidimensional scale that measures an individual's attitude towards AI by combining cognitive, affective, and behavioral facets. Each item was scored on a five-point scale, strongly disagree (1) to strongly agree (5). Examples of the scale items are: AI will make this world a better place (cognitive); I am afraid of AI (affective); I would rather choose a technology with AI than one without it (behavioral). This scale was selected due its established reliability and validity, and its application across contexts. In addition to the 12 items, we added four other items: (1) How comfortable do you feel with AI being integrated into

everyday products and services (e.g., virtual assistants, chatbots, self-driving cars)? (2) How concerned are you about the potential risks of AI, such as loss of privacy or job displacement? (3) Would you trust an AI system to make decisions on your behalf in critical areas like healthcare, the judicial system, or financial management? (4) Do you think AI should be used to perform jobs that have traditionally been done by humans (e.g., customer service, data analysis)?

### Research Question

At our historically black institution, faculty across disciplines, tested the following research question: Does infusing artificial intelligence tools in the curriculum have an impact on student attitudes and academic outcomes? The current paper reports the results of this artificial intelligence tool infusion by professors at CAU.

## METHODS

### Methods: General Biology

As artificial intelligence becomes an increasingly familiar presence in education, its role in shaping student engagement with complex scientific concepts continues to warrant investigation (Bates et al., 2023). In Fall 2024, students in an introductory biology course participated in a study designed to explore the role of AI in supporting their understanding of cellular respiration and bioenergetics. At the center of this investigation was an inquiry into the effects of AI-assisted learning on students' ability to analyze the biochemical impact of 2,4-Dinitrophenol (DNP), a mitochondrial uncoupling agent known to disrupt oxidative phosphorylation (Terada & Watanabe, 2022). The key question was not whether AI could generate correct answers but whether it could help students refine their reasoning, deepen their understanding of thermodynamic consequences, and engage more critically with biochemical mechanisms (Holmes et al., 2021). The study sought to determine whether AI-supported learning promoted more sophisticated cognitive engagement or merely facilitated rote information retrieval (Kluttz & Banerjee, 2022).

### Participants

A total of 89 first-year undergraduate students participated in this study, with 92 percent identifying as African American and 88 percent as female. Their participation provided a critical opportunity to examine how artificial intelligence can support learning in a historically Black institution (Charleston & Jackson, 2021).

### Procedure

The study was structured into three stages. First, students independently analyzed the biochemical case study, forming their initial hypotheses without AI intervention. Second, they submitted their analyses to ChatGPT or Claude, receiving AI-generated feedback in return (Varanasi & Belova, 2023). Finally, they critically evaluated AI's explanations, reflecting on whether they clarified concepts, introduced inaccuracies, or lacked the depth necessary for robust learning (Vallor, 2021). The framework of this study was designed to position AI as a

collaborator in learning, not as an authoritative source of knowledge (Selwyn & Pangrazio, 2022).

Data collection was structured to capture both conceptual understanding and attitudinal shifts in response to AI engagement (Lai & Bower, 2020). The pre-test established students' baseline comprehension of oxidative phosphorylation, ATP synthesis, and thermodynamic energy transfer. The post-test, administered in December 2024, measured how students applied AI-assisted insights to novel biochemical scenarios. Additionally, the ATTARI-12 survey, conducted in November, assessed student perceptions of AI's role in education, including trust in AI-generated explanations and comfort with AI as an academic tool (Scherer et al., 2019).

**Results**

The findings provide a nuanced picture of AI's role in learning. On the quantitative side, students demonstrated moderate confidence in AI-generated responses, with an average trust score of 2.920 (SD = 0.671). Although engagement with AI correlated positively with perceived learning benefits ($\beta = 0.136$, $p = 0.045$, $R^2 = 0.047$), qualitative reflections revealed a recurring concern: students found it difficult to recognize subtle inaccuracies in AI-generated explanations (Prather et al., 2023). This raises an important question: How can AI tools be structured to cultivate better scientific skepticism?

Students' overall perceptions of AI remained relatively stable, as indicated by the ATTARI-12 survey. However, a notable shift in comfort levels was observed. The mean affective score increased from 11.3 (SD = 2.5) pre-test to 12.9 (SD = 3.6) post-test ($t = 2.3$, $p = 0.041$), suggesting that while AI did not fundamentally change students' views on its reliability, it did reduce initial apprehension (Yeung et al., 2022). This is an important finding in the broader discussion of AI in education—it may not immediately revolutionize how students think, but it does shape their willingness to engage with AI as a learning partner rather than as a black-box authority (Reich & Ito, 2021).

**Discussion**

These results align with prior research distinguishing between AI-directed and AI-supported learning paradigms (Holstein et al., 2020). In AI-directed learning, the system dynamically adjusts content, guiding students through an adaptive learning pathway. In contrast, AI-supported learning allows students to take an active role, using AI as a tool for refining and testing their own reasoning (Kim & Lim, 2022). This study supports the latter model, reinforcing the notion that AI is most effective when used as a reflective tool rather than as an instructional substitute (Kasparov & Greengard, 2017).

**Methods: Statistics**

During the Fall 2024 semester, students in a statistics class, were instructed to use an artificial intelligence (AI) tool for an assignment in the course. Student attitudes towards the utility of the tool as well as student scores on the assignment were assessed. The following describes the participants, measures, procedures, and results.

**Participants**

Undergraduate students in statistics classes, n (pre-intervention) = 44 and n (post-intervention) = 40, were asked to respond to an online survey, to assess their attitudes towards the use of AI tools. Archival data was then compared to study the impact of the AI tool on student performance on the assignment. Majority of the students were black and female, and students at our historically black institution.

**Measures**

Student attitudes towards AI tools were assessed, at two points in time—October 2024 for the pretest (n = 44), and then in December 2024, for the posttest (n = 40). The ATTARI-12 scale was administered via an online platform, Qualtrics. Students responded to an online consent form before answering the survey questions. Students were awarded extra credit for their participation. Academic performance as a function of the utility of the AI tool, was defined as the test scores of students on the assignment for which they were prompted to use the AI tool (n = 46). The test scores were compared to those in the previous semester (n = 42).

**Procedures**

AI tool to practice problems, (2) use it as a study resource, when interacting with the content, (3) develop confidence in solving statistical problems devoid of the stereotype threat associated with 'numbers/math'. The following instructions were included in the course for the assignment:

A. Take the following survey for extra credit-
- https://cau.co1.qualtrics.com/jfe/form/SV_eqVBNG4cFIULhuC

B. Use an Artificial Intelligence tool (AI) to generate and practice content related questions.

Please use the following PROMPTS:

- Can you generate two practice one sample t-test problems specifying if the test is one or two tailed?
- Now try solving the problems and then submit the following prompt--
- For problems one and two, is reject the null correct?
- With this prompt you can check your own work with the AI generated solution

C. Submit the conversation link to the assignment box

To answer the post test, the following prompt was posted:

- Please complete the following online survey about your use of AI: https://cau.co1.qualtrics.com/jfe/form/SV_0ffRKj5LsIJ78bk.
- Also, please let me know if you have used AI for more problems in Statistics as well as in other classes--a simple sentence in the comment box will suffice

Archival data from Fall 2024 (post test) and Spring 2024 (pre test) on the assignment (one-sample test) were compared to assess student performance as a function of the AI infusion.

**Results**

Data were analyzed using a between group t-test. The SPSS 28.0 version was used for data analyses. A comparison of pre-post scores on the ATTARI-12 revealed that there were significant differences on one item of the scale— "I want to use technologies that rely on AI", t

(81) = -2.16, p = .017). The pre test scores (n = 43, M = 2.63, SD = .900), and post test (n = 40, M = 3.05, SD = .876) revealed that students agreed significantly more to using AI technologies, thus demonstrating a positive behavioral attitude towards the utility of AI tools.

A comparison of the scores on the assignment was conducted, using an independent groups t-test. Results revealed no significant differences between the scores on the Spring 2024 assignment scores (pre test), t (86) = .023, p = .491). The pre test scores (n = 42, M = 20.55, SD = 5.19), and post test (n = 46, M = 20.52, SD = 5.28) were not affected by the use of the AI tools.

Reflections from the students on the utility of AI were coded using Atlas-Ti version 9.1. The following themes emerged: AI as 'utility'(n = 25) and 'negative affect'(n = 3). Examples of the theme 'utility' are: Sometimes I have issues with putting together all my notes and how each thing connects to each other so I use ai to help connect the dots; I have used AI for other things in my life that is very helpful especially with tedious things or if I come to a mental block and need ideas! ; create example problems or elaborate on questions I don't understand to get a better understanding of what I'm supposed to be doing for the class or in a specific assignment . I've also asked AI to write emails from time to time." Examples of the theme 'negative affect' are: "…have not used Artificial Intelligence in any of my classes besides my Statistics class. I think this is because there are more physical and interpersonal reactions with peers so it is not needed"; "I'm open to the idea however I prefer using my own comprehension skills rather than AI".

**Discussion**

Results thus suggest that students can appreciate the use of AI as a resource for their coursework. Although the assignment grades did not show a significant difference as a function of AI infusion, perhaps the short length of time for the AI use was not sufficient to enhance the effect size. Qualitative data however suggest that students did show an appreciation of AI as an educational tool, and the negative affect associated with the use of AI may be explained by the characteristics of the students. At our historically black university, research indicates that culturally relevant pedagogical techniques, such as the efficacy of 'relationships' and 'group projects' are a preferred learning strategy (Talpade & Talpade, 2020). The role of interpersonal communication is valued more than the role of technology. Comments also suggest that variables such as racial identity, self-efficacy, may moderate the impact of AI use in education. Future implications include plans for infusion of AI in the course for a prolonged period of time, supported by teacher-student relationships and group projects.

**Methods: Spanish**

During the Fall 2024 semester, students in introductory Elementary Spanish classes were instructed to use an artificial intelligence (AI) tool for an assignment in the course. Student attitudes towards the utility of the tool as well as student scores on the assignment were assessed. The following describes the participants, measures, procedures, and results.

**Participants**

Undergraduate students in an introductory Elementary Spanish class, n (pre-intervention) = 57 and n (post-intervention) = 44, were asked to respond to an online survey, to assess their attitudes towards the use of AI tools. Archival data was then compared to study the impact of the

AI tool on student performance on the assignment. Majority of the students were black females at our historically black institution.

**Measures**

Student attitudes towards AI tools were assessed at two points in time—November 2024 for the pretest (n = 57), and then in December 2024, for the posttest (n = 44). The ATTARI-12 scale was administered via an online platform, Qualtrics. Students responded to an online consent form before answering the survey questions. Students were awarded extra credit for their participation. Academic performance as a function of the utility of the AI tool, was defined as the test scores of students on the assignment for which they were prompted to use the AI tool of choice (n = 47). The test scores were compared to those in the previous semester (n = 59).

**Procedures**

The utility of the AI tools for course activities were expected to help students (1) use the AI tool to expose students to alternative uses of the vocabulary and structure of the language, (2) use it discriminatorily as a study resource, when interacting with the content, (3) develop confidence in being expressive and creative with the language. The following instructions were included in the course for the assignment:

A. Take the following survey for extra credit-
- https://cau.co1.qualtrics.com/jfe/form/SV_eqVBNG4cFIULhuC
B. Use an Artificial Intelligence tool (AI) to generate and practice content related questions.

1. Administer pre test via qualtrics in my Elementary Spanish course [https://cau.co1.qualtrics.com/jfe/form/SV_eqVBNG4cFIULhuCLinks to an external site.]
2. Use AI to generate a conversation in Spanish in which two students are talking about their mothers. Ask and Answer each other's questions about their respective mothers including:

**Part A**

1. name
2. how she is doing
3. where she comes from
4. number of children
5. age
6. Ask how she is (as in Describe her) Answer with 3 characteristics

**Part B** (use the verbs 'ir' and 'tener' as in lesson 3)

1. where she goes/is going
2. what she is going to do
3. what she has to do
4. what she feels like doing,
5. Take leave of each other (Say your farewells/goodbyes.)

**Part C**

1. Submit all PROMPTS used in the assignment.
2. Look closely at the AI generated conversation and Highlight or Underline all material covered in this class only (the information used in this class like vocabulary, grammar, verbs, adjectives, etc.)

3. Submit the entire conversation with your highlights as a Word document. This will be counted as a test grade for lesson 4.

To answer the post test, the following prompt was posted:

- Please complete the following online survey about your use of AI: https://cau.co1.qualtrics.com/jfe/form/SV_0ffRKj5LsIJ78bk.

**Results**

Archival data from Fall 2024 scores (posttest) and Spring 2024 scores of the same assignment were compared to assess student performance as a function of the AI infusion. An independent groups t-test was conducted, and the results did not show significant differences between the Spring 2024 and Fall 2024 scores. The mean for the pretest was= 66.22 (SE = 3.71), for the posttest, the mean = 71.53 (SE = 3.39).

Responses were compared using a between group t-test and analyzed using SPSS 28.0. Significant differences between the pre- and posttest responses to the following item on the ATTARI-12 and other questions, were found:

AI will make this world a better place (cognitive), t (99) = 1.986, p = .025). The pre test scores (n = 57, M = 3.42, SD = .963), and post-test (n = 44, M = 3.02, SD = 1.04). Thus, students did not agree with this statement after the AI infusion.

Furthermore, there were significant differences between the responses to the following items as well:

How comfortable do you feel with AI being integrated into everyday products and services (e.g., virtual assistants, chatbots, self-driving cars)?, (1= very comfortable; 5= very uncomfortable)), t (99) = 1.899, p = .030). The mean pre-test score (n = 57, M = 3.00, SD = 0.886) was greater than the posttest score (n = 44, M = 2.64, SD = 1.04). Thus, students became more uncomfortable with this statement after the AI infusion.

**Discussion**

The results indicate that students consider AI a beneficial resource for learning and improving performance in this Spanish course, although they are wary of its use in some other spheres of life. The immediate goal in the activity for which the AI tool was employed was to ascertain student understanding of the language. The issue was whether students were cognizant enough to be able to recognize the material covered in class and discriminate between which resources provided by AI were relevant and complementary, and which were not, based on course material provided. The results indicate that ultimately, the use of AI did not have a positive outcome to any significant degree. The results may be dependent on other factors outside the scope of this study. The increase of two percentage points in the mean (archival 69% in the Spring 2024 to the 71% post AI activity in the Fall 2024) could be seen as promising, a

precursor to an increasingly positive outcome over time and scope. In other words, it is not implausible to expect that an increase in the number of assignments over a longer period, and wider scope could yield significantly more positive results.

**Methods: Conservation Biology & Sustainability**

Students enrolled in a conservation biology and sustainability course in Fall 2024 used AI to produce a fictional or nonfictional story about the ecology, threats, and conservation actions of a selected endangered species. The intended reading level was for 8-10 year olds, but no other constraints were used in the prompt. Students were permitted to use any AI generator (i.e, ChatGPT, Google Gemini, etc.), and submitted a written reflection on the AI output evaluating the accuracy, appropriateness, and creativity of the stories.

**Participants**

Eight out of 24 students enrolled in the class participated in the study by completing an online survey designed to assess their attitudes toward AI (Stein et al., 2024). All participants were Black and female; 25% were sophomores, 12.5% were juniors, and 62.5% were seniors.

**Measures**

To measure changes in attitudes toward AI tools, students completed the ATTARI-12 survey before and after the AI assignment. The pre-survey was completed in October 2024, and the post-survey was completed in December 2024. Participation was incentivized with extra credit. The survey was administered via Qualtrics with students providing consent prior to both completions. Academic performance as a function of AI tool use could not be determined as this was a new assignment and a comparable control group was not available. However, relationships between AI attitudes and children's book scores were examined.

**Procedures**

Use of AI tools for this assignment was intended to help students develop a first draft of a story that included characters, setting, plot, and ecological information. Students were required to build upon and revise the AI-generated story, and produce an age-appropriate digital picture book to accompany the text. The following instructions were provided during the AI portion of the project:

- Enter **ONE** of the following prompts specific to your selected IUCN Red List species to one of your preferred AI generators (i.e., ChatGPT, Google Gemini, etc.).
- Generate a fictional children's story for 8-10 year olds about the ecology, threats, and conservation actions of the __(i.e., endangered Asian elephant)_____.
- Generate a nonfictional children's story for 8-10 year olds about the ecology, threats, and conservation actions of the __(i.e., endangered Asian elephant)_____.
- Copy the output into a separate Word document and upload it here.
- In a separate Word document **evaluate the story on the following**:
- How accurate is the information provided in terms of biodiversity, ecology, threats and conservation? Use what you have learned from your research this semester.

- Evaluate the appropriateness of the terminology and phrasing produced. Is it appropriate for 8-10 year olds? Provide examples.
- How creative, original, and interesting is the story/narrative/text? Do you think children would want to read it? Why or why not?
- What elements of the output will you incorporate in your children's book? Why?
- What ideas did the output inspire?

A dependent t-test was used to identify changes in pre-post survey responses. Pearson's correlation was used to examine the relationship between pre-post responses and final children's book scores. All analysis was completed using SPSS.

**Results**

The mean composite ATTARI-12 pre-test score (n = 8, M = 33.5, SD = 7.2) was not different than the ATTARI-12 post-test score (n = 8, M = 36.2, SD = 7.9) (dependent t-test, t = -2.1, p = .07). However, there was a positive shift in affective responses. The mean summed affective score in the post-test was 13.4 (n = 8, SD = 3.8), significantly higher than the pre-test (n = 8, M = 11.5, SD = 2.2) (dependent t-test, t = -2.5, p = .044). No differences were found in the cognitive and behavior pre-post scores. The average score on the final children's book was 45.2 (n = 8, SD = 1.7) out of a maximum of 50. Book scores were not significantly correlated with composite ATTARI-12 pre- or post- scores, nor the cognitive, affective, and behavior summed scores.

Student responses regarding comfort, concern, trust, regulation, and use of AI did not shift over the course of this study. On the post-test survey, students were neutral regarding how comfortable they were about AI being integrated into everyday projects and services, but moderately concerned with the potential risks of AI, such as loss of privacy and job displacement. Given this concern, it is not surprising that seven out of eight respondents would not trust an AI system to make decisions on their behalf in areas such as healthcare, judicial system, and financial management. A majority (62.5%) indicated that using AI to perform jobs traditionally done by humans is a bad idea, and that it important for AI to be regulated.

**Discussion**

This work broadens the generalizability and use of the ATTARI-12 instrument within underrepresented demographics and cultures (Stein et al., 2024). Specifically, we set out to understand undergraduate HBCU student attitudes and beliefs about AI within academic coursework. Although the single intervention did not shift composite ATTARI-12 scores in conservation biology and sustainability, students did demonstrate an increase in affective responses. This indicates that after using AI for coursework, students experienced less fear of and more positive emotions toward the technology. This positive affective shift, however, was tempered by concerns about the risks of AI use for privacy, job displacement, and decision-making.

Two paradigms of AI use in STEM education are AI-directed and AI-supported (Ouyang et al., 2022). AI-directed approaches are similar to adaptive learning platforms that adjust content for students based on performance with the goal of moving along a predetermined, linear learning pathway. In an AI-supported system, the technology serves as a tool with which the student can interact with bidirectional activity, producing a more collaborative and learner-centered experience (Ouyang et al., 2022). In this case, students used AI to jumpstart their

creative process in integrating academic information with storytelling for a younger audience, illustrating an AI-supported implementation.

In addition, this study meets calls for centering marginalized populations within AI research. By providing students with an opportunity to use AI for creative and academically productive purposes, this work demonstrates how AI in education research can simultaneously work for diversity, equity, and inclusion (Roscoe et al., 2022).

This portion of the study was limited by a small sample size and lack of control group. Increasing student participation would lend more statistical power and improve the generalizability of the results toward the undergraduate population at HBCUs. The simultaneous implementation of AI and a new assignment prevented comparison with non-AI cohort. Future work may include use of the new assignment without AI to establish a control, which would provide clarity on use of AI for improving student performance outcomes.

**Methods: Mathematics**

During Fall 2024 semester, students in a mathematics course, were instructed to use an artificial intelligence (AI) tool for an assessment in the course. Student attitudes towards the utility of the tool as well as student scores on a course assessment were assessed. Students' results on the assessment were compared to a similar population of students who took the assessment in Fall 2022. The following describes the participants, measures, procedures, and results.

**Participants**

Undergraduate students in mathematics classes, n (pre-intervention) = 13 and n (post-intervention) = 11, were asked to respond to an online survey, to assess their attitudes towards the use of AI tools. Archival data was then compared to study the impact of the AI tool on student performance on the same assessment given to a comparable student population in Fall 2022, n = 13. Most students were black and females, and students enrolled at a historically black institution.

**Measures**

Students' attitudes toward AI tools were assessed, at two points in time, October 2024 for the pretest (n = 13), and then in November 2024, for the post test (n = 11). The ATTARI-12 scale was administered via an online platform, Qualtrics. Students responded to an online consent form before answering the survey questions. Students were awarded extra credit for their participation. Academic performance as a function of the utility of the AI tool, was defined as the test scores of students on the assessment for which they had used the AI tool to aid in test preparation, (n = 7), Fall 2024. The test scores were compared to those in a previous semester who had not used the AI tool to prepare for the assessment, (n = 6), Fall 2022.

**Procedures**

The utility of the AI tool ChatGPT in improving students' understanding of mathematical concepts and to serve as a mathematics tutor were investigated. Students were given instructions

on how to use ChatGPT. Specified course assignments were designed to explore these issues. The following instructions were included in the course for the assignment:

Part I: Take the following survey for extra credit--
https://cau.co1.qualtrics.com/jfe/form/SV_eqVBNG4cFIULhuC

Part II: Use AI (artificial intelligence) to solve and explain 2 of each problem type, using the given prompt. Then handwrite and explain a problem similar to the problem shown in chat gpt, writing the step by step instructions. Next make a video or voice recording of you explaining your problem. Only explain #1, #2 below, that is only make 2 video or voice recordings.

Try the following prompts:

1. Create and solve 2 first order linear differential equations with constant coefficients
2. Create and solve 2 second order linear differential equations with constant coefficients
3. Create and solve 2 higher order differential equations with constant coefficients
4. Create and solve 2 second order differential equations with constant coefficients using the method of undetermined coefficients
5. Create and solve 2 differential equations using the LaPlace Transform with specific initial conditions given
6. Create and solve 2 problems which use a table of LaPlace Transforms to find the LaPlace transform of a given function
7. Create and solve 2 problems which use the definition of the LaPlace transform of a given function

Part III: To answer the post test, the following prompt was posted:

- Please complete the following online survey about your use of AI: https://cau.co1.qualtrics.com/jfe/form/SV_0ffRKj5LsIJ78bk.

Archival Data from Fall 2022 and Fall 2024 on an examination were compared to assess student performance as a function of the AI infusion.

## Results

Data was analyzed using a between group t-test. The SPSS 28.0 version was used for data analyses. Responses were compared using a between group t-test and analyzed using SPSS 28.0. Significant differences between the pre- and posttest responses to the following item were found: I have strong negative emotions about AI (affective), $t(21) = -1.709$, $p = .051$). The pre test scores ($n = 12$, $M = 2.00$, $SD = 1.044$), and post-test ($n = 11$, $M = 2.82$, $SD = 1.25$). Thus, students increased agreement with this statement after the AI infusion.

## Discussion

The AI intervention assignment directly influenced students' performance on the subsequent assessment given in the course. Descriptive statistics follow. The mean of assessment scores for the control group was 45. The mean of assessment scores for the experimental group who completed the AI intervention assignment was 72. The median score was 32 for the control group. The median score was 71 for the experimental group. Regardless of statistical significance, this was an impressive improvement in the descriptive statistics results for students in the experimental group who engaged in the AI infusion, compared to students in the control group on the assessment, which was a course examination.

Qualitative results were also impressive in this study. Students were asked to hand write solutions to problems similar to problems shown by ChatGPT. Previous studies have indicated that the process of handwriting information may lead to deeper understanding of the concepts. Secondly, students were requested to make either a voice recording or video explaining two of the problems that were handwritten. Examination of these videos lead the instructor to conclude that most of the students who subsequently passed the course had gained a deeper understanding of the assessments content by explaining it in their own words. The recordings and videos of most students who passed the course were exemplary.

General conversations with students indicate that many question the efficacy of AI interventions as it relates to general societal uses of various AI technologies. Hence this might explain the following result, "strong negative emotions about AI (affective)". Overall, the academic improvements outweigh this affective result.

**Methods: Abnormal Psychology**

During the Fall 2024 semester, students in an undergraduate Abnormal Psychology class were instructed to use a generative AI tool to complete a case study that would be used in class activity designed to help them learn how to detect symptoms associated with specific diagnoses. Student attitudes towards the usefulness of the tool as well as their exam grade was assessed. The following describes the participants, measures, procedures, and results.

Student attitudes towards AI tools were assessed using the ATTARI-12 scale. The measure was administered before and after the class activity using the online survey-tool product, Qualtrics. Academic performance as a function of the utility of the AI tool, was defined as the test scores of students on the exam for which they used the Ai skills as a study tool (n = 28). The test scores were compared to those in the first half of the semester (n = 36).

**Participants**

Undergraduate students in abnormal psychology classes, n (pre-intervention) = 37 and n (post-intervention) = 28, were asked to respond to an online survey, to assess their attitudes towards the use of AI tools. Archival data was then compared to study the impact of the AI tool on student performance on the assignment. Majority of the students were black and female, and students at our historically black institution.

**Measures**

Student attitudes towards AI tools were assessed at two points in time—October 2024 for the pretest (n = 37), and then in December 2024, for the posttest (n = 28). The ATTARI-12 scale was administered via an online platform, Qualtrics. Students responded to an online consent form before answering the survey questions. Academic performance as a function of the utility of the AI tool, was defined as the test scores of students on the assignment for which they were prompted to use the AI tool (n = 28). The test scores were compared to those in the previous semester (n = 36).

**Procedures**

During the first half of the class, students completed a class activity where the professor divided the students into groups of 4. The groups chose a case, then determined the diagnosis, symptoms, examples of the symptoms and etiology.

During the second half of the class, AI tools were used during two weeks of course activities. In session one, the professor taught the students how to use generative AI to create cases. In session two, students independently created cases using the skills that were learned during the first session.

The utility of the AI tools for course activities were expected to help students (1) use the AI tool to teach students how to independently use cases to generate cases that can be used as a group study tool, (2) use it as an interactive skill building tool that fosters learning while creating cases, (3) develop confidence in applying the knowledge that they have learned. The following instructions were included in the course for the assignment:

A. Take the following survey for extra credit--
https://cau.co1.qualtrics.com/jfe/form/SV_eqVBNG4cFIULhuC

B. Students were split into groups of 4. Use the generative Artificial Intelligence tool (AI) Chat gpt to create a case study. After you complete and submit the case. Another group of students will read the case study and determine the following

- Diagnosis
- Symptoms
- Examples of the symptoms from the case study
- Etiology of the diagnosis

C. To answer the post test, the following prompt was posted:
Please complete the following online survey:
https://cau.co1.qualtrics.com/jfe/form/SV_0ffRKj5LsIJ78bk.

Archival data from Fall 2024 (Exam 1 pre-test) and Fall 2024 (Exam 2 post-test) on the assignment (providing the diagnosis, symptoms, examples of the symptoms, and etiology) were compared to assess student performance as a function of the use of generative AI to produce case studies and learn diagnostic skills.

**Results**

Responses were compared using a between group t-test and analyzed using SPSS 28.0. A significant difference between the pre- and posttest responses to the following item on the following question, was found. How important do you think it is for AI to be regulated by governments or international organizations? (1= very important, 5 = not important at all), ), $t(63) = -1.705$, $p = .047$). The pre test scores ($n = 37$, $M = 2.16$, $SD = .986$) were lower than the posttest scores ($n = 28$, $M = 2.57$, $SD = .920$). Thus, students indicated a decrease in importance with this statement after the AI infusion. The assignment scores, pre- and post-infusion of AI although not significant, did reveal an increase in the assignment scores: Pretest, $n = 36$, Mean = 79.82, $SD = 16.75$; Posttest, $n = 28$, Mean = 83.04, $SD = 18.92$. No significant differences were identified on the items of the ATTARI-12 scale or assignment scores.

## RESULTS ACROSS DISCIPLINES

A between groups t-test was used to compare the responses on the Attitudes towards AI online survey. The pretest responses were compared with the post-test responses. The response format was the 5-point scale ranging from Strongly Agree = 5, Somewhat Agree = 4, Neutral = 3, Somewhat Disagree = 2, and Strongly Disagree = 1. Items on the scale were reverse scored and overall attitudes towards AI were analyzed. Results are depicted in Table 1. Specifically, results revealed significant differences on the following items:

AI will make this world a better place (cognitive), t (598) = 2.24, p = .013). The pre test scores (n = 217, M = 3.28, SD = .986), and post-test (n = 383, M = 3.10, SD = .962).

I have strong negative emotions about AI (affective), t (595) = -2.77, p = .003). The pre test scores (n = 216, M = 2.48, SD = .959), and post-test (n = 381, M = 2.71, SD = .996).

AI offers solutions to many world problems (cognitive), t (593) = 1.96, p = .025). The pre test scores (n = 216, M = 3.43, SD = .986), and post-test (n = 379, M = 3.26, SD = 1.007).

When I think about AI, I have mostly positive feelings (affective), t (596) = 3.38, p = .001). The pre test scores (n = 215, M = 3.37, SD = .849), and post-test (n = 383, M = 3.12, SD = .876).

I would rather avoid technologies that are based on AI (behavioral), t (595) = -2.36, p = .009). The pre test scores (n = 215, M = 2.80, SD = .851), and post-test (n = 382, M = 2.97, SD = .885).

Thus, students reported an increase in agreement to the following statements: I have strong negative emotions about AI; I would rather avoid technologies that are based on AI. Results also showed decrease in agreement to the following statements: AI will make this world a better place; AI offers solutions to many world problems; When I think about AI, I have mostly positive feelings. In general, student responses indicate negative attitudes (cognitive, affective) towards the utility of AI. Overall results suggest the same, significant negative shift in attitudes on the post test, specifically on the cognitive and affective items, but not on all the behavioral items.

## DISCUSSION

The answer to the research question, Does infusing artificial intelligence tools in the curriculum have an impact on student attitudes and academic outcomes? delivered varied outcomes. However, across the disciplines, there were shifts in the attitudes towards AI use in the classroom. The cognitive and affective responses showed negative shifts, while the behavioral attitudes did not align with the affective and cognitive reports. Academically, there were non-significant but positive shifts in student performance. General findings (Schepman & Rodway, 2023) suggest that most have apprehensions about AI and how it is used, while Schradle's (2020) acknowledgement that quantum computing demonstrates AI supremacy in tandem with Apocalyptic AI, may explain the associated fear and anxiety towards AI, and the negative attitudes towards AI. Behaviorally however, students were guided by instructors to use the AI, thus removing any guilt associated with its use, and demonstrating how it can be used in the academic landscape. The acknowledgement of AI use upon guidance may explain the positive behavioral attitudes toward the utility of AI.

Limitations of this campus wide infusion are acknowledged. The short time frame in which the instructors used to infuse the AI and evaluate its impact lowered the effect size.

Attitudes of the instructors may have affected the student attitudes. It is also important to assess how the information is presented by the instructor to the student (Sit et al., 2020). Thus, future directions include intentional and guided AI infusion for a longer period of time and the evaluation of instructor and student attitudes towards AI which may moderate the impact of the intended infusion to enhance academic performance.

Thus, direct engagement with AI tools could positively influence academic outcomes, yet limited critical engagement persist as challenges. These findings underscore the importance of adopting a Human-in-the-Loop (HITL) model, wherein faculty validate AI outputs to ensure accuracy and promote critical thinking. By addressing the complexities of AI adoption, this study provides actionable insights for enhancing the educational value of AI while safeguarding against its pitfalls. The utility of AI in sync with HITL serves as a trendsetter for ensuring optimal applications of AI in the field of education.

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**Table 1**
***Pre-Post Comparison of Attitudes Towards AI Across Disciplines***

**Group Statistics**

| | prepost | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| overallAI | pre | 201 | 38.7960 | 6.67781 | .47102 |
| | post | 373 | 37.0724 | 7.15028 | .37023 |
| cognitive | pre | 211 | 13.2370 | 2.55990 | .17623 |
| | post | 377 | 12.5438 | 2.59886 | .13385 |
| behavioral | pre | 207 | 11.9227 | 2.43833 | .16948 |
| | post | 381 | 11.7087 | 2.60701 | .13356 |
| affective | pre | 210 | 13.5381 | 2.83028 | .19531 |
| | post | 378 | 12.8598 | 3.01612 | .15513 |

**Independent Samples Test**

| | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|
| | | | | Significance | | Mean |
| | | t | df | One-Sided p | Two-Sided p | Difference |
| overallAI | Equal variances assumed | 2.819 | 572 | .002 | .005 | 1.72363 |
| | Equal variances not assumed | 2.877 | 434.337 | .002 | .004 | 1.72363 |
| cognitive | Equal variances assumed | 3.119 | 586 | <.001 | .002 | .69320 |
| | Equal variances not assumed | 3.132 | 440.321 | <.001 | .002 | .69320 |
| behavioral | Equal variances assumed | .973 | 586 | .166 | .331 | .21404 |
| | Equal variances not assumed | .992 | 447.722 | .161 | .322 | .21404 |
| affective | Equal variances assumed | 2.671 | 586 | .004 | .008 | .67831 |
| | Equal variances not assumed | 2.720 | 455.416 | .003 | .007 | .67831 |

**Independent Samples Effect Sizes**

| | | Standardizer[a] | Point Estimate | 95% Confidence Interval Lower | Upper |
|---|---|---|---|---|---|
| overallAI | Cohen's d | 6.98871 | .247 | .074 | .419 |
| | Hedges' correction | 6.99789 | .246 | .074 | .418 |
| | Glass's delta | 7.15028 | .241 | .069 | .413 |
| cognitive | Cohen's d | 2.58497 | .268 | .099 | .437 |
| | Hedges' correction | 2.58828 | .268 | .099 | .437 |
| | Glass's delta | 2.59886 | .267 | .097 | .436 |
| behavioral | Cohen's d | 2.54898 | .084 | -.085 | .253 |
| | Hedges' correction | 2.55225 | .084 | -.085 | .253 |
| | Glass's delta | 2.60701 | .082 | -.087 | .251 |
| affective | Cohen's d | 2.95119 | .230 | .061 | .399 |
| | Hedges' correction | 2.95497 | .230 | .060 | .398 |
| | Glass's delta | 3.01612 | .225 | .055 | .394 |

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.