AI Literacy, Collaboration, and Future STEM Interests: An Informal Seven-Week Dual-Enrollment Presidential AI Challenge

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Abstract

As artificial intelligence (AI) becomes part of everyday life, preparing young learners to understand and use it responsibly is no longer optional. This study examines the impact of the IDEA-AI: Presidential AI Challenge, an intensive, project-based program designed for dual-enrollment high school students at Miami Dade College. Over a seven-week period, students worked in teams to design AI-informed solutions to real-world community problems. The program integrated foundational AI literacy, ethical reflection (including bias, privacy, and social impact), hands-on prototyping, design thinking workshops, mentoring, and optional industry micro-credentials. Using a structured post-program survey with retrospective pre/post items, we examined changes in students' confidence, understanding of AI concepts, teamwork experiences, and future academic interests. Findings suggest meaningful increases in students' confidence discussing AI, a stronger understanding of how AI can address community challenges, and greater awareness of ethical considerations in AI development. Students reported that collaborative prototyping—including exploratory "vibe coding" sessions—and mentoring strengthened both their technical understanding and communication skills. Importantly, participation also helped many students clarify or deepen their interest in AI, computer science, and related STEM majors. These findings provide insight into how informal, project-based AI programs can responsibly introduce AI education at earlier stages. By intentionally integrating technical learning with ethical awareness and community relevance, such programs demonstrate how AI education can balance technological competence with human-centered thinking. The model offers a practical framework for educators seeking to bridge secondary and higher education while preparing students for thoughtful participation in an AI-driven world.

Keywords: artificial intelligence literacy, project-based learning, dual enrollment, informal STEM learning, ethics in AI education, community-based learning

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Introduction

Artificial intelligence (AI) is increasingly shaping communication, healthcare, business, education, and everyday decision-making. As generative AI systems and AI-powered tools become more pervasive, educators and policymakers have emphasized the importance of preparing students to understand, evaluate, and use AI responsibly. Recent scholarship has argued that AI literacy should be considered a foundational competency rather than a specialized technical skill reserved only for advanced computing students (Casal-Otero et al., 2023; Ng et al., 2021).

AI learning experiences are most effective when they combine conceptual understanding with hands-on exploration, ethical reflection, and collaborative problem solving (Leisten & Toth, 2025; Lee et al., 2021). Rather than focusing exclusively on coding or technical implementation, contemporary AI education initiatives emphasize helping students understand how AI systems can be applied to real-world challenges and how AI technologies affect individuals and communities.

Informal and project-based learning environments may be especially valuable for introducing AI concepts to pre-college students. Informal STEM learning environments provide opportunities for experimentation, creativity, collaboration, and mentorship while reducing some of the pressure associated with formal academic assessment. For dual-enrollment students specifically, informal AI experiences may also serve as bridge opportunities that support early exploration of future STEM pathways.

The IDEA-AI: Presidential AI Challenge at Miami Dade College was developed as an informal, seven-week, project-based learning experience for dual-enrollment high school students. The program integrated AI literacy, ethical reflection, design thinking, collaborative problem solving, mentoring, and hands-on prototyping activities centered around community-based challenges. Students worked in teams to develop AI-informed solutions to real-world problems while exploring the social and ethical implications of emerging technologies. The program, and all of its components provided a useful context for examining how informal AI experiences may influence students' perceptions of AI, teamwork, and future STEM interests.

This study examines how participation in the IDEA-AI: Presidential AI Challenge influenced students' AI literacy, collaboration experiences, and future STEM interests. Specifically, the study explores students' self-reported perceptions of learning and development before and after participation in the program. This study was guided by the following research questions:

- **RQ1:** How does participation in an informal, project-based AI program influence students' AI literacy and ethical awareness?
- **RQ2:** In what ways does participation in the program influence students' collaboration and teamwork experiences?
- **RQ3:** How does participation in the program influence students' future STEM interests and academic intentions?

Program Overview

The IDEA-AI: Presidential AI Challenge was implemented at Miami Dade College as an informal, seven-week learning experience designed for dual-enrollment high school students interested in artificial intelligence, innovation, and community problem solving. The program emphasized applied AI learning rather than advanced technical specialization and was

structured to introduce students to foundational AI concepts in accessible and collaborative ways.

Students participated in team-based activities focused on identifying real-world community challenges and developing AI-informed solutions. Throughout the program, participants engaged in design thinking workshops, collaborative brainstorming activities, mentoring sessions, project proposal development, and hands-on prototyping experiences.

The instructional design intentionally combined technical exploration with ethical reflection. Students examined issues such as fairness, bias, privacy, and social impact while considering how AI systems may influence communities and everyday life. Rather than treating ethics as a separate topic, responsible AI considerations were integrated throughout the project development process.

The program additionally incorporated experiential learning activities using tools such as Google AI Studio, Teachable Machine, Figma, and collaborative design platforms. Exploratory "vibe coding" sessions encouraged experimentation, rapid prototyping, and creative engagement with emerging technologies.

Mentoring was also a central component of the program structure. Students received feedback and guidance from mentors throughout project development, allowing teams to refine ideas, troubleshoot challenges, and strengthen project proposals.

In addition to project-based learning activities, students had opportunities to complete optional industry micro-credentials related to AI and technology. These experiences were intended to support both skill development and future STEM exploration.

The program concluded with collaborative project presentations in which student teams communicated their proposed AI-informed solutions and reflected on the potential community impact of their work.

Related Work

AI Literacy in Pre-college and Informal Education

Recent scholarship has increasingly emphasized the importance of AI literacy for broader learner populations beyond computer science majors and technical professionals. Ng et al. (2021) describe AI literacy as a multidimensional construct that includes understanding AI concepts, evaluating AI technologies critically, recognizing ethical implications, and applying AI responsibly within society. Similarly, Whyte et al. (2024) argue that AI literacy initiatives should prioritize accessibility, ethics, and human-centered understanding, particularly for younger learners.

Growing attention has also been given to introducing AI education in K-12 and pre-college contexts. Wishart-Smith (2026) notes that AI education is increasingly moving toward interdisciplinary and socially grounded approaches rather than narrowly technical instruction. This shift reflects concerns that students must be prepared not only to use AI tools, but also to critically examine how AI systems influence communities, workplaces, and everyday decision-making.

Research on AI learning environments further suggests that students benefit from opportunities to engage with AI concepts through hands-on exploration and authentic problem solving (Lee et al., 2021). Rather than teaching AI solely through programming-intensive instruction, many recent initiatives incorporate design thinking, collaborative learning, prototyping, and ethical reflection. These approaches align closely with the structure of the IDEA-AI challenge.

Ethics has also emerged as a central theme in AI education research. Casal-Otero et al. (2023) argue that responsible AI education should include fairness, transparency, accountability, and social impact considerations alongside technical understanding. In the context of this study, ethical AI learning was integrated directly into students' project development process rather than treated as a separate instructional topic.

Project-Based Learning and Experiential AI Education

Project-based learning continues to be widely recognized as an effective framework for STEM and AI education because it situates learning within authentic and meaningful contexts. Recent work by Kokotsaki et al. (2016) highlights that project-based learning environments can improve student engagement, collaboration, communication, and deeper conceptual understanding when students work toward solving real-world problems.

Project-based learning additionally provides a framework for understanding collaboration within the program. Team communication, shared responsibility, collaborative experimentation, and peer feedback are not simply logistical elements of project work; they are core mechanisms through which learning occurs.

In AI education specifically, project-based and experiential approaches appear especially valuable because AI concepts can be highly abstract for novice learners. Leisten and Toth (2025) found hands-on AI education and first-hand experience at the level of the learner is when AI literacy is most effective. Experiential learning environments may also reduce intimidation associated with emerging technologies by allowing students to explore ideas creatively and iteratively.

The IDEA-AI challenge incorporated project-based learning through team-based problem solving, iterative design, prototyping, presentations, and mentor-supported feedback cycles. Students were asked to identify real-world community challenges and develop AI-informed solutions, reflecting recent recommendations that AI education should emphasize socially relevant applications rather than isolated technical exercises.

Informal STEM Learning and Interest Development

Recent STEM learning research emphasizes the importance of informal and out-of-school learning environments for supporting student engagement, interest development, and exploration of future academic pathways. Bell et al. (2009) argue that informal STEM experiences can help students connect STEM learning to personal interests, community relevance, and future aspirations.

Informal learning environments may be particularly important in emerging technology fields such as AI due to schools having limited formal AI curriculum opportunities. Short-term enrichment programs, camps, and challenge-based experiences therefore provide opportunities for students to experiment with AI concepts in accessible and low-risk environments.

Research additionally suggests that early exposure to authentic STEM experiences can influence students' future academic interests and confidence. Through engaging students in meaningful problem solving and collaborative learning, informal STEM programs help students better envision themselves participating in future STEM pathways (Dou & Cian, 2021).

In the present study, the IDEA-AI challenge functioned as an informal exploratory experience rather than a formal AI certification or technical training program. As a result, the study focuses on students' self-reported interest development, pathway clarification, and future learning intentions rather than long-term identity formation or persistence outcomes.

Dual-Enrollment and Transitional Learning Contexts

Dual-enrollment programs occupy a unique space between high school and college. Students are simultaneously developing secondary-level academic identities while encountering postsecondary expectations, disciplinary language, and possible career pathways (Taie & Lewis, 2020). For AI education, this transitional context is important because students may be ready to engage with emerging technologies but may not yet have access to formal AI coursework.

The Presidential AI Challenge therefore functioned as a bridge experience. It introduced dual-enrollment students to AI concepts, collaborative project development, ethical reflection, and future STEM possibilities in an informal setting. The related literature suggests that such bridge experiences can support early exploration and confidence-building, particularly when they combine authentic problems, mentoring, collaboration, and opportunities for students to see the relevance of STEM learning to their own futures.

Conceptual Framework

This study uses an integrated conceptual framework grounded in three established areas of scholarship: AI literacy, project-based learning, and informal STEM learning. These frameworks were selected because they correspond directly to the design of the IDEA-AI: Presidential AI Challenge and to the constructs measured in the student survey. The framework does not propose a new theory; rather, it applies existing frameworks to an informal, dual-enrollment AI education context.

AI Literacy Framework

First, Long and Magerko's (2020) AI literacy framework is appropriate because it defines AI literacy as the ability to understand, critically evaluate, communicate about, and use AI technologies in everyday contexts. Their framework emphasizes competencies such as recognizing AI, understanding what AI can and cannot do, interpreting AI outputs, and considering ethical implications.

The AI4K12 framework further supports this study by identifying core ideas that younger learners should understand about AI, including how AI systems perceive, reason, learn, interact, and affect society (Touretzky et al., 2019). These ideas map closely onto the MDC Presidential AI Challenge, which asked students to understand AI concepts, explore AI applications, and consider how AI-informed solutions could address community problems.

In this study, AI literacy is operationalized through survey items that assess students' self-reported understanding of what AI is, confidence discussing AI concepts, understanding of how AI can address real-world problems, awareness of ethical issues, consideration of social impact, and preparedness to use AI responsibly. This operationalization is intentionally broad since the program was designed as an introductory informal experience rather than an advanced technical AI course.

Project-Based Learning Framework

The second component of the framework is project-based learning. Krajcik and Blumenfeld (2006) describe project-based learning as an instructional approach in which students investigate meaningful problems, collaborate with others, produce artifacts, and develop understanding through sustained inquiry. This framework is applicable because the Presidential AI Challenge was structured around team-based problem identification, design thinking, prototyping, mentoring, and presentation of AI-informed solutions.

Project-based learning serves as the mechanism through which AI literacy was expected to develop. Students did not learn AI only through abstract explanation; they learned by applying AI ideas to community-centered design challenges. The survey items related to their defining of real-world problems, understanding AI components in prototypes, explaining project ideas, developing project specifications, and using prototyping tools are therefore interpreted as indicators of applied project-based learning.

This framework also emphasizes the study's focus on collaboration. In project-based learning, collaboration is not simply a classroom management strategy, it is a central learning process. Students build understanding through communication, shared responsibility, feedback, and iterative refinement. For this reason, survey items related to teamwork, communication, fair distribution of responsibilities, valued contributions, and mentor support are analyzed as part of the project-based learning environment.

Informal STEM Learning Framework

The third component of the framework is informal STEM learning. The National Research Council's (2009) framework for learning science in informal environments identifies multiple strands of informal science learning, including interest, understanding, participation, reflection, and identity-related outcomes. The National Research Council's later report on productive out-of-school STEM programs emphasizes effective informal STEM programs can support interest, engagement, learning, and future participation across settings (National Research Council, 2015).

The IDEA-AI program was informal, short-term, and exploratory and matches this framework component. The goal was not only to teach AI content, but to also help students explore whether AI and related STEM fields might be relevant to their future academic or career plans. Accordingly, the survey included items on college major interests, academic or career clarification, perceived usefulness of AI for future studies, influence on intended major, and interest in continued AI learning.

The study does not directly measure long-term STEM identity formation or persistence, instead, it examines early indicators of STEM interest development and pathway exploration.

This distinction is important because students' survey responses capture perceived influence immediately following the program, not long-term academic outcomes.

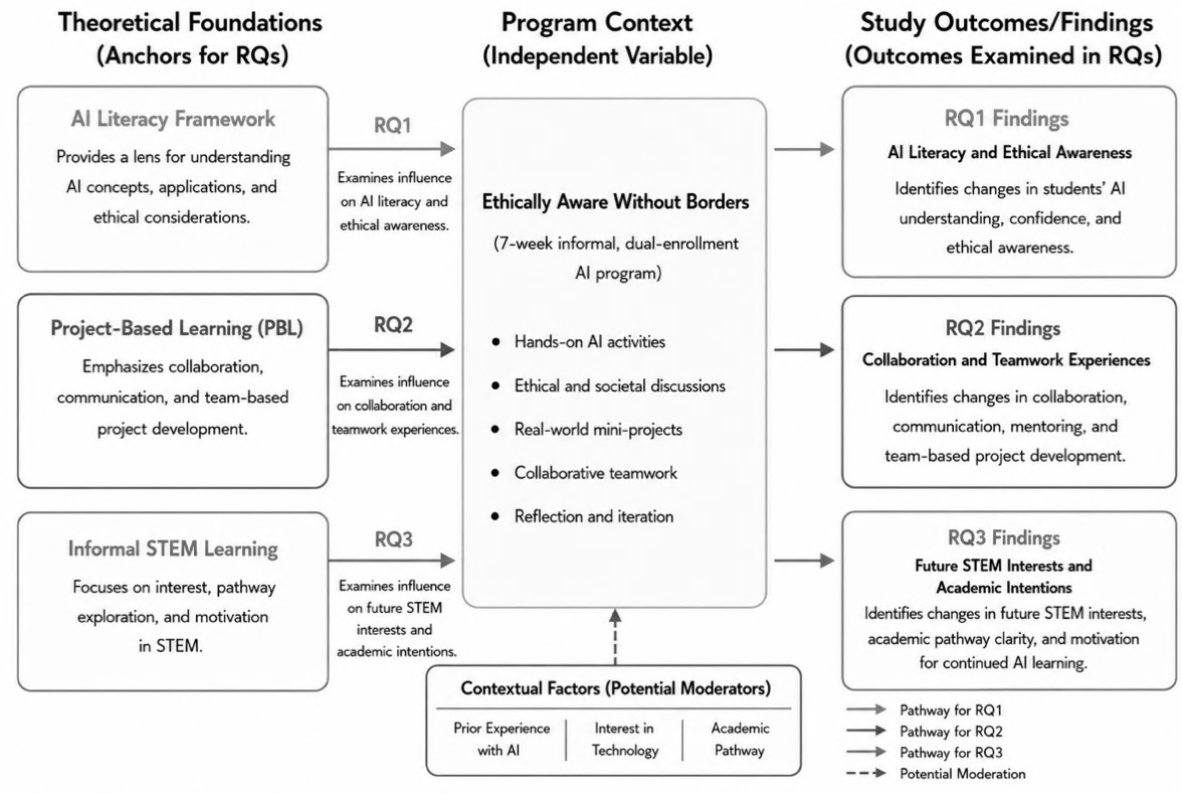
Integrated Application to the Present Study

Together, these three frameworks outline the logic of the study. AI literacy identifies the primary learning outcome; project-based learning explains the instructional mechanism; and informal STEM learning explains the relevance of students' future interests and academic intentions.

As shown in Figure 1, the framework aligns directly with the research questions. RQ1 is grounded in AI literacy because it examines changes in AI understanding, confidence, and ethical awareness. RQ2 is grounded in project-based learning because it examines collaboration, communication, mentoring, and team-based project development. RQ3 is grounded in informal STEM learning because it examines future STEM interests, academic pathway clarification, and motivation for continued AI learning.

Figure 1

Integrated Conceptual Framework for the IDEA-AI Study



This framework is particularly useful for interpreting findings from a dual-enrollment context. Students in the program were not full-time college students but were engaging with postsecondary learning experiences and future academic decision-making. The framework therefore positions the Presidential AI Challenge as a bridge experience supporting early AI literacy, collaborative learning, and STEM pathway exploration.

Methodology

Participants and Data Collection

Participants were 18 dual-enrollment students participating in the IDEA-AI: Presidential AI Challenge at Miami Dade College and represented learners at an important transitional stage between secondary and postsecondary education.

Data were collected using a structured post-program survey containing retrospective pre/post Likert-scale items and open-ended response questions. Survey items measured students' perceptions of:

- AI understanding and confidence
- Ethical awareness and responsible AI use
- Collaboration and teamwork
- Project development skills
- Mentoring experiences
- Workshop effectiveness
- STEM interests and future academic intentions

The retrospective pre/post design allowed students to reflect on perceived changes in understanding and confidence resulting from participation in the program.

Data Analysis

Descriptive analysis was conducted on quantitative survey responses to identify trends across constructs related to AI literacy, collaboration, and STEM interests. Open-ended responses were reviewed to identify recurring themes related to student learning experiences, challenges, and perceived outcomes.

Given the exploratory nature of the study and the relatively small participant group, the analysis focused on identifying patterns and trends rather than establishing causal relationships or statistical generalizability.

Results

Results are organized according to the three research questions guiding this study. Quantitative findings from retrospective pre/post survey responses are integrated with qualitative findings from open-ended responses to provide a more comprehensive understanding of students' experiences in the IDEA-AI: Presidential AI Challenge.

Participant Overview

Eighteen students completed the post-program survey. Participants represented students with varying levels of prior familiarity with artificial intelligence, STEM fields, and project-based learning experiences. Survey responses indicated that many students entered the program with interest in technology and innovation, although several participants reported limited confidence in discussing AI concepts prior to participation.

Most participants expressed interest in AI-related or STEM-related majors following participation in the program, including artificial intelligence, computer science, cybersecurity, engineering, and data science.

RQ1: AI Literacy and Ethical Awareness

The first research question examined how participation in the IDEA-AI program influenced students' AI literacy and ethical awareness. Overall, quantitative findings demonstrated positive shifts across nearly all AI literacy indicators. Students reported increased confidence discussing AI concepts, stronger understanding of how AI can address community challenges, and greater awareness of ethical considerations associated with AI technologies.

Understanding Artificial Intelligence

As shown in Table 1, students reported increased understanding across all AI literacy measures, with the largest gains in confidence discussing AI concepts and understanding of how AI can address community problems.

Table 1

Retrospective Pre/Post Responses on AI Literacy and Understanding

Survey Item	Pre: Agree/Strongly Agree	Post: Agree/Strongly Agree
I understand what artificial intelligence is	72.2%	94.4%
I understand how AI can address community problems	66.7%	94.4%
I feel confident discussing AI concepts	55.6%	94.4%
I feel prepared to use AI responsibly	61.1%	88.9%

Students' confidence discussing AI concepts demonstrated one of the largest shifts across survey items. Prior to participation, several students selected "Neutral" when asked about confidence discussing AI concepts. Following the program, nearly all students selected either "Agree" or "Strongly Agree."

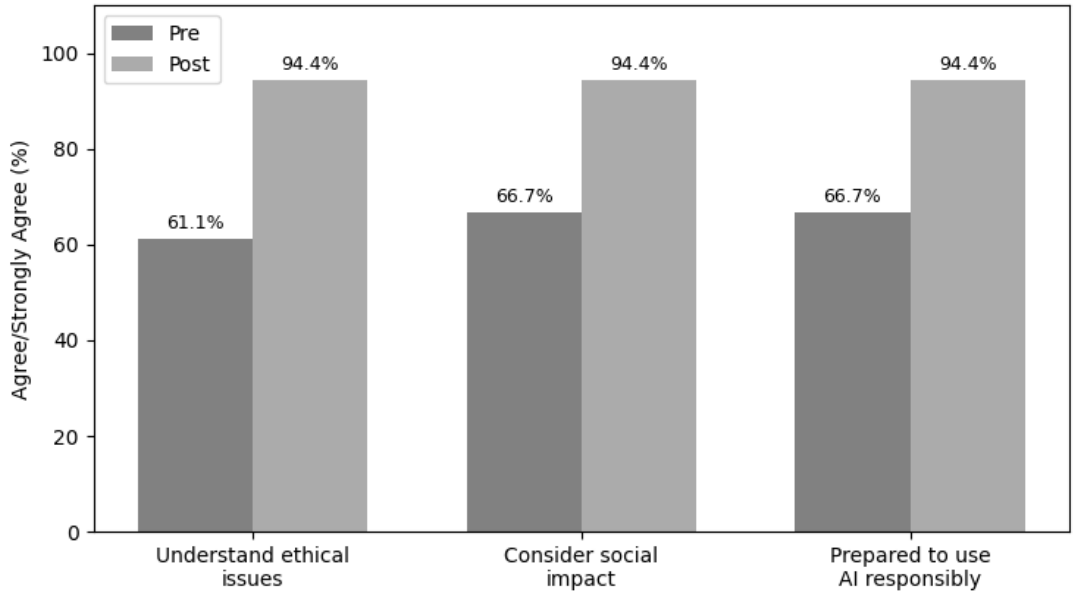
Similarly, students reported increased understanding of how AI can be used to address real-world community problems. The program's project-based structure appears to have helped students connect AI concepts to socially relevant applications.

Ethical Awareness and Responsible AI

As shown in Figure 2, students reported increases across all AI awareness measures, including fairness, bias, privacy, and social impact.

Figure 2

Retrospective Pre/Post Student Ratings of Ethical AI Awareness



Across these items, students reported stronger agreement following participation in the program. The largest change appeared in students' understanding of ethical issues related to AI, which increased from 61.1% to 94.4%. Students also demonstrated increased recognition that AI technologies have both technical and societal implications.

Qualitative findings reinforced these trends. Students frequently referenced ethical and community-centered motivations in open-ended responses. One student explained: "AI can be a deeply fulfilling tool to help society if used correctly." Another participant noted: "I learned that AI is not just about technology. It also involves understanding ethics, people, and the impact solutions can have on communities."

Several participants also described entering the program with limited understanding of AI beyond popular media representations. Following the challenge, students described AI as a practical and socially relevant tool connected to real-world problem solving.

One participant reflected: "At first I thought AI was mostly just chatbots and automation. Now I understand how AI can actually help solve community problems when designed responsibly."

These findings suggest that the program supported both conceptual and ethical dimensions of AI literacy.

Confidence in Learning Future AI Concepts

As shown in Table 2, nearly all students expressed confidence in learning more advanced AI concepts and interest in pursuing additional AI learning.

Table 2
Post-program Confidence in Future AI Learning

Survey Item	Agree/Strongly Agree
I feel capable of learning more advanced AI concepts in the future	94.4%
I am interested in pursuing additional learning related to AI	94.4%

These findings suggest that the program may have reduced anxiety associated with AI learning while increasing students' confidence engaging with emerging technologies.

Collectively, the quantitative and qualitative findings related to Research Question 1 indicate that participation in the IDEA-AI challenge contributed to increased AI literacy, stronger ethical awareness, and greater confidence engaging with AI concepts.

RQ2: Collaboration and Teamwork Experiences

The second research question examined how participation in the program influenced students' collaboration and teamwork experiences. Overall, findings suggest that collaboration was one of the strongest dimensions of the learning experience. Students consistently reported positive experiences related to teamwork, communication, idea sharing, and collaborative problem solving.

Teamwork and Communication

As shown in Table 3, students reported substantial improvements across all collaboration measures.

Table 3
Retrospective Pre/Post Responses on Teamwork and Collaboration

Survey Item	Pre: Agree/Strongly Agree	Post: Agree/Strongly Agree
I work effectively as part of a team	72.2%	94.4%
I communicate effectively with team members	66.7%	94.4%
I feel confident explaining project ideas	72.2%	100%
I can define a real-world problem suitable for an AI solution	55.6%	94.4%

Students additionally reported strong agreement with post-program items related to:

- Shared responsibility among team members
- Feeling that their ideas were valued
- Meaningful contribution to teamwork
- Learning AI concepts more effectively through teamwork

Students also viewed collaboration as important for strengthening communication and project development skills.

Mentoring and Collaborative Support

Mentorship emerged as a significant theme throughout both quantitative and qualitative findings.
Most participants agreed or strongly agreed that:

- Mentoring sessions provided helpful guidance
- Mentors were accessible and supportive
- Mentor feedback improved project quality
- Mentoring helped teams overcome challenges

Qualitative responses further illustrated the importance of mentor support. One participant explained: “Building a project that was applicable to the real world and getting personal feedback from mentors was the most valuable part.”

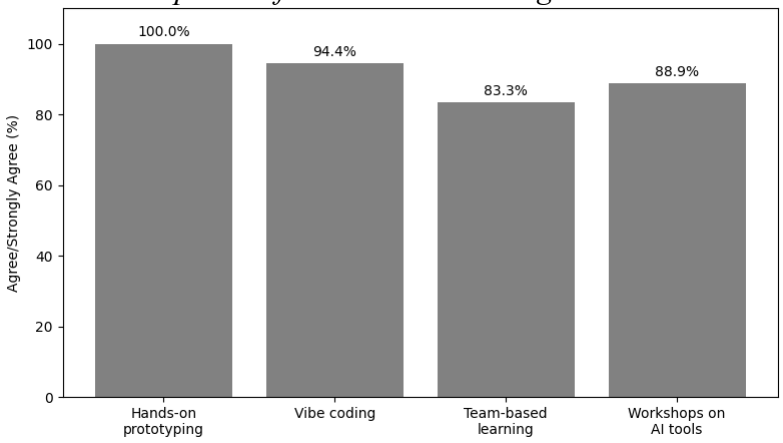
Another student noted: “The mentoring helped us improve our ideas and think more critically about how the solution would actually work.”

These findings suggest that mentoring functioned as an important scaffold supporting both collaboration and project refinement.

Hands-On Prototyping and Collaborative Learning

Figure 3 presents students’ perceptions of the program’s hands-on learning activities, including prototyping and exploratory “vibe coding” sessions, which were reported as highly valuable.

Figure 3
Student Perceptions of Hands-On Learning Activities



Qualitative responses indicated that students valued opportunities to experiment creatively and collaboratively. One participant stated: “The prototyping activities helped me understand AI better than lectures alone because we were actually building something.”

Another reflected: “Working with my team helped me understand different perspectives and improve our project.”

These findings suggest that collaborative and experiential learning activities played a central role in supporting student engagement and conceptual understanding.

RQ3: Future STEM Interests and Academic Intentions

The third research question examined how participation influenced students' future STEM interests and academic intentions. Findings suggest that the program contributed to increased interest in AI and related STEM pathways while also helping students clarify future educational goals.

STEM Interests and Academic Pathways

As shown in Table 4, students reported strong agreement with survey items indicating that participation influenced academic interests and future learning intentions.

Table 4
Student Perceptions of STEM Interests and Future Academic Pathways

Survey Item	Agree/Strongly Agree
The project helped me clarify my academic or career interests	88.9%
Learning about AI will be useful for my future studies or career	100%
Participation influenced my interest in my intended college major	83.3%
I am interested in pursuing additional AI learning	94.4%

Students additionally identified interest in majors and pathways including:

- Artificial Intelligence
- Computer Science
- Cybersecurity
- Data Science
- Engineering
- Information Systems Technology

These findings suggest that the program may have strengthened both awareness of and interest in STEM-related educational opportunities.

Community Relevance and Purpose

An important qualitative theme involved students connecting AI learning to community impact and social relevance. Several students described the value of developing projects connected to real-world needs. One participant explained: "I wanted to work on something that could actually help people in my community."

Another student noted: "The project showed me that AI can be used to solve meaningful problems, not just technical problems."

Students additionally connected AI learning to entrepreneurship, innovation, and future professional opportunities. One participant described having: "A deep passion for building real, tangible products using modern software and artificial intelligence."

Another explained that the challenge strengthened their interest in: “Creating tools to solve real and relevant problems.”

These findings suggest that students viewed AI not only as a technical discipline, but also as a socially meaningful and interdisciplinary field.

Overall Program Reflections

Students generally reported positive perceptions of the overall IDEA-AI challenge experience. Most participants agreed that:

- The program met expectations
- They would recommend participation to other students
- Workshops were useful and engaging
- The intensive format supported learning

Students particularly valued:

- Collaborative teamwork
- Mentorship
- Hands-on project development
- Exposure to real-world AI applications
- Opportunities to explore future STEM pathways

Collectively, the findings suggest that participation in the IDEA-AI challenge supported students’ evolving STEM interests, future academic aspirations, and understanding of AI as a socially relevant field.

Discussion

The findings from this study highlight several important considerations for informal AI education in dual-enrollment contexts. Rather than simply demonstrating that students reported positive experiences, the results provide insight into how project-based and ethically grounded AI learning environments may support early engagement with emerging technologies.

Interpreting AI Literacy Development

The increases observed across AI literacy and ethical awareness measures suggest that introductory AI experiences do not need to rely exclusively on advanced technical instruction to be meaningful (RQ1). Students appeared to develop stronger confidence and broader conceptual understanding when AI learning was connected to authentic community-centered problems.

This finding aligns with recent AI literacy scholarship emphasizing that students should understand AI not only as a computational tool, but also as a social and ethical system that affects communities and decision-making processes (Casal-Otero et al., 2023; Ng et al., 2021). The program’s integration of responsible AI discussions throughout project development may have helped students move beyond simplified or media-driven understandings of AI.

Importantly, the findings suggest that ethical reflection can be meaningfully integrated into introductory AI learning environments without requiring separate ethics-only instruction.

Students appeared to interpret ethical awareness as part of the design process itself, particularly when considering fairness, privacy, and community impact.

Collaboration as a Central Learning Mechanism

The study additionally suggests that collaboration functioned as more than a structural feature of the challenge (RQ2). Team-based learning, mentoring, and collaborative prototyping appear to have shaped how students engaged with AI concepts and project development.

This interpretation is consistent with project-based learning frameworks, which position collaboration, communication, and shared problem solving as central mechanisms for knowledge construction (Kokotsaki et al., 2016). In the context of this study, collaboration may have reduced some of the uncertainty associated with learning unfamiliar AI concepts by creating opportunities for peer discussion, experimentation, and collective exploration.

The role of mentoring is noteworthy. Rather than functioning only as technical support, mentors appeared to support reflection, idea refinement, and problem-solving processes. This suggests that mentorship may be particularly valuable in informal AI learning environments where students are navigating both technical and conceptual uncertainty.

Informal AI Learning and STEM Pathway Exploration

The findings further suggest that informal AI learning experiences may contribute to students' exploration of future STEM pathways (RQ3). Students' reported interest in continuing AI learning and considering AI-related majors reflects the broader role that informal STEM experiences can play in shaping educational aspirations.

Importantly, this study does not claim a seven-week experience determines long-term STEM persistence or identity formation. However, the findings do suggest that short-duration programs can influence how students perceive the accessibility, relevance, and social purpose of AI-related fields.

The dual-enrollment context may be especially important in this regard. Because students were positioned between secondary and postsecondary education, the program functioned as a bridge experience that exposed participants to collaborative college-level learning environments while allowing exploration of emerging technologies in lower-risk and more exploratory ways.

Students' emphasis on community relevance and socially meaningful problem solving is also significant. Many participants appeared to view AI not solely as a technical discipline, but as a tool connected to helping communities and addressing real-world issues. This finding reinforces recent calls for more human-centered and socially responsive approaches to AI education.

Implications for AI Education Practice

Several practical implications emerge from this study. First, informal AI programs may serve as effective entry points for introducing students to foundational AI concepts before formal college specialization. Second, combining ethical reflection with project-based learning may help students develop more balanced and socially aware understandings of AI. Third,

collaborative and mentor-supported learning environments may be especially important for novice learners who are encountering AI concepts for the first time. Last, dual-enrollment settings may provide valuable opportunities for connecting secondary students to postsecondary STEM exploration through accessible and interdisciplinary learning experiences.

Limitations

This study has several limitations. The participant group was relatively small and limited to one institutional context, which restricts generalizability. In addition, the study relied on self-reported survey responses rather than direct assessments of learning outcomes.

The retrospective pre/post design may also introduce response bias, as students reflected on prior understanding after completing the program. Future research could incorporate longitudinal approaches, interviews, or performance-based assessments to better understand how informal AI learning experiences influence student development over time.

Conclusion

This study examined the impact of the IDEA-AI: Presidential AI Challenge, an informal seven-week AI program designed for dual-enrollment high school students at Miami Dade College. The findings suggest that participation in the program supported growth in AI literacy, ethical awareness, collaboration, and future STEM interests.

Students reported increased confidence discussing AI concepts, stronger understanding of how AI can address real-world challenges, and greater awareness of ethical issues related to AI technologies. Collaborative learning experiences, mentoring, and hands-on prototyping activities were perceived as especially valuable components of the program.

The findings suggest that informal, project-based AI programs may help students clarify future academic interests and explore possible STEM-related pathways. By intentionally integrating technical learning with ethical reflection and community relevance, programs such as the IDEA-AI challenge can support more human-centered approaches to AI education.

As AI continues to influence education and society, there is growing importance in creating accessible learning opportunities that help students engage critically, collaboratively, and responsibly with emerging technologies. Informal dual-enrollment programs may represent one promising model for supporting early AI learning and future STEM exploration.

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