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WIP: Understanding Student Attitudes toward Artificial Intelligence (AI) in a First-Year Aerospace Engineering Course

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Work in Progress: Artificial Intelligence (AI) is increasingly framing aerospace engineering, however undergraduate exposure to AI applications in early coursework remains very limited. In a freshman level aerospace engineering course at a large research university, we explored students' perceptions of AI and their strategies for maintaining added value in the future with AI. To provide hands-on experience without requiring programming, we implemented simple AI activities using Google Teachable Machine and Quick, Draw! models. Students trained a simple image classifier to categorize a topic of interest in aerospace engineering and observe how AI models learn from visual patterns. The activities emphasized pattern recognition, model limitations, and the role of human supervision in engineering applications. Preliminary results from student reflections and post-activity surveys indicate increased awareness of AI's potential and limitations. This Work-in-Progress paper presents the design and implementation of the activity, summarizes early findings, and suggests plans for integrating AI experiences in the similar future courses.

Introduction

Higher education institutions are entering a new educational era in which Artificial Intelligence (AI) is present in many aspects of students' learning experiences[1][2]. Existing data indicates that a significant number of students already use AI in their academic work. According to the Higher Education Policy Institute (HEPI) survey of over 1000 undergraduate students, AI tool usage has jumped from 66% in 2024 to 92% in 2025 [3]. Another survey of 11706 undergraduate students between 2024-2025 across 15 countries reveals that 80% of students worldwide have used AI tools to support their studies [4]. However, despite this extensive adoption by students, AI literacy remains mostly absent from many engineering curricula. This gap is particularly critical for first-year engineering students, who have little to no prior coding experience and are beginning their academic journeys in a special time when AI is significantly transforming engineering practice[5][6][7]. The objective of this work is to introduce AI literacy through structured, in-class activities integrated into an introductory aerospace engineering course. These activities are designed to expose students to how AI systems operate without the need for coding, while also encouraging self-reflection on the potential and limitations of AI within the engineering context.

Methodology

This study was conducted in fall 2025 in an introductory aerospace engineering course in the department of mechanical and aerospace engineering at the University of California, San Diego. The course enrolled 100 students, primarily first-year students with a small portion of transfer students. The course covered a range of foundational topics that students will explore in greater depth in future courses, including aerodynamics, propulsion, flight dynamics, and orbital mechanics. In addition, the course included two hands-on projects: (1) building a glider and (2) designing and 3D printing an optimized carrier for a specific propeller–motor combination using CAD.

It should be noted this introductory course offers flexibility to expose students to topics that are important for their academic and professional development. The instructor used this opportunity to integrate AI literacy into the curriculum. The objectives were to assess students' baseline understanding and perceptions of AI and to guide them toward a deeper understanding about AI literacy which include discussion on what AI is, how it functions, and how it can be used responsibly in an engineering context. For this purpose, students completed a survey during the first week of the course to assess their initial understanding of AI. Then they participated in two in-class activities as a part of an AI literacy lecture in week 8 of the term and completed a final reflection survey. Students' responses to the first week survey, AI literacy lecture activities, and reflections are discussed in this study.

First Week Survey

During the first week of the course students completed a survey to capture their perspectives on the following questions:

1) As they start their journey in aerospace engineering, how do they hope to keep their unique values, skills, and perspectives as an engineer in the presence of AI?
2) Do they see AI as an opportunity, a challenge, or both in their career? Why?

The total number of N=95 students responded to this survey as icebreaker open-ended questions. The response analysis for each question will be discussed in the following section:

Question 1 Response Theme: How Can Engineers Remain Unique with AI?

Students' responses to this open-ended question were organized into thematic categories and ranked based on the frequency of each theme. The thematic responses are shown in Figure 1. The first dominant theme in responses was using AI mainly as a tool not a replacement to their learning. In above 70% of responses, AI has been considered as an additional tool for helping them to learn concepts or check their thought process, not a replacement to their critical thinking skills. This level of awareness among freshmen in the first week of the term was encouraging, especially given that the survey was conducted before any formal instruction on AI literacy.

Another high frequency theme (approx. 60%) was students' belief in the lack of human creativity, intuition, imagination, and hands-on experiences in AI which make humans unique compared to AI in the engineering field.

Moreover, many students (approx. 50%) valued critical thinking and deep learning to keep their values in the presence of AI. They recognized the importance of authentic learning and engaging in productive struggle to keep their skills unique in engineering practice.

Interestingly, around 35% of students mentioned personal discipline for limiting AI use in their academic work. Some terms they used in responses were: "won't use it unless needed", "don't rely on it." or "use it only to check"

Other scattered themes to keep their unique value in presence of AI were commitment to professional responsibility and maintaining ethics in their career (approx. 30%), expressing

anxiety and uncertainty about future of AI and their career (approx. 25%), and strong human interaction and social aspects of engineering (approx. 15 %). Several comments highlighted students' insights into human skills such as leadership and teamwork that cannot be replaced by AI. For instance, they mentioned that: "AI can't build relationships." or "Teamwork and leadership make us unique."

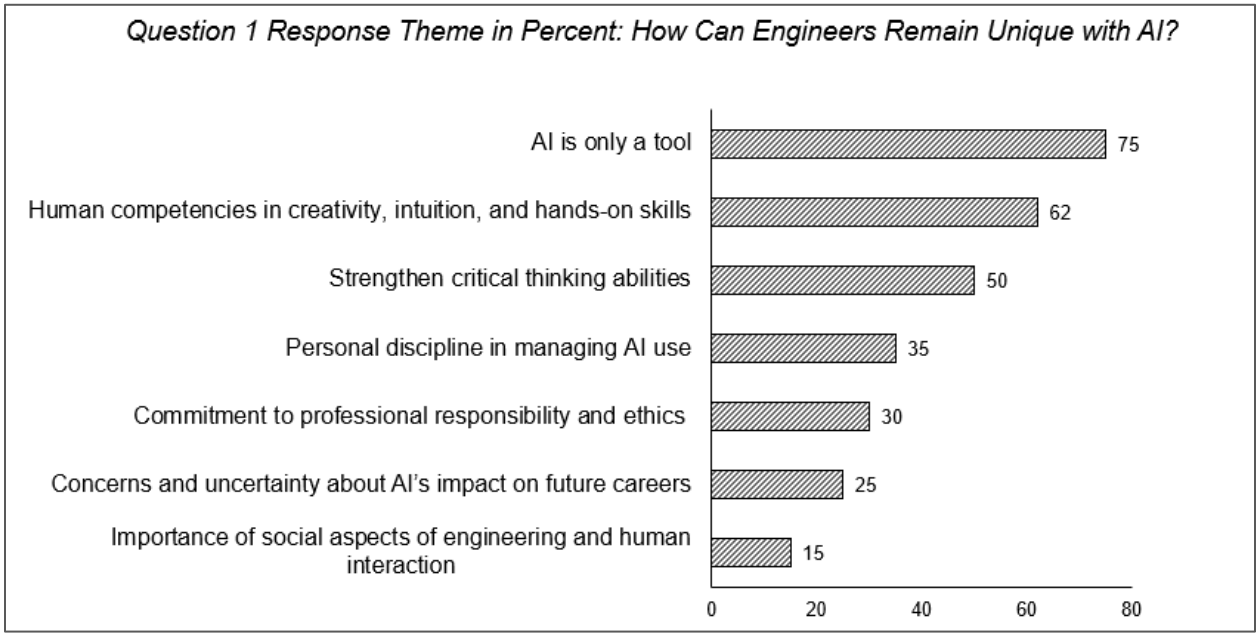

Figure 1: Thematic Response to the survey question: "How Can Engineers Remain Unique with AI?"

Question 2 Response: AI as an opportunity, a challenge, or both?

For the second question students showed a different perspective on AI. Half of students (approx. 50%) perceived AI as an opportunity, others (approx. 35%) saw it as both opportunity and challenge and fewer (approx. 15%) considered it more as a challenge. The key themes in students' responses are discussed here with representative comments from each category. Sample comments for the opportunity approach:

"AI is definitely an opportunity as it will help increase productivity by offloading much of the tedious work, allowing you to focus on the real problem solving."
"Opportunity because it can be used to fact check, but it shouldn't be the only reliable tool."
"I see AI as an opportunity to streamline calculations and cut down on development time."

Sample comments for both opportunity and challenge approach:

"I see it as both. It is an incredibly useful tool that can automate a lot of tasks that take humans a lot of time, and free them up to do things like actual innovation and critical thinking, but over-reliance on it is very dangerous and a slippery slope that needs to be monitored."

"AI will definitely be both. While it is an incredible opportunity to use it as a tool for research and many other ideas, it can be abused to generate answers and solutions that are wrong or dangerous."

Sample comments for the challenge approach:

"AI is more of a challenge because it's reducing the great ability of people to be engineers and be in the field."
"I see it as a challenge restricting me from being able to get my first internship and further training and careers."

AI Literacy Instruction

In week 8 of the term students were introduced to the concept of AI literacy using material adopted from TeachAI [8]. The lecture covered: A brief introduction to Artificial Intelligence, important terms like Machine Learning (ML), Deep Learning (DL), and Large Language Models (LLM), and Generative AI (Gen AI). Students then asked to complete a pre-activity survey, followed by two in-class activities on AI. The results for each part are presented here.

Pre-Survey Results Analysis

In the pre-survey activity students shared their prior familiarity with AI tools, their confidence in explaining how AI works, making decisions, and also human role in its training and supervision. A total of 65 students completed the survey, and their responses are summarized below. Responses to Likert-scale questions were measured on a five-point scale.

Student's familiarity with AI tools: 51 % of students indicated adequate familiarity (scale 4-5) with AI tools. Around 38% of students mentioned moderate familiarity (scale 3) while only 11% of students considered themselves not very familiar with these tools. The results suggest that AI tools are commonly adopted among students.

Confidence in explaining how AI works: students self-reported their confidence in explaining how AI makes decisions. Only 23% of students reported high confidence (scale 4-5). The remaining responses were distributed nearly the same between the other two categories: 40% of students expressed moderate confidence (scale 3), while around 37% reported low confidence (scale 1-2). These results suggest that while students have some familiarity with AI tools, relatively few feel confident explaining how these tools make decisions. These findings indicate the need for more instructional support about AI.

Human role: students were also asked about their perspective on the importance of human role in training and supervision of AI systems. The majority rated human role as essential (scale 4-5, 83%) while 10% considered it moderately important. Only a small percentage of students (6%) viewed the human role in training or supervision as not very important. The responses show the perceptions of freshman students about the importance of human role in training and supervision of AI systems.

How AI learns: finally, students responded to an open-ended question about how AI learns. The results showed that most students think AI learns primarily from large data sets, particularly human-generated data or internet-based resources. Pattern recognition also was another dominant theme, with students frequently describing AI as identifying patterns and trends in datasets. A few responses also demonstrated familiarity with machine learning mechanisms, such as model training. Several students suggested that AI learns from live user interactions or searches the internet, which reflects inaccurate understanding of AI learning processes.

Proposed Class Activities

After students completed the pre-survey, two short browser-based activities offered in class: For the first activity, students played with an online game called Quick Draw [9] individually and then they worked with Teachable Machine [10] in teams of 3-4 students to create a simple ML model.

In the *Quick, Draw!* activity, students interacted with the tool in which an AI model attempts to detect hand-drawn sketches in real time. This activity was used to introduce the idea of pattern recognition and to show how AI performance depends on the data it has been trained on.

In the second activity, students worked with Teachable Machine which allows students to train a simple machine learning model without coding. The tool allows the user to upload images in different classes, so the model can learn to recognize patterns associated with each class. For this activity, students were provided with images in several categories of aerospace vehicles: drones, fighter aircraft, rockets, and helicopters. They created multiple classes by uploading these images. Then they examined how accurately their trained model classifies a new input image. Also, they were asked to interact with the model by changing the number and quality of training images to observe and reflect on how it impacted their model accuracy and performance.

Post-Activity Reflection Survey

At the end of the lecture, students reflected on the two activities. The total number of 61 responses were collected for the post-activity survey. For Quick Draw activity, most students (85%) reported that the tool was able to recognize their drawings accurately, while approximately 15% indicated that the tool made errors in recognizing theirs. Students also mentioned the types of errors they observed: 41% reported misclassification of complex objects, 25% mentioned that the tool failed to recognize their drawings entirely, 23% reported no noticeable mistakes, and 11% noted misclassification of simple shapes.

When explaining the reasons for the tool's failure, most students perceive the model errors to limitations in their own drawing skills. A second dominant theme was the use of an insufficient training dataset. Students also identified a lack of diversity in drawing styles in the training data as a possible contributor to misclassification. Students also mentioned reasons such as visual similarity across categories and challenges in drawing abstract or complex subjects.

Similar questions were asked regarding the Teachable Machine activity. For this tool, students perceived the trained model as less successful overall. Only 20% of students reported that the

model consistently worked as expected, while 58% expressed that the model worked only sometimes as expected. The remaining 22% mentioned that the model rarely worked as expected or not at all.

Students also responded to an open-ended question to discuss the factors affecting the Teachable Machine model performance. 59% of students considered the lack of enough dataset as the most significant factor in model performance. The other 13% believed too much variation in input data as the main factor impacting model accuracy. The remaining 27% were scattered responses that mentioned reasons such as poor training examples, camera or environment issues as the main impacting factor on model performance.

When students asked how the Teachable Machine model could be improved, most students emphasized the need for additional training data. They suggested increasing the number of images per class, while others also focused on the significance of data diversity. Some responses indicated using varied angles, contexts, and more specific classes to enhance dataset design and improve the model performance. It should be noted that a smaller portion of responses expressed uncertainty about the model and suggested opportunities for scaffolding instruction in future iteration of this class activity.

Overall, based on students' feedback, 73% ranked human role as essential or very important for building the model, 18% moderately important, and 10% slightly important.

At the end of the survey students responded to an open-ended reflection prompt ("What did these activities teach you about AI limitations and the human role?") The responses were analyzed and the recurring themes with some representative comments are discussed in this section. Figure 2 shows the dominant themes in responses along with the frequency of each theme.

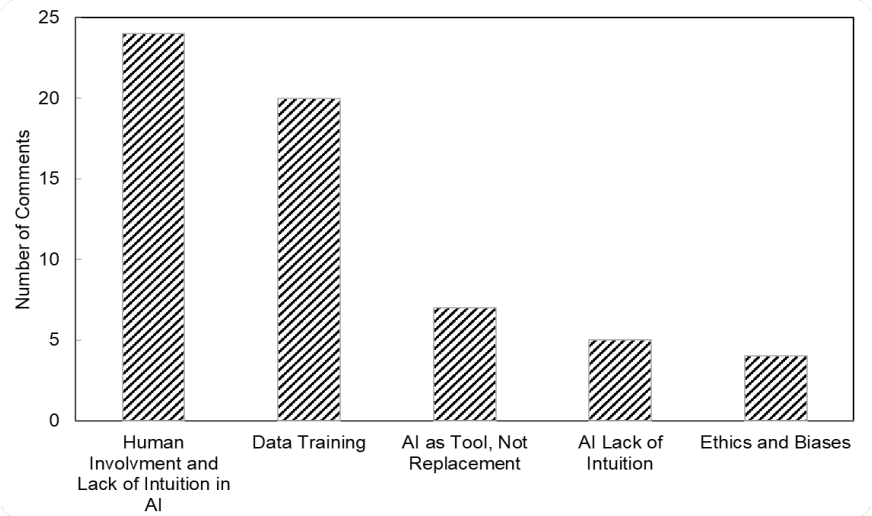

Figure 2: Thematic categorization of student responses to the question: What did these activities teach you about AI limitations and the human role?

The first theme was interesting as they indicated the need for continuous human involvement to initiate, lead, supervise and validate AI models. Some representative comments are quoted here:

“Humans must monitor and check AI to prevent it from making wrong assumptions.”
“Both have to be hand in hand, AI cannot work well single-handedly.”

The second theme was related to the importance of data quality and training in model accuracy and performance. Some example comments include:

“AI depends on the data it receives. Garbage in, garbage out.”
“AI needs lots and lots of data to be even slightly reliable.”
“AI is limited by how much data it consumes and how much it has to learn from.”

The other reflection themes were more scatted and included looking at AI as tools rather than replacements for humans, recognizing the lack of human cognition in AI, and noting the role of human responsibility and ethical values in shaping AI. The representative comments for these categories are shared below:

“The power of AI is ultimately left in humans’ hands.”
“Since humans organize and upload the database that trains the models there is always a bias that affects the AI model.”
“If taught incorrectly it can lead to false statements from the AI.
“AI doesn’t intuitively understand. It just recognizes patterns and guesses.”
“AI's primary limitations are its lack of true emotional intelligence, creativity, contextual understanding, and ethical judgment.”

Conclusion and Future work

This work in progress aims to introduce AI literacy to freshman aerospace engineering students by integrating in-class AI activities. Students’ reflections were thematically analyzed to understand their perceptions of AI literacy after the class activities. The results suggest that students understand the importance of human involvement and training data in the accuracy of AI models. Students also viewed AI primarily as a tool rather than a replacement for humans and demonstrated awareness of potential biases and ethical concerns. While these initial findings provide useful insights, they represent only an early stage of the study. Future work will extend this study to investigate how freshman students’ perceptions of AI evolve over time and to identify additional instructional strategies for engaging students in more freshman-level AI activities.

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