Teaching First-Year Engineering Students to Use GenAI Ethically: Surveys and Course Developments

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Overview:

November 22, 2022
OpenAI released ChatGPT

Spring 2023
Survey results: Some first-year engineering students are using ChatGPT for HW.
Course adaptation: Integrated ChatGPT into a final team project.

Fall 2023
Survey results: Greater use of ChatGPT.
Course adaptation: Integrated ChatGPT into more projects, with the intention of teaching students to use ChatGPT ethically.
GenAI and Education

“Artificial-intelligence tools present the greatest creative disruption to learning that we’ve seen in my lifetime”

Sarah Eaton, Academic Integrity Researcher & Associate Professor of Education, University of Calgary

https://www.chronicle.com/article/chatgpt-is-already-upending-campus-practices-colleges-are-rushing-to-respond
March 6, 2023
Potential Impacts of GenAI on Learning

Learning Enhancements
Asking conceptual questions
Exploring related ideas
Live, on-demand tutoring
Improve learning of difficult concepts

Learning Threats
Completing entire assignments
Copy and paste
Reduce recall practice
Reduce thinking

Academic Dishonesty
How will GenAI be used by undergraduate engineering students?

What we know about engineering school:

- Engineering students have high workloads.
- Some may feel pushed to choose the quickest path towards assignment completion to avoid failure.
- Some students sometimes choose academically dishonest ways to complete their work.
Theory: Ethical Decision-Making

• Awareness > Judgement > Intention > Behavior

• Judgement is based on individual factors like feelings and values

• Because we have not yet established Norms and Standards for GenAI, and the disruption of Norms due to COVID-19, we need to look at students’ incoming feelings and values to understand their ethical decision-making.

Survey 1: February, 2023

Participants: 52 students in ENGR 110 – Engineering Tools, Methods, and Practice I

Method: An in-class survey via Mentimeter (an anonymous, live survey platform), following a lecture on ethics and the engineering profession.

Have you tried ChatGPT on a HW assignment?

- Yes, I've tried it on a HW assignment: 8
- No, I've tried it, but not on a HW assignment: 8
- No, I haven't tried it: 34

If you tried it on HW, did it feel like cheating?

- Yes: 3
- No: 7
- I didn't try it on a HW assignment: 41

Survey 2: September, 2023

Participants: 455 students in ENGR 110 – Engineering Tools, Methods, and Practice I

Method: Blackboard survey, prior to any discussion of ethics or GenAI.

How much experience have you had interacting with ChatGPT?

- None (I've tried it a few times): 31%
- Minimal (I've tried it several times with a purpose in mind): 35%
- Moderate (I've used it regularly for specific tasks): 25%
- Expert level (I've used it): 7%
If some students are using ChatGPT on their homework, let’s teach all students to use it ethically.
Course Integration 1: Final Team Project, Spring 2023

Original Assignment:

Create a Python program that repeatedly offers the user a menu of three functions, performs whichever function is selected, and ends when the user enters “exit.”

Integration of GenAI:

1. Plan the menu structure
   • Identify input/output, loops, and branching structures needed
   • Plan the order of execution
2. Use ChatGPT to write the syntax
3. Compare the generated code with the original plan
4. Test the code
5. Write a code documentation file describing 1-4
Plan Example

Inputs:
- Point, latitude
- Point, longitude

Functions:
- `input(latitude1, long1)`
- `input(latitude2, long2)`
- `def functions(input function 1, 2, 3 or exit)`
- `while choice != exit`
- `do function` (Enter function again)
ChatGPT syntax Example

Appropriate functions

Appropriate loop

Different Sentinel

Good input location

Appropriate branching

New Function

Additional functionality
Course Integration 1 (Cont’d)

Python Program Functions:

Function 1: Unit conversion
Function 2: Rough distance calculation
Function 3: Haversine distance calculation

ChatGPT code:

Function 1: success
Function 2: failure
Function 3: success
Student Reflections

Students came to understand restrictions and limitations of GenAI through this applied assignment.

“ChatGPT is very strong at assisting in writing code. Using this can increase the speed you create programs and increase your knowledge.

We used ChatGPT as a code check, where we wrote code and asked it to duplicate what we had already written (or something similar). We noticed errors in the “code” that ChatGPT produced.”
Course Integration 2: Research Paper, Fall 2023

Original Assignment:

*Research a Grand Challenge of Engineering. Describe the challenge as well as 3-4 recent engineering solutions in a paper and video, citing relevant sources of information.*

Integration of GenAI:

1. Test the ability of ChatGPT to generate references
   • (It fails)
2. **Use ChatGPT for ideation**
3. Learn how to cite ChatGPT
   • Personal communication
   • In-text only
   • For example: (ChatGPT, personal communication, 2023-10-05)
Questions in class – a different conversation

“Can we use ChatGPT to edit our whole report?”
(yes, but remember to check it for correctness!)

“How would we cite that?”
(an explicit, in-text citation at the beginning or end of the report detailing how it was used.)

“What if we use it on one paragraph? How do we cite that?”
(write an explicit, in-text citation at the end of the paragraph.)
Ethical Decision-Making Theory

Ongoing work – Pre/Post Survey, Fall 2023

**Attitudes** toward GenAI tools

General Internet Attitude Scale* (adapted for ChatGPT).

**Trust** of GenAI tools

What is the likelihood that ChatGPT will generate a correct answer to this prompt: “What was the exchange rate between the dollar and the euro in 2006?”

**Ethics** of using GenAI tools

“It is ethical to use ChatGPT to complete entire engineering homework assignments.”

“It is ethical to use ChatGPT to write programming code in the engineering workplace.”

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Questions?