The Use of Chatbots in Engineering Including Critical Thinking and Problem Definition

Dr. Hugh Jack P. Eng., Western Carolina University

Dr. Jack is the Cass Ballenger Distinguished Professor of Engineering in the School of Engineering and Technology within Western Carolina University. His interests include robotics, automation, and product design.

Dr. Yanjun Yan, Western Carolina University

Yanjun Yan is an Associate Professor in Engineering and Technology at Western Carolina University. Her research interests include engineering education, artificial intelligence, swarm robotics, and statistical signal processing.

The Use of Chatbots in Engineering Including Critical Thinking and Problem Definition

Abstract

Recent developments in machine learning have impacted the professional and educational worlds. Most notably, chatbots like ChatGPT have made it possible to produce answers to complex questions and perform a limited set of professional tasks. While these tools are far from perfect, they can act as semi-competent assistants for engineers. We should expect these results to improve over time and allow engineers to produce more advanced work in a shorter time. However, this calls for an effective approach to work with AI while cultivating the ability to think critically and the ability to ask the right questions. Engineering educators are expected to adapt the pedagogies to educate students on how to use AI effectively and ethically.

This paper describes the use of chatbots in undergraduate courses to enhance student abilities with sample scenarios. A survey of student learning was conducted, which revealed that Chatbots supported programming courses the most. Meanwhile, such tools were effective as a starting point of developing a solution, while further verification and revisions by the students were essential. Interestingly, through such verification procedures, the students took on the role of almost a Teaching Assistant to assess and correct the flawed work of undergraduate AI students. This procedure put the students to learn in the metacognition mode, enhancing their learning. The faculty and students also acknowledged that the present AI tools still lacked the ability in complex system modeling, analysis, and calculation. Using such tools effectively requires the faculty and students to cultivate the skills in prompt engineering and critical thinking.

Introduction

Computer based Artificial Intelligence/Machine Learning (AI/ML) has been a subject of study for many decades. Early developments included symbolic [1] and connectionist methods [2]. Despite early setbacks [3], the field has flourished with the help of the attention of funding agencies, advent of ubiquitous computing, and consumer thirst for technology. Today we find ourselves in a highly connected environment where anybody can freely access relatively complex AI tools such as ChatGPT [4]. Given the accelerating history of technology adoption [5], we can expect it, as a consumer product, to reach saturation within a few short years. As a result, the freshmen starting our programs now, will graduate to professions where AI (in the interest of brevity the authors will use AI as a collective description including ML) tools are integral tools in the workplace. As educators, we must prepare them, as we prepare ourselves.

The situation we find ourselves in now has many parallels to the advent of the low cost scientific calculator [6]. Prior to the 1970s calculators were large and expensive. In 1972, Hewlett-Packard (HP) released the portable HP-35 calculator for $395, approximately equal to $3,000 in today's equivalent. By 1978 HP released a calculator for $60. Calculators were easier and faster to use than slide rules. They also provided functions that replaced lookup tables and nomographs. Calculators made it possible to work faster. Before calculators it was a point of pride to do multistep calculations in one's head and be able to approximate functions like logarithms. Some of this number sense was traded for the convenience of calculators. Over time we have seen similar issues with programmable calculators, laptop computers, the Internet, cell phones, etc.

AI has already found its way into the professional engineering toolbox. Examples of usage observed by an author include using ChatGPT to write a first draft of a summary, asking for a suggestion of circuit components, and interactive learning. On a larger scale the use of the tools has received media attention, e.g. [7]. In other words, many engineers have tried AI, they liked what it can do, and they plan to use it more. The proverbial genie is out of the bottle.

At [University] we have programs in Electrical and Mechanical Engineering, as well as Engineering Technology programs in similar disciplines. Each program has the standard technical core required for their disciplines. However, we add a number of multidisciplinary Project Based Learning (PBL) courses to prepare students for industry [8]. There are also a number of courses, such as programming, that mix students from multiple programs. In this paper we will consider students from multiple programs.

As of late, AI has been a vigorous topic of discussion among faculty at [University], as it has been at other schools. The topics range from 'how can we use it?' to 'how can we stop students from using it?' Discourse has shown that there is no consensus and that we need to know more. In the finest academic sense, some faculty have chosen to experiment with AI tools in teaching with the hopes of enhancing the education of their students. While some faculty have adopted a wait-and-see posture, while others have been actively trying to deal with AI based academic integrity violations.

The authors of this paper have chosen to deploy AI tools in some courses. The current tools, like ChatGPT, are heavily text oriented. This means that they have difficulty with technical figures, schematics, equations, free body diagrams, etc. However, they are well suited to describing common knowledge and programming. As a result, the first successful applications have been using AI as a programming tool. Students are still taught the syntax of programming and learn common programming patterns. However, when it comes time to construct full program, students are able to use AI to reduce tedium, confusion, and frustration.

Teaching Example

In a classical programming experience, students are taught the mechanics of the programming languages and given examples to exercise their understanding. Eventually they are tasked with constructing programs from a description. They are often encouraged to use structuring tools like flow-charts to organize their thoughts. Although many rush to program without a full understanding of the task or structure for the program. As a result they spend countless hours making semi-random modifications and rerunning the program in hopes that it will work. Aimless and endless debugging is the main reason many students develop a strong dislike of programming.

When teaching program development using AI, the focus is on teaching students how to write prompts. When they write the chatbot prompts (queries) they must understand the program function to get better results. Regardless of the query the students will get a program that runs, but rarely satisfies the homework problem requirements. They must then examine and think critically about the results. If they are close the students will look into the program to identify and fix issues. If the results are too far from the target, they are encouraged to reformulate their query and generate new code. This encourages the students to better understand the system instead of making random changes. Although the experiences vary, students spend more time with operational programs, and less time looking for delimiters and keywords.

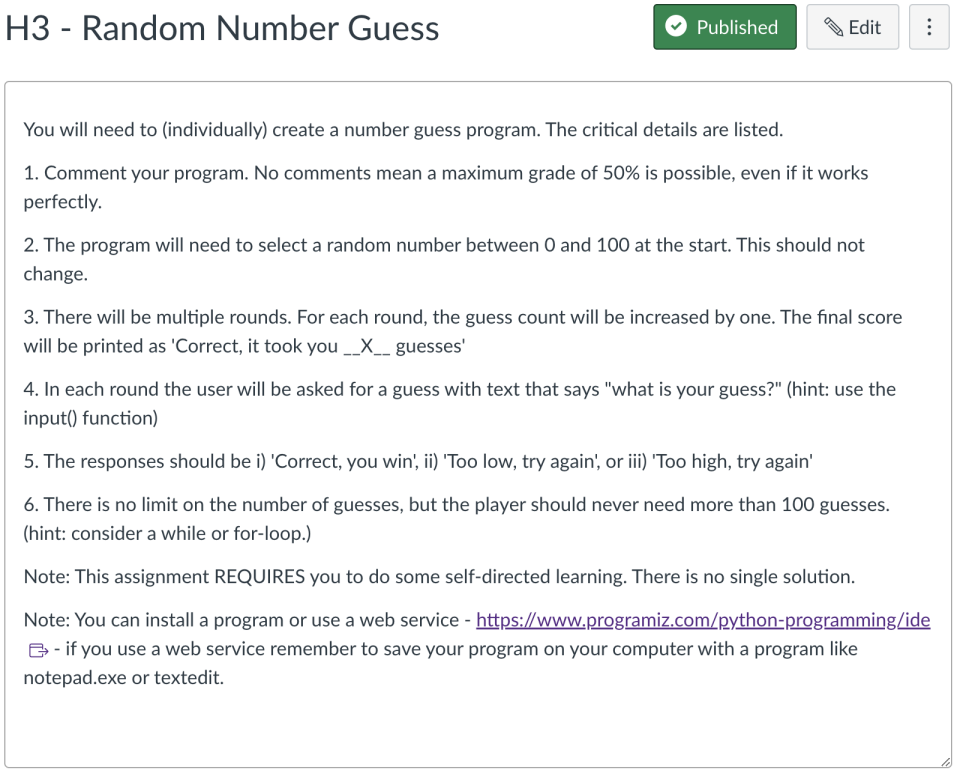

Figure 1 - A Python Programming Assignment

Consider the homework example in Figure 1. This was given to a second-year project class with students from all disciplines. Some students had learned to program in Matlab, but few had learned the required programming language, Python. The previous homework assignment required them to develop a program in Python to flash an LED with the Morse code pattern for 'SOS'.

When it was assigning in Fall 2023, ChatGPT would produce a working program, but it would not generate comments (it does now, 3 months later.) By requiring comments in a specific style, students were required to look at the program and understand it at a structural level. This was not a programming course. It was a project-based learning course where students needed to learn how to develop specifications for design projects.

A more detailed example of queries for a system flashing SOS can be seen in Figure 2. The full lecture notes can be seen in the notes for a Mechatronics lecture [9].

```
Query 1 - Write a program for an Arduino Uno that will vary the flash
frequency of an LED connected to Pin 13. The frequency should vary
between 100 Hz and 1 Hz every 20 seconds.
Query 2 - How can I connect an LED for this example?
Query 3 - My LED is not blinking, what should I check?
```

Figure 2 - Sample Queries asking ChatGPT to Generate an Arduino Program to Flash SOS

Within the same lecture students were shown how to design a more complex system to make cookies using an Arduino board. The queries are shown in Figure 3. The ChatGPT responses can be seen in the lecture notes [9]. Query 1 was used to get basic recipe/instructions for making a cookie. After some detailed discussion with the class Query 2 was created to implement the recipe. Please notice that during the discussion with the class we framed the system in terms of inputs and outputs, as well as process steps. ChatGPT responded with an expanded description of the system, but no program yet.

At this point ChatGPT understood the system and it was asked to write a program with Query 3. The resulting program implemented most of the required functionality, but was missing some important details. Query 4 asked for a missing function. And Query 5 asked for a critique of the program. The resulting program would require work to make the system function as desired. Query 6 and 7 were used to illustrate that additional steps, such as purchasing, are required in system design.

There are other teaching examples in multiple courses, but given the space limitation, they will not be presented here. Several common tips in using the AI tools effectively include stating the task as specific as possible, asking for clarifications and sources whenever relevant, and verifying the answers externally and using conversations to guide the output generation.

```
Query 1 - Problem: We want to make cookies with a very simple recipe
Query 2 - Problem: We will use an arduino to control a machine to make sugar cookies
       Assumptions:
              We will mix all of the ingredients at once dispensers pre-measure
              ingredients
              Egg shells are already removed
              The oven heats when the start button is pushed.
              When the stop button is pushed the oven is turned off and the baking
              cookies are allowed to finish
       OUTPUTS:
              Oven Heat
              Mix Bowl Contents
              Dispense Butter
              Dispense Sugar
              Dispense Egg
              Dispense Flour
              Dispense Baking Powder
              Dispense Vanilla Extract
              Dispense Salt
              Dispense Paper to sheet
              Conveyor on Eject Dough Ball
       INPUTS:
              Oven Hot - true when baking temp
              Start - get the process going
              Stop - halt the process and clear the oven Process
       Steps:
              Preparation: Preheat your oven to 375°F (190°C). Line a baking sheet with
              parchment paper.
              Creaming: In a large bowl, cream together the softened butter and
              granulated sugar until the mixture is light and fluffy. This should take
              about 2-3 minutes with an electric mixer.
              Egg and Vanilla: Beat in the egg and vanilla extract (if using) until
              fully incorporated.
              Dry Ingredients: In a separate bowl, whisk together the flour, baking
              powder, and salt. Gradually add the dry ingredients into the wet
              ingredients and mix until just combined.
              Forming Cookies: Using a spoon or your hands, take a small amount of
              dough and roll it into a ball, then flatten slightly to form a cookie
              shape. Place each cookie onto the prepared baking sheet.
              Baking: Bake in the preheated oven for 8-10 minutes, or until the edges
              of the cookies are lightly golden.
              Cooling: Allow the cookies to cool on the baking sheet for a few minutes,
              then transfer them to a wire rack to cool completely.
Query 3 - Write a C program to control the machine connected to an arduino uno
Query 4 - Write a function to dispense the ingredients
Query 5 - What important features are missing from the program?
Query 6 - Do you have any suggestions for a system that would mix the ingredients in a
single bowl?
Query 7 - Do you know any companies that supply industrial versions of this system?
```

Figure 3 - Queries for a Cookie Making Machine

Student Survey Results

To capture the opinions of students in the classes using AI programming tools, a survey was formulated and distributed. The survey was administered anonymously through Qualtrics after approval by the university human subjects review committee. Email was used for distribution, using lists composed of students in specific sophomore and junior courses. Approximately 100 students received the request for the survey and 17 provided complete responses. The raw results for the survey are provided in Appendix A. Of note, several students selectively bypassed the multiple-choice options but provided substantial comments. These were marked under the N/A category. A list of the survey questions, with summary points follows.

Question 1 - For/In which course(s) below that you have used ChatGPT (or other chatbots)? Choose all that apply. (Note: students could select more than one course)

(1 respondent) RAE 301 - Mechatronics

> An introduction to mechatronics with an emphasis on industrial applications. Topics will include sensors, actuators, wiring, controllers, programming, applications, and safety. The course will emphasize application of standards for controlling industrial equipment and products. 2 Lecture, 2 Lab.
> Prerequisites EE 200.

(4 respondents) EE 200 - Computer Utilization

> An introduction to the use of computers and computing methods to solve engineering problems.

(5 respondents) ENGR 200 - Engineering Practices and Principles II

> Engineering practices and principles, teaming, project planning, written communications, and conceptual design processes will be introduced through lecture and project-based learning activities. 2 Lecture, 2 Lab.
> Prerequisites A grade of C or better in ENGR 199.

(8 respondents) Declined to answer. The authors speculate that students wanted to ensure anonymity.

Question 2 - Indicate if you find ChatGPT (or other chatbots) useful for the following tasks: Literature survey, Problem definition, Coding support, Debugging, Report/essay generation, Solving homework/test problems, Answering non-homework problems, Project work

- This question focused on student's overall opinions of the usefulness of the tools.
- An inconsistent number of responses for this question category suggests a hesitancy to respond. Even though there were assurances of anonymity, some of these topics could be related to academic integrity. For example, 4 responded positively to 'it is helpful solving test/homework problems' while 7 responded positively to the question about the value of non-homework problems.

Question 3 - Feel free to share your comments on why you found ChatGPT (or other chatbots) to be helpful or not helpful for particular tasks that you answered above.

- Chatbots can be used to create outlines for writing or programming, but require additional student work to refine and extend.
- Students do not have confidence in complex problem solutions.
- Many students indicate they do not want to use it, or be required to use it.
- AI is useful as an editing and wordsmithing tool.
- It is a good starting point for exploring topics and answering simple question.

Question 4 - In the case that the answers provided by ChatGPT (or other chatbots) are not fully correct, what would you do with them?

- Most comments indicate a general distrust of the results.
- Many students generate a problem solution and expect to verify and correct.

Question 5 - Did ChatGPT (or other chatbots) help you or push you to cultivate the following skills? Problem-solving, Critical Thinking, Coding, Troubleshooting, Course content learning.

- This question asked about the value of specific tools. Notably, programming received a high level of positivity. There was a lower level of enthusiasm about solving general problems.

Question 6 - Have you used ChatGPT (or other chatbots) for other non-academic tasks?

- Students show a high level of interest in using the tools for learning. The authors speculate that this could become an option that supports self-learning the way that libraries and internet search engines have been used in the past.

Question 7 - Would you use ChatGPT (or other chatbots) in the future?

- The responses show that 7 of 17 respondents are enthusiastic about using chatbots in the future while 5 of 17 do not see the need for or want to use the tools. Given that the tools have been widely available for about a year before the survey, the level of support is quite high.

Question 8 - To what extent do faculty consider ChatGPT (or other chatbots) in other courses?

- A majority of students are in courses that use and/or require AI use.
- A majority of students are in courses that discourage the use of AI.
- There is a lack of instruction in ethical usage.

Question 9 - Feel free to share some comments on why or why not you want to use ChatGPT (or other chatbots) in the future.

- Students question the value to support learning and feel it may reduce their learning.
- The responses that focus on AI reducing the rigor of education are encouraging to faculty and illustrate honest student motivation.

Question 10 - Have you used any online services, such as ChatGPT (or equivalent), to get help on homework and/or exams?

- A majority of students have not used chatbots to help with tests and homework.

Question 11 - You answered that you used online services. Could you explain a bit why you decided to use that? How did you use it? Did it help? Was it allowed?

- It is helpful for finding starting points to problem solutions and weriting.

Question 12 - Do you have any concerns about integrity and fairness issues for yourself and others when using ChatGPT (or other chatbots)? Please explain. Do you have any suggestions?

- There are concerns it allows cheating (and isn't fair.)
- Some students think it will make their tests and homework more difficult.
- Some students view it as another professional tool.
- The shortcomings are many.

Faculty Opinions

An anonymous survey of faculty was administered but the number of responses was too small to be statistically significant. The survey was distributed to 23 faculty via email under IRB, and only 3 responded. The reason for the low response rate was because not all 23 faculty members had adopted AI in their classrooms. Only the faculty members who had adopted them responded, as the survey was about faculty practices but not faculty perceptions. However, despite the limited number of responses, their comments do inform the discussion and are summarized to complement the authors' statements in this paper. The limited number of faculty that chose to respond were positive. Anecdotally this suggests that at least 20%, probably much more, of the faculty are actively using chatbots in teaching. Student opinions make it clear that students are concerned about academic integrity and want the use of the tools to be fair. Naturally, faculty have these concerns too. A summary of their opinions follows….

- [ChatGPT] helped with writing, information gathering, and searching through tutorials, etc. As to specific coding exercises, the accuracy of the returned results may depend on how the prompt is written, if the problem is a well-defined one, and so on.
- It's quite obvious when ChatGPT materials are student submitted because:
    - 1) the resultant code is nonfunctional, yet well commented
    - 2) the student lacks an appreciable understanding of the problem solved
- [Use of these tools] may depend on the course level and content. We do want our students to master a solid background to be able to tell the correct information from incorrect information, to use such tools with critical thinking.
- I allowed [my students to use online services], but the students must demonstrate their own thinking to reach the correct answer, as the given answers may not be correct at all, and the students should be able to find resources to support their conclusion.
- They used online services because they wanted the answer, versus learning.
- We want to prohibit cheating and plagiarism. Perhaps using open-ended questions will help prevent misuse. Not all students can pay for the service so their answers might not be as good as the ones from the paid service. We could perhaps share the results from a common prompt as a common starting point for the class.
- Students are welcome to use any tool they can successfully leverage, that's the engineering approach.

Not all opinions presented above are accepted by all the faculty. Like any pedagogy, the adoption of AI tools has its pros and cons, depending on the course content, the student maturity, and the faculty comfort levels. Faculty practices and perceptions of AI tools are evolving, together with the development of the AI tools.

Conclusion

Based on inconsistent response rates for certain questions there are indications of student concern about academic integrity. Additional work is required on student perceptions of academic integrity issues surrounding AI tools. Suitable solutions will allow expanded use of tools like ChatGPT in education and professional work. This is consistent with the trend in the literature.

Programming seems to have one of the highest support rates, and faculty opinions support this view. There is also interest in using the tools for problem-solving, but currently, the tools do not have the ability to deal with complex system modeling, analysis, and calculation.

Students seem to primarily be using AI as a way to start developing problem solutions. They will spend time verifying and correcting the solutions. An interesting analogy is that our students are becoming the equivalent of Teaching Assistants assessing and correcting the flawed work of undergraduate AI students.

Observations of the authors and anonymous faculty respondents include,

- Students must learn to pose questions to get useful results.
- Results are rarely 'correct' and require the students to critically review the solution for suitability as an answer.
- The students' homework and test roles change from executing basic problem-solving steps to defining problems and critical review of solutions.
- ChatGPT and similar tools are a thread to the education process that focuses on problem solving details.
- There are mixed opinions about the value of the tools in education. i.e., we are far from a consensus.
- The tools will improve and provide better results. Additionally, the tools will add more capabilities for technical topics like orthographic projection, circuit modeling, system modeling, data analysis, symbolic mathematics, component selection, etc. These tools are already beginning to appear in routine software and hardware.

Chatbots, and what will come next, increases the importance of critical thinking. Students will need to learn to work at higher levels. Professionals will use the tools to accelerate routine tasks. Faculty will need to learn how to prepare students for the new professional normal. This will not be easy and our professional approaches are being disrupted.

References

[1] Turing, A. M. (1950). Computing machinery and intelligence. Mind, 59, 433–460.
[2] Rosenblatt, F. (1958). The perceptron: A probabilistic model for information storage and organization in the brain. Psychological Review, 65(6), 386–408.
[3] Minsky, M., Papert, S. (1969). Perceptrons: An Introduction to Computational Geometry. Cambridge, MA, USA: MIT Press.
[4] T. Wu et al., (2023). "A Brief Overview of ChatGPT: The History, Status Quo and Potential Future Development," in IEEE/CAA Journal of Automatica Sinica, vol. 10, no. 5, pp. 1122-1136, May 2023.
[5] McGrath, R., "The Pace of Technology Adoption is Speeding Up", Harvard Business Review, Sept., 25, 2019, accessed 02/08/2024 - https://hbr.org/2013/11/the-pace-of-technology-adoption-is-speeding-up
[6] Hochman, A., "Math Teachers Stage a Calculated Protest", The Washington Post, April 3, 1986.
[7] Dreibelbis, E., "Samsung Bans ChatGPT After Engineers Use it to Fix Proprietary Code", PCMag, last accessed 02/08/2024 - https://www.pcmag.com/news/samsung-bans-chatgpt-after-engineers-use-it-to-fix-proprietary-code
[8] Reference omitted for blind review - it will describe the PBL core of the university
[9] Reference details omitted for blind review - https://docs.google.com/document/d/1TSMwSS4IWPHSg-qUNB34VgV_bFw8M3RW514wbrQDtuA/edit

Appendix A - Student Survey Questions and Responses

These questions were administered through Qualtrics using a survey approved by the university human studies review board. The survey was anonymous.
Note that some of the student comments were edited for minor spelling and grammar errors for clarity.

Q1. For/In which course(s) below that you have used ChatGPT (or other chatbots)? Choose all that apply. (Note: students could select more than one course)

5	ENGR 200 - Engineering Practices and Principles II
1	RAE 301 - Mechatronics
4	EE 200 - Computer Utilization
8	N/A

Q2. Indicate if you find ChatGPT (or other chatbots) useful for the following tasks:

Q2.1 Literature survey

It helped a lot	okay	It wasted my time	N/A
3	2	0	12

Q2.2. Problem definition

It helped a lot	okay	It wasted my time	N/A
1	6	0	10

Q2.3. Coding support

It helped a lot	okay	It wasted my time	N/A
3	5	2	7

Q2.4. Debugging

It helped a lot	okay	It wasted my time	N/A
3	4	2	8

Q2.5. Report/essay generation

It helped a lot	okay	It wasted my time	N/A
2	2	1	12

Q2.6. Solving homework/test problems

It helped a lot	okay	It wasted my time	N/A
0	4	1	12

Q2.7. Answering non-homework problems

It helped a lot	okay	It wasted my time	N/A
2	5	0	10

Q2.8. Project work

It helped a lot	okay	It wasted my time	N/A
1	6	1	9

Q3 Feel free to share your comments on why you found ChatGPT (or other chatbots) to be helpful or not helpful for particular tasks that you answered above.

- I don't use it.
- The greatest success I've had in using ChatGPT is with **creating layouts for essays**. I would supply my notes and my essay prompt and it would organize my notes into bullet points in a layout. I have had little success in ChatGPT with coding solutions. It gives wrong answers frequently which **still require coding knowledge to debug**.
- I have never used ChatGPT and don't plan to unless instructed to, which I hope is never a requirement.
- I found ChatGPT helpful in **formulating pretty much anything that is written** such as reports or just an essay. I use it to get me started and point me in the right direction for what might work out. However, I do not use it for solving problems as I often ask insanely complicated things and it only confuses me more as it tends to be wrong.
- I haven't used any ai chatbots
- It was useful for **get a "first draft" of code**. The code it provided needed to be debugged and edited. Some knowledge of code was needed.
- I've found ChatGPT to be useful for **paraphrasing** statements. It is able to take in a paragraph and paraphrase it in multiple ways quickly which can then be chosen from and edited further. It also helps with title alteration as it can quickly spit out several different wordings of a title which can be choose from.
- Haven't had a chance to explore chat gpt yet/ never signed up
- I do not use the ChatGPT.
- I used more as a **dictionary**. It helped me breakdown a term or subject by explaining with non technical terms.
- I found chatbots helpful as they were able to **find problems in my code** that I wasn't able to find.
- I use AI to search for complex information faster. I find that AI is usually good at giving a direct and straight forward answer in moments. It means I don't have to scour through a few dense articles to **find the information I need**.
- This semester was the first time I had ever opened up ChatGPT. The professor I had ENGR 200 encouraged the class to utilize this resource for coding help and project ideas/brainstorming. I found it incredibly helpful with coding.
- We were encouraged to use them in class and it was very helpful as a tool. Not for doing the work, it took me a while to understand it on how it can be used as a tool such as a calculator. Such as debugging and outlines were for helpful for me to fix my code and **see the larger scope of a assignment** if I got stuck. It really **just made work quicker**.

Q4. In the case that the answers provided by ChatGPT (or other chatbots) are not fully correct, what would you do with them?

- I would always make sure to know what it's giving back to me.
- When I've used it for coding, it usually gives me the wrong answer. I usually **give up using it after that**.
- I have never used it because **I do not trust the response**.
- Retry to ask the question again
- I like to take a look at the steps as it does a very good job of explaining how it gets the answer, even if it's wrong. **I like to see how my work compares to that of ChatGPT and then I try to improve my solution, or sometimes I would ask how to approach a problem rather than it solving it for me, which gives me more steps to look at**.
- N/A
- I would have to debug the code myself to make sure it would work.
- I haven't used it for anything that would really be considered an answer.
- I would ask again with more details and then I would google my question
- I would go in and **fix the errors myself**.
- If a chatbot spits out an incorrect answer is I look for the answer independently. If it spits out a partially correct answer, **I do research on the topic independent of the chatbot and correct/add to the answer**.
- I would test the provided codes and communicate with the AI when the code would not work to help narrow in on the issue.
- I would search for the answers using google to **double check the AI**.
- I would use my existing knowledge to see what it changed or how it is off. Usually it is, so I would do more research on the topic if I'm not understanding it and then make a prompt to help me on something such as code. Where I will tell it to use this example code I found in the internet to help with further troubleshooting.

Q5. Did ChatGPT (or other chatbots) help you or push you to cultivate the following skills?

Q5.1. Problem-solving

ChatGPT enhances	ChatGPT is okay	ChatGPT prevents	N/A
1	5	2	9

Q5.2. Critical thinking

ChatGPT enhances	ChatGPT is okay	ChatGPT prevents	N/A
3	6	1	7

Q5.3. Coding

ChatGPT enhances	ChatGPT is okay	ChatGPT prevents	N/A
4	6	1	6

Q5.4. Troubleshooting

ChatGPT enhances	ChatGPT is okay	ChatGPT prevents	N/A
5	4	1	7

Q5.5. Course content learning

ChatGPT enhances	ChatGPT is okay	ChatGPT prevents	N/A
2	5	2	8

Q6. Have you used ChatGPT (or other chatbots) for other non-academic tasks?

3	Resume building
2	Artistic creation
2	Cover letter drafting
5	Learning a new topic that I am interested in
1	(Other - write-in) Finances

Q7. Would you use ChatGPT (or other chatbots) in the future?

7	Absolutely!
5	I don't mind, either way.
5	I don't see the need to use it or I don't want to use it.
0	I wish that it was not invented.

Q8. To what extent do faculty consider ChatGPT (or other chatbots) in other courses?

Q12.1. Discouraged or not allowed

All classes	Some classes	No classes	N/A
3	10	2	2

Q12_2. Encouraged or required

All classes	Some classes	No classes	N/A

0	10	4	3

Q12_3. Teach how to use it

All classes	Some classes	No classes	N/A
0	6	8	3

Q12_4. Teach ethical use

All classes	Some classes	No classes	N/A
1	4	8	4

Q12_5.Use it during lectures

All classes	Some classes	No classes	N/A
0	6	8	3

Q9. Feel free to share some comments on why or why not you want to use ChatGPT (or other chatbots) in the future.

- I will use ChatGPT **when it gets better** at coding solutions for creating web-based portfolios.
- While I could see it being a tool for helping achieve certain tasks more rapidly and possibly even more precise, **I don't believe it helps develop a learning and inquisitive mind**, which I feel is the whole point of university.
- I see the benefits in using this only as a tool and not for it to do it all for you. If it is used to guide you on the right path and you are learning from it, don't stop and keep using that to your advantage. If you are asking hey "Does this sound good in a resume?" go for it. However, if you are having it do everything for you, then there is no point as you are only putting yourself in a bad position.
- It is good at **helping with small tasks** that you would usually have to get colleges together on to provide input. It just helps speed along the process of editing and refining. It however, is very noticeably not a full substitute
- Haven't had the chance to use it yet. However, **I like to check answers**/ be sure about the information I report. Doing the research/ homework first hand ensures that I understand the information. However, I think that ChatGPT could be a useful tool I just haven't had the chance to really try it out in a way that wouldn‚Äôt harm my learning process.
- I have chosen not to use the tool. I consider it contradictory to my primary purpose for being in the EE program (i.e., learning).
- ChatGPT is a great resource but it limits creativity and out of the box thinking since its a readily available resource.
- The reason why I don't want to use chatbot in the future is that chatbots don't actually comprehend the subject being discussed. They are simple designed to make a

conversation. For instance, if you ask a chatbot to design a rocket engine, it will draw on various images of rocket engines to create a response that looks like a rocket engine, but is nonfunctional. The chatbot doesn't know that to make a rocket, you have to mix a fuel with an oxidizer, light it, and expel it out of a nozzle to produce thrust.

- Because coding is its own language and varies depending on the chosen platform, I believe that it is a **valuable tool for engineers and technologists to use when writing code** would help in their work or research to aid in data analysis, robotics, etc.

Q10. Have you used any online services, such as ChatGPT (or equivalent), to get help on homework and/or exams?

Yes	No
6	9

Q11. You answered that you used online services. Could you explain a bit why you decided to use that? How did you use it? Did it help? Was it allowed?

- I've used it only for **creating essay outlines**. It helped because for me that's the hardest part of getting started on an essay.
- Didn't understand the problem or was **stuck trying to figure something out**.
- I have only used it for homework and help me with reports. I have never asked for it solve a problem, but rather **how to approach a kind of problem**. As for reports, it is very nice to see what it comes up with versus what I came up with, **compare things**, see what works on that one versus what works on mine and then come up with a final well developed report, again, **its a tool** to help you be a better engineer.
- I used it for homework to **explain complicated topics in a simpler manner** with less technical terms.
- There was an error in my code that I could not understand and was unable to easily find useful information on the topic online. I had **plugged both my code and the error message in the AI**. Yes this teacher had encouraged the use of chatbots

Q12. Do you have any concerns about integrity and fairness issues for yourself and others when using ChatGPT (or other chatbots)? Please explain. Do you have any suggestions?

- I feel like it's going to **cause exams to be tougher** so that it can't be used. I don't use it and wish that it wasn't used but we can't have it all.
- I only have concerns for essay writing with ChatGPT as it's **easy to cheat using chatbots**. More complex things either need better prompting or are not as fleshed out, and therefore less helpful.
- if my classmates are using it, they might have an unfair advantage against those that are not using it.

- I do think is not fair to me and other students if others use it purely for getting answers and getting good grades. There is really no good way to stop that but I think if we had **seminar on good use vs. bad use** of this chatbots then it could be really helpful to prevent such things.
- I feel that even though I don't use it, **well structured homework and exams wouldn't be effected greatly by the use of ai**
- In this particular discipline, not really. It's a tool just like any other (mathway, symbolab etc) and when used responsibly it should just augment learning. I don't feel like we really do anything in the engineering department that it could be outright used to cheat with.
- So far, I have continued to not use ChatGPT for my work because personally working through problems is how I learn best. I know that other students are currently using it without gaining the knowledge of several courses however that is their own personal decision. I don't really have an issue with the use of ChatGPT because all students have to learn the material in order to complete exams.
- I consider the tool to be deleterious to learning and intellectual growth. I am not here to use a tool that essentially removes the need to think.
- I used it for homework which as itself is a learning tool and I do not have concerns about integrity or fairness issues. Using it for exams would create integrity issues.
- I am not particularly concerned about academic integrity issues with chatbots since frankly, chatbots are pretty stupid. Which means that if a student uses one while designing a product, the student still has to do the heavy lifting to make what the chatbot spits out work. Also, if a student uses a chatbot to write an essay, it is easy to detect since the chatbot doesn't have the same mannerisms and patterns that the student has, this makes it easy to spot in an essay, and the chances of the chatbot being wrong are high.
- It worries me that students use this to write essays or cheat on their assignments
- In my opinion, **i think its a tool**. Nothing that will replace the work but something to make work easier. I think if someone is using it as a tool to further their knowledge I'm totally for it.