

*Can Artificial Intelligence Be Used as a Tutor to Improve Student Performance  
in a Technical Writing Class?*

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**Abstract**

The utilization of artificial intelligence in language modeling has seen a significant rise in recent years, particularly in the area of text generation. One of the most prominent models in this field is ChatGPT3. This study aims to assess ChatGPT's ability to provide feedback on college-level technical reports. The research tested three different control groups, one was ChatGPT, the other was a student who barely worked with ChatGPT, and one who took it step by step with ChatGPT. Several different technical report writing assignments and projects were assigned to ChatGPT to evaluate its ability to guide a student through their completion and help them improve the quality of their writing. The merit of each component and final product was evaluated using the instructor's grading rubrics. Several types of reports were tested such as resumes and cover letters, argumentative essays, position papers, critical approach analyses, and high level technical lab reports. This study demonstrates the potential of ChatGPT as an AI tutor for technical writing tasks. The results of the study show that ChatGPT has the ability to provide insightful feedback on college-level technical reports. The findings of this research provide valuable insights into the effectiveness of using AI in language modeling to support student learning in a practical and efficient manner. The implications of this study could have a significant impact on the education field and the future use of AI as a tool for language modeling and teaching.

Keywords: Artificial Intelligence (AI), ChatGPT, Tutor, Technical Report

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## Introduction

The Socratic method, which has been revered for its effectiveness as a personalized form of tutoring for thousands of years, is still highly sought after in today's education landscape. In ancient times, only the privileged few, such as Aristotle, had the ability to be tutored using this method. However, with the modern-day education system failing to cater to the diverse learning styles of students. The demand for personalized tutoring has surged tremendously. Unfortunately, the high cost of such tutoring makes it out of reach for most students.

Recent advancements in artificial intelligence have provided a glimmer of hope for students looking for affordable, personalized tutoring. ChatGPT is one such advancement that holds significant potential to revolutionize the tutoring industry. As an AI language model based on the GPT-3.5 architecture. ChatGPT is designed to interact with users using natural language and provide tailored responses to their queries. ChatGPT is able to describe any concept to anybody exactly how they want it, and in a way that helps the user understand the concept that they happen to be struggling with. ChatGPT might be able to help people understand complex processes such as surgery (Tel et al., 2023). Which poses the question what is ChatGPT, that question is pondered by Gordijn, and Have in their paper "ChatGPT: Evolution or Revolution" where these questions are looked at in depth.

ChatGPT is new, having only come out in November of 2022, so there's a lot of different tests being used on it, where some use it to write a college application (Tremblay, 2023). It's being asked to solve physics questions (Wang, 2023). ChatGPT's responses have been compared with many real human written articles (Ariyaratne et al., 2023), some of the responses from ChatGPT are so detailed, written abstracts are able to even fool scientists (Else, 2023). However, with how detailed many of ChatGPT's answers are, the question arises if ChatGPT is a valid author (Teixeira da Silva, 2023). Some cite plagiarism as a reason for why it can't be an author, "A violation of these policies will constitute scientific misconduct no different from altered images or plagiarism of existing works" (Thorp, H. H. 2023). However, this study does not look at the validity of ChatGPT as an author but looks at it as a tutor.

In traditional classroom settings, students may feel hesitant to ask questions due to the fear of being judged or embarrassed in front of their teachers and peers. This can lead to students missing out on valuable learning opportunities and struggling to keep up with their peers. However, ChatGPT's non-judgement nature can provide a more inclusive learning environment where students feel comfortable asking questions without fear of judgment.

This research study seeks to explore the extent to which ChatGPT can serve as a low-cost personalized tutor. Specifically, it will investigate the efficacy of ChatGPT in assisting students with the challenging tasks of helping students write their resumes and cover letters, as well as helping them navigate the intricacies of writing academic papers with the guidance of their respective rubrics and assignments descriptions. To determine how valuable ChatGPT's advice is, it was asked to regrade papers after grading them. To figure out if its own self-evaluation is accurate, and its abilities to write assignments are to the college level, the assignments that ChatGPT made, as well as helped students write were graded by a technical report writing teacher.

The main goal was not to see if ChatGPT could complete the assignments for the student, but to instead see if it could judge the quality of the work submitted by the student and then

accurately help them improve it. The aim was to gauge ChatGPT's ability to serve as a reliable tool for evaluating and refining the students' assignments rather than just be another way to cheat.

This research aims to bridge the gap between traditional personalized Socratic tutoring and modern-day technology by evaluating the ability of ChatGPT to provide personalized, low-cost tutoring services to students. The findings of this study could potentially pave the way for a new era of accessible, affordable, and effective personalized tutoring, with the potential to level the playing field for students from all walks of life. ChatGPT's capabilities were evaluated, then a student who only worked with ChatGPT briefly who will be known as student A, and finally a student who took everything step by step with ChatGPT who will be known as Student B.

## **Methodology**

This research serves as a pilot study aimed at assessing the effectiveness of utilizing ChatGPT as a Socratic method tutor in a technical report writing class. Due to the rapidly evolving technology the study was limited to a small number of subjects. Whenever ChatGPT was used, it was given the following prompt, "In this dialogue you will act as a socratic tutor, that will constantly guide the student (the user) to the correct answer after you tell them their grade based on the assignment description." First, ChatGPT's own capabilities were tested on how well these reports could be written by it. Next, Student A wrote a single paper with guidance from ChatGPT. Finally, Student B wrote as many drafts needed for ChatGPT to deem the quality of the paper as 90% or greater. All grades used in the research come from the researchers using the professor's grading rubric.

This research looks at five major assignments. The first assignment is a job application in which a student had to find a job listing that they wanted to apply for. They had to tailor their resume for this job, as well as write a cover letter for said job listing. Next, was the argumentative essay that took a clear and arguable stance on a tightly focused and specific topic. Then, the position assignment where the students had to craft a paper that responds to a current social issue. The students primarily had to take a stance on a current issue within society, with their intended audience being any stranger wondering about the issue at hand. Next, for the critique assignment, Students are expected to use critical theory to reanalyze any media of their choice and develop a critique and a new way to look at that piece of media. Students are allowed to choose any topics like the idea of marxism being represented in "The Lion King." Finally, the chatbot was tested for its ability to aid with high level technical projects in engineering experiments.

ChatGPT is known for its ability to chat with any user using regular interhuman dialogue, meaning its functionality as a tutor and a mentor is already present. The first scenario that was tested was a job application in which a student had to find a job listing that they wanted to apply for. They had to tailor their resume for this job, as well as write a cover letter for said job listing. When meeting with Student B was instructed to interact with ChatGPT and go through each detail, from the job they specifically want, along with the skills that are needed for that job. The student even realized they wanted to change their job choice from a UX researcher to a content writer. The student even changed where they wanted to apply to different software companies that have different objectives. ChatGPT was able to adapt to these changes and guide the content of the assignments based on these changes.

After this interaction the tutor naturally transitioned into guiding the student to the cover letter. Where the tutor consistently asked the student what should be included on a cover letter, giving an outline at the end of the dialogue. After creating the templates for each section of the cover letter as shown in Figure 1, the student wrote their cover letter and a resume to accompany it.

Dear Hiring Manager,

I am excited to apply for the Content Writer position at Cocobolo Group. As an experienced writer with a passion for creating engaging content, I am confident that I have the skills and experience needed to succeed in this role.

My name is [Your Name], and I have [Number of years of experience] of experience in [Industry/Field]. During this time, I have honed my skills in [specific skills or areas of expertise], and have a proven track record of producing high-quality content that engages and informs audiences.

In my previous roles, I have gained valuable experience in writing, problem solving, communication, and brainstorming. As a content writer at [Previous Company], I was responsible for creating engaging and informative content for a variety of audiences. Through this experience, I learned how to research and analyze information, collaborate with other team members to develop ideas, and write clear and concise copy that effectively communicates key messages.

In addition to my writing experience, I also have strong problem-solving skills that enable me to tackle complex issues and find creative solutions. Whether working on a difficult writing assignment or collaborating with colleagues on a team project, I am able to bring a strategic and analytical approach to problem solving that helps to achieve successful outcomes.

Furthermore, I am highly skilled in communication and brainstorming. Throughout my career, I have developed a reputation for being an excellent communicator, both in writing and in person. I am able to clearly and effectively convey ideas, listen actively to feedback, and collaborate with others to develop innovative solutions.

Thank you for considering my application for the Content Writer position at Cocobolo Group. I am excited about the opportunity to bring my skills and experience to your talented team, and to contribute to your company's success.

If you require any additional information or have any questions, please do not hesitate to contact me at [Your Phone Number] or [Your Email Address]. I look forward to the opportunity to speak with you further about my qualifications for the position.

Thank you again for your time and consideration.

Best regards,  
[Your Name]

Figure 1: ChatGPT Guided Template for a Cover Letter

However, the student made changes to the template to suit their actual experience and skills that student B has. All changes and the difference found in the cover letter can be found within figure 2.

Student B

Student B's Contact Info.

Date

Cocobolo Group

C/O Steven Sponder

6531 Park of Commer Blvd

Student B's Address

Re: Application for Marketing Content Writer

Dear Steven Sponder,

I am writing to apply for the position of content writer for your new restaurant app for Cocobolo Group. I came across this opportunity on handshake and I am thrilled to express my interest in this. As a sophomore studying Communications, I am very interested in becoming a content writer as I have strong writing and problem-solving skills.

As a current student studying communications, I have gained strong writing and research experience. Within my news writing class, I wrote stories that captured stories that are significant to specific audiences and provided information. I also currently work as a writing tutor and have demonstrated clear communication skills to converse ideas with my tutees and brainstorming for a solution to their needs. I can apply these same skills to create engaging material for your restaurant app and work towards it with my peers through effective communication.

I am very interested in the role of a content writer and would like to learn more, and I hope you will contact me for an interview to discuss more about the position. You can reach me StudentB@gmail.com or via phone anytime at (111)-111-1111. Thank you for taking the time to review my cover letter and resume.

Sincerely,

Student B

Figure 2: Student B's Cover Letter

Next, the students were tasked with working on the argument assignment. First, ChatGPT was given the assignment description and asked to complete the assignment. Next, the students were provided with the detailed assignment description, which the students were tasked to read through before starting the assignment. Student A wrote their paper with partial guidance from ChatGPT, while student B took their time, taking input and direction from ChatGPT. Student A would ask things of ChatGPT like what would be an appropriate topic for these assignments. Student B's initial draft was given a low grade by ChatGPT. ChatGPT sited that Student B's initial draft was 60% because it wasn't "coherent" and it was "informal." Student B's initial draft that was submitted to ChatGPT can be seen in Figure 3.

Technology is coming fast and AI is its partner in crime. We have self driving cars and Siri is smarter which is cool. With that, we can see AI basically everywhere in our lives. In school we also see it with this new program called ChatGPT. However, the program has worried the general public because of its privacy is uncertain, potential to domestic attacks, and finally because it can put humanity in danger. The ethical problems surrounding AI in general has been a problem for as it puts education at risk. I will be talking about why ChatGPT is good and why it should be introduced to education.

In the United States, we have minorities and they don't have easy access to education. School teachers are also facing unemployment at a high rate because of bad wages. This will put kids at risk. And the future of the United States. However, by promoting ChatGPT, kids can get general knowledge in a good way because the program chats while giving information. This should be incorporated and encouraged because then it could be installed in computers. Computers are found in libraries and their libraries can rise in popularity. If it rises in popularity, it will get more funds, overall this program can be groundbreaking for the future of the country.

### Figure 3: Student B's Initial Argument Draft

With this response, ChatGPT's aptitude of providing proper feedback can be tested. However, the real test is determining if ChatGPT's feedback is actually beneficial for the student. After seeing the feedback that ChatGPT gave, the student then began drafting their next attempt keeping in mind the feedback that was given to them by ChatGPT. Student B finished their second draft and was given a higher grade by ChatGPT. The intermediate draft was given an 80%.

After Student B received feedback on their intermediate draft, Student B revised their paper and resubmitted it to ChatGPT to evaluate it. ChatGPT deemed that the final draft was worthy enough for a 95% on their essay. Student B's final essay can be seen in Figure 4. ChatGPT believes the paper is "clear and concise" believing Student B argued their topic well.

With the emergence of technology in society, AI (Artificial Intelligence) strides alongside it and makes their presence unknown. From self-driving cars to an even smarter Siri, AI can be seen making its appearance throughout essentially everywhere in our normalcy. Even in education, there is a rise in AI with a program called ChatGPT. However, this has raised concerns of privacy, terrorism, and ultimately the safety of humanity's future. The ethical issues surrounding AI have been a major concern for everyone and the validity of education is being questioned if they are to integrate ChatGPT within. Within this essay, ChatGPT will be argued on why it is beneficial and should be welcomed as it allows marginalized groups to readily access it making them gain a foundation to concepts, bridge gaps of knowledge, and is an overall better alternative to cheating.

Education is not accessible to everyone throughout the United States as marginalized groups and minorities suffers from lack of access to education. Schools are facing teacher unemployment at a high rate due to low wages and putting children at risk for their future and the country as a whole. Communities that are poor are at higher risks of this. However, by promoting ChatGPT, children can access it to gain general knowledge in a healthy manner. ChatGPT maintains a conversational tone while giving information, making it unbiased and easy to understand for users. This AI should be incorporated into libraries and onto computers, making it accessible to the public. Also, by encouraging people to go to the library for this program, more people will get a library card and garner more attention to libraries. This will finally lead to an increase of funds as libraries are in higher demand and making education more accessible for all. By gatekeeping what could lay a foundation education and general knowledge, the country as a whole will never progress and therefore needs ChatGPT to be accessible to all.

Figure 4: Student B's Final Argument Draft

Next, the position assignment was analyzed. Where the same order occurred, that being ChatGPT was given the assignment description and wrote about gun control, student A wrote about climate change because ChatGPT instructed it that it was a good topic choice, and student B wrote about education funding. Just like the last assignment student B kept resubmitting to ChatGPT to get its evaluation of the paper.

Figure 5 displays the initial draft Student B wrote for the position paper. ChatGPT gave the draft a tentative grade of 80%. ChatGPT gave student B the feedback that they need to improve the areas of "organization, clarity, and evidence."

The United States is notorious for its massive fundings toward its military interests, but what about education? Education serves as a foundation for the country and its future as it provides everyone with knowledge and strengthens the future generation. By increasing funding, more money will go toward school supplies, teacher wages, and improving libraries; all gaining more attention and encouraging the use of it. By doing so, students will get quality education in and out of school as they are more likely to go to libraries. This paper will argue for the great societal benefit from increased education funding as both students and teachers will have higher incentives to learn.

By increasing funding, it will affect the school directly as it improves school technology, supplies, and increase teacher wages. By having better school technology, students can learn effectively and can be exposed to technology fairly. Those in less fortunate communities are at constant risk of having education diminished as they get less attention toward their experience as opposed to the students in the upper class. Having more supplies available will mean teachers will not have to pay out of their pocket for these supplies, further cutting their pay. Overall, having more supplies will allow teachers to use tools that were once unavailable, making the educational experience stronger. By increasing education funding, they can increase their wages by making an incentive to work better. This can also counter the increasing unemployment of teachers throughout the nation.

By increasing education funds, libraries are also affected as they have more attention as they improve. Similar to schools, they can gain better technology and supplies, ultimately providing people with a higher quality of education when they seek books or to research. Again, those in less fortunate communities will benefit greatly from this as they can seek further education out of school.

#### Figure 5: Student B's Initial Position Draft

Student B noted the feedback given by ChatGPT, and began work on their next draft. The student constantly kept referring to the advice given by ChatGPT. As a result, the student only had to make one more draft, their final draft was submitted to ChatGPT. Figure 6 shows student B's final draft. ChatGPT graded the paper and gave it a 90%. ChatGPT gives praise to the paper's work where it says, "It flows better, and your points are more organized and clearer." But it still gives some suggestions on how to make the essay stronger, "However, your essay can be improved by providing more statistical evidence to support your claims."

The United States is notorious for its massive fundings toward its military interests, but what about education? In the age of the rising technology, the need for education is rising at a rate in which the government cannot keep up currently. The education system is outdated and because the internet is ever-growing, which at times serves as a better resource than what is offered at institutions, the government too must do their part in providing for students. The decline in quality of education can be noticeable at the higher levels of high school and college with the income gaps and places of poverty, not serving all students equally in education in which in turn violates a basic right to education and a better future which is vital to everyone and for society. Education serves as a foundation for the country and its future as it provides everyone with knowledge and strengthens the future generation. By increasing funding, more money will go toward school supplies, teacher wages, and improving libraries; all gaining more attention and encouraging the use of it. By doing so, students and minority communities will get quality education in school and out of school as libraries are of higher quality. The United States should have increased funding for education because it will benefit society overall as both students and teachers have incentive or access to education nationwide even in minority or marginalized communities.

By increasing funding, it will affect the school directly as it improves school technology, supplies, and increase teacher wages. By having better school technology, students can learn effectively and can be exposed to technology fairly. Those in less fortunate communities are at constant risk of having their education diminished as they get less attention and funding toward their experience as opposed to the students in the upper class. These less fortunate communities tend to have minorities and marginalized groups who already suffer financially and affect the quality of education experienced. In the future, these students will come out of school with skills that were once not able to be gained which makes them able to compete in the job market. Having more supplies available will mean teachers will not have to pay out of their pocket for these supplies, further cutting their pay. Overall, having more supplies will allow teachers to use tools that were once unavailable, making the educational experience stronger. By increasing education funding, they can increase their wages by making an incentive to work better. This can also counter the increasing unemployment of teachers throughout the nation. Having a lack of teachers will put students at risk and the future of the country. By increasing funding for the United States, it increases accessibility for marginalized groups and minorities which decreases gaps between classes making equality closer to be achieved.

By increasing education funds, libraries are also affected as they get more attention as they improve. Similar to schools, they can gain better technology and supplies, ultimately providing people with a higher quality of education when they seek books or to research. By having access to technology, minority or marginalized groups can use them freely and be exposed to knowledge which they were not before. Again, minority or marginalized communities will benefit from this as they can seek further education outside of school. Libraries serve for the community as free education and therefore should not be neglected. Improving the library will allow access to education freely along with the technology within the building.

Figure 6: Student B's Final Position Draft

Next, the students worked on the critique assignment. ChatGPT chose feminist theory within Harry Potter. Student A chose poststructuralism and the religious experience of hindus and christians. ChatGPT told student A that the topic would be great for the assignment and would work in context with the assignment. Finally, student B decided on the topic of gender identity within the novel, "The Brief Wondrous Life of Oscar Wao" by Junot Diaz. With their topics picked, each of the students then began writing their drafts. After finishing their first draft, student B uploaded it to ChatGPT. Student B's initial draft as seen in figure 7 was

given 89%. Where ChatGPT noted the areas of improvement, “Firstly, it would be helpful to provide more context on the concept of patriarchy and its historical and cultural significance in the Dominican Republic. This would help to provide a more in-depth understanding of how patriarchy operates in the novel. Additionally, while your analysis of the characters Oscar, Yunior, Lola, and Belicia is effective, it would be helpful to provide more specific examples from the novel to support your arguments.”

This essay examines how the novel “The Brief Wondrous Life of Oscar Wao” by Junot Diaz engages with patriarchy during the time of Trujillo, a Dominican Republic dictator, from the mid to late 20th century. This novel takes place in the Dominican Republic under the Dictator Trujillo and in New Jersey. Patriarchy is a system of male dominance which establishes men at the top of the hierarchy in society, which creates a gender inequality between men and women, valuing masculine traits and undervaluing femininity. Furthermore, it creates a divide amongst men as masculine traits are more valued than women which makes men that are less masculine as less valued. Covering three generations, each character take the center of the story: 1944-1946(Abelard), 1955-1962(Belicia), and 1974-1995(Oscar). Rafael Leonidas Trujillo's dictatorship (1930-1961) is a time of extreme censorship, brutality, and intimidation which allowed for complete control of the country. Trujillo serves as an entity within the story as a man with no regard for all as he upholds toxic culture of machismo. This essay discusses how the damaging and sometimes toxic patriarchal culture of machismo affects gender identity within the Dominican Society through a feminist and cultural lens. Specifically, this study examines how characters such as Oscar, Yunior, Lola, and Belicia conform to or challenge traditional gender roles.

Oscar is the main character within this novel who can be described as emotional, soft, introverted, and nerdy. These traits do not fall under the category of masculinity, which makes him inferior to most men throughout the novel and ruins the image for himself. However, another character, Yunior, who is referred to as the epitome of masculinity can be seen aggressive, independent, unemotional, and sexually driven; effectively embodying the culture of machismo. Within the novel though, he can be seen struggling internally as he wants to help Oscar but cannot as it makes him vulnerable, which is something he as a man cannot do. Oscar, through his failure to conform, falls into a deep depression as he was ostracized and bullied. He serves as an antithesis to men as he refuses to conform later in the novel which allows him to find his identity.

Belicia is Oscar and Lola's mother and can be described as a hard-working mother who is strict as she upholds traditional sense of being a woman. Lola can be seen as a rebellious with a punk style as she shaved her head, challenging the traditional woman. By not reaching the feminine ideals of subservience and physical attractiveness, women are taught they are not valuable as they will not attract men. Furthermore, this will prevent them from creating a family, which women are objectified for as they're main goal in life. By not conforming to the standards of gender roles later in her life, Lola can be in a relationship and family that is fulfilling as she has a voice of her own.

Within this novel, through the contrast of Yunior and Oscar, Belicia, and Lola along with the many peeks into the different lives and perspectives of the characters, a power structure is established under the effect of patriarchy and with that how the lives are affected by it. As the tragic story unfolds, identities are questioned by characters as they are figuring out who they are and their place within the system or their desire to be away from the system and as themselves. The gender roles and expectations of abiding the traits of masculinity and femininity are seen within this novel as the members of the family and the characters throughout reject these roles or comply with them. These themes offer a deep commentary of a society that is heavily affected by the culture of machismo and the reliance of the structure of patriarchy, which affects the lives of the characters throughout.

Figure 7: Student B's Initial Critique Draft

Through the student's constant writing of assignments, the student can be seen showing improvement between each assignment. Figure 8 shows Student B's final critique draft, which ChatGPT gave a 90%. ChatGPT believes the strength of the paper is its structure, "The essay provides a clear and coherent structure, covering three generations, with each character taking the center of the story."

Finally, ChatGPT was tested for its ability to tutor the writing of technical reports containing advanced engineering topics. The topic of subsonic experimental aerodynamics was chosen. Experimental aerodynamics is a branch of aerodynamics that deals with the study of fluid dynamics around various objects through experimental methods. This subject is an advanced topic taught to Aerospace Engineering students that requires a firm understanding of incompressible aerodynamics and fluid mechanics to be able to understand the experiments. This particular subject was identified as many students struggled writing lab reports that correctly analyzed the results of the experiments.

The chatbot was presented with technical terminology related to the concept of laminar and turbulent flow, which can often pose challenges for students trying to understand these advanced topics. To assess ChatGPT's ability to explain these concepts effectively, a specific prompt was given requesting an explanation suitable for a five-year-old audience.

Imagine you are in a bathtub filled with water and you are making waves with your hands. If you move your hands slowly, the water will move smoothly and quietly, like a calm river. This is called laminar flow.

But if you start moving your hands very fast, the water will become very messy and chaotic, with waves and bubbles going in all directions. This is called turbulent flow.

Turbulent flow is like when you mix up all the toys in your toy box and they get jumbled together. It's very messy and hard to control. Laminar flow is like when you put your toys away neatly in their own compartments. It's very organized and easy to control.

In real life, turbulent flow can happen when air or water moves very fast, such as in a river rapid or in the wake of an airplane. Laminar flow can happen when air or water moves slowly and smoothly, such as in a calm river or in a pipe with low

Figure 8: ChatGpt's explanation of different flow types

Experiments related to these engineering topics are usually performed in subsonic wind tunnels. Students would need to understand this information before completing the experiment, but after completing the experiment, they would need to be able to analyze the raw data and to be able to explain the trends.

For a very basic example experiment, ChatGPT was asked what would happen if a ping pong ball and a golf ball were placed separately into a wind tunnel and the drag directly behind the object was recorded. The chatbot was able to correctly identify and explain what is in Figure 9.

If the ping pong ball and the golf ball were identical in size and shape, had the same Reynolds number, and the only difference was the ridges on the golf ball's surface, the ping pong would be expected to have higher drag.

The ridges on the golf ball's surface create turbulence in the boundary layer of the flow, which is the thin layer of air directly adjacent to the surface of the ball. This turbulent boundary layer reduces the pressure difference between the front and back sides of the golf ball, resulting in less drag compared to the smooth surface

Figure 9: ChatGPT's prediction of experiment

## Results

First, the job report assignment was analyzed. After taking student B's rubric given from the professor and comparing the grades ChatGPT gave against the Professor's grades, ChatGPT's grades were harsher than the Professor. ChatGPT gave student B's cover letter a 95%, when the professor graded the student with a 100%.

Second, the argumentative assignment demonstrated varying degrees of proficiency between ChatGPT's responses and the professor's evaluation. All five drafts of the assignment were diligently submitted to the professor for assessment. While ChatGPT's own response to the essay received a grade of 65%, the professor's evaluation revealed a less favorable outlook, stating, "This essay may be categorized as a 60, but it is perilously close to failing. It predominantly reads as explanatory rather than presenting a debatable topic and substantiating the argument's stance. Moreover, there are perplexingly disjointed paragraphs towards the end of the essay that do not align with the overall piece." Student A, however, displayed some improvement in their draft, receiving a commendable 80% from the professor. The professor commented, "This work would place in the lower range of the 80s or upper 70s for me. Although it presents a foundational argument, it remains rudimentary and inadequately developed. The essay adopts a formulaic approach, lacking an attempt to create a stylistic design that appeals to a distinct and specific audience." These contrasting outcomes between a paper written solely by ChatGPT and a paper guided by ChatGPT indicate a discernible trend where ChatGPT's expertise lies in assisting students in their work rather than executing it on their behalf.

Next, student B's initial draft received a satisfactory grade of 75%, surpassing ChatGPT's initial assessment. The professor explained the reasoning behind this score, stating, "This essay exhibits moments of insightful thoughts but remains underdeveloped, requiring further contextualization of ideas. Additional support is needed to elevate this essay to the 80/90 range for me." In this case, ChatGPT's guidance appears to be more stringent, as evident in the job report assignment and the students' grades. However, student B's final draft received a diminished grade of 65%. This demonstrates that ChatGPT may struggle to provide appropriate grading or valuable advice for more intricate assignments.

Moving on to the position assignment, ChatGPT's independent endeavor received a modest grade of 75% indicating its ability to produce average-quality papers on its own. Regrettably, student A's paper, despite ChatGPT's guidance, only garnered a grade of 65% from the professor. Despite the assistance provided by ChatGPT, student A was unable to reach the desired 70% or higher. Similarly, student B's performance revealed a lack of improvement, with their initial draft earning a score of 60%, which remained constant in the professor's

evaluation of their final draft. Thus, it is apparent that ChatGPT's capabilities may fall short when assisting students with more complex assignments.

Lastly, the critique assignment underscored the significant disparity between ChatGPT's performance and that of the professor's evaluation. ChatGPT's attempt at the assignment received a respectable grade of 75%. However, student A's paper received the lowest grade of all, with the professor noting that the chosen topic failed to adhere to the assignment guidelines, resulting in a score of 50%. The professor stated, "This paper would receive a failing grade as it does not fulfill the assignment's purpose. Students were expected to apply the framework of a critical theory to a context of their choice, preferably an artifact, and religion does not fit within this category." This predicament arose from ChatGPT providing erroneous guidance to student A, affirming the acceptability of their chosen topic despite it clearly diverging from the assignment guidelines. In contrast, student B's initial draft received a grade of 75%, coinciding with ChatGPT's initial attempt. This indicates that ChatGPT can offer rudimentary assistance. Remarkably, student B's final draft received an improved grade of 85%. Consequently, it can be inferred that ChatGPT's guidance is more effective in facilitating improvements with less complex assignments.

For the high level technical report, the chatbot was able to explain engineering topics in a way that would be able to help an outsider complete the experiments. Figure 8 showcases ChatGPT's response to this prompt which successfully transformed the complex subject matter into an easily comprehensible explanation. The generated response struck a balance between simplicity and comprehensiveness, ensuring that the fundamental differences between laminar and turbulent flow were conveyed accurately.

Experiments using topics such as these are not usually performed in a classroom setting until a college student is at least an upperclassman. The simplicity and clarity of ChatGPT's explanation make it suitable for students who need a basic understanding of the distinction between laminar and turbulent flow before engaging in experiments or further exploration of the topic. By providing a sensible explanation, ChatGPT has the potential to enhance students' comprehension and ensure a solid foundation for their participation in experimental activities related to fluid dynamics.

ChatGPT's prediction in figure 9 was correct. It was able to come to the conclusion in figure 9 purely based on its knowledge of what was expected to happen and did not need to have any raw data from the actual experiment. This means that the student could easily ask ChatGPT what the expected result of the experiment is and be given an answer and a justification. The student could then easily cross check their experimental results with the expected results in order to see if they matched. This could also help the student provide a deeper analysis of what the data means and give a deeper conclusion to the experiment.

Overall, ChatGPT had a deep understanding of this technical engineering topic being experimented on. It could explain the concept in very simple terms so that anyone could understand it going into the experiment. Based on these concepts, it could then predict what it thought would happen in the experiment. This would help the student have a deeper understanding of their data and provide them with a resource to understand what was happening.

## Conclusion

In conclusion, ChatGPT has demonstrated its efficacy in enhancing students' academic performance and offering valuable insights and guidance, particularly in assignments of lesser complexity such as the job report and critical theory tasks. Its contribution can often be the differentiating factor between a passing and failing grade in these types of assignments. However, the limitations of ChatGPT become apparent when tackling more intricate tasks, such as the position paper and argumentative assignment. In these cases, both its own scores and the quality of advice provided are average at best.

It is crucial for students to exercise caution when relying on ChatGPT for assistance with complex assignments, as it may even have a detrimental effect on their potential grade, as evidenced by student B's final argumentative draft receiving a 10% lower score than their initial draft. Notably, a significant flaw observed in ChatGPT's functionality is its inability to accurately identify appropriate topics for students, as exemplified by student A's critical theory assignment, where they failed due to ChatGPT's assurance that their chosen topic was suitable. Furthermore, ChatGPT's tendency to offer similar or identical advice throughout different assignments suggests a limitation in its ability to provide diverse and nuanced feedback. Therefore, while ChatGPT can be a valuable tool in aiding students with simpler assignments, it is prudent for students to seek additional guidance from professors or other reliable sources when tackling more complex academic tasks. This ensures a comprehensive and well-rounded approach to their assignments, leveraging the strengths of both human expertise and AI assistance.

It is important to highlight that ChatGPT's grading approach appears to be more stringent in simpler assignments, such as the job application. However, it exhibits greater generosity when assessing more complex assignments, aligning with the findings of a previous study that stated, "Application and interpretation of knowledge with more complex analysis is not well processed by ChatGPT" (Fergus et al., 2023). While ChatGPT proves beneficial in providing general advice, it may encounter limitations when dealing with advanced assignments. Nevertheless, successful implementations of ChatGPT have been observed in a Java programming class, as evidenced by the paper "The Development and Evaluation of an Artificial Intelligence (A.I.) Tutor for a Java Programming Class" (Butka et al., n.d.), wherein it effectively supports students in enhancing their understanding of the object-oriented paradigm. This is supported by the results from the high level technical report where the chatbot was able to provide technical knowledge as well as its (correct) prediction on the results of an experiment.

Despite the promising outcomes, ongoing debates persist regarding the merits and drawbacks of ChatGPT ("ChatGPT: friend or foe?"; 2023). As ChatGPT is a relatively new technology, discussions regarding its ethical implications are still ongoing (Graf & Bernardi, 2023). However, due to the increasing prevalence of ChatGPT, educators are faced with the challenge of incorporating it into their teaching methodologies (Yang, 2023). Various perspectives exist on the advantages and disadvantages of ChatGPT (Chavez, 2023), and while this research study concludes that ChatGPT can or cannot be used as a technical report writing tutor, it is important to note that many individuals perceive the use of ChatGPT as a potential threat to academic authority ("ChatGPT and usurping academic authority"; 2023). Nonetheless, there are also proponents who outline strategies for ethically integrating ChatGPT into educational practices ("Tools such as ChatGPT..."; 2023). It is crucial to acknowledge that the issue of technology's impact on academic integrity predates ChatGPT,

as students who seek to cheat have long utilized tools like Google to find answers. However, relying solely on ChatGPT as a cheating tool without developing a deeper understanding of the subject matter may result in generic and superficial writing lacking in depth and originality.

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