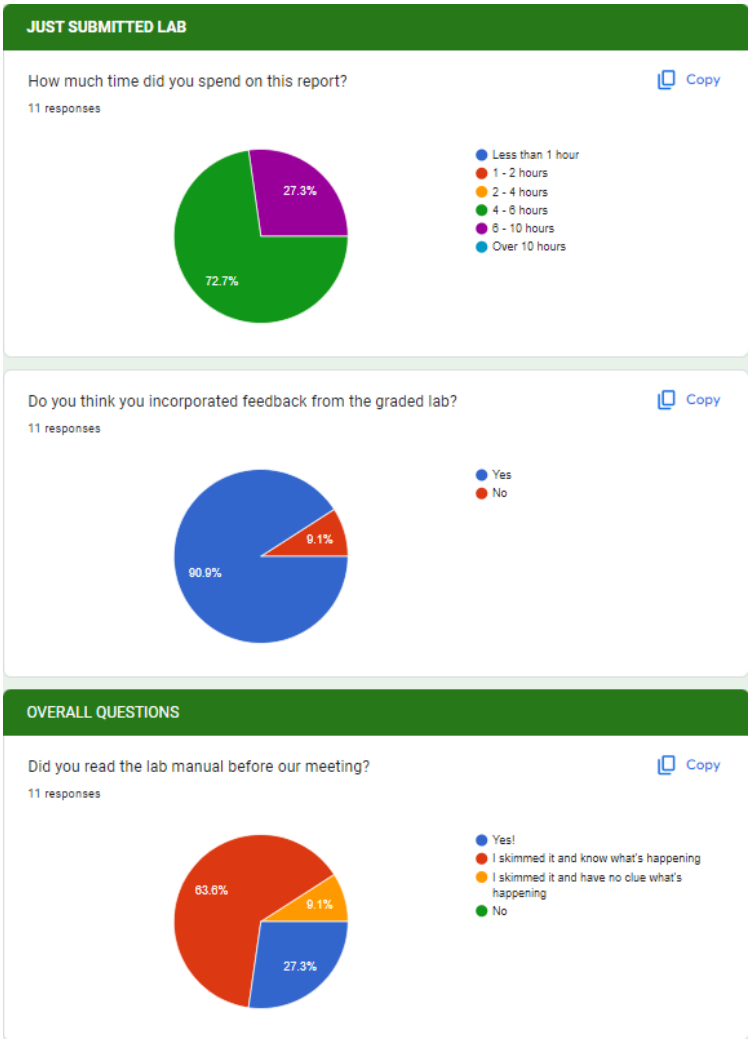
Entry and Exit Tickets

In the spring of 2024, I added entry and exit tickets to the laboratory session I was teaching. The entry tickets were completely anonymous: I wanted the students to answer as honestly as possible. In the picture below, I asked them how much time they had spent on their weekly report, whether they thought they had incorporated feedback from the previous one, and if they had read the laboratory manual before our meeting. These became very useful to me as I planned our weekly meetings; if students, for example, had not spent enough time on the laboratory manual, then I could deliver some information before they started the experiment.



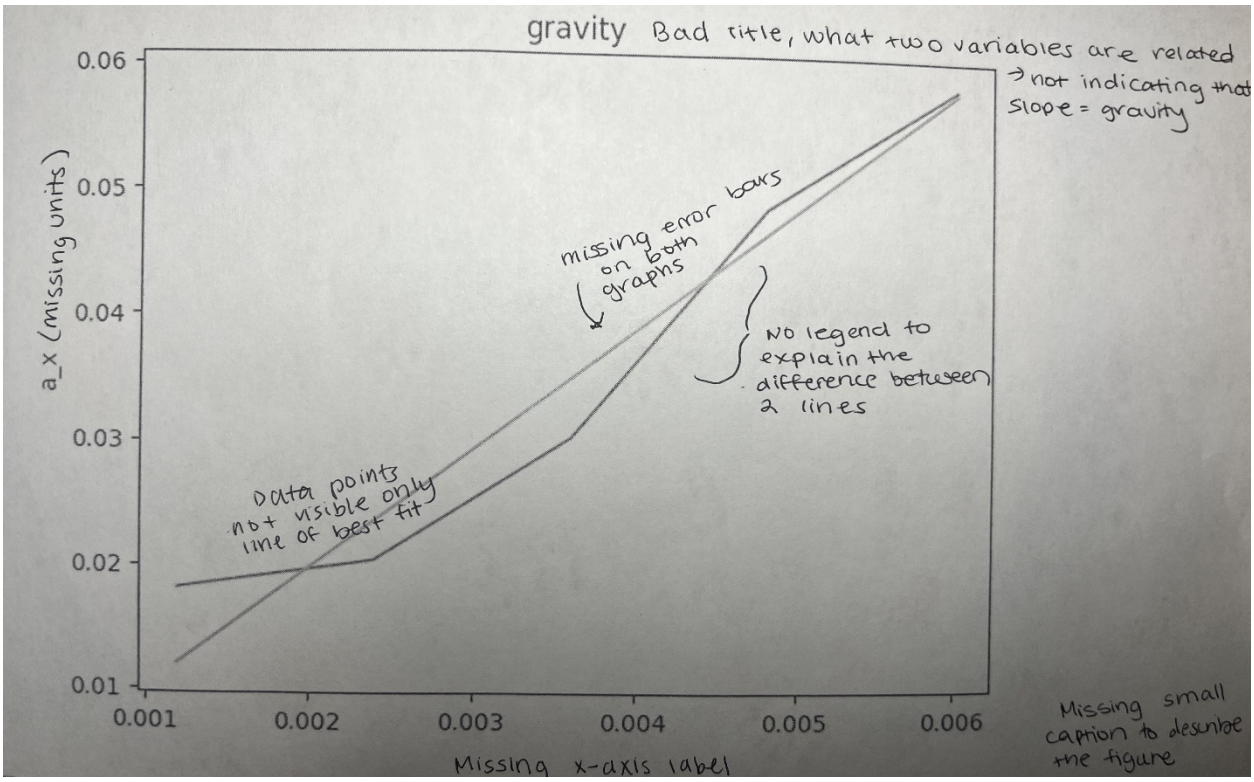
Below is an example of a student response to an exit ticket. The exit ticket asks students to answer the following two questions: “What is one thing you learned today?” and “What is one thing you still struggle with from today?”.

1. I learned to calculate velocity from the different heights we measured.
2. I struggled with maintain constant units between meters and centimeters when doing my calculations.

These exit tickets allow me to better assess how students view the course and what relevant practices/information they take away. They also create a routine for students to actively reflect on their three hours in the lab meeting and to feel they have agency in this course. If many students write similar struggles, I am able to collect that information and plan an intervention to address their concerns.

Data Analysis

In the physics laboratory courses, we put a lot of emphasis on analyzing and visualizing data. Plots become crucial to reporting results and discoveries from experiments. In the beginning of the semester, I printed out a plot that lacked many key elements, such as axes labels, units, error bars. I gave these to students and asked them to point out things they would change to improve the figure. Below is an example of what a student annotated. This activity was very positive, with students reflecting that "I thought the demonstration with the Python and the graphs was pretty useful;" "I learned more tools to create a better graph using Python (like adding labels);" and "I learned new skills in python." Throughout the semester, many commented in person that they had been using many of these skills in their other engineering courses.



ChatGPT in the Classroom

In the Fall of 2023, I brought a pertinent question into my classroom: Should OpenAI's ChatGPT be part of the curriculum? Every week, students conduct an experiment and then write a six-page laboratory report. The reports simulate writing a peer-review scientific publication, which can be quite intense and time consuming. For one of their assignments, instead of writing every section, I asked students to request an introduction and a conclusion from ChatGPT. Since they had "less" writing to do, I asked them to add a reflection on the experience. Below you can find a full reflection written by a student.

For this assignment, I fed ChatGPT my lab report, which included the methodology, results, and analysis sections. I specifically instructed the AI to "Write an introduction and conclusion for this scientific report; limit the intro to 400 words and conclusion to 200 words". Upon reviewing the generated content, I believe that the generative AI wrote a stronger conclusion than the introduction. This is because of the distinct purposes of the conclusion and introduction. The conclusion summarizes the key findings derived from the experiment. The AI excels at this by utilizing the provided sections. In contrast, the introduction contextualizes the report. The AI is limited, as the provided sections lacked the scientific background information necessary for introducing concepts. As a result, the AI-generated introduction did not incorporate contextualizing equations or explain relevant scientific theories. Moreso, generative AI is advantageous as it can express ideas with clarity and effectiveness. But this comes with a cost as the generated texts tend to be repetitive and flowery. In my lab report, the AI employed inflammatory language, using phrases like "cornerstone in understanding," "pivotal parameter," and "crucial experiments". Scientific lab reports should maintain an objective, concise, passive tone, as their primary goal is to convey findings in a manner that is conducive to replication by others. Nevertheless, I found the generative AI to be helpful overall, as it enhanced the readability of my report. However, I firmly believe that generative AI should be utilized in conjunction with human intelligence. Human intelligence often lacks clarity and is prone to errors. AI on the other hand lacks the capability to provide novel insights unless explicitly instructed or provided input by a human. If used improperly AI can become a crunch, resulting in less fruitful and insightful reports. Through the usage of AI, there is a potential loss in communication skills. However, skills in effective editing and critical thinking are gained. This is due to the process of writing a lab report becoming more centered on the content itself rather than just communicating findings in a readable manner. This relates to the focus of the lab course, which I believe should deemphasize writing skills since AI is better for scientific dissemination, and other classes can address writing skills more effectively. Instead, I believe that the focus should be on data analysis and visualization, which is more content-focused. Overall ChatGPT can be a double-edged sword, with its impact entirely contingent on how users utilize generative AI.