From Board to Interactive Hub: Integrating AI into Online Mathematics Courses

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Discussion boards have been a traditional component of online courses, used to promote student interaction and collaboration. When trying to use them, I often found uneven participation, students struggling to find relevant conversations, and responding at a surface level. Also, questions can unintentionally reinforce the perspective of a solution focus rather than a focus on understanding process and building intuition. As mathematics is the engine behind AI, it would be relevant to have students reflect on what they are learning as well as the processes of AI. Putting the ideas together, I saw an opportunity to shift the focus of a passive, solution-based Q&A model of a discussion board, to one of experiential learning, active exploration and reflection, and a chance to be more process oriented.

Context and timing are important components of any pedagogical strategy. In fact, context is key in the approach I took to incorporating AI. In the second week of a course, I introduce our first AI discussion board. The prompt details how AI is a great tool to help in understanding. Students are asked to reflect on the purpose and context of an AI response to a problem we have worked on versus how we communicate the ideas in our notes and coursework. Follow up questions vary and can ask why this is important, do they communicate the same way in all situations, or are these ethical or practical questions. Students reflect on the varying reasons for differences and audiences, as well as on making sure AI responses are valid, which leads to many more questions. These questions delve into both mathematical practices and how we can leverage AI, while simultaneously evaluating its responses.

The types of questions and prompts I have integrated vary by course. For Applied Calculus, we can look at where we are headed and the interpretation of results. In Linear Algebra, we can focus on mechanics and ethical issues of AI, given that Linear Algebra plays a key role in how AI works. Sometimes prompts can be used for either, especially when looking to evaluate generative AI responses. For example, one prompt was developed from my social media feed where it was shown that generative AI can have trouble with a relatively simple question: How many "r's" are in the word strawberry? The video showed some of the AI process and why it gets this question wrong. Students

watch the video and reflect on the mechanics of how AI is working (from a general perspective, not from a technical/coding perspective). Students provide a short response on the implications of how AI currently works; whether and in what ways it matters how we quantify different types of data; whether they have ever used AI and received a "wrong" answer and how they knew it was wrong. Student responses are summarized to respond to in future discussion boards. Notably, the responses often allude to ideas we will have in applications later, so I refer to responses/summaries in future discussion boards.

In Applied Calculus, we spend significant time on algorithms and more abstract ideas to build to real world applications. Students are from diverse majors, not necessarily STEM, and need foundational ideas as well as to see where they are headed. Some example prompts in discussion boards that incorporate AI can vary from review, to summary, to reflection. Some starting prompts I have found success with are:

- Generative AI is a tool we can use to help us navigate and gain understanding. As a society we are still looking at its value and how best to use it. Let's use it like a modified search engine.

  Using a generative AI like ChatGPT, Gemini, or CoPilot., copy and paste the following prompt using your major and/or current work:

  Why would someone majoring in [your major here] need to know about mathematical limits? What are at least three applications and corresponding links to sites for each?

  Reviewing the results, which application/result do you find most interesting and why?

- We have been focusing a lot on mechanics here lately, with some applications and interpretation of results. Put the following prompt in a generative AI like ChatGPT, Gemini, or CoPilot.

  You are explaining derivatives to a fellow classmate that has just learned the general rules. They understand how to calculate the derivatives but want to know more about why they are important and how they fit into the bigger picture of their professional goals. List three key concepts and interpretations in the area of [insert area of professional interest here].

  Reading over the results, what was the most interesting to you? Why?

- We need to see a broader picture of where you are headed. In this course we spend much time starting to interpret results and perform the background calculations. These are the basis for developing your intuition and value in the workforce as an interpreter of results. Let's use AI to help us see what we are currently studying and how it applies to your major.

  In a free generative AI, like ChatGPT, Gemini, or CoPilot, put in the following prompt:

  "I am an Applied Calculus student, and I'm currently learning about the first and second de-

rivative tests. My field of study is {Insert your major/field of study here].

Can you explain, in detail, about at least two current applications of the first and second derivative tests that are relevant to my chosen field?

Looking at the AI response, answer the following:

1. What is an application of the first derivative test that stood out to you?
2. What is an application of the second derivative test that stood out to you?
3. Reflecting on your answers to questions 1 and 2, explain how understanding these derivative concepts can contribute to your overall studies or your career aspirations. Maybe think about it as - in what way does a deeper analytical understanding benefit you as a future professional?

Students respond that they are surprised by the connections. In addition, student responses are in-depth, personal, and engaging. In follow up discussions we focus on topics that students' responses have directed us to and help provide experiential learning opportunities.

For Linear Algebra, a second-year course, prompts include technical and ethical questions as well. As Linear Algebra is foundational to the construction of AI, students in these courses have an interesting context through which to examine AI. This can range from considering how understanding Linear Algebra aids in new applications and as well as to its implications for how we represent and use data. For example, students are asked to reflect on how we can quantify any kind of data, mainly in terms of a language model in this case. One idea would be: how does the system quantify ideas like sarcasm? Another example of an AI ethical concern is "hallucinations." Students are provided with a real-world example from a chatbot confidently providing false information about subscription policies (with a link to the real-world article from 2025). Students are provided some framework from a linear algebra perspective about how this can happen given how we represent vast datasets, vector representations, and how AI interprets "similarity." While this chatbot example seems harmless, students are asked about the business perspective, customer perspective, and developer perspective regarding the hallucination, as well as the role of Linear Algebra for each perspective. As a follow up students are also asked:

- What about in your areas of study or future professional work? What are the current cutting-edge ideas and concerns? Let's get an idea of how our foundational work here is being used and the role it plays in development and ethical reviews.

In a free generative AI, like ChatGPT, Gemini, or CoPilot, put in the following prompt:

I am currently working through the key concepts of Linear Algebra. Provide a bullet point list of three promising AI applications in [insert your current major or future professional goal- the more specific the better]. For each bullet point include one significant ethical concern, and a

relevant link to an article or resource discussing that concern. Also include a key Introductory Linear Algebra concept that plays a role in the application or concern.

Provide a short response (four-sentences or more) in the text box below that could include your thoughts on

- What was the most interesting application to you and why?
- Were the ethical concerns well-articulated and relevant?
- Were the links helpful and reliable? How do you evaluate and decide which are helpful and reliable?
- How might the linear algebra concepts we've discussed (like data representations, vector representations, vector spaces, factorizations and so on) contribute to the application or ethical concerns identified in the response?

There are other prompts which are more technical in nature that also help to connect students future work to the work in the course – helping provide context and tailored experiential learning opportunities for students.

The integration of AI into online mathematics courses in this discussion board format has been exciting for me as an instructor. These discussion boards in my courses are essentially assessed on participation, and students do participate. This format provides new opportunities for connections to the content as well as personal connections for both students and instructors. It helps make material personally relevant for the student and is not overwhelming as an instructor. I have also found that the inclusion of AI in the discussion boards provides an opportunity to reinforce how AI can be a support system and valuable tool; however, it complements, not replaces, genuine understanding and learning.