## Introduction

Over the past few months, we've all been hearing a lot about AI in math both from AI companies, and also from Fields medalists, well-established professors, and senior members of the math community. But early career researchers often have different concerns and priorities from established faculty, and their voices should be heard too. After all, current graduate students are the future of the field. It's important that faculty are aware of the concerns at the forefronts of their advisees' minds and take concrete steps to address these concerns.

Two weeks ago, we wrote and sent out a survey to MIT math graduate students with some questions about AI usage in math. The main questions we hoped to answer with this survey were:

1) Are graduate students significantly anxious and/or excited about AI? What is the general mood in the department?
2) Which aspects of AI are the most worrying or exciting to graduate students?
3) What can faculty members do to address student concerns?

Our survey was shared to the grad student mailing list and filled out by 45 students (out of ~120). In this letter, we will share with you some tentative answers to the three questions above based on the data we collected.

More specifically: in the next section, we'll briefly summarize some clear trends and takeaways from our survey. We'll share both numerical answers and some selected, striking quotes from free-response questions. Direct quotes are always italicized. We will finish by passing along some suggestions and questions that respondents had for faculty members. Attached to our email is the full survey with all responses.

Finally, to be clear, the point of this survey/letter is not to advance a position on whether AI is good or bad for math. Rather, the point is to take a quick temperature check, encourage open communication about AI and its consequences, and suggest some simple ways faculty can support graduate students during these transformative times.

## Summarizing the survey results: highlights and takeaways

Among the 45 survey responders, many of them had strong opinions they wanted to share, ranging from "*People need to take greater advantage of AI*" to "*I refuse to use AI for*

*anything.*" We had both multiple-choice questions, and a few open-ended free response questions. In this section, we've spliced some of the direct quotes for brevity/clarity, but the full responses are available in the attached survey.

It should be mentioned that while we have attempted to be objective, these interpretations of the survey results are ours, and that our personal opinions on AI may have influenced these interpretations. The full survey responses attached to this email are untampered with.

With that said, here are some general trends we noticed:

1) Many students have worries about their futures in academia. It's possible that these worries are significantly impacting their motivation, productivity, or future career plans.
    a) **76.7 percent** of students believe AI will make it harder for them to get tenure-track jobs (only **4.6 percent** believe it will be easier).
    b) **71.1 percent** of students say the probability they continue into academic math after grad school has decreased or significantly decreased this summer.
    c) A few striking quotes:
        i) *"I would love to continue in math, but I feel it's likely AI will make it boring and add negative externalities to the conventional day-to-day work of being a mathematician."*
        ii) *"I would love to minimize the use of AI in my research but I think the game theory aspect of it is brutal -- I am afraid of falling behind if I don't use it."*
        iii) *"It's a HUGE motivation killer – knowing that AI can solve and write everything better than I can… makes you think there's no point coming to work."*
        iv) *"The worry that AI might solve a problem you've been working on should weigh much more heavily on graduate students."*
        v) *"The issues that the math community faces may soon be felt in many other areas and professions. In some sense, we have the opportunity to set an example for how to deal with this situation in a way that does not drastically threaten the careers and livelihoods of many thousands of people. I don't think we've done a good job thus far."*
2) Graduate students are already noticing the impact of AI on their undergraduate classes and UROP/PRIMES/SPUR

a) **47.6 percent** said that undergrad usage of AI has negatively impacted classes they teach (as opposed to **19 percent** who said that the impact is both negative and positive, **28.6 percent** who haven't noticed an impact, and one person out of forty-five who reported a mostly positive impact).
    *i) "I graded for a class in the winter and it was quite simply a disaster."*
b) The story is happier for undergraduate research projects than it is for coursework. **47.1 percent** noticed both positive and negative impacts on undergraduate research projects, and **35.3 percent** noticed predominantly positive impacts.

3) Many students are concerned about the long-term future of mathematics (what will 'doing math' look like in twenty years? Where is the field as a whole headed?)
    a) **71.1 percent** of respondents are either 'very worried' or 'extremely worried' about the long-term future of math research.
    b) **60 percent** of students feel mostly negative emotions when they see posts about OpenAI/Anthropic/etc solving famous problems (as opposed to **11.1 percent** who feel mostly positive).
    c) Some dramatic quotes:
        i) *"If I were faculty now, I would be extremely worried and upset about my career and choices I made in life."* (No offense intended to the readers of this letter!)
        *ii) "It's so sad to me how much media coverage AI-solved problems get compared to human-solved problems."*
        *iii) "I'm honestly hoping AI usage in math will implode on itself."*
        *iv) "I'm afraid that the pace of papers… would be increased too fast and that I will not keep up and therefore my phd would be considered lame."*
        *v) "It has also been sad to see several recognized professors performing, over the last month or two, what can be described as a publicity stunt in favor of OpenAI/Anthropic/etc. It seems that their desire to be at the center of the ongoing development outweighs their feeling of responsibility towards the math community and society overall."*
4) Many students are worried that AI will make it harder for them to grow as researchers. They want their advisors to be aware of this particular issue, and help them structure their research accordingly.

a) *“With such ‘oracle’ tools it becomes very easy to turn to them when encountering the slightest hurdle and to stop meaningfully interacting with a problem… when we are supposed to develop independent problem solving skills and an understanding of a particular research topic, it seems quite counterproductive to be dependent on AI.”*
b) *“I worry that my own mathematical development has had a negative impact due to excessive AI usage… If I don’t go through the classical training of solving (often AI-able) exercise level problems (which is what an early grad student does) then I might not learn how to ask the right questions…”*
c) *“I find it really surprising how quickly postdocs and late-stage graduate students have taken to using AI for everything. As an early graduate student myself, I feel like I am still conveyed the message of “learn everything you can for yourself…” But it seems to me that a slightly older age range is not getting those same messages, and are flocking to [AI] for everything – in ways that make it hard to work with said people, and in fact has led to the ending of some collaborations for me.”*

5) We want to highlight that responses were not uniformly negative. The most ‘neutral’ questions (where data was most uniformly spread out) had to do with how grad students currently use AI. For questions such as ‘How much do you use AI in your research?’ and ‘Is it clear to you how AI can or should be used in the research process?’, the responses were not significantly skewed to either side.
    a) *“I generally use AI to expedite coding, not to do my thinking for me.”*
    b) *“I use AI primarily for literature review, for typo identification, and to clarify specific points of minor confusion with my general mathematical background. For these pursuits, it's helpful and effective.”*

## What do students want faculty to do?

1) Primarily: students want clear, transparent communication from faculty, as much advice as we can get on ‘hard questions,’ and more departmental discussions around AI.
    a) In-person conversations and two-way discussions are especially helpful (as opposed to emails, one-way talks, written articles, etc)

b) *"Be very explicit about new expectations, if there are any. When I started phd I was told that I need at least 3 papers to complete it, if the quota is updated to say 7 papers, then I want to know that as soon as possible… Any other metric is also good, this is just a stupid example of course (I mean, define "a paper"...)"*

c) A long list of 'hard questions' from one respondent included:
   i) *"Is it okay to ask an AI to solve a problem/lemma for us?"*
   ii) *"What should graduate students be focusing on… Should we be focusing on other adjacent skills, e.g. looking at the bigger picture and getting a better understanding?"*
   iii) *"Are bigger, more important/central questions to be avoided by students to avoid being scooped by others?"*

d) *"In general I think that talking about this unknown scary situation *is a good thing* and I'm happy that you send this survey… ignoring [AI] is not going to do any good for anyone."*

e) *"Probably some discussions on how AI will reshape the academic landscape and faculty system."*

f) *"Nobody can predict the situation perfectly, but faculty members probably have much more information about how AI will shape the job market than grad students do. I would love for them to be more transparent with whatever information they have."*

g) We need more conversations discussing how and when should AI be credited: *"I feel that AI should be in some sense credited (though broadly, without a specific model name, in recognition of the fact that AI companies are currently looking to math for effectively free advertising, and that I view providing such advertising as generally negative) whenever it should be reasonably understood as contributing something genuinely new to a given work."*

2) Several respondents voiced concerns about being pressured by faculty to use AI.
   a) *"...Not encourage AI use for everything, and especially never expect students to use AI who don't want to."*
   b) *"Help make sure there is a way forward for people who don't want to use AI."*

**Some simple suggestions for you**

We hope you keep the following ideas in mind as you prepare for the upcoming academic year. None of these suggestions are demands – they're just ideas, based on the responses we received, for concrete ways you can help support your students.

1) It would be helpful for advisors to have individual conversations with their advisees about AI. Students were all over the map with regards to how much they want to use AI in research. One student might want to use it all the time, one might never want to use it, and these students require different kinds of support. Many students might also have individual questions related to AI they want to ask you about (eg: "should I keep working on project X, or should I pivot to something less computational?")
    a) If you have thoughtful answers to questions like, "how will you evaluate hiring candidates in the AI age?" or "have you updated your expectations for my thesis work?" then students want to hear your answers!
2) Stay on top of AI developments to the best of your abilities, and reflect on how your advice might change accordingly.
3) More community activities/infrastructure:
    a) It might be useful to organize a department-wide meeting, where students, postdocs, and faculty can all have open, informal conversations about these issues (and we would be happy to assist with the planning of such a meeting!)
    b) We have additional ideas about infrastructure that would be useful to implement in the department (eg: a community-organized AI committee), and would be very happy to meet with you to talk further
4) Course instructors: please be open to feedback and concerns from your TAs about grading. Consider changing your grading schemes. Possibly schedule a meeting with your assigned TAs at the beginning of the course to discuss AI-related grading issues.
5) For PRIMES/SPUR/RSI/UROP/etc organizers: set clear expectations about AI in undergraduate research, and potentially have in-person discussions with mentors about these expectations.
6) Generally: be empathetic and mindful of the fact that many of your students may be stressed, worried about their futures, demoralized, etc.

Thank you for reading our letter (and, hopefully, taking a closer look at the survey itself). Looking forward to having deeper conversations with you,
Anna, Dora, and Hanna