Knowledge-GAP: the Impact of Mentoring on the Graduate School Application Process

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MSRI CIME 2018

Photo taken by David Eisenbud

What was AMP?

The Advanced Mathematics Program (AMP) was a graduate student led summer workshop for marginalized mathematics majors at the University of California, Riverside. It ran from 2017 to 2021 and had over 150 participants over those 5 years.

AMP to Graduate School

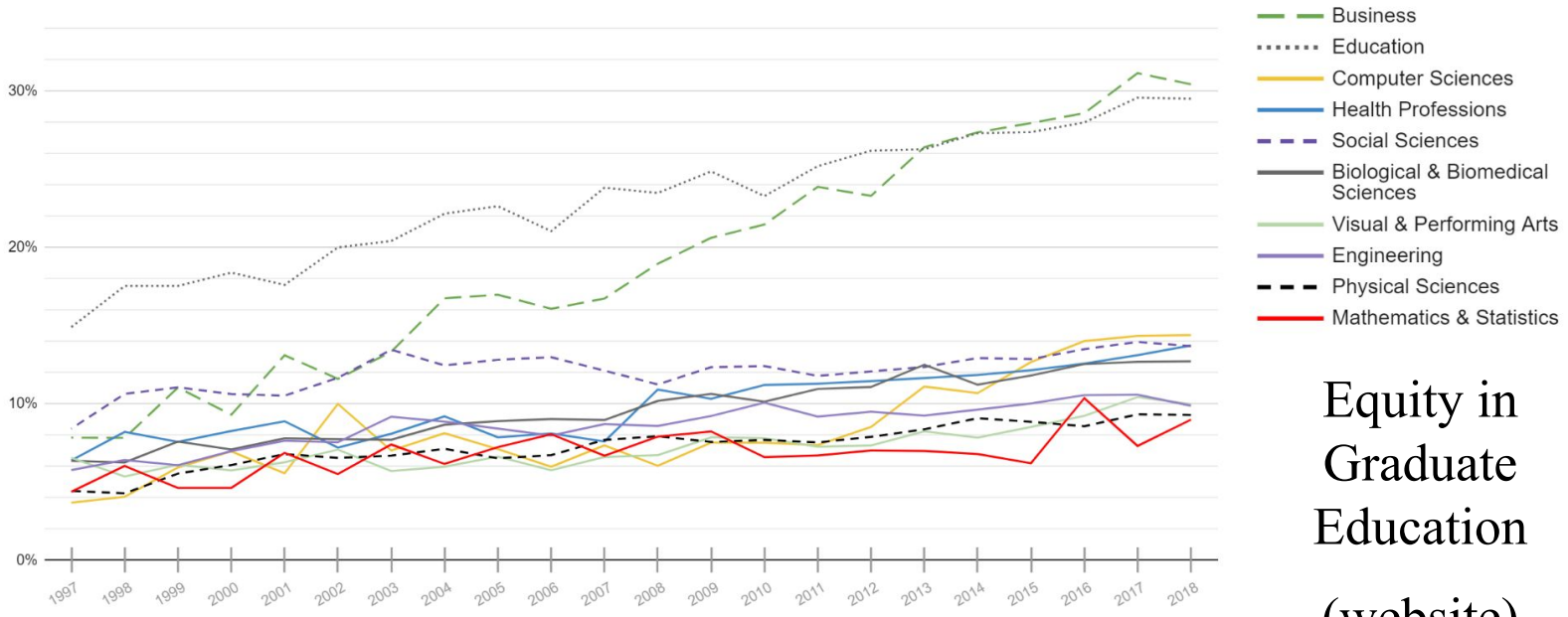
A major goal for AMP was to help students prepare to apply to graduate school.
However, most of our participants:

- were in their final undergraduate year.
- did not know about graduate school or how to apply.

Why was there this clear gap in knowledge among these marginalized students in AMP and does this gap exist outside UC Riverside?

Graduate School in Mathematics

Percentage of Doctoral Degrees Conferred to Black/African American, Hispanic/Latinx, and Indigenous Students

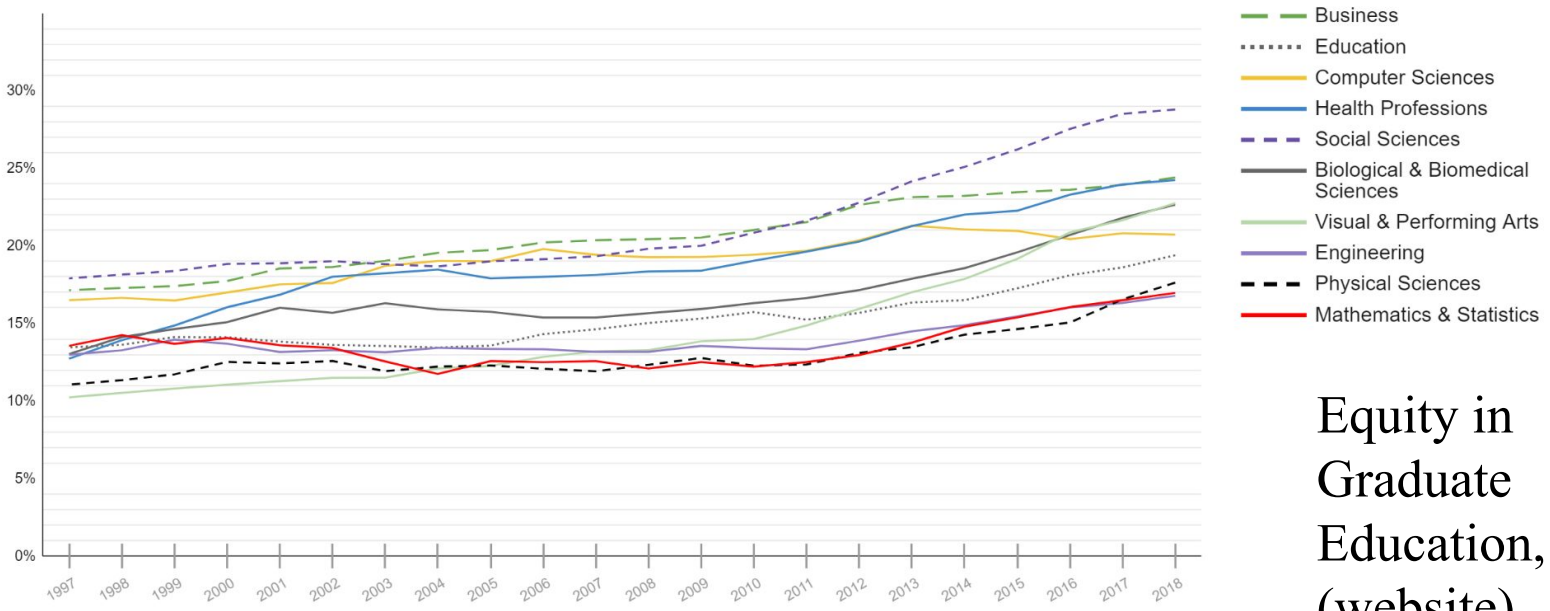


Equity in Graduate Education

(website)

Undergraduate Math Majors

Percentage of Bachelor's Degrees Conferred to Black/African American, Hispanic/Latinx, and Indigenous Students



Equity in Graduate Education, (website)

Literature on Admissions

- Most admissions to graduate programs are by the individual departments
- Faculty have to decide on the metrics and admissions
- Faculty are increasingly reliant on the quantifiable applicant information: College GPA, GRE scores, and the ranks of their undergraduate institution

(Posselt, 2016)

Need to Know

What are the essential knowledge and resources necessary to apply to graduate school?

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What are the essential knowledge and resources necessary to apply to graduate school?

- Letters of Recommendations (from mathematicians)
- (Good?) GPA
- GRE
- **Money**

Do undergraduate math majors have access to the necessary knowledge and resources to apply to graduate school?

Undergraduate Knowledge of the Mathematics Graduate School Application Process (Knowledge-GAP)

CENTER FOR EXCELLENCE IN STEM EDUCATION

National Science Foundation

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Research Questions

1. What do undergraduate mathematics majors know about graduate school application process?

2. Does knowledge of the graduate school application process and access to the required application resources differ by income level, ethnicity, and gender of the students?

Survey

To begin answering these questions we created the Knowledge-GAP survey.

This survey was emailed through multiple listservs and directly emailed to chairs and program directors at 987 colleges/universities.

Survey Contents

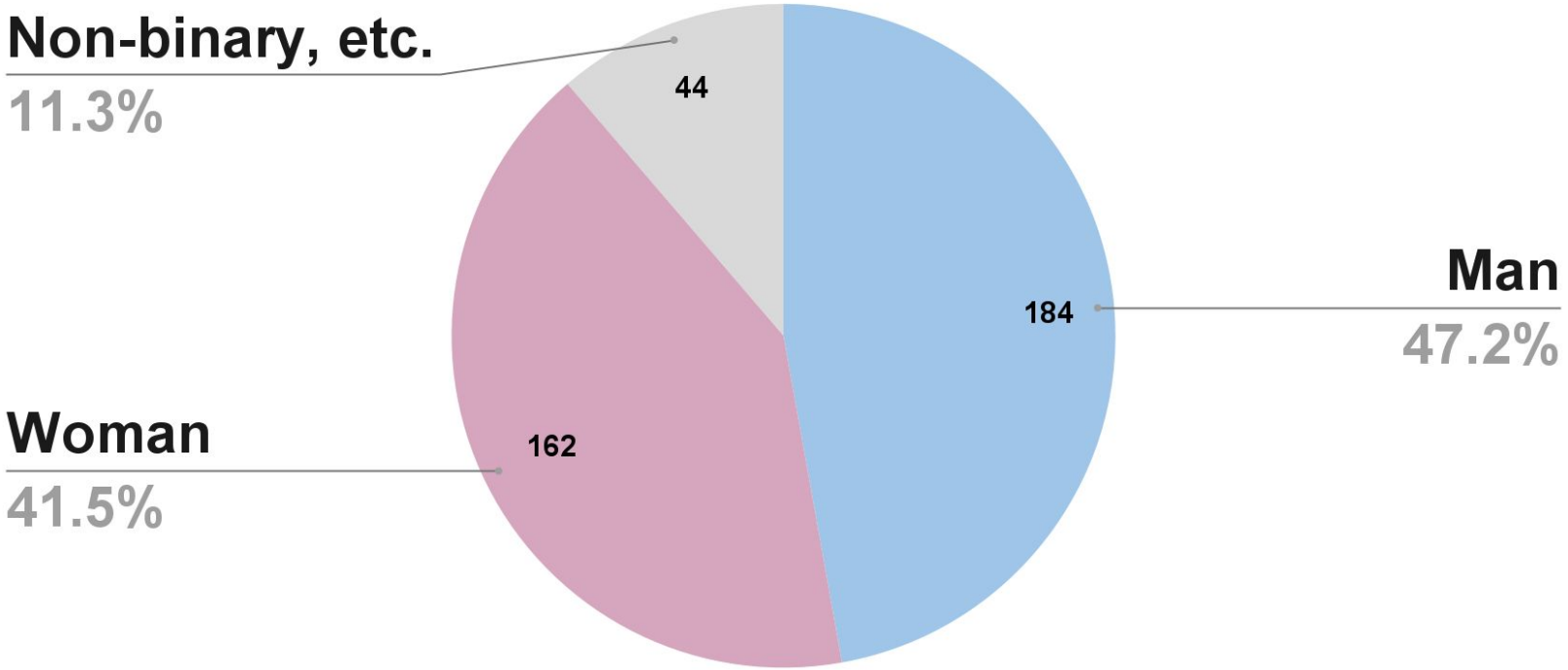
- Do you believe that before you took this survey, you knew enough about the application process that you could apply to graduate school in mathematics?
- Which of the following describes your interest in graduate school in mathematics?
    - What made you decide that you are not interested in attending graduate school in mathematics?
- Do you have someone you consider a mathematical mentor? (This is someone who has not necessarily been formally assigned to you by your institution but gives you advice on how to advance your career in mathematics.)
    - Who is (are) your mathematical mentor(s)?
    - How has your mathematical mentor(s) helped you?
- What is your gender? (Please mark all that apply.)
- With which racial and ethnic groups do you identify? (Please mark all that apply.)

Preliminary Results

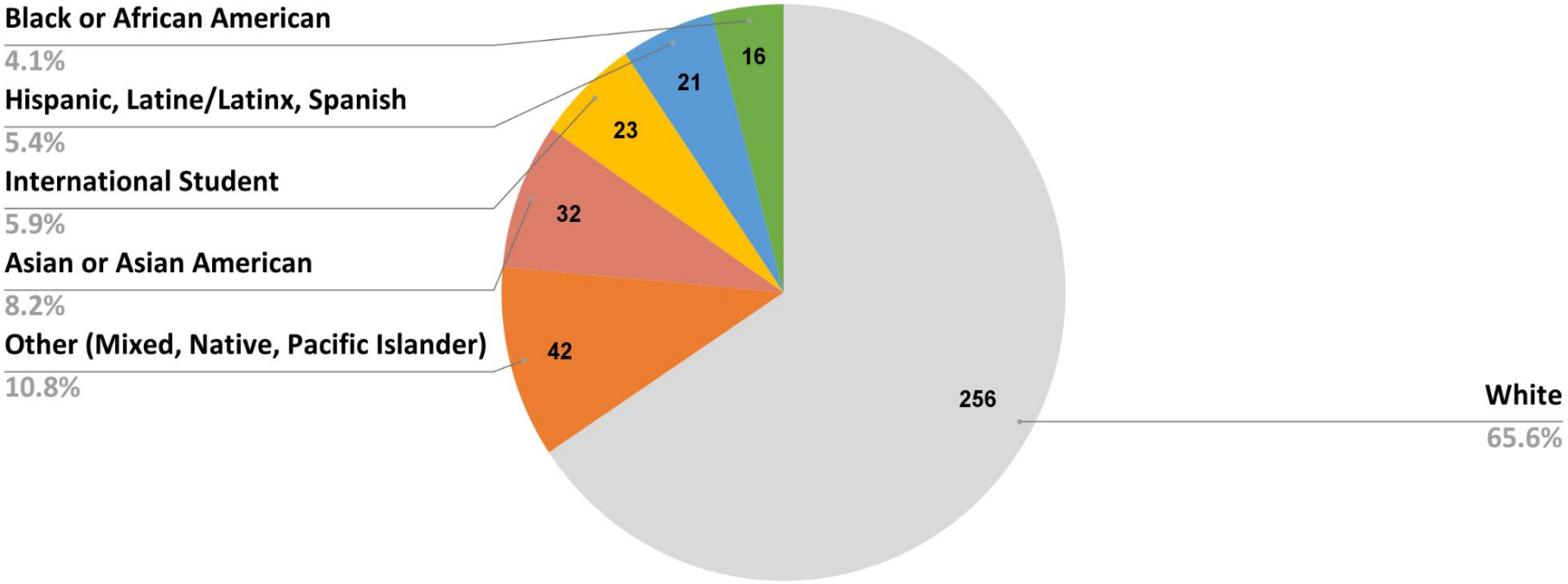
This presentation will be on the 442 of the 826 survey responses that responded to the following question:

“Do you have someone you consider a mathematical mentor?”

Respondent Gender



Respondent Race & Ethnicity



Which of the following describes your interest in graduate school in mathematics?

Interest in Graduate School	# of responses	% of responses
Not interested in graduate school in math	62	14.0%
Masters degree only	76	17.2%
Masters or a post baccalaureate program before earning a doctorate	111	25.2%
Doctorate directly after undergraduate degree	112	25.4%
Not sure	80	18.2%

Do you have someone you consider a mathematical mentor?

Only 55% of participants said they had someone they consider a mathematical mentor.

Associations Between Mentoring and Applying to Graduate School

Do you believe that before you took this survey, you knew enough about the application process that you could apply to graduate school in mathematics?

	Yes	No	Not Sure	Total
Mentor	91	85	66	242
No Mentor	46	95	58	199
Total	137	180	124	441

Participants with a mentor were significantly more likely to report feeling prepared to apply to graduate school.

$$\chi^2(2, N = 441) = 11.77, p = .003.$$

Which of the following describes your interest in graduate school in mathematics?

	No	Masters	M -> PhD	PhD	Unsure ▲	Total
Mentor	31	40	56	81	35	243
No Mentor	31	36	55	31	45	198
Total	62	76	111	112	80	441

Participants with a mentor were significantly more likely to report wanting to apply to a PhD directly.

$$\chi^2(4, N = 441) = 19.40, p < .001.$$

Do you have someone you consider a mathematical mentor?

There was not a significant association between participants' gender and whether they had a mentor.

$$\chi^2(2, N = 391) = 4.945, p = .084.$$

There was not a significant association between participants' race/ethnicity and whether they had a mentor.

$$\chi^2(5, N = 391) = 8.168, p = .147.$$

Do you believe that before you took this survey, you knew enough about the application process that you could apply to graduate school in mathematics?

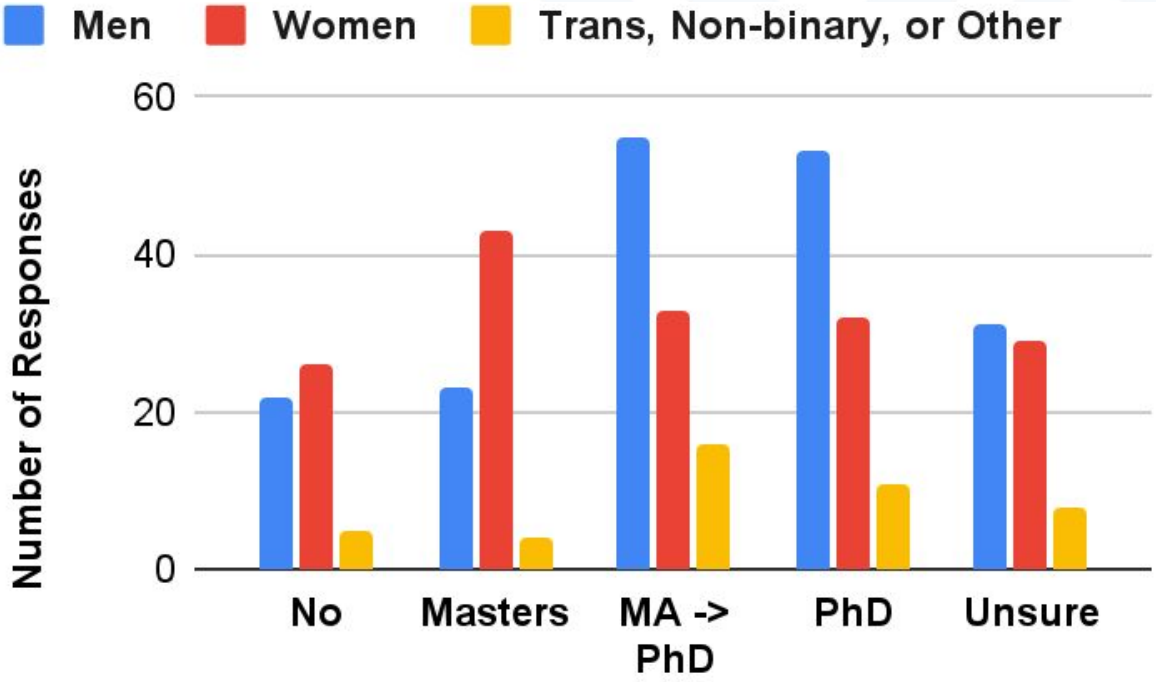
There was not a significant association between participants' gender and whether they feel like they could apply to graduate school.

$$\chi^2(4, N = 390) = 2.418, p = .659.$$

There was not a significant association between participants' race/ethnicity and whether they feel like they could apply to graduate school.

$$\chi^2(10, N = 390) = 3.946, p = .950.$$

Which of the following describes your interest in graduate school in mathematics?



Men were significantly more likely to report they wanted a Ph.D.

Women were significantly more likely to report Masters only or not interested.

Non-binary were more likely to report Masters into Phd than Masters only.

$\chi^2(8, N = 391) = 20.47$, $p = .009$.

Race/Ethnicity and Interest in Graduate School in Mathematics

There was not a significant association between participants' race/ethnicity and whether they were interested in graduate school.

$$\chi^2(10, N = 391) = 19.567, p = .485.$$

40% of the cells in this table had < 5 entries. We do not have enough participants to say strong about this association.

To what extent do you have mentors who encourage you to study mathematics?

Based on independent sample *t*-test of a 5 point Likert scale item, we found that:

The group composed of Women and Transgender, Nonbinary, and other participants ($M = 3.75$, $SD = 1.29$) were more likely to report being encouraged to pursue mathematics than the group composed of Men ($M = 3.46$, $SD = 1.45$), $t(390) = -2.14$, $p = .033$.

To what extent do you have mentors who encourage you to study mathematics?

White participants ($M = 3.71$, $SD = 1.32$) were more likely to report being encouraged to pursue mathematics than the group composed of Asian, International, Latin*, Black, and Other participants.

$$(M = 3.30 , SD = 1.52), t(389) = 2.57, p = .011.$$

What did participants have to say?

Why not pursue graduate school?

95% of participants who said they were not going to apply to graduate school in mathematics gave a text response explaining why. Here is a typical response:

“I have decided to pursue graduate school in a different field instead.”

Feeling Lost

“I have been miserable during my entire undergrad career so far and I'd rather get a boring job.”

“[..]When I saw my dad getting his Masters in Applied Mathematics when I was young I did not want to get a master's degree because of how unpleasant I saw it to be.”

Being Given the Chance

"A mathematician that came to visit my campus told me more about [graduate school] and invited me to a conference. Her name is Dr. Pamela Harris[..]. Before that, I had no knowledge at all about graduate school."

What have you learned about the graduate school application process by taking this survey?

"That I should find a mentor"

The Knowledge-GAP Team

Student Contributors

Danielle Maldonado is a second-year physics Ph.D. student studying physics education research at West Virginia University.

Zachary Lightcap is a mathematics major at West Virginia University in his final year of undergraduate education.

Project Mentors

Jessica Deshler is the Assistant Dean for Graduate Studies for the Eberly College of Arts and Sciences at West Virginia University.

Lynn Michaluk is a Research Assistant Professor working for the West Virginia University Center for Excellence in STEM Education.

Tim McEldowney

Tim McEldowney is a Postdoctoral Researcher associated with the West Virginia University Center for Excellence in STEM Education. He is the PI of the Undergraduate Knowledge of the Mathematics Graduate School Application Process (Knowledge-GAP). He studies the equity and access mathematics graduate education while being interrupted by his two cats Ruby and Tracy.

References

Equity in Graduate Education (n.d.). Equity in Graduate Education | Numbers https://sites.google.com/igenetwork.org/equity-in-graduate-education/learning/numbers?authuser=0

Posselt, J. R. (2016). *Inside graduate admissions: Merit, diversity, and faculty gatekeeping.* Harvard University Press. (Cambridge, Massachusetts).

Thank You

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Please follow this link for access to the survey and instructions to send it to your students.