

## Introduction

Even before the Covid-19 pandemic, graduate students were found to be increasingly in crisis. A widely cited Harvard study from 2018 found that graduate students were *six times more likely than the general population* to experience anxiety and depression (1), at levels comparable to incarcerated populations. A subsequent report from the US National Academies of Sciences, Engineering, and Medicine (2) found that this problem was bigger than ever post-pandemic.

In order to support graduate student mental health in our programs/departments, we have launched a so-called Peer-On-Peer (PoP) mentoring program for graduate students, which started during the academic year 2023/24. It is well established that mentoring – when done right - can improve graduate student retention, success, and well-being (3-7), particularly for students from historically underrepresented groups. Importantly, new research suggests that having a ‘constellation’ of mentors (8) is advantageous to the development of new scientists. The constellation model is one that breaks with the tradition of the research advisor being the primary or even sole mentor of a graduate student – instead, in this model students should create ‘webs’ of meaningful relationships (6) that extend to other students, staff members, and multiple faculty members outside of their primary research advisor, where these diverse social relationships ‘sustain them through, and beyond, college’ (6, 9, 10).

### Participate in a tiny survey!

Our working hypothesis is that, long term, the PoP mentoring program will increase the students’ sense of community (both for mentors and mentees), and that this improved sense of community will enhance students’ overall wellbeing and resilience. Since the mentoring program launched in 2023/34, and a meaningful assessment of its impact will require data collection over multiple years, **the goal of the first phase of this SoTL project is to analyze the results of the pre-survey.** In the fall quarter of 2023, we surveyed students from three different programs (Physics and Astronomy, Chemistry and Biochemistry, and Molecular and Cellular Biophysics) on their Sense of Community and their Self-Efficacy, both as a baseline for the assessment of the mentoring program’s impact, and in order to assess the students’ Sense of Community in our normal program setting.

## Methods

We conducted an anonymous Qualtrics survey that was sent out to all DU graduate students in the Molecular and Cellular Biophysics (BIOP) program, in the Physics and Astronomy (PHYS) program, and in the Chemistry and Biochemistry (CHEM) program. In addition to basic demographic information, the survey collected the following data:

### Question block 1: Quantitative Questions about Sense of Belonging

We adapted the Harvard-Panorama Student Perception Survey scale on Sense of Belonging (11) and Yorke’s (12) Sense of Belonging in Higher Education scale for our purposes; these scales are thus based on published literature and have already undergone a rigorous, research-based development process to enhance reliability (13).

Examples:

*How connected do you feel to the community of staff and faculty within your program (e.g. administrative assistants, technical staff, faculty other than your research advisor)?*

Not at all connected	Slightly connected	Somewhat connected	Quite connected	Extremely connected
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*How welcoming have you found your program to be?*

Not at all welcoming	Slightly welcoming	Somewhat welcoming	Quite welcoming	Extremely welcoming
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### Question block 2: Qualitative Question about How Students Build their Community

*What activities have you found helpful for building your sense of community (within the program, within the division, or within the university as a whole)? For example: Required subject courses, ‘Introduction to Research’ course (Physics Department only), teaching assistant duties, lab rotations, department seminars or colloquia, formalized mentoring program, informal mentoring activities, campus-wide recreation activities, self-organized social activities with other students.*

### Question block 3: Quantitative Questions about Self-Efficacy

Academic confidence was measured by a portion of the Academic Behavioral Confidence (ABC) scale (14, 15). The ABC scale is originally a psychometric measure of the confidence of undergraduate students ‘in their anticipated study-related behaviors in a largely lecture-based course’; we slightly adapted the scale to select or introduce items more relevant to the graduate student experience.

Examples:

*How confident are you in your ability to study effectively on your own?*

Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
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*How confident are you in your ability to manage your workload to meet deadlines?*

Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
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## Results 1: Demographics

We had 44 respondents, which break down as follows:

Program	N
Chemistry and Biochemistry	20
Molecular and Cellular Biophysics	13
Physics and Astronomy	11

Race	N
White	22
All Other Races, including Mixed Race	6
Prefer not to self-identify, or no response	11

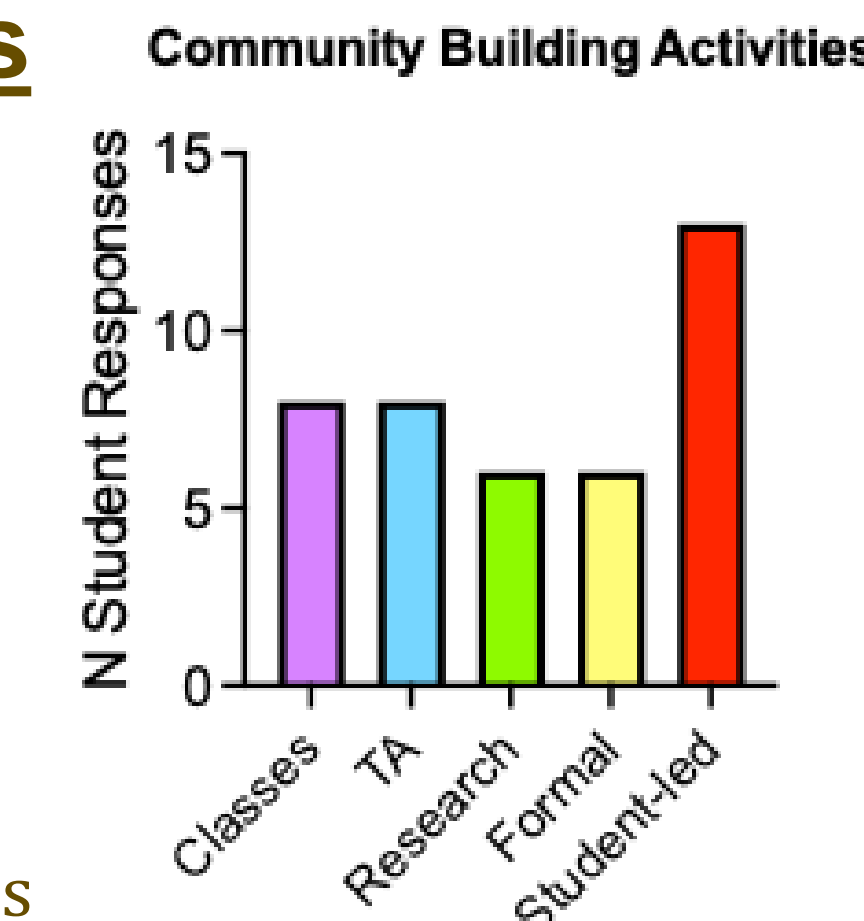
Sexual Identity	N
Heterosexual	21
Gay or lesbian	1
Bisexual	7
Prefer not to self-identify, or no response	15

Gender Identity	N
Male/Man	14
Female/Woman	14
Trans or non-binary	3
Prefer not to self-identify, or no response	13

## Results 2: Qualitative Analysis

Out of 44 survey respondents, 26 responded to the free response text prompt in Question Block 2 about what activities helped them build community. We coded the answers as follows:

- **Classes:** mentions positive role of classes
- **TA:** mentions positive role of teaching assistant duties
- **Lab:** mentions positive role of current lab or past lab rotations
- **Formal:** mentions positive role of activities that are organized by the department or university
- **Student-led:** student mentions positive role of self-organized activities



**R1: Students mentioned student-led activities (both work-related activities as well as social activities with peers in their free time) twice as often as formal activities such as departmental colloquia, seminars, or other activities organized by professors or staff.**

**R2: There are many mentions of required classes and teaching assistant duties as a source of community (even more than lab mates), and many students explicitly and positively mention the role of their cohort here, even though we didn’t use the term in the prompt.**

Notably, a significant number of students also used the free response opportunity in a way we didn’t anticipate, specifically to discuss barriers or negative community experiences. We coded these as well:

- **Lack/constraint:** comments on the lack of general community, or mentions (neutrally or negatively) that their social contacts are largely constrained to their research lab.  
Examples:  
*My lab is pretty good, but that’s the extent of my “community”.*  
*I also have met maybe one student outside of the chemistry dept.*
- **Barriers:** mentions barriers to either building a community or maintaining one.  
Examples:  
*Once I stopped teaching there was nothing holding my cohort together and no real overlap with students in other years*  
*Then we basically never saw each other again once we had to join labs, unless we took time out of our paid work day to walk and see each other.*

Classes	8
TA	8
Lab	6
Formal	6
Student-led	13
Lack/constraint	8
Barriers	2

**R3: Many students mention a positive impact from good relationships with their lab mates, but many respondents also say - sometimes in the same sentence - that they either don’t know, or don’t have time to socialize with, many people outside of their lab.**

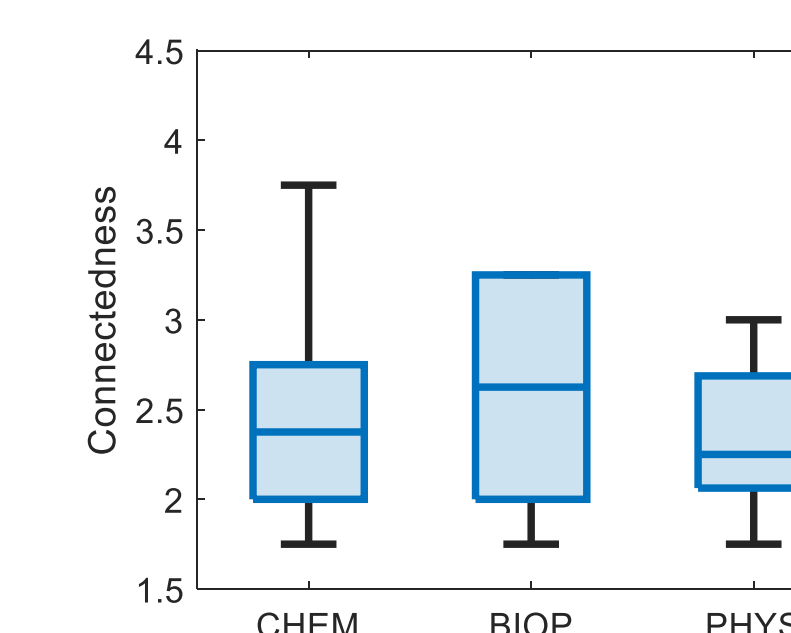
**R4: A barrier that was mentioned explicitly is the perceived pressure to constantly be present in the lab, which prevents maintaining meaningful relationships with cohort friends (and other peers) in other labs.**

## Results 3: Quantitative Analysis

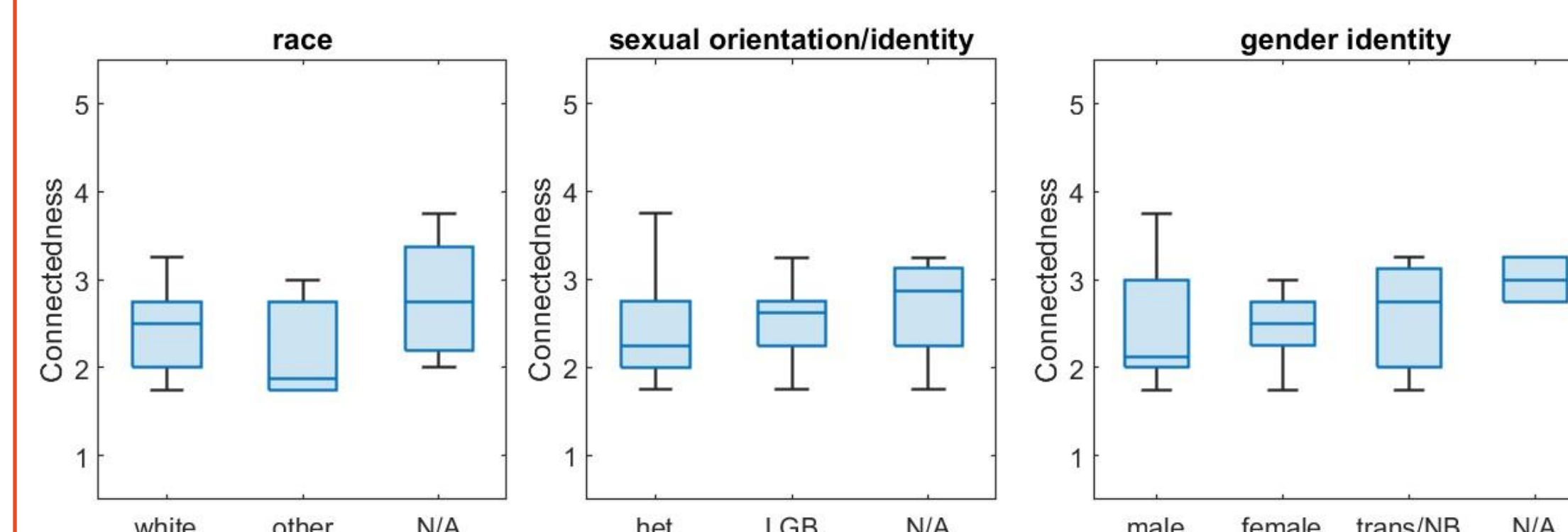
Note: We are reporting all of the quantitative results in the following as box charts (median and interquartile ranges), as opposed to mean and standard deviation.

*Does connectedness differ between academic programs?*

Within the current dataset, the biophysics (BIOP) students are reporting somewhat higher levels of connectedness than students in the Physics & Astronomy (PHYS) or the Chemistry & Biochemistry (CHEM) programs.

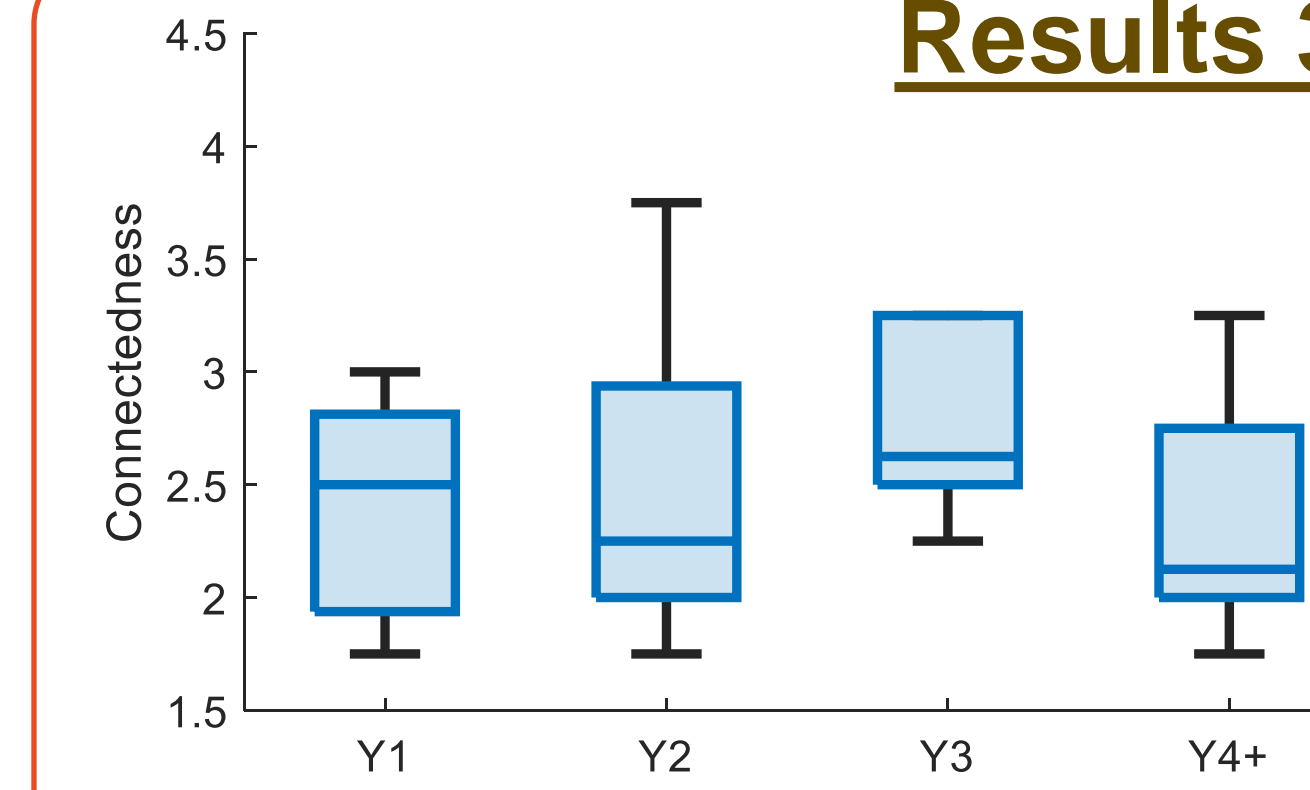


*Do minority students experience less connectedness?*



The data suggest that non-white students experience less net connectedness, but there’s currently no indication that this is the case for LGBTQ+ students.

## Results 3: Quantitative Analysis



*Does connectedness increase with time?*  
Probably not. Within the current dataset, we don’t see a robust trend of increase of connectedness with time, although we saw a higher value in the current 3<sup>rd</sup> year students.

*Does self-efficacy increase with time?*

The self-efficacy does not increase continuously, and also doesn’t follow a u-shaped trajectory; instead, in the current dataset, the reported self-efficacy values actually decrease systematically with the amount of time spent in the program.

Within the self-efficacy category, there were 9 individual questions related to various skills relevant to graduate school.

The two *highest-scoring questions* were:

*h1: ability to study effectively on your own*

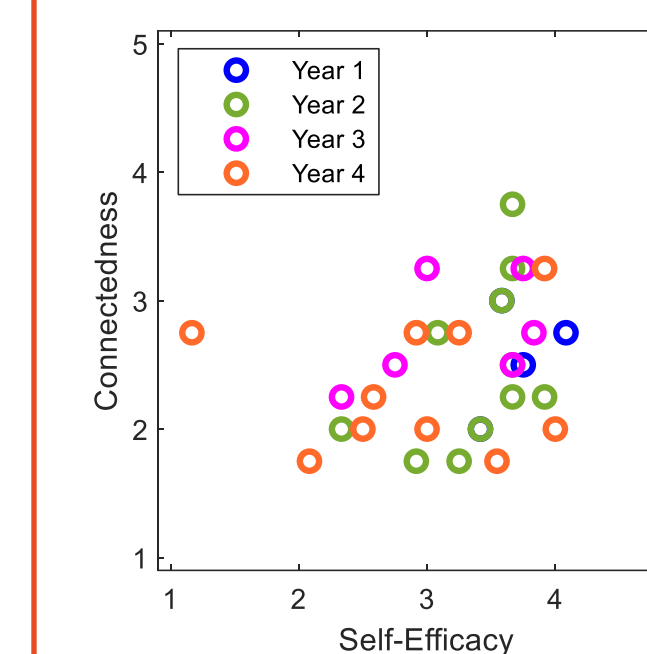
*h2: ability to manage your workload to meet deadlines*

The two *lowest-scoring questions* were:

*l1: ability to give a presentation to a large group (e.g., colloquium, conference)*

*l2: ability write about your research in an appropriate academic style*

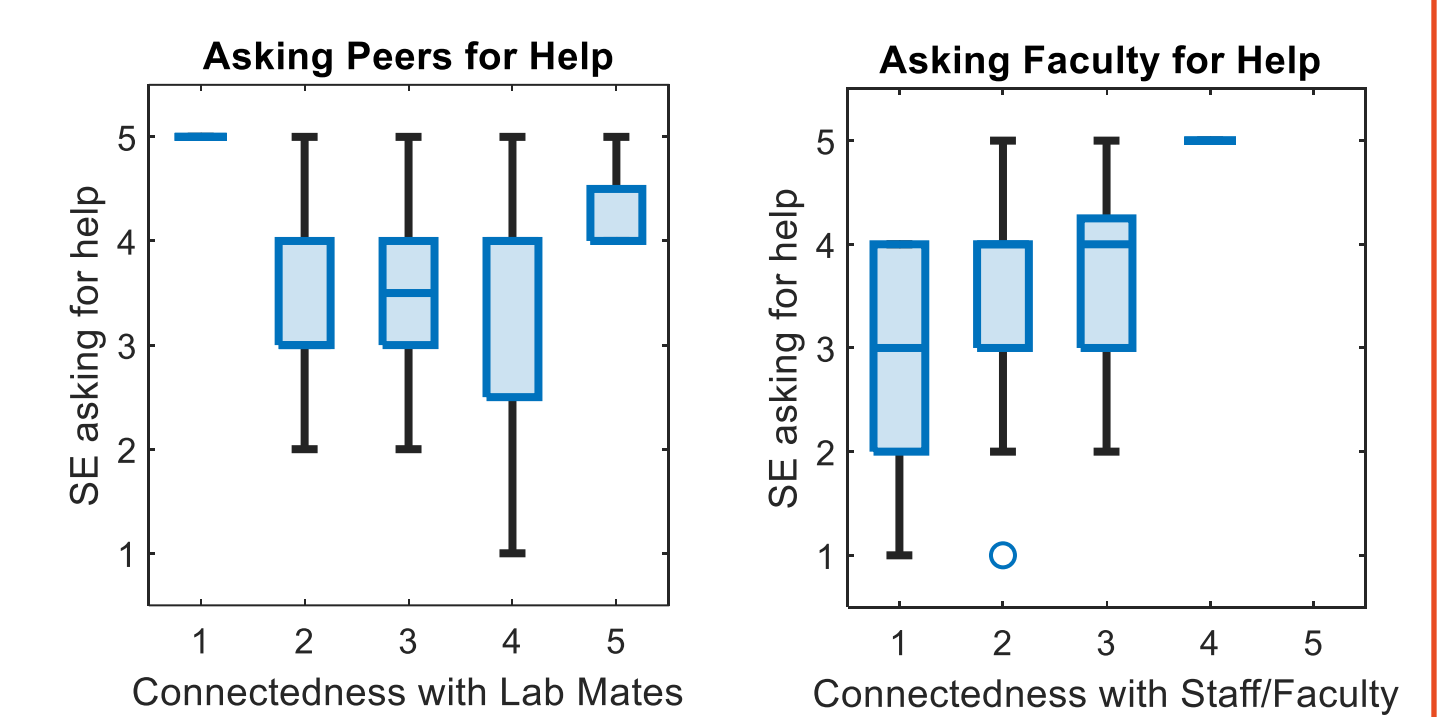
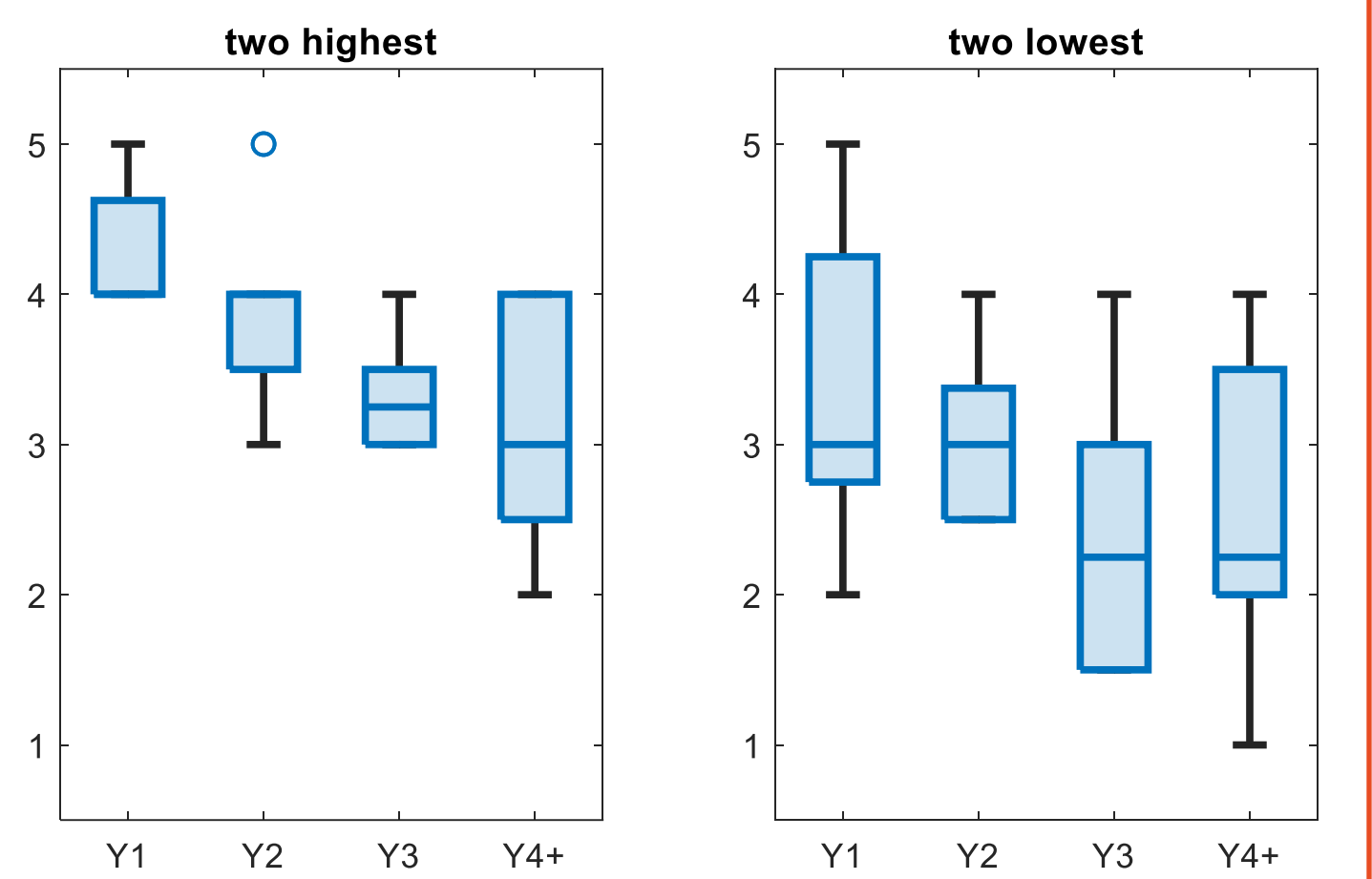
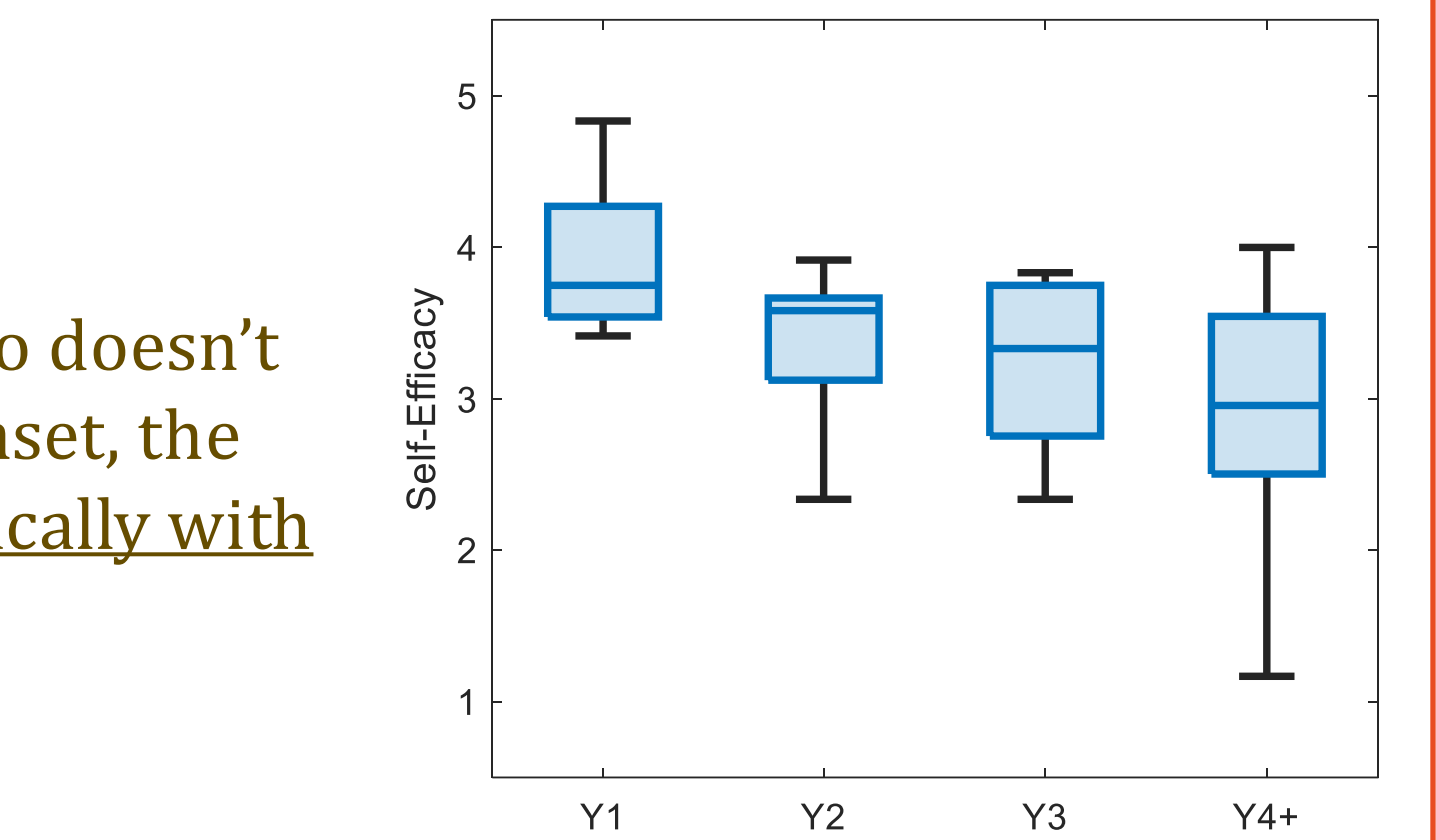
Both sets follow the same overall trend



*Does a higher level of connectedness predict a higher level of self-efficacy?*  
Not in our current dataset, due to the outsized effect of the program year (i.e. the program year predicts reported self-efficacy much better than connectedness does).

*Does a higher level of connectedness predict anything useful then?*

We see that a higher level of connectedness of students with faculty predicts a higher level of self-efficacy with respect to asking Faculty for Help – this effect is not seen for peers.



## Conclusions and Future Directions

- (1) Students responded to the qualitative question in ways that we didn’t anticipate, so we are adding additional questions next year to allow students more space to express their opinions.
- (2) Peer-led activities have an outsized effect on building students’ community. What are departments doing to support student-led social activities?
- (3) The students’ first-year cohort (as opposed to lab mates) may be an underappreciated source of community. What can the departments do help students maintain these meaningful relationships?
- (4) The finding about self-efficacy is unexpected and alarming, and we need to study this more.

## References

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