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SCOAM Annual Report

Prepared for the

INDIANA UNIVERSITY OF PENNSYLVANIA - DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES

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Executive Summary

This report represents the outcome of data collected and provided to evaluate the Scholarships Creating Opportunities for Applying Mathematics (SCOAM) program in the Department of Mathematical and Computer Sciences at Indiana University of Pennsylvania (IUP).

The SCOAM program aims to recruit and retain math majors, minors, and graduate students; strengthen the academic culture of the department; and strengthen the relationships between STEM fields on campus and beyond through a series of mandatory activities designed to target these goals. These activities include presentations by outside speakers, workshops in computer programming languages, small group activities, peer-led team learning sessions, and monthly meetings.

Data for this evaluation was collected by an end of semester survey in Spring 2021 and Fall 2021, student reflection narratives, student essays, and a report on the peer-led team learning sessions that contained survey and interview data. Results presented are from the descriptive analyses of quantitative survey data and a qualitative analysis of the student narratives, peer-led team learning sessions report, and survey comment data. The responses are from the sixth and seventh semesters of an overall 10-semester data collection effort. Data for all 7 semesters are reported for program activities and possible trends were noted.

In Spring 2020, the COVID-19 pandemic required universities to move to an online format. Both students and faculty found this transition to be challenging. The Fall 2020 semester appeared to be even more challenging for students, especially freshmen. Data was again solicited from students regarding their experiences and opinions during both the Spring 2021 and Fall 2021 semester to get a sense of the ongoing impact of the pandemic on their learning experiences.

The primary investigators have implemented a series of activities designed to target the three overall program goals. Analyses of data collected from each activity suggested that students have begun to; connect as a cohort, see the value in the cohort and networking with the larger STEM community, make connections between the concepts they are studying in class and the larger STEM community, and engage in scholarly activities. These responses suggest that the set of activities were successful in targeting all three SCOAM program goals and helping students stay connected and motivated during the unprecedented global pandemic.

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Introduction

This report presents the results of data collected and provided to evaluate the Scholarships Creating Opportunities for Applying Mathematics (SCOAM) program in the Department of Mathematical and Computer Sciences at Indiana University of Pennsylvania (IUP).

The SCOAM program was begun at IUP in 2010. At the initial program's conclusion, the Primary Investigators (PIs) re-applied for funding for a similar, but expanded, program based on experiences with the prior program. This expanded SCOAM program was funded in 2018 through the National Science Foundation (NSF). This external evaluation was completed on directive from NSF to provide an outside unbiased review of the efficacy of the program in meeting its overall goals during the past year.

The project has 3 broad goals as stated in the grant application:

1. increase the number of students graduating with a major, minor, or master's degree in mathematics,
2. strengthen the academic culture of the Department of Mathematical and Computer Sciences, and
3. strengthen relationships with the broader STEM community within and beyond the university.

The project aims to achieve these goals by providing financial assistance to students in need to pursue their degree and developing a series of activities each semester designed to strengthen relationships within the academic and STEM communities. Several activities are offered; presentations by speakers from the STEM industry focused on career options for STEM graduates, workshops to develop computer programming skills, and a series of group activities:

- student-led small group activities,
- peer-led team learning sessions, and
- monthly meetings in which SCOAM participants present original research and have conversations about career topics (e.g., resume building, career options),

designed to encourage relationships among the students in the cohort.

In the Spring of 2020, a pandemic caused by the COVID-19 virus forced the closure of face-to-face classes on university campuses across the United States. The NSF's Division of Undergraduate Education (DUE) acknowledged that the outbreak of COVID-19 altered undergraduate education in unforeseen ways, including delivering all classes in an online format. As a result, DUE requested institutions already involved in investigations to consider how the impact on students and faculty could provide important new knowledge about STEM learning using online environments and the impact on learning that moving STEM courses online had on students. In response to this request, the principal investigators (PIs) of the SCOAM Project decided to investigate the impact of moving

STEM courses online on both faculty and SCOAM scholarship students. As classes have moved back towards a more traditional model, several questions related to online instruction asked in Spring 2020 and/or Fall 2020 were retained for comparison purposes.

This report is an annual external review for the Spring 2021 and Fall 2021 SCOAM semesters. The report first presents the general scope and method of the evaluation and then the results of the analyses organized by program goal.

Method

Sample

The Spring 2021 SCOAM survey cohort consisted of 28 students; 2 of whom began in Spring 2021. Overall, there were 24 students who identified as White and 2 who identified as Black or African American. Two students that identified as being of Hispanic or Latinx ethnicity.

Of the 24 students completing the survey, 16 reported they were undergraduate students while 6 reported they were graduate students. Four undergraduate students in the cohort were freshman and the remaining 12 were upper classmen (3 sophomores, 6 juniors, and 3 seniors). There were 10 students who identified as female and 12 as male. Of the students answering the question, 11 identified as mathematics majors and 11 as math minors. Three were first generation college students.

The Fall 2021 SCOAM survey cohort consisted of 26 students; 9 of whom started the program during the fall; 6 as freshmen and 3 as graduate students. The majority of students beginning the program in Fall 2021 identified as White (n = 25) with 1 student identifying as Black or African American. One student identified as being of Hispanic or Latinx ethnicity. Additionally, one student reported having a disability.

Of the new and continuing students, 22 completed the survey. Of these students, 14 were undergraduates (4 freshmen and 10 upper classmen) and 6 were graduate students. Additionally, 10 students identified as male and 10 as female. When reporting college major, 12 students identified as mathematics majors and 8 as math minors. Four reported they were first generation college students.

Data

Three sources of information were used for this report; quantitative and qualitative data gathered from an End of Semester survey, student reflection narratives concerning their experiences with the SCOAM program, and a report generated 'in-house' that summarizes and evaluates the peer-led team learning sessions. Data for both the Spring 2021 and Fall 2021 semesters were used to compile this report. Additionally, for both semesters, the evaluator had access to an End of the Year Report in which students wrote an essay about how participation in the scholarship program has impacted or changed their educational or career goals. Data from previous Annual Reports were used as appropriate for comparison.

Surveys

The End of Semester survey was created by the external evaluator in collaboration with the PIs and asked if participation in activities; increased motivation to do well in class, provided opportunities to learn new skills, allowed for exploration of career options, and provided the opportunity to interact meaningfully with faculty and students. In addition, in an effort to capture networking skills, the survey asked about the nature of the conversations with faculty and students inside and outside the mathematics department and SCOAM program to determine the extent to which SCOAM students were talking about academic versus non-academic topics, specifically, internship, research, graduate school, and career options and opportunities.

Because of the theorized relationship between mathematics mindset and perseverance with mathematical tasks, the survey also asked students to rate their identification with both positive and negative statements about their mathematics and science ability.

Additionally, freshmen were a part of this cohort of SCOAM participants. Literature on college retention rates suggest that students, and freshman particularly, can find the transition to college (and graduate school) difficult. A series of questions was included on the survey to target the main reasons identified in the literature for transition issues and give a sense of how students were transitioning.

Due to the COVID-19 pandemic and its substantia impact on higher education, the 2021 surveys also contained questions about their opinions on online learning and their educational experiences, and their preferences for online versus in-person courses. For the purposes of these additional survey questions, a STEM course was defined as being in the field of mathematics, natural sciences, engineering, computer and information sciences, or social and behavioral sciences. The Institutional Review Board (IRB) was informed of the modification to the SCOAM End of Semester survey according to established procedures.

In addition to 4-point Likert-type items, several open-ended comment questions were offered on the survey to gather any additional information not conducive to selected-response items and to collect alternate suggestions for future activities.

These survey data were collected through the Qualtrics survey package, and the email link was sent to all SCOAM participants with the expectation that it was mandatory to complete. Response data was downloaded directly from the Qualtrics site by the evaluator for analysis. Quantitative data analyses consisted of preparing a descriptive analysis for survey items while comments were subjected to a qualitative data analysis in which emergent themes were identified. Comments that were illustrative of themes and ideas were included in the report.

Social Group Activities

Students were also asked to participate in 3 small group activities each semester that are social in nature. In cross-generational groups (i.e., freshman, upper classman, graduate student), students

were to seek out and attend activities on campus or create their own social event. This activity was designed to encourage relationships between members of the cohort and to foster a sense of 'belonging.' For Fall and Spring 2021, social groups were given the choice of meeting face-to-face, virtually, or both depending on state guidelines and personal comfort levels.

Additionally, each semester, one of the social group activities must focus on a specific topic provided by the PIs. In Spring 2021, that topic was time management. For Fall 2021, the topic was machine learning/artificial intelligence/deep learning.

Peer-Led Team Learning Sessions

Goals for the learning sessions were two-fold; to give select upper classmen the opportunity to teach and give all student opportunities to extend the knowledge and skills they were learning in Calculus 1, Calculus 2, and Introduction to Linear Algebra. Peer leaders were upper class math majors. Sessions were highly recommended for SCOAM participants but were open to non-SOCAM students as well. In Spring 2021, PLTL sessions were conducted online while Fall 2021 PTLS sessions were in-person.

A report was generated 'in house' and provided to the external evaluator. The report consisted of survey data from participants as well as interview data from peer tutors. This report was reviewed and informal conversations between the external evaluator and 'in house' evaluator were held as necessary to interpret results. Results presented emerged from the report findings as well as from the informal conversations with the internal evaluator.

Essays from End of Semester Report

As part of the End of the Semester self-report, students provide an essay of at least 300 words to explain the impact that participating in the SCOAM program has had on their educational and career goals. Essays were subjected to a qualitative data analysis to determine emergent themes and for quotes that represented these themes.

Recruitment, Graduation Rates, Grade Point Averages

Exact frequencies concerning number of recruits, graduation rates and grade point averages for SCOAM participants are provided under separate cover from the principal investigators of the project and were not specifically used as part of this evaluation except as reported by participants. This report instead focuses on the more ephemeral impact of participation in the program on the students as it relates to the specified goals of the program.

Results

Goal 1: Increase number of major, minor, and graduate students in math

Goal 1 refers to increasing the number of students enrolling and completing a math major, minor, or graduate degree. This SCOAM goal overlaps with the departmental and university goal of increasing enrollment and retention.

End of Semester Survey – Activity Participation Data

Students were required to participate in several types of activities throughout the semester: monthly meetings, presentations, workshops, and social group activities. All activities were designed to promote connectedness among SCOAM students and/or between students and faculty within the math and science departments. A set of items on the survey were designed to capture how well the activities promoted 'connectedness' among SCOAM students and motivated students to work hard and complete their coursework. Raw data for all survey results are presented in Appendix A.

Spring 2021 Workshops and Presentation: Due to continued COVID-19 mitigation efforts, workshops and presentations in Soring 2021 were virtual. Five of the 24 students reported they did NOT attend either Python workshop and twelve students reported that they would not have attended if they were not a part of the scholarship group. Survey results show that the Introduction to Python workshops and were successful in helping a majority of students feel more connected to faculty within (79%) and outside of their department (74%) and other SCOAM (79%) and non-SCOAM students (74%). In addition, the workshops also helped motivate most students to work harder in their classes (79%) and continue in their program (79%) with 89% of participants believing the Python workshops taught them a new skill beneficial for their future.

All students were satisfied with the academic level and content of the Alumni Panel presentation although 6 noted that they would not have attended the presentation if they were not a part of the scholarship group. Survey results show that the presentation was successful in helping a majority of students feel more connected to faculty within (75%) and outside of their department (75%) and other SCOAM (81%) and non-SCOAM students (79%). In addition, the presentation also helped motivate most students to work harder in their classes (79%) and continue in their program (100%).

Fall 2021 Workshops and Presentation: Workshops and presentation during the Fall 2021 semester were held in-person. Responses suggest that the 3D printer workshops helped some students feel more connected to faculty within (78%) and outside their department (46%), as well as other SCOAM students (92%). In addition, the workshops also helped motivate most students to work harder in their classes (69%) and continue in their program (85%) with 92% of participants believing the 3D printer workshops taught them a new skill beneficial for their future.

Responses suggest that the SIAM Visiting Lecture with Dr. Sumanth Swaminathan was not very successful in helping students feel more connected to faculty within (46%) and outside their department (36%). The presentation was more successful in helping students feel connected to other SCOAM (64%) and non-SCOAM students (73%). However, the presentation also helped motivate most students to work harder in their classes (82%) and continue in their program (82%) with 72% of participants stating the presentation helped them think about possible career options.

> *When I first became a member of SCOAM I did not know much that I could do with my degree. I thought the only career that I was really qualified for was to work at a bank. Over the semesters listening to other undergraduate and graduate students talk about the internships/jobs that they have worked, has helped me broaden my job search to more places than just banks.*
>
> *- Fall 2021*

Trends in Workshops and Presentations: Trends in percent agreement for workshops and presentations are in Table 1. Workshop data tends to follow the same pattern across semesters although latter semesters have seen an increase in percent agreement concerning connectedness to other students and a high rate of agreement that a new skill is learned. The presentations do not seem to be promoting connectedness among students and faculty, but rather are giving students with career options and motivating them to complete their coursework. Fall 2021 was an exception to the overall pattern in both workshops and presentations, especially for feeling connected to faculty outside of their department. Also, the 3D printer workshop was not helpful in thinking about career options but was highly valuable for the skills learned.

Suggestions for future presentation topics include software engineering, sciences other than computer science, careers in academia and elementary and secondary education.

Table 1. Trends in percent agreement for workshops and presentations

	Fall 2018	Spring 2019	Fall 2019	Virtual Spring 2020	Fall 2020	Spring 2021	Fall 2021
Workshops							
feel more "connected" to faculty members in my department other than my adviser or mentor	80.0%	46.7%	58.9%	64.7%	56.5%	79.0%	76.9%
feel more "connected" to faculty members outside of my department.	40.0%	80.0%	82.4%	76.5%	73.9%	73.7%	46.2%
feel more "connected" to the students in the scholarship group	90.0%	53.3%	53.0%	88.2%	82.6%	79.0%	92.3%
feel more “connected” to other math and science students	100.0%	80.0%	76.5%	88.3%	87.0%	73.7%	84.6%
think about possible career options	70.0%	86.6%	82.4%	94.2%	91.3%	84.2%	53.9%
learn a new skill that will be beneficial in the future	100.0%	80.0%	70.6%	94.1%	95.7%	89.4%	92.3%

	Fall 2018	Spring 2019	Fall 2019	Virtual Spring 2020	Fall 2020	Spring 2021	Fall 2021
feel motivated to work hard in my classes	80.0%	80.0%	88.2%	70.6%	69.5%	79.0%	69.2%
feel motivated to continue as a mathematics major/minor	100.0%	93.3%	70.6%	88.2%	82.6%	79.0%	84.6%
Presentations							
feel more "connected" to faculty members in my department other than my adviser or mentor	62.5%	75.0%	55.5%	62.5%	63.1%	75.1%	45.5%
feel more "connected" to faculty members outside of my department.	50.0%	87.5%	88.9%	75.0%	79.0%	75.0%	36.4%
feel more "connected" to the students in the scholarship group	87.5%	75.0%	55.5%	75.0%	63.2%	81.3%	63.6%
feel more “connected” to other math and science students	100.0%	100.0%	66.6%	62.5%	78.9%	75.0%	72.7%
think about possible career options	87.5%	87.5%	66.6%	62.5%	84.2%	93.8%	72.7%
feel motivated to work hard in my classes	87.5%	100.0%	88.9%	100.0%	89.5%	93.8%	81.9%
feel motivated to continue as a mathematics major/minor	100.0%	100.0%	88.9%	75.0%	84.2%	100.0%	81.9%

Spring 2021 Social Group Activities and Monthly Meetings: Most social group activities were conducted online this semester (n = 22, 88%). Survey results suggested that most students felt the social group activities and monthly meetings helped them feel more ‘connected’ to their fellow SCOAM students (96%) and were successful in increasing their motivation to work hard in their classes (87%) and continue with their coursework (78%).

> *I became more interested in quantifying my productivity and exploring methods of becoming more efficient with my time. It drove me to track metrics for each day and develop a system of organizing thoughts, obligations, and interests in a way that can be implemented through methods like time blocking, journaling/blogging, and creating Trello boards.*
>
> *- Spring 2021*

The social group topic for Spring 2020 was time management. Twenty-one students provided comments about learning something new or interesting from the activity. Eight students reported learning new methods of time management or ways to improve their time management. Two noted the importance of incorporating self-care while three mentioned the importance of sleep. Other themes mentioned were prioritization, being too distracted by their phone, how much control they really had over their time and how others schedule their day to accommodate their busy lives.

Monthly meetings also helped students feel more ‘connected’ to their fellow SCOAM students (100%). According to these results, the monthly meetings also helped motivate most students to work harder

in their classes (91%) and continue in their program (87%) while teaching them new skills they thought would be beneficial (81%) and helping them think about possible career options (96%).
Fall 2021 Social Group Activity and Monthly Meetings: Survey results suggested that students most students felt the social group activities substantially helped them feel more 'connected' to their fellow SCOAM students (91%), were successful in increasing their motivation to work hard in their classes (86%) and continue in their coursework (86%).

Monthly meetings also helped students feel more 'connected' to their fellow SCOAM students (90%). According to these results, the monthly meetings also helped motivate most students to work harder in their classes (100%) and continue in their program (91%) while teaching them new skills they thought would be beneficial in the future (81%).

> *I learned about the different applications of machine learning, including the ways they can be used to detect images like facial features, and create these same images. This can be used for good, but it can also be dangerous. I also learned how simple it is for people to create these things with basic machine learning or a smartphone.*
>
> *- Fall 2021*

For Fall 2021, the social groups topic was machine learning/AI/deep learning. Students were asked to share something new or interesting they learned from the presentations. Eighteen students left comments concerning the topic of artificial intelligence/machine learning. Almost all (n = 14) mentioned learning about how artificial intelligence (AI) works including applications to industry. Additionally, two students mentioned learning about possible careers using AI/machine learning. Three students noted learning about deep fakes and the concerns associated with it.

Trends in Social Group Activities and Monthly Meetings: Trends across semesters are presented in Table 2. There has been a steady increase in percent agreement among SCOAM scholars concerning the social group activities. The upward trends follow the change in social group activities that has taken place over the course of the program. Initially, social groups were to seek out activities on campus to attend (e.g., a lecture on social equity) while currently students can make their own social event (e.g., go get pizza together). Over the last 3 semesters, one social group activity has focused on a specific topic. Even with this additional parameter in place, agreement remains high about scholars as to helpfulness of this activity.

Opinions concerning the monthly meetings have remained fairly stable over the course of the program, the transition to remote learning in Spring 2021 notwithstanding. Students appear to struggle with feeling connected in an online environment. However, this does not seem to have impacted the social group activities given that students chose to meet online rather than in-person.

Table 2. Trends in percent agreement for social group activities and monthly meetings.

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Spring 2020 Virtual	Fall 2020	Spring 2021	Fall 2021
Social Group Activities								
feel more "connected" to the students in the scholarship group	85.7%	84.6%	90.4%	93.4%	80.8%	90.0%	95.7%	90.5%
think about possible career options	33.4%	38.5%	54.8%	60.0%	69.2%	53.3%	73.9%	66.7%
learn new skills that will be beneficial in the future	38.1%	42.3%	51.6%	60.0%	76.9%	76.7%	69.5%	80.9%
feel motivated to work hard in my classes	57.2%	61.6%	71.0%	60.0%	76.9%	80.0%	86.9%	85.7%
feel motivated to continue as a mathematics major/minor	61.9%	73.0%	77.5%	86.7%	92.3%	83.3%	78.3%	85.7%
Monthly Meetings								
feel more "connected" to the students in the scholarship group	90.5%	80.7%	87.1%	81.5%		77.4%	100.0%	90.4%
think about possible career options	100.0%	100.0%	87.1%	85.1%		90.3%	95.7%	100.0%
learn new skills that will be beneficial in the future	100.0%	88.5%	96.8%	88.9%		96.8%	91.3%	81.0%
feel motivated to work hard	100.0%	88.5%	83.9%	81.5%		96.8%	91.3%	100.0%
feel motivated to continue as a mathematics major/minor	100.0%	92.3%	87.1%	81.5%		90.3%	86.9%	90.5%

End of Semester Survey – Mindset Items

There is a theorized link between mathematics mindset and perseverance with mathematical tasks. Fourteen items on the End of Semester survey were designed to capture information about mindset and motivation. Data for the narrative presented below is found in Appendix B.

Spring 2021: Responses showed that SCOAM students have a positive mindset towards their math abilities but a slightly less positive mindset towards their science abilities. Students tended to; think they are good at math (100%), liked going to their math (96%) classes, believed others think they are good at math (95%), and believed they understand the relationships between different areas of math (91%). Students were confident in their ability to explain math (91%) concepts to others but

were considerably less confident in their ability to explain science (68%) concepts to others. In general, students tended to be less confident in their science abilities compared to their math abilities. Finally, over half of the students 'used to think they were good at' math (62%) and science (73%).

Since freshmen may be of particular concern, the data was analyzed again across freshmen only. Patterns across freshmen mirrored the results of the overall survey for math, but freshmen were much more positive in assessment of their science abilities compared to the entire SCOAM cohort including their ability to explain science concepts to others.

Fall 2021: Responses showed that SCOAM students, again, seemed to have a more positive mindset towards their math than science abilities. Students tended to; think they are good at math (95%), liked going to their math (95%) classes, believed others think they are good at math (100%), and believed they understand the relationships between different areas of math (100%). Students also were confident in their ability to explain math (85%) concepts to others. Finally, a large proportion of students 'used to think they were good at' math (90%).

Again, freshmen data were analyzed separately. Patterns across freshmen mirrored the results of the overall survey for math, but freshmen attitudes towards their science abilities were considerably higher compared to the SCOAM cohort.

Trends in Mindset Items: Trends across semesters are presented in Table 3. Mindset for mathematics ability is fairly stable across time. The 2018-2019 cohort appeared to improve their mathematics and science mindset in spring compared to the fall. The 2019-2020 cohort began with a similar math and science mindset compared to the 2018-2019 cohort only to experience a more negative mindset in the spring. It is noted that the spring semester was impacted by COVID-19. The 2020-2021 cohort began moderately high in Fall 2020 and trended a bit more positive for math in Spring 2021 but a bit more negative for science in the Spring 2021.

The trend for freshmen, however, is toward a more positive math and science mindset compared to previous freshmen cohorts. Given the rebound of freshmen mindset across Spring and fall 2021, the lower mindset in Spring 2020 could be attributed to the impact of COVID-19 on the college experience.

Table 3. Trends in mindset data

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021
Mindset – Overall							
I am good at math.	95.2%	100.0%	90.3%	96.1%	90.0%	100.0%	95.0%
I enjoy going to my math classes.	100.0%	95.9%	93.6%	96.2%	83.3%	95.5%	95.0%
Others think I am good at math.	100.0%	100.0%	96.7%	88.5%	96.7%	95.4%	100.0%

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021
I used to think I was good at math.	71.5%	75.0%	67.7%	61.6%	83.3%	68.2%	90.0%
I can explain math ideas to other students.	76.2%	91.7%	90.3%	84.6%	86.6%	90.9%	85.0%
Math will be useful for my future.	95.2%	100.0%	96.8%	96.2%	100.0%	100.0%	100.0%
I understand the relationship among different areas of mathematics.	85.7%	91.7%	93.5%	96.1%	96.7%	90.9%	100.0%
I am good at science.	85.7%	91.7%	80.6%	73.0%	93.4%	90.9%	80.0%
I enjoy going to my science classes.	76.2%	83.3%	74.2%	65.4%	86.7%	77.3%	80.0%
Others think I am good at science.	80.9%	83.3%	80.7%	76.9%	83.3%	81.8%	80.0%
I used to think I was good at science.	66.7%	58.3%	67.8%	57.7%	90.0%	72.7%	75.0%
I can explain science concepts to other students.	76.2%	70.8%	67.8%	65.4%	80.0%	68.2%	75.0%
Science will be useful for my future.	90.5%	91.7%	90.3%	88.5%	80.0%	81.8%	85.0%
I understand the relationship among different areas of science.	95.2%	87.5%	87.1%	77.0%	90.0%	77.3%	80.0%
Mindset - Freshmen							
I am good at math.	100.0%	100.0%	85.7%	80.0%	81.8%	100.0%	100.0%
I enjoy going to my math classes.	100.0%	83.3%	85.8%	80.0%	72.8%	100.0%	100.0%
Others think I am good at math.	100.0%	100.0%	85.7%	80.0%	90.9%	100.0%	100.0%
I used to think I was good at math.	83.4%	83.3%	71.5%	60.0%	90.9%	100.0%	75.0%
I can explain math ideas to other students.	66.7%	100.0%	85.8%	80.0%	81.8%	75.0%	100.0%
Math will be useful for my future.	83.3%	100.0%	85.7%	80.0%	100.0%	100.0%	100.0%
I understand the relationship among different areas of mathematics.	100.0%	100.0%	85.8%	80.0%	90.9%	100.0%	100.0%
I am good at science.	83.4%	100.0%	85.7%	60.0%	100.0%	100.0%	100.0%
I enjoy going to my science classes.	66.7%	83.3%	57.2%	60.0%	100.0%	75.0%	100.0%
Others think I am good at science.	83.4%	100.0%	85.7%	60.0%	90.9%	100.0%	75.0%
I used to think I was good at science.	83.4%	66.7%	71.4%	40.0%	90.9%	100.0%	50.0%
I can explain science concepts to other students.	83.4%	66.7%	85.7%	40.0%	81.8%	100.0%	100.0%

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021
Science will be useful for my future.	83.3%	100.0%	71.4%	80.0%	81.8%	100.0%	100.0%
I understand the relationship among different areas of science.	100.0%	100.0%	71.5%	80.0%	72.8%	100.0%	100.0%

End of Semester Survey – Transition Items

Additionally, research into retention of college students suggest that some students have trouble transitioning to college and/or graduate school and this difficulty may impact graduation rates. Eleven End of Semester Survey items, for both undergraduate and graduate, asked students about issues typically associated with transition difficulties. Data in support of the presented narrative is presented in Appendix C.

Spring 2021 Undergraduate: Less than half of undergraduate students found college to be as expected (44%) and felt they fit in with other students in their major (75%). Most felt their high school classes were less challenging than their college classes (81%) and most agreed that they spent more time studying in college (88%) and had to teach themselves new information (88%). Only half of the students (13%) were scheduling time to study during the week unless a test was upcoming even though students seemed to plan their week to get everything done (81%). On a positive note, students overwhelmingly felt they knew professors (94%) and students (94%) whom they could ask for help. Most students believed their professors were giving them sufficient reminders about due dates (81%) and believed their professors were interested in their academic progress in class (60%).

> *Since COVID shut down most of the campus, meeting people was very difficult, especially people in a major like mine because most of my classes were online. This scholarship allowed me to not only meet other people but gain relationships that are also beneficial to my academic career in the long run. Many of the students offered their help with any problems I had academically and made the transition to college, especially during such a hectic year, a little easier.*
>
> *– Spring 2021*

Freshmen are of particular concern with regards to transition, so data was examined across freshman only. The distribution mirrored that of the rest of the undergraduate sample. Students felt they were spending more time studying and teaching themselves new information compared to high school and that their college experience was not what they expected. However, most students knew professors (75%) and students (100%) to whom they could go for help.

Fall 2021 Undergraduate: Less than half of undergraduate students found college to be as expected (43%) while more than half felt they fit in with other students in their major (71%). A large majority of the students believed their high school classes were less challenging compared to their college classes (81%), and most agreed that they spent more time studying in college (88%) and had to teach themselves new information (88%). Additionally, while students seemed to plan their week

to get everything done (86%), they did not seem to spend time studying unless a test was upcoming (79%). Most students felt they knew professors (86%) and students (93%) whom they could ask for help and more than half of the students believed their professors were giving them sufficient reminders about due dates (64%) and were interested in their academic progress in class (57%).

Again, freshmen are of particular concern with regards to transition, so data was examined again across freshman only. Again, the distribution mirrored that of the rest of the undergraduate sample. However, again, there are a few notable differences. First, all freshmen stated they planned their week to get everything done, but only 25% said they study even if there is no upcoming test. The sample size for this freshman class was small, so proportions can be a bit misleading. However, in general, freshmen seem to be struggling with the transition from high school to college. Whether this is due to the impact of the COVID-19 pandemic on their senior year in high school or the impact of online courses at the college level or both is unknown and might be worthy of a focus group conversation.

Trends in Undergraduate Transition Items: Trends across semesters are presented in Table 4. Prior to COVID-19, certain trends in transition items were emerging; more students learned to schedule time for studying regardless of upcoming tests by the spring and most students felt their instructors were interested in their course progress by spring. Since COVID-19, more students seem to be struggling with adjusting to college. Specifically, they do not know instructors or students to whom they can go to for help, are more likely to struggle with due dates, and do not study unless there is an upcoming test. Freshmen report consistent difficulty with carving out studying time, fitting in with their peers, and feeling as if their professors care about their academic progress.

Table 4. Trends in undergraduate transition items

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021
Transition - Undergraduate							
College is how I expected it to be.	73.3%	58.9%	66.7%	65.0%	50.0%	43.8%	42.8%
My high school classes were just as difficult as my college classes.	26.7%	41.2%	29.2%	20.0%	16.7%	18.8%	28.6%
I plan my week to make sure I get everything done.	93.3%	88.2%	87.5%	90.0%	83.3%	81.3%	85.7%
I schedule study time every day even if I don't have a test that week.	40.0%	47.1%	29.2%	50.0%	33.4%	12.5%	21.4%
My instructors do NOT remind me about due dates for assignments and tests enough.	13.3%	17.7%	12.5%	5.0%	33.4%	18.8%	35.7%
I have to teach myself new information for my classes.	86.7%	94.2%	75.0%	75.0%	87.5%	87.5%	64.3%

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021
I have to spend more time studying than I did in high school.	93.3%	88.3%	95.8%	95.0%	91.6%	87.6%	92.9%
I feel like I fit in with the other student in my major.	80.0%	82.3%	79.1%	70.0%	66.6%	75.1%	71.4%
I know instructors I can ask for help.	100.0%	100.0%	83.4%	90.0%	79.2%	93.8%	85.7%
I know students I can ask for help.	93.3%	82.3%	91.7%	85.0%	79.2%	93.8%	92.9%
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.	40.0%	23.5%	33.4%	10.0%	45.8%	37.6%	42.9%
Transition – Freshmen							
College is how I expected it to be.	83.4%	66.7%	57.1%	40.0%	45.5%	50.0%	50.0%
My high school classes were just as difficult as my college classes.	33.4%	66.7%	42.9%	40.0%	36.4%	25.0%	50.0%
I plan my week to make sure I get everything done.	100.0%	100.0%	100.0%	80.0%	63.7%	75.0%	100.0%
I schedule study time every day even if I don't have a test that week.	50.0%	50.0%	42.9%	40.0%	36.4%	25.0%	25.0%
My instructors do NOT remind me about due dates for assignments and tests enough.	16.7%	16.7%	28.6%	0.0%	45.5%	25.0%	0.0%
I have to teach myself new information for my classes.	83.3%	100.0%	42.9%	40.0%	72.7%	75.0%	50.0%
I have to spend more time studying than I did in high school.	100.0%	100.0%	85.7%	80.0%	90.9%	100.0%	75.0%
I feel like I fit in with the other student in my major.	83.4%	100.0%	85.7%	80.0%	54.5%	75.0%	50.0%
I know instructors I can ask for help.	100.0%	100.0%	57.2%	80.0%	63.6%	75.0%	100.0%
I know students I can ask for help.	83.4%	66.7%	85.7%	80.0%	72.7%	100.0%	100.0%
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.	50.0%	33.3%	57.2%	0.0%	45.5%	50.0%	25.0%

Spring 2021 Graduate: Graduate students also all found graduate school to be as expected (100%) but only half felt they fit in with other students in their major (50%). Most students felt their undergraduate classes prepared them well for graduate school (67%) and half felt their undergraduate classes were as challenging as their graduate classes (50%). Also, most students did not participate in undergraduate research opportunities (67%). Again, on a positive note, students overwhelmingly felt they knew professors (100%) and students (100%) whom they could ask for help, and believed their professors were interested in their academic progress in class (100%). Graduate students also reported knowing how to plan their time to get everything done (83%).

Fall 2021 Graduate: Most graduate students found graduate school to be as expected (67%) and felt they fit in with other students in their major (83%). Most students felt their undergraduate classes prepared them well for graduate school (83%) but were split on how challenging they felt their undergraduate classes to be (50% agreeing, 50% disagreeing). Most students did not participate in undergraduate research opportunities (67%). Again, on a positive note, students overwhelmingly felt they knew professors (100%) and students (100%) whom they could ask for help, believed their professors were interested in their academic progress in class (100%), and knew how to plan their time to get everything done (83%).

Trends in Graduate Transition Items: Trends across semesters are presented in Table 5. In general, trends in transitioning to graduate school are stable across time, especially prior to COVID-19. However, even graduate students appear to be struggling with due dates and feel as if their instructors are not interested in their course progress. Of note is the continually increasing trend of more graduate students carving out study time during the week even if there is not upcoming exam. It should also be noted that there are only around 6 graduate students in a cohort.

Table 5. Trends in graduate transition items

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021
Transition - Graduate							
Graduate school is how I expected it to be.	66.7%	85.7%	100.0%	100.0%	66.6%	66.7%	83.4%
My undergraduate classes prepared me well for my graduate classes.	100.0%	100.0%	71.4%	66.7%	83.3%	83.3%	66.7%
My undergraduate experiences (e.g., research, internship) prepared me well for my graduate classes.	50.0%	71.4%	42.9%	83.4%	100.0%	83.3%	83.4%
I participated in research activities as an undergraduate student.	16.7%	28.6%	42.9%	33.4%	66.7%	83.4%	83.4%
My undergraduate classes were just as difficult as my graduate classes.	0.0%	14.3%	42.9%	50.0%	50.0%	16.7%	50.0%
I feel like I fit in with the other graduate students.	83.4%	100.0%	85.7%	50.0%	83.3%	50.0%	83.4%

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021
I know how to plan my week to make sure l get everything done.	33.3%	100.0%	85.7%	83.3%	83.3%	83.4%	100.0%
I can teach myself new information easily.	66.6%	100.0%	100.0%	83.3%	100.0%	66.7%	83.3%
I know instructors I can ask for help.	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	83.4%
I know students I can ask for help.	100.0%	100.0%	100.0%	100.0%	100.0%	66.7%	100.0%
My college instructors are interested in how I am doing in their class.	83.3%	100.0%	85.7%	100.0%	100.0%	83.4%	100.0%

Goal 2: Strengthen the academic culture of the Department of Mathematical and Computer Sciences

Goal 2 is measured by the increased number of students participating in research activities and internships as well as tracking students' academic performance in required and elective courses. Tracking students' academic performance in required and elective courses is provided under separate cover from the PIs directly. This SCOAM goal also overlaps a similar departmental goal.

End of Semester Survey – Conference/Colloquia Participation Data

Some SCOAM students participated in research conferences/ colloquia during the Spring 2021 semester (n = 4) and the Fall 2021 semester (n = 3). Two students from Spring 2021 and 1 student from Fall 2021 reported that they would not have participated in the research conference/colloquia if they were not in the SCOAM program.

Additionally, during the semester or summer break, almost all students (Spring 2021, n = 22; Fall 2021, n = 21) reported plans to do some activity related to academics or work; preparing for GRE exam or graduate school, applying for or continuing to work at an internship or job, or taking classes.

End of Semester Survey – Conversation Data

Spring 2021 Conversation Data: SCOAM students reported that most conversation between themselves and other students and faculty, as expected, were about class assignments and other academic topics (37% to 65%). The lowest proportion of those conversations were with non-SCOAM students in their activity group while the highest proportions were with faculty in their department (65%), faculty mentors/advisors (60%), and faculty outside their department (58%). Conversations concerning research and career opportunities differed little between faculty mentor (32%), faculty within their department (24%) and other SCOAM students (31%).

Conversations between SCOAM students and SCOAM students not in their social activity groups were more balanced between academic and social topics. SCOAM students reported most of their non-academic conversations were with non-SCOAM students (56%), other SCOAM students (40%), SCOAM students in their social group (46%), and faculty outside of their department (28%). This was not the case for conversations with faculty mentors/advisors (8%) and faculty within their department (10%).

Fall 2021 Conversation Data: SCOAM students reported that most conversation between themselves and other students and faculty, as expected, were about class assignments and other academic topics (39% to 63%). The lowest proportion of those conversations were between SCOAM students in their social activity group (39%) and the highest proportions were with faculty mentors (63%), and faculty within their department (63%). Conversations concerning research and career opportunities (14%

- 36%) were somewhat similar between SCOAM students and faculty and peer groups with the highest proportions being with students in their social activity group (24%) or faculty outside of their department (36%).

SCOAM students reported most of their non-academic conversations were with other students regardless of peer group (35% - 39%). Non-academic conversations with faculty occurred with similar but less frequency (8% - 15%).

Trends in Conversation Data: Trends across semesters in conversation data is presented in Table 6. The two most notable trends are an increase in student conversations about academic topics and research opportunities with faculty in other departments and a decrease in student conversations about academic topics with students in their social groups.

Fall 2020 seems to be point of change for conversations in many ways. Student conversations with faculty outside their department about non-academic topics decreased dramatically but seems to be rebounding. There was also an increase in academic conversations with students in their social group in Fall 2021 despite the online environment and a decrease in non-academic conversations. Additionally, there was an overall decrease in conversations concerning research and career opportunities during this semester regardless of faculty or peer group. Many of these proportions are beginning to return to their previous levels which suggests that observed differences could be due to the impact of COVID-19 on their educational experiences.

Supporting data in the form of graphs depicting the breakdown of conversation topics mentioned for faculty and peer groups are included in Appendix D.

Table 6. Average percent of time spent on different conversation topics with faculty and peers.

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021
Courses or Assignments	average percent time						
Faculty Mentor	32	36	39	36	37	40	40
Faculty in Department	58	48	55	57	55	55	52
Faculty Outside Department	29	41	15	34	43	42	29
SCOAM Students in Social Group	34	20	21	16	24	23	17
SCOAM Students not in Social Group	41	37	28	33	36	27	30
Non-SCOAM Students	27	32	32	24	36	27	34
Other Academic Topics	average percent time						
Faculty Mentor	17	23	18	28	37	20	23
Faculty in Department	13	14	13	15	13	10	11
Faculty Outside Department	13	19	25	20	20	16	13
SCOAM Students in Social Group	14	17	19	32	16	19	22
SCOAM Students not in Social Group	12	17	16	16	15	14	16
Non-SCOAM Students	14	20	16	14	13	10	10

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021
Research, Internships, Careers				average percent time			
Faculty Mentor	43	32	32	31	18	32	26
Faculty in Department	16	26	19	19	17	24	23
Faculty Outside Department	33	17	29	20	23	14	36
SCOAM Students in Social Group	29	26	22	29	23	12	24
SCOAM Students not in Social Group	25	20	20	20	15	19	20
Non-SCOAM Students	21	20	17	22	12	8	14
Non-Academic Topics				average percent time			
Faculty Mentor	8	10	10	6	8	8	11
Faculty in Department	13	13	13	10	14	10	14
Faculty Outside Department	25	22	30	27	15	28	22
SCOAM Students in Social Group	23	36	38	23	37	46	37
SCOAM Students not in Social Group	22	26	36	31	35	40	34
Non-SCOAM Students	38	29	35	40	39	56	42

Peer-Led Team Learning Sessions – Student Perspective

Additionally, peer-led team learning (PLTL) sessions were designed to deepen a student's understanding of and ability to apply mathematical concepts being learned in mathematics courses. All students in eligible classes were asked to complete a survey. Participating students were asked their agreement with statements about the impact of the sessions and non-participating students were asked about the reasons why they did not participate and if they participated in other department offered tutoring experiences. The survey, interviews, and report are completed by a faculty member in the Department of Mathematics and Computer Sciences. The report is provided to the external evaluator for inclusion in this report.

The following summary is from data for the Spring 2021 and Fall 2021 semester report. Sessions returned to in-person meetings this semester after being conducted virtually during the last academic year.

The PTLT survey was sent to all 88 students enrolled in Math 125, 126, and 171 in Spring 2021. Twenty-two students responded to the survey (25%). Of the responding students, three attended 10 or more learning sessions during the semester. All three students were SCOAM scholars, and all reported being science majors. All students agreed or strongly agreed that the sessions helped them prepare for math class, complete their homework assignments, and increased their confidence in preparing for tests and exams and improved their performance on exams. All three participants stated that attending the sessions did not increase the likelihood of them doing a math-related internship or pursuing math-related research opportunities.

Open-ended comments referred to benefits including real world applications for what they were learning in class and interaction with the peer leader. Students like that the sessions are facilitated by a peer. It makes the students more comfortable asking questions. All three respondents remarked on the ability of their peer leader to explain the applications in detail. The only suggestion for improvement was to get the materials earlier in the week.

For those not attending the sessions, reason given were did not know about it, time conflicts, did not need it, or were just too busy.

The PTLT survey was sent to all students (n = 65) enrolled in selected math classes during the Fall 2021 semester. Thirty students completed the survey (46%). Of the responding students, 9 attended the learning sessions and 18 did not. Of the 89 participants, 4 were SCOAM students. Twenty-two of the respondents identified as science or computer science majors. SCOAM students attended roughly the same number of sessions than non-SCOAM participants with 2 attending 10 or more sessions and 1 attending 7-9 sessions. Six (86%) of non-SCOAM students attended 7 or more sessions while 14% (n = 1) attended less than 3 sessions compared to no SCOAM students who attended less than 7-sessions.

I got to take part in the PLTL weekly sessions. These sessions helped me immensely in my understanding of class materials for MATH 125. Without Dr. Radelet's activities and Heidi's helpful videos and weekly zoom meetings, I would have had a much harder time succeeding in the calculus course.
– Spring 2021

Most students (71%) attending the sessions felt the PLTL session better prepared them for math class and were a valuable resource (86%). A majority of students also remarked that the sessions increased their confidence to take exams and quizzes (71%) and helped them with completing homework assignments (57%) and improved their final exam performance (57%). A smaller percentage stated the sessions influenced how they prepared for exams and quizzes (42%). A majority of students supported continuing to offer the learning sessions (86%) however, a smaller percentage of students stated the sessions encouraged them to seek out other peer-led opportunities (71%) or increased their willingness to seek out internship (57%) or research opportunities (42%) in math.

Open-ended comments concerning benefits of the session focused on the real-world application of problems studies in class and the opportunity to ask questions. Comments concerning peer leaders remarked on the knowledge and ability of leaders to explain concepts well and increased approachability because they were a peer. Some students would not change anything about the sessions. However, one student asked for the packets to be sent out at the same time each week while others remarked it should be more engaging with opportunities to ask questions or that the focus should be topics with which the math class is struggling. It is important to note that the PLTL sessions beginning in Fall 2020 employed a flipped teaching model in which students were sent videos of application problems in advance of the sessions with the expectation that they would complete the work prior to the session.

The main reason given by non-participants for not attending the sessions was scheduling conflicts (53%). Interestingly, comments given by non-participants suggested they wanted tutoring sessions, or they did not feel the need, or did not want to attend.

Participation in the PLTL sessions this semester was lower than in the past, however, ratings and comments were similar showing programmatic consistency across time. It is notable that, anecdotally, the pandemic continues to impact in-person activities and learning, and it is not unexpected that attendance is affected while transitioning back to in-person activities.

Peer-Led Team Learning Sessions – Peer Leader Perspective

The PLTL sessions were designed to help students, but to also provide select math majors the opportunity to lead and teach encouraging their own academic growth. Peer leaders (n=3) were interviewed for 30-40 minutes using a series of 13 questions about their experiences leading the team learning sessions.

All peer leaders attended PLTL sessions when they were enrolled in the requisite math classes and continued to use the flipped model mentioned above during the sessions. Two of the peer leaders have chosen education as a career path and valued the additional opportunity to gain teaching experience. All leaders remarked on the lack of attendance for the sessions and felt the sessions would be more impactful with a larger group of students. In the Spring, it was hoped that online PLTL sessions would increase attendance, but that did not happen. All peer leaders remarked that leading the sessions caused them to think about math and how it is used differently. They began to see connections between procedures and concepts and wanted the help the students see the same connections.

Goal 3: Strengthen relationships with the broader STEM community

This goal is defined very broadly as exploring workforce and career options, increasing the number of students taking entry-level licensing exams or the GRE/GMAT exam, and improving communication and networking skills.

End of Semester Survey – Activity Participation Data

Students were required to participate in several types of activities throughout the semester: monthly meetings, presentations, workshops, and small group activities. All these activities were designed to encourage relationships between SCOAM students and other math and science students as well as between SCOAM students and faculty outside of their department and professionals outside of the university. A set of items on the survey were designed to capture how well the activities promoted these connections and introduced students to career possibilities.

Spring 2021 Activities Data: End of the Semester Survey results suggested that the Python workshops and Alumni Panel presentation helped students feel more connected to faculty outside their department (74% and 75%, respectively) and students outside of the SCOAM program (74% and 75%, respectively). Additionally, the workshops and presentation helped students to think about possible career options (84% and 94%, respectively).

Fall 2021 Activities Data: Survey results suggested that the 3D printer workshops and the SIAM Visiting Lecture with Dr. Sumanth Swaminathan did not help students feel more connected to faculty outside their department (46% and 36%, respectively) but did help students feel connected to other students outside of the SCOAM program (85% and 73%, respectively). This is a departure from previous semesters. Likewise, the workshops and presentation were not as strongly associated with career options as in the past (54% and 73%, respectively).

End of Semester Survey – Student Conversation Data

As discussed previously, students are having conversations with faculty and students within and outside of their program and departments and these conversations include topics about research and career opportunities. While Spring 2021 conversations were had with faculty within their department, Fall 2021 conversations were more balanced between faculty within and outside their departments. It is highly probable that COVID-19 mitigation measures are responsible for the shift as well as the decrease in conversation concerning research and career opportunities across all faculty and peer categories (Appendix D).

End of Semester Survey – Licensing and Graduate School Exam Data

Nine students in Spring 2021 reported that had taken or would take the GRE, PRAXIS, or actuarial exams. Also, nine students in Fall 2021 reported they have taken or will take the GRE, PRAXIS or

actuarial exam. Twelve students from Fall 2021 and 13 students from Spring 2021 have no interest in taking any exams at this time.

End of Semester Survey – Open-Ended Comment Data

In the comments portion of the survey, students provided open-ended feedback about the most beneficial activity attended and provided suggestions for future activities. The summary provided here reflects comments made across Spring and Fall 2021 semesters.

Most students provided one activity they felt was most helpful. In Spring 2021, overwhelmingly students felt the Alumni Panel presentation was the most beneficial activity. Monthly meetings, in general, or specific monthly meeting activities were also mentioned frequently, specifically the time management presentations and the career preparation activities such as mock interviews, LinkedIn profiles, personality trait survey. During Fall 2021, the 3D printer workshop and monthly meetings, specifically the machine learning/AI presentations were most frequently mentioned. Other singly mentioned activities were the social group activities, career options presentations, team building exercise, and the visiting lecture.

> *The monthly whole-group SCOAM meetings. I enjoy the people in the SCOAM. Most are outgoing and friendly. they all have fun and laugh. It is nice to be around people not in my cohort for a few hours. It was nice listening to everyone's take on machine learning. The PD exercises teams put on were enjoyable too.*
>
> *- Fall 2021*

Future activities, as suggested by the students in their open-ended survey comments, generally fall into 3 broad categories: career options, career preparation, and opportunities for skill development. Specific suggestions for presentations were bringing researchers and industry workers, especially alumni, on campus to explain what they do and more career exploration presentations. Career preparation specific suggestions involved resume development, how to improve applications for jobs, internships, and graduate school, development of professional communication and presentation skills, and graduate school preparation. Finally, several students mentioned coding workshops in multiple languages and GIS workshops.

> *Most likely the Alumni Panel. I enjoy listening to past students and what careers they obtained. For the most part, all I know is education and seeing how there are many options that alumni have taken, give me more options to consider. I also am grateful for the advice they give such as for interviews or what certain jobs require.*
>
> *- Spring 2021*

When asked if there were any additional comments they would like to add, students from both semesters responded positively about their experiences in the SCOAM program. They reported participation as a wonderful experience and expressed their gratitude for being able to participate.

SCOAM Scholar COVID-19 Impact

In March 2020, a global pandemic forced universities across the nation to transition to online learning for the safety and well-being of their students. The Spring 2020 semester transitioned to remote learning after starting with traditional face-to-face classes while the Fall 2020 semester featured remote and/or hybrid learning with very few face-to-face courses. Spring 2021 and fall 2021 continued this trend of offering remote and/or hybrid learning but expanded the face-to-face options.

Any continued impact of an online environment on student learning was of continuing interest. Additionally, STEM students often take a mixture of lecture and lab courses (e.g., computer science, chemistry lab) and there was concern that the impact would be felt differentially based on course format. A more formal and comprehensive evaluation of student opinions was included in the 2021 Annual Report, but several questions related to student opinion, student preferences, and student motivation were retained or included again to look for changes over time. Data supporting the following narrative can be found in Appendix E.

Student Motivation

Students seem to feel that they are able to motivate themselves to do their online work, organize their week to complete their work and are learning the content as well online as they would in-person (Table 7). Ironically, a large majority of students felt they need an in-person course to learn. This is in direct contrast to what faculty are anecdotally reporting about student motivation and learning.

Table 7. Trends in student motivation during online learning.

	Spring 2020	Fall 2020	Fall 2021
I found it easy to motivate myself to do my online coursework.	34.6%	50.0%	55.0%
I found it difficult to organize my week to get all my coursework completed.	57.7%	53.3%	40.0%
Face-to-face contact with a professor is necessary for me to learn.	53.9%	66.7%	70.0%
I understand the content I was taught online as well as the content I was taught face-to-face.	34.6%	46.7%	60.0%
I was persistent in asking my professor questions until I understood the content being taught.	61.5%	63.3%	65.0%

Student Opinions about Online Learning

For both lecture and lab courses, a large majority of students continued to report that remote learning was NOT the same for them compared to face-to-face instruction. Fall 2021 was the lowest proportion of students stating that learning was the same in both types of formats. Likewise, a very small proportion of students preferred to take their lab courses online while almost half stated they preferred to take their lecture courses online. However, fewer students over time reported that they had to learn more on their own in their remote courses.

While more students comparatively preferred to take their lecture courses online, the proportion reporting their preference for online courses was small. That proportion was even smaller when asked about lab courses. In Spring 2021 students were asked their preferred course format for both lecture and lab courses. For lecture courses, eleven students (46%) preferred in-person, six preferred hybrid, three preferred online, and 2 said format didn't matter. For lab courses, thirteen students (54%) preferred in-person, two preferred online, one preferred hybrid, and six said format didn't matter.

> *Additionally, being able to visit professors in their offices for help or ideas was something I took for granted.*
>
> *– Spring 2021*

Table 8. Trends in student opinions about online learning.

	Spring 2020	Fall 2020	Spring 2021	Fall 2021
Learning is the same for me in an online lecture course as in a face-to-face lecture course.	15.4%	23.4%	27.3%	10.0%
I have to learn on my own more in an online lecture class compared to a face-to-face lecture course.	84.6%	60.0%	72.7%	45.0%
I prefer to take my lecture courses online.	19.2%	26.7%	N/A	N/A
Learning is the same for me in an online lab course as in a face-to-face lab course.	7.6%	20.0%	13.6%	10.0%
I have to learn on my own more in an online lab class compared to a face-to-face lab course.	50.0%	46.7%	36.3%	15.0%
I prefer to take my lab courses online.	11.5%	10.0%	N/A	N/A

Student Course Preferences

In Fall 2020 and Fall 2021, students were asked to provide feedback on scheduling preferences for the following spring semester. In Fall 2020, a small proportion of students (20%) stated they would have preferred to change or changed their schedule to avoid taking an online lecture or lab class. However, a large majority (70%) stated they could not change their schedule because of the courses they needed to take in the spring. In Fall 2021, while a small proportion of students still stated they would have preferred to change their schedule, 75% - 90% of students reported that they did not schedule or need to schedule an lecture or lab online course. Therefore, a smaller proportion of students reported they did not have the option of changing their schedule due to required courses.

Table 9. Trends in student preferences concerning schedule preferences.

	Fall 2020		Fall 2021	
	% Agree	% Did not take/apply	% Agree	% Did not take/apply
I would have preferred to change my [current] schedule to avoid taking online LECTURE courses.	20.0%	0.0%	5.0%	75.0%
I would have preferred to change my [current] schedule to avoid taking a hybrid / online synchronous LECTURE course.	N/A	N/A	10.0%	75.0%

	Fall 2020		Fall 2021	
	% Agree	% Did not take/apply	% Agree	% Did not take/apply
I would have preferred to change my [current] schedule to avoid taking online LAB courses.	20.0%	46.7%	0.0%	90.0%
I changed my [current] schedule to avoid taking an online LAB or LECTURE course.	6.9%	17.2%	0.0%	80.0%
I would have preferred to change my [future] schedule to avoid taking an online LECTURE course.	20.6%	6.9%	40.0%	35.0%
I would have preferred to change my [future] schedule to avoid taking online LAB courses.	20.0%	33.3%	25.0%	65.0%
I did not have the option of changing my [future] schedule because of the courses I was required to take.	70.0%	6.7%	10.0%	50.0%

Summary and Recommendations

Summary

The SCOAM program has 3 primary goals; 1) recruit and retain math majors, minors, and graduate students, 2) strengthen the academic culture of the department, and 3) strengthen the relationships between STEM fields on campus and beyond. The PIs have developed a series of mandatory activities to further these goals; presentations by outside speakers, workshops in computer programming languages, social group activities, peer-led team learning sessions, and monthly meetings. Each of these activities is designed to specifically support one goal but may support more than one goal. The results presented here are for the sixth and seventh semesters of an overall 10-semester data collection effort. Whenever possible and appropriate, data from previous semesters has been used for comparison. This discussion focuses on general impressions of the impact of the activities on students. Of note is the substantial impact of the COVID-19 pandemic and resultant move to online learning that continues to linger over the college experience during the Spring and Fall 2021 semesters.

> *I have taken actuarial statistics, analysis, and [done] research allowing my master's thesis to be approved and published. S-COAM has given me the support of allowing me to research and publish my findings.*
>
> *– Fall 2021*

Results indicated that, in general, a majority of SCOAM students believe participating in the workshops, monthly meetings, and social group activities helped them feel more connected to each other. The workshops and monthly meetings were particularly helpful in building new skills that the students felt would be beneficial in the future. Specifically, students mention building their career preparation skills such as developing interviewing skills, presentation skills, and professional communication skills. Most students agreed that the monthly meetings, social group activities, workshops, and presentations motivated them to work harder and continue their studies in math. The presentations and monthly meetings helped students think about career options.

> *I am extremely thankful for the opportunity to be surrounded with like-minded individuals in the S-COAM program. S-COAM has been a great reminder for me to keep myself on track to setting and achieving educational and career-specific goals. S-COAM has been a place where I feel I can openly speak my mind and hold meaningful conversations with others.*
>
> *– Spring 2021*

Most students remarked that the workshops, monthly meetings, and presentations were most beneficial for thinking about potential careers and motivating them to work hard and complete their coursework. The social group activities continue to have the desired effect of forming and strengthening relationships among the students. Most Overall, the required activities accomplished their goal for a majority of the scholarship students.

Mindset items from the End of Semester survey suggested that students in Spring and Fall 2021 had a positive view of their math abilities but were not as confident in their science abilities. Freshmen, however, had equally high regard for their math and science abilities. However, science confidence tends to shrink in the spring compared to the previous fall each academic year suggesting some students may be experiencing the phenomenon of a slump in confidence identified in the literature concerning mindset in science and mathematics. Data from successive semesters suggests the confidence may be cohort specific depending on the proportion of math majors compared to math minors and science majors if not just fluctuations in data. Also, the notable differences for Freshmen last year seem to have 'increased' during this reporting period lending some weight to the anecdotal idea that a slump was due to the online learning environment. More in-depth analysis of this data is warranted.

One way in which the S-COAM scholarship program impacted me this semester is that it opened up, or rather broadened my understanding on what I can do with an advanced math degree. This came through networking with other students in the program as well as attending several of the recommended seminars and workshops. One result of all of this I am reconsidering career paths and considering other fields of mathematics to work in.

-Fall 2021

The organization has provided me with a great amount of networking and hearing presentations from past students who have come back about their jobs or graduate school after IUP has helped me cement my decision to go to graduate school. Because of the additional math classes, I have taken, I hope to use more software, programming, or other materials to advance my chemical research in graduate school. Someday I plan to come back and present on my career and help future students in the program as well.

- Spring 2021

Transition items from the survey suggested that few undergraduate students find college to be as expected. However, the Fall 2021 cohort of graduate students felt their experiences were more in line with their expectations. Regardless of undergraduate or graduate status, most students seemed to be challenged by their classes and felt an increased need to study. It is noteworthy, however, that most graduate students reported they participated in undergraduate research opportunities. Undergraduate students still are not carving out daily study time unless there was an upcoming exam, but both undergraduate and graduate students reported planning their week to get everything done. While these trends have remained similar across semesters, students in Spring and Fall 2021 reported much lower scores for college being as expected and feeling faculty kept them on track to complete assignments. Importantly, in both semesters higher scores for knowing faculty and students to whom they can go for help were reported.

Next, the math related activities performed during the S-COAM monthly meetings along with the peer tutoring sessions had made me become more comfortable and confident in my math abilities. This is also due in part through the support of the S-COAM cohort and has led me to be more comfortable pursuing applications of mathematics as a career goal.

– Fall 2021

Transition items for graduate students showed a similar, but not as pronounced, decrease as transition items for undergraduate students. Graduate students have increased in their perception of the need to set aside study time every day but feel less prepared by their undergraduate experiences than previously. This could be due to the transition to online learning they experience during the pandemic.

> *With the scholarship I was able to come to IUP and not have to get as much out in other loans as I would have and that was a huge burden lifted off of me. I am able to focus on my work here instead of worrying about how I will pay for school.*
> *– Spring 2021*

Not surprisingly, conversations with faculty focused mainly on class assignments and other academic topics, but conversations with students focused on academic and non-academic topics in a more balanced way. In general, the trend has moved backed to the pre-COVID-19 trend in that faculty mentors and faculty in their departments tended to be academic resources with conversations with other students, SCOAM and non-SCOAM, and, sometimes, faculty outside their departments being more balanced between academic and non-academic topics. For career advice, SCOAM students turn to faculty and students equally.

Students are already participating in academic conference and colloquia even though some are only doing so because it is a requirement. A majority of students do not have plans to take advanced exams (e.g., GRE) or certification and licensing exams at this point.

For both the Spring 2021 and Fall 2021, the evaluator had access to short essays written by students as part of a reflection activity about the semester. Evidence from those essays is presented in the text boxes throughout this discussion section and provides evidence that students are grateful for the financial assistance, but also feel the program is worthwhile. Students repeatedly mention the career skills (e.g., interviewing, elevator pitches) they learn from participating in the monthly meetings along with the awareness they gain of career options in education and research in math and science fields as benefits to the program participation.

> *Every time I go to a monthly meeting or attend a workshop, I learn something new and interesting.*
> *- Fall 2021*

All students addressed the impact of the COVID-19 pandemic on their Spring 2021 experiences. Many remarked about the difficulties they faced with an online learning environment and the difficulty of

> *Due to the COVID-19 pandemic and the changes it has had on the delivery of education, I've had to make changes to my approach for my studies. I've had to be more intentional about the way that I spend my time, and I've had to find new ways to learn. This has included more time independently studying class materials and developing my skills of communicating mathematics, in order to ask necessary questions. While this has been a challenge, I have learned a significant amount this year. Additionally, I've had more opportunities to attend presentations and expand myself in my field, since many events have taken place through zoom. Overall, the pandemic has made attending school more challenging, but there have been great benefits to the shift.*
> *– Spring 2021*

keeping themselves focused and motivated to do their coursework and meet deadlines. Others learned to adapt and make the most of a bad situation adjusting to accommodate their specific learning needs. Still others, particularly freshmen, remarked about not being able to make meaningful connections and form relationships. Most students from the Spring 2021 survey mentioned they were excited to be moving back to in-person classes in the fall.

For students who know their career path, they are quick to acknowledge that the program solidifies their career goals and motivates them to continue their path. For those that enter the program uncertain of the career path, students are grateful for the career options to which they are exposed. A common theme throughout the essays is that students participate in worthwhile activities (e.g., campus lectures, colloquia, research opportunities) that they would not have participated in if not for the SCOAM program. Also, students feel they are exposed to career options and networking opportunities that they would not have been exposed to if not involved in the program.

> *Overall, S-COAM encourages me to work hard, and the skills I have learned through this program will aid me in pursuing a future career and education.*
>
> *- Fall 2021*

Next Steps

In preparation for a program-wide analyses in summer of 2022, psychometric investigation of mindset and transition items will be completed in the upcoming months. If successful, this will allow for the longitudinal analysis of mindset and transition data across 4 academic years of program implementation. Data will be linked across years by individual and associated with year in school, gender, and race/ethnicity to investigate the sufficiency of the data for different types of longitudinal data analysis. If sample sizes and power are sufficient and allow for promised confidentiality, total scores from the mindset and transition items using an appropriate longitudinal method of analysis (e.g., trend analysis, GLM, nonparametric) will be completed individually or by panel as appropriate.

Recommendations

The following recommendations are offered for consideration:

1. The transition back to in-person learning should be a positive one for most students, or at least, something they anticipate positively. The convenience of scheduling online activities, whoever, may decrease attendance in some activities (e.g., PLTL sessions) until the programs can be re-established and students are used to being back on campus regularly.
2. Continue to focus on a specific topic for one social groups activity. Student responses have been overwhelmingly positive concerning this addition to the program activities.
3. Students have requested that career option exploration include educational career paths (e.g., teacher, professor), sciences other than computer science, and software engineering.

Final Comments

The SCOAM program provides students with a web of activities that are supportive of the overall program goals. Quantitative and qualitative evidence shows that students are making strong connections with other SCOAM scholars as their cohort continues to grow and evolve across semesters. These relationships proved to be significant during the COVID-19 pandemic and disruption of the college experience. Students are clearly learning about career options as well as the communication and collaboration skills necessary in today's job environment. They are also participating in scholarly activities they would not have if not for program requirements. Most students were appreciative of the 'extra' experiences offered by the SCOAM program and remarked about the value of these experiences in their educational and career planning.

Responses from Spring 2021 and Fall 2021 generally mirror the responses from previous semesters in many ways. However, the impact of COVID-19 on learning was evident. Students have commented on the difficulty they had with learning in the online environment whether due to distractions because they are home and feeling isolated from students and faculty. Even under these circumstances, students acknowledge that the SCOAM program has kept them connected.

Comments from Fall 2021 did not mention COVID-19 or the transition back to in-person learning. The PIs were able to continue the SCOAM program activities online during the Spring 2020 transition to online learning. The most recent program innovation requiring a research topic for each semester that focuses one social group activity and culminates in a monthly meeting presentation has been well-received.

Appendix A:
End of Semester Survey - Activity Data

Table 10. Spring 2021 survey results for attending workshops.

Attending the workshops helped me:	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
feel more "connected" to faculty members in my department other than my adviser or mentor			4	21.1%	12	63.2%	3	15.8%
feel more "connected" to faculty members outside of my department.	1	5.3%	4	21.1%	12	63.2%	2	10.5%
feel more "connected" to the students in the scholarship group	1	5.3%	3	15.8%	14	73.7%	1	5.3%
feel more “connected” to other math and science students	1	5.3%	4	21.1%	11	57.9%	3	15.8%
think about possible career options			3	15.8%	13	68.4%	3	15.8%
learn a new skill that will be beneficial in the future			2	10.5%	10	52.6%	7	36.8%
feel motivated to work hard in my classes			4	21.1%	12	63.2%	3	15.8%
feel motivated to continue as a mathematics major/minor			4	21.1%	9	47.4%	6	31.6%

Table 11. Spring 2021 survey results for attending the presentation.

Attending the presentation helped me	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
feel more "connected" to faculty in my department other than my adviser or mentor	1	6.3%	3	18.8%	11	68.8%	1	6.3%
feel more "connected" to faculty outside of my department			4	25.0%	10	62.5%	2	12.5%
feel more “connected” to the students in the scholarship group			3	18.8%	9	56.3%	4	25.0%
feel more "connected" to other math and science students			4	25.0%	10	62.5%	2	12.5%
think about possible career options			1	6.3%	4	25.0%	11	68.8%
feel motivated to work hard in my classes			1	6.3%	6	37.5%	9	56.3%
feel motivated to continue as a mathematics major/minor					6	37.5%	10	62.5%

Table 12. Spring 2021 survey results for attending social group activities.

Attending the presentations helped me:	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
feel more "connected" to the students in the scholarship group			1	4.3%	14	60.9%	8	34.8%
think about possible career options	1	4.3%	5	21.7%	15	65.2%	2	8.7%
learn new skills that will be beneficial in the future	1	4.3%	6	26.1%	11	47.8%	5	21.7%
feel motivated to work hard in my classes	1	4.3%	2	8.7%	11	47.8%	9	39.1%
feel motivated to continue as a mathematics major/minor			5	21.7%	10	43.5%	8	34.8%

Table 13. Spring 2021 survey results for attending monthly meetings.

Attending the monthly meetings helped me:	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
feel more "connected" to the students in the scholarship group					15	65.2%	8	34.8%
think about possible career options			1	4.3%	14	60.9%	8	34.8%
learn new skills that will be beneficial in the future	1	4.3%	1	4.3%	11	47.8%	10	43.5%
feel motivated to work hard	1	4.3%	1	4.3%	11	47.8%	10	43.5%
feel motivated to continue as a mathematics major/minor	1	4.3%	2	8.7%	9	39.1%	11	47.8%

Table 14. Fall 2021 survey results for attending workshops.

Attending the workshops helped me:	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
feel more "connected" to faculty members in my department other than my adviser or mentor			3	23.1%	7	53.8%	3	23.1%
feel more "connected" to faculty members outside of my department.			7	53.8%	5	38.5%	1	7.7%
feel more "connected" to the students in the scholarship group			1	7.7%	9	69.2%	3	23.1%
feel more “connected” to other math and science students			2	15.4%	9	69.2%	2	15.4%
think about possible career options			6	46.2%	6	46.2%	1	7.7%
learn a new skill that will be beneficial in the future			1	7.7%	9	69.2%	3	23.1%
feel motivated to work hard in my classes			4	30.8%	7	53.8%	2	15.4%
feel motivated to continue as a mathematics major/minor			2	15.4%	7	53.8%	4	30.8%

Table 15. Fall 2021 survey results for attending the presentation.

Attending the presentation helped me	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
feel more "connected" to faculty in my department other than my adviser or mentor	1	9.1%	5	45.5%	4	36.4%	1	9.1%
feel more "connected" to faculty outside of my department	1	9.1%	6	54.5%	4	36.4%		
feel more “connected” to the students in the scholarship group	1	9.1%	3	27.3%	6	54.5%	1	9.1%
feel more "connected" to other math and science students			3	27.3%	7	63.6%	1	9.1%
think about possible career options			3	27.3%	2	18.2%	6	54.5%
feel motivated to work hard in my classes	1	9.1%	1	9.1%	4	36.4%	5	45.5%
feel motivated to continue as a mathematics major/minor			2	18.2%	4	36.4%	5	45.5%

Table 16. Fall 2021 survey results for attending social group activities.

Attending the presentations helped me:	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
feel more "connected" to the students in the scholarship group			2	9.5%	10	47.6%	9	42.9%
think about possible career options	1	4.8%	6	28.6%	9	42.9%	5	23.8%
learn new skills that will be beneficial in the future	1	4.8%	3	14.3%	13	61.9%	4	19.0%
feel motivated to work hard in my classes	1	4.8%	2	9.5%	11	52.4%	7	33.3%
feel motivated to continue as a mathematics major/minor			3	14.3%	7	33.3%	11	52.4%

Table 17. Fall 2021 survey results for attending monthly meetings.

Attending the monthly meetings helped me:	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
feel more "connected" to the students in the scholarship group	1	4.8%	1	4.8%	15	71.4%	4	19.0%
think about possible career options					12	57.1%	9	42.9%
learn new skills that will be beneficial in the future	1	4.8%	3	14.3%	11	52.4%	6	28.6%
feel motivated to work hard					16	76.2%	5	23.8%
feel motivated to continue as a mathematics major/minor	1	4.8%	1	4.8%	14	66.7%	5	23.8%

Appendix B:
End of Semester Survey - Mindset Data

Table 18. Spring 2021 results from mindset survey items.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I am good at math.					13	59.1%	9	40.9%
I enjoy going to my math classes.	1	4.5%			15	68.2%	6	27.3%
Others think I am good at math.			1	4.5%	12	54.5%	9	40.9%
I used to think I was good at math.	1	4.5%	6	27.3%	7	31.8%	8	36.4%
I can explain math ideas to other students.			2	9.1%	13	59.1%	7	31.8%
Math will be useful for my future.					11	50.0%	11	50.0%
I understand the relationship among different areas of mathematics.			2	9.1%	12	54.5%	8	36.4%
I am good at science.			2	9.1%	13	59.1%	7	31.8%
I enjoy going to my science classes.	2	9.1%	3	13.6%	10	45.5%	7	31.8%
Others think I am good at science.	1	4.5%	3	13.6%	13	59.1%	5	22.7%
I used to think I was good at science.	1	4.5%	5	22.7%	11	50.0%	5	22.7%
I can explain science concepts to other students.	1	4.5%	6	27.3%	10	45.5%	5	22.7%
Science will be useful for my future.			4	18.2%	9	40.9%	9	40.9%
I understand the relationship among different areas of science.	1	4.5%	4	18.2%	9	40.9%	8	36.4%

Table 19. Spring 2021 results from mindset survey items – freshman only.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I am good at math.					2	50.0%	2	50.0%
I enjoy going to my math classes.					3	75.0%	1	25.0%
Others think I am good at math.					2	50.0%	2	50.0%
I used to think I was good at math.					2	50.0%	2	50.0%
I can explain math ideas to other students.			1	25.0 %	1	25.0%	2	50.0%
Math will be useful for my future.					2	50.0%	2	50.0%
I understand the relationship among different areas of mathematics.					3	75.0%	1	25.0%
I am good at science.					2	50.0%	2	50.0%
I enjoy going to my science classes.			1	25.0 %	1	25.0%	2	50.0%
Others think I am good at science.					2	50.0%	2	50.0%
I used to think I was good at science.					2	50.0%	2	50.0%
I can explain science concepts to other students.					3	75.0%	1	25.0%
Science will be useful for my future.					1	25.0%	3	75.0%
I understand the relationship among different areas of science.					1	25.0%	3	75.0%

Table 20. Fall 2021 results from mindset survey items.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I am good at math.			1	5.0%	13	65.0%	6	30.0%
I enjoy going to my math classes.	1	5.0%			7	35.0%	12	60.0%
Others think I am good at math.					11	55.0%	9	45.0%
I used to think I was good at math.	1	5.0%	1	5.0%	12	60.0%	6	30.0%
I can explain math ideas to other students.	1	5.0%	2	10.0%	9	45.0%	8	40.0%
Math will be useful for my future.					8	40.0%	12	60.0%
I understand the relationship among different areas of mathematics.					14	70.0%	6	30.0%
I am good at science.			4	20.0%	12	60.0%	4	20.0%
I enjoy going to my science classes.	1	5.0%	3	15.0%	12	60.0%	4	20.0%
Others think I am good at science.			4	20.0%	12	60.0%	4	20.0%
I used to think I was good at science.	1	5.0%	4	20.0%	13	65.0%	2	10.0%
I can explain science concepts to other students.	2	10.0 %	3	15.0%	10	50.0%	5	25.0%
Science will be useful for my future.			3	15.0%	13	65.0%	4	20.0%
I understand the relationship among different areas of science.	1	5.0%	3	15.0%	12	60.0%	4	20.0%

Table 21. Fall 2021 results from mindset survey items – freshmen only.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I am good at math.					3	75.0%	1	25.0%
I enjoy going to my math classes.					2	50.0%	2	50.0%
Others think I am good at math.					3	75.0%	1	25.0%
I used to think I was good at math.			1	25.0%	3	75.0%		
I can explain math ideas to other students.					3	75.0%	1	25.0%
Math will be useful for my future.					2	50.0%	2	50.0%
I understand the relationship among different areas of mathematics.					4	100.0%		
I am good at science.					4	100.0%		
I enjoy going to my science classes.					3	75.0%	1	25.0%
Others think I am good at science.			1	25.0%	3	75.0%		
I used to think I was good at science.			2	50.0%	2	50.0%		
I can explain science concepts to other students.					4	100.0%		
Science will be useful for my future.					4	100.0%		
I understand the relationship among different areas of science.					4	100.0%		

Appendix C:
End of Semester Survey - Transition Data

Table 22. Spring 2021 results from undergraduate transition survey items.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
College is how I expected it to be.	1	6.3%	8	50.0%	7	43.8%		
My high school classes were just as difficult as my college classes.	3	18.8%	10	62.5%	2	12.5%	1	6.3%
I plan my week to make sure I get everything done.			3	18.8%	10	62.5%	3	18.8%
I schedule study time every day even if I don't have a test that week.			14	87.5%			2	12.5%
My instructors do NOT remind me about due dates for assignments and tests enough.	3	18.8%	10	62.5%	2	12.5%	1	6.3%
I have to teach myself new information for my classes.			2	12.5%	12	75.0%	2	12.5%
I have to spend more time studying than I did in high school.			2	12.5%	7	43.8%	7	43.8%
I feel like I fit in with the other student in my major.	1	6.3%	3	18.8%	9	56.3%	3	18.8%
I know instructors I can ask for help.			1	6.3%	8	50.0%	7	43.8%
I know students I can ask for help.			1	6.3%	11	68.8%	4	25.0%
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.	5	31.3%	5	31.3%	3	18.8%	3	18.8%

Table 23. Spring 2021 results from undergraduate transition survey items – freshman only.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
College is how I expected it to be.	1	25.0%	1	25.0%	2	50.0%		
My high school classes were just as difficult as my college classes.			3	75.0%	1	25.0%		
I plan my week to make sure I get everything done.			1	25.0%	3	75.0%		
I schedule study time every day even if I don't have a test that week.			3	75.0%			1	25.0%
My instructors do NOT remind me about due dates for assignments and tests enough.	1	25.0%	2	50.0%	1	25.0%		
I have to teach myself new information for my classes.			1	25.0%	1	25.0%	2	50.0%
I have to spend more time studying than I did in high school.					2	50.0%	2	50.0%
I feel like I fit in with the other student in my major.			1	25.0%	3	75.0%		
I know instructors I can ask for help.			1	25.0%	3	75.0%		
I know students I can ask for help.					4	100.0%		
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.	1	25.0%	1	25.0%			2	50.0%

Table 24. Fall 2021 results from undergraduate transition survey items.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
College is how I expected it to be.	2	14.3%	6	42.9%	5	35.7%	1	7.1%
My high school classes were just as difficult as my college classes.	3	21.4%	7	50.0%	2	14.3%	2	14.3%
I plan my week to make sure I get everything done.	1	7.1%	1	7.1%	9	64.3%	3	21.4%
I schedule study time every day even if I don't have a test that week.	1	7.1%	10	71.4%	1	7.1%	2	14.3%
My instructors do NOT remind me about due dates for assignments and tests enough.	2	14.3%	7	50.0%	4	28.6%	1	7.1%
I have to teach myself new information for my classes.			5	35.7%	9	64.3%		
I have to spend more time studying than I did in high school.			1	7.1%	6	42.9%	7	50.0%
I feel like I fit in with the other student in my major.			4	28.6%	7	50.0%	3	21.4%
I know instructors I can ask for help.	1	7.1%	1	7.1%	7	50.0%	5	35.7%
I know students I can ask for help.			1	7.1%	11	78.6%	2	14.3%
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.	1	7.1%	7	50.0%	4	28.6%	2	14.3%

Table 25. Fall 2021 results from undergraduate transition survey items – freshman only.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
College is how I expected it to be.			2	50.0%	1	25.0%	1	25.0%
My high school classes were just as difficult as my college classes.	1	25.0%	1	25.0%	1	25.0%	1	25.0%
I plan my week to make sure I get everything done.					4	100.0%		
I schedule study time every day even if I don't have a test that week.			3	75.0%	1	25.0%		
My instructors do NOT remind me about due dates for assignments and tests enough.			4	100.0%				
I have to teach myself new information for my classes.			2	50.0%	2	50.0%		
I have to spend more time studying than I did in high school.			1	25.0%	1	25.0%	2	50.0%
I feel like I fit in with the other student in my major.			2	50.0%	2	50.0%		
I know instructors I can ask for help.					4	100.0%		
I know students I can ask for help.					4	100.0%		
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.			3	75.0%	1	25.0%		

Table 26. Spring 2021 results from graduate transition survey items.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
Graduate school is how I expected it to be.			2	33.3%	3	50.0%	1	16.7%
My undergraduate classes prepared me well for my graduate classes.			1	16.7%	5	83.3%		
My undergraduate experiences (e.g., research, internship) prepared me well for my graduate classes.			1	16.7%	5	83.3%		
I participated in research activities as an undergraduate student.	1	16.7%			4	66.7%	1	16.7%
My undergraduate classes were just as difficult as my graduate classes.	1	16.7%	4	66.7%	1	16.7%		
I feel like I fit in with the other graduate students.	1	16.7%	2	33.3%	2	33.3%	1	16.7%
I know how to plan my week to make sure l get everything done.	1	16.7%			1	16.7%	4	66.7%
I can teach myself new information easily.	1	16.7%	1	16.7%	3	50.0%	1	16.7%
I know instructors I can ask for help.					2	33.3%	4	66.7%
I know students I can ask for help.			2	33.3%	1	16.7%	3	50.0%
My college instructors are interested in how I am doing in their class.	1	16.7%			1	16.7%	4	66.7%

Table 27. Fall 2021 results from graduate transition survey items.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
Graduate school is how I expected it to be.			1	16.7%	4	66.7%	1	16.7%
My undergraduate classes prepared me well for my graduate classes.	1	16.7%	1	16.7%	3	50.0%	1	16.7%
My undergraduate experiences (e.g., research, internship) prepared me well for my graduate classes.	1	16.7%			4	66.7%	1	16.7%
I participated in research activities as an undergraduate student.			1	16.7%	4	66.7%	1	16.7%
My undergraduate classes were just as difficult as my graduate classes.	1	16.7%	2	33.3%			3	50.0%
I feel like I fit in with the other graduate students.			1	16.7%	4	66.7%	1	16.7%
I know how to plan my week to make sure l get everything done.					3	50.0%	3	50.0%
I can teach myself new information easily.			1	16.7%	3	50.0%	2	33.3%
I know instructors I can ask for help.			1	16.7%	1	16.7%	4	66.7%
I know students I can ask for help.					3	50.0%	3	50.0%
My college instructors are interested in how I am doing in their class.					3	50.0%	3	50.0%

Appendix D:
End of Semester Survey - Student Conversations

Figure 1. Spring 2021 conversation topics with advisors and mentors.

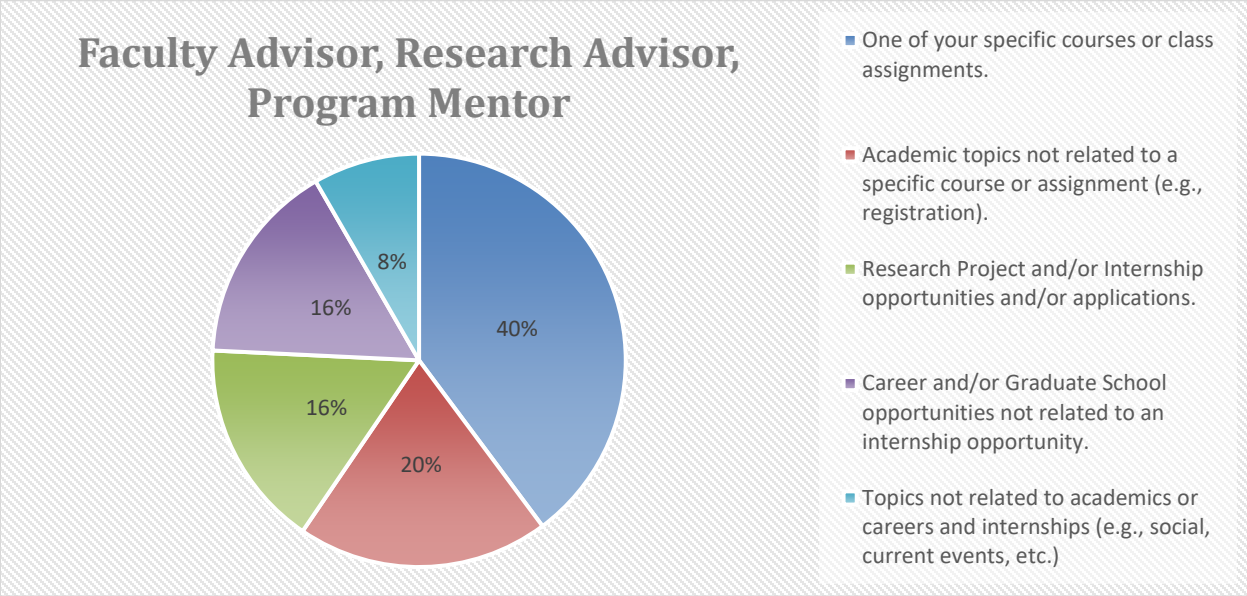


Figure 2. Spring 2021 conversation topics with faculty in the same department.

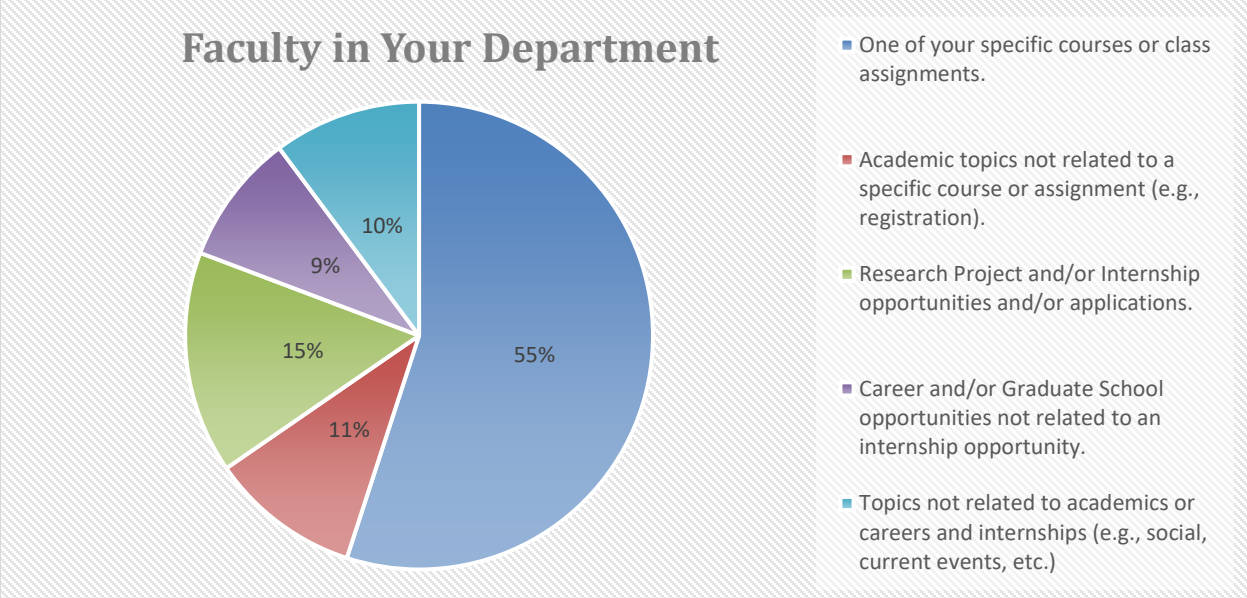


Figure 3. Spring 2021 conversation topics with faculty in other departments.

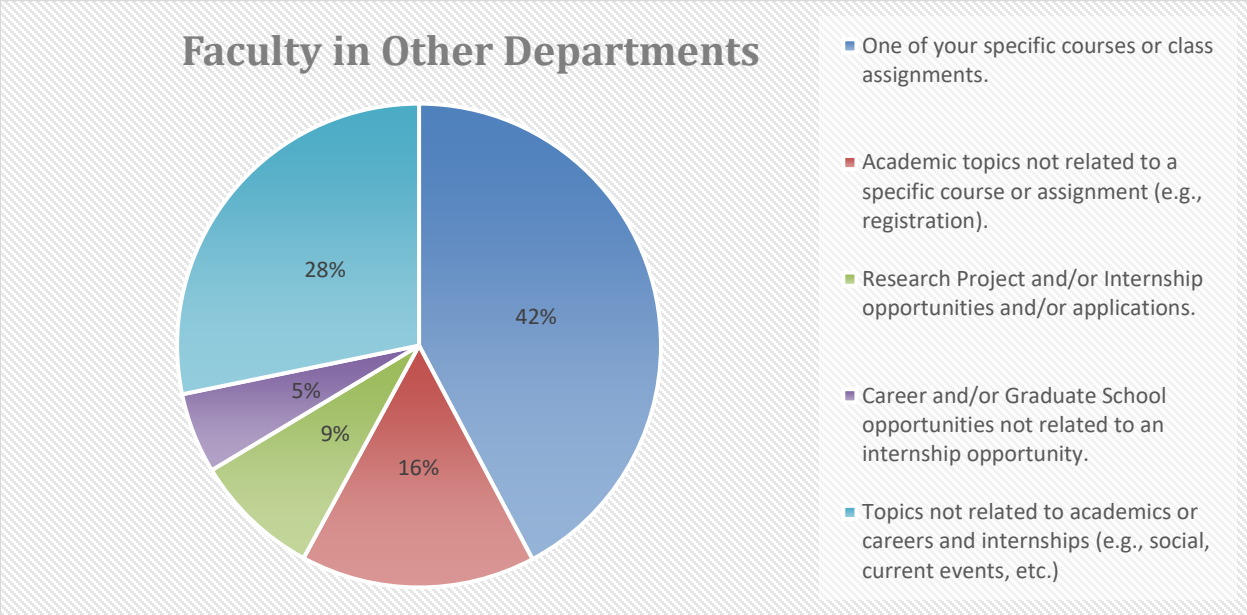


Figure 4. Spring 2021 conversation topics with SCOAM students in the same activity group.

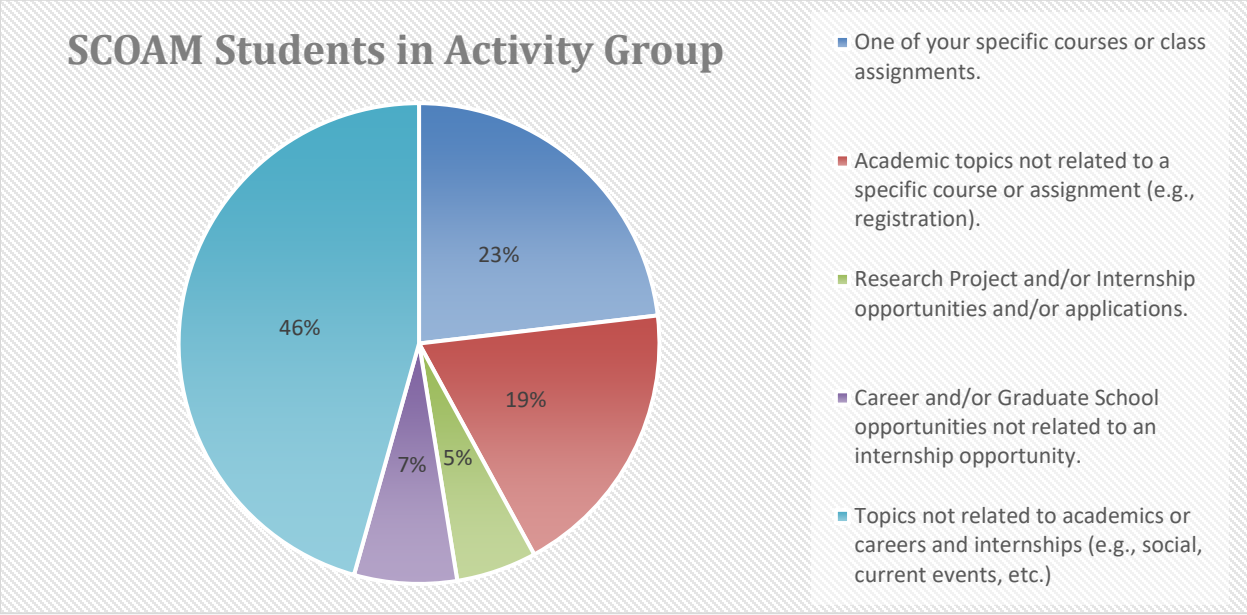


Figure 5. Spring 2021 conversation topics with other SCOAM students.

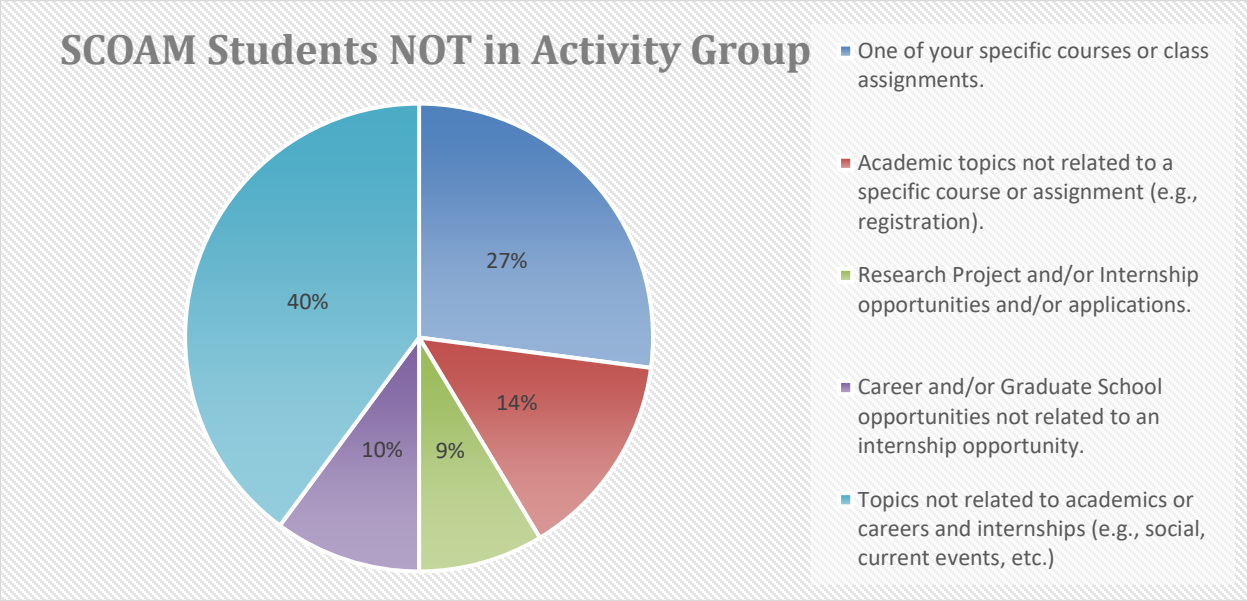


Figure 6. Spring 2021 conversation topics with non-SCOAM students.

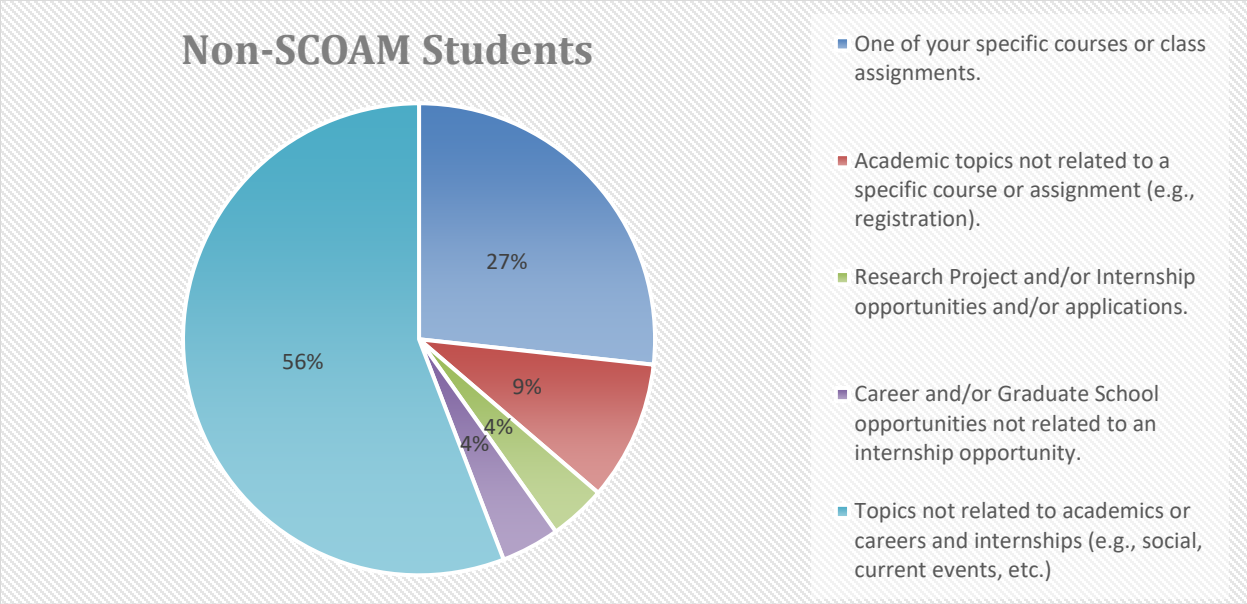


Figure 7. Fall 2021 conversation topics with advisors and mentors.

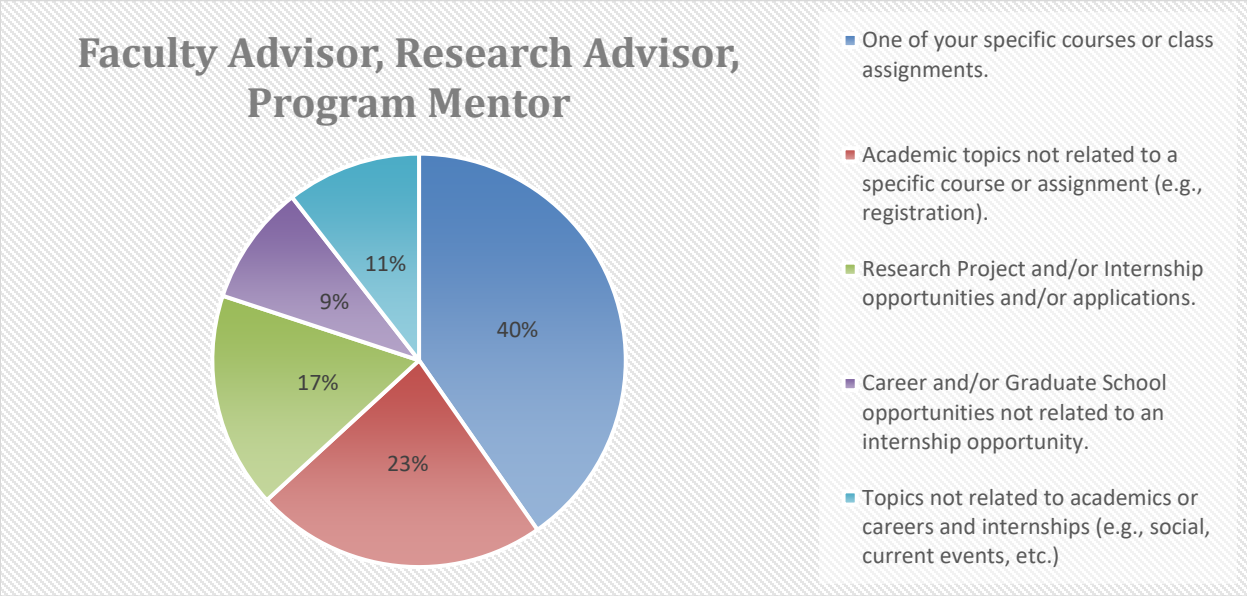


Figure 8. Fall 2021 conversation topics with faculty in the same department.

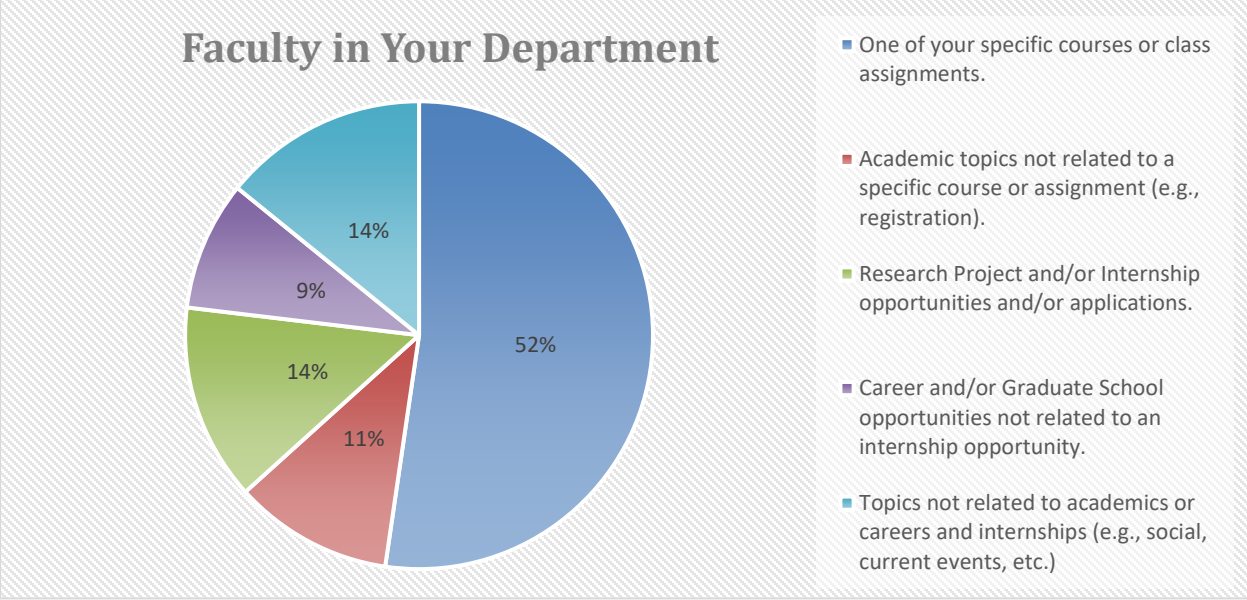


Figure 9. Fall 2021 conversation topics with faculty in other departments.

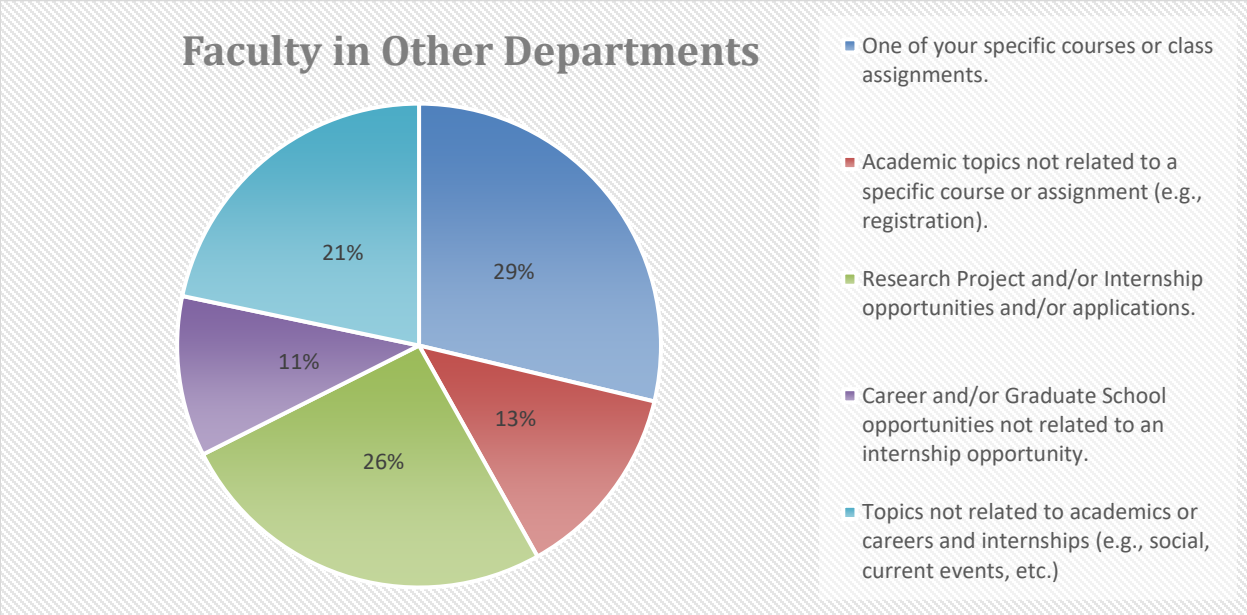


Figure 10. Fall 2021 conversation topics with SCOAM students in the same activity group.

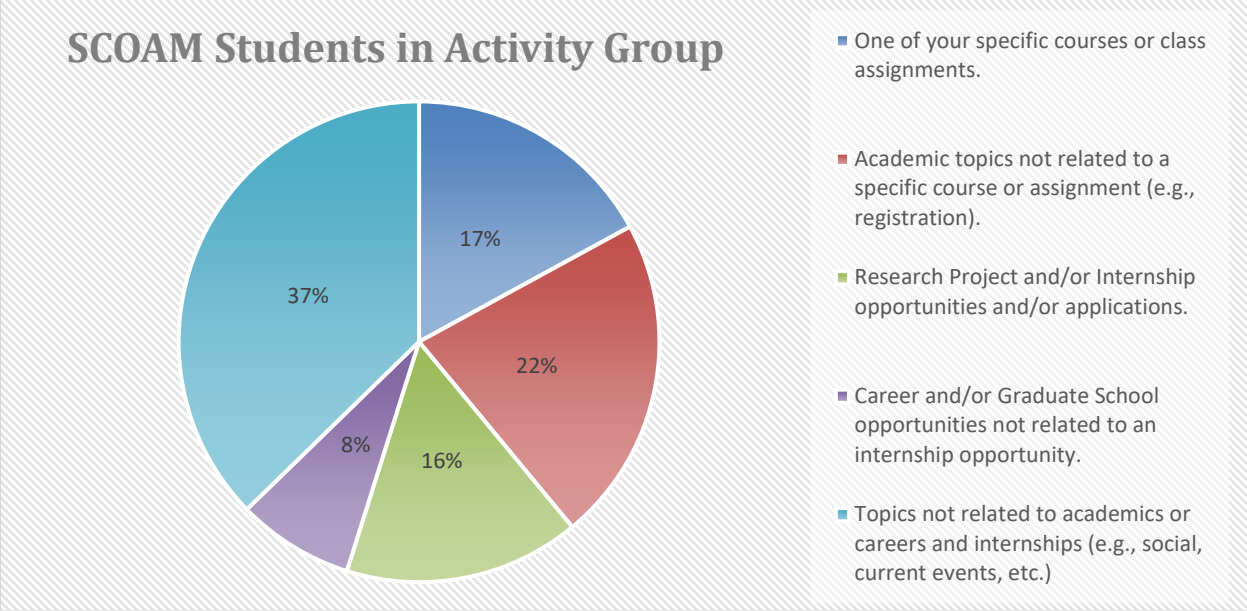


Figure 11. Fall 2021 conversation topics with other SCOAM students.

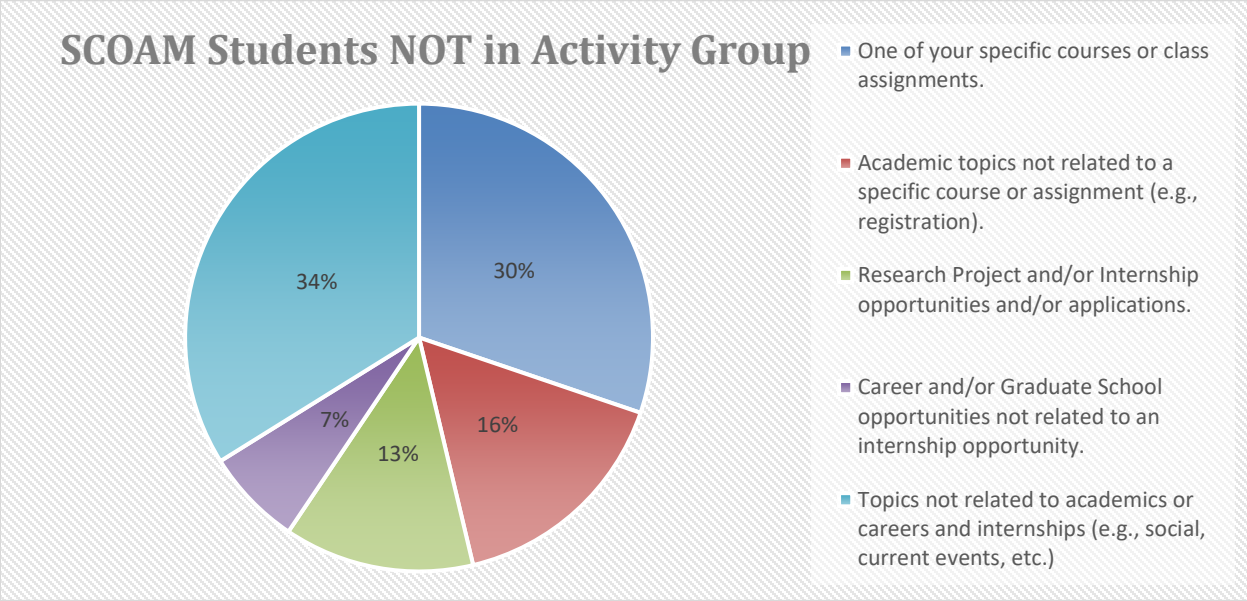
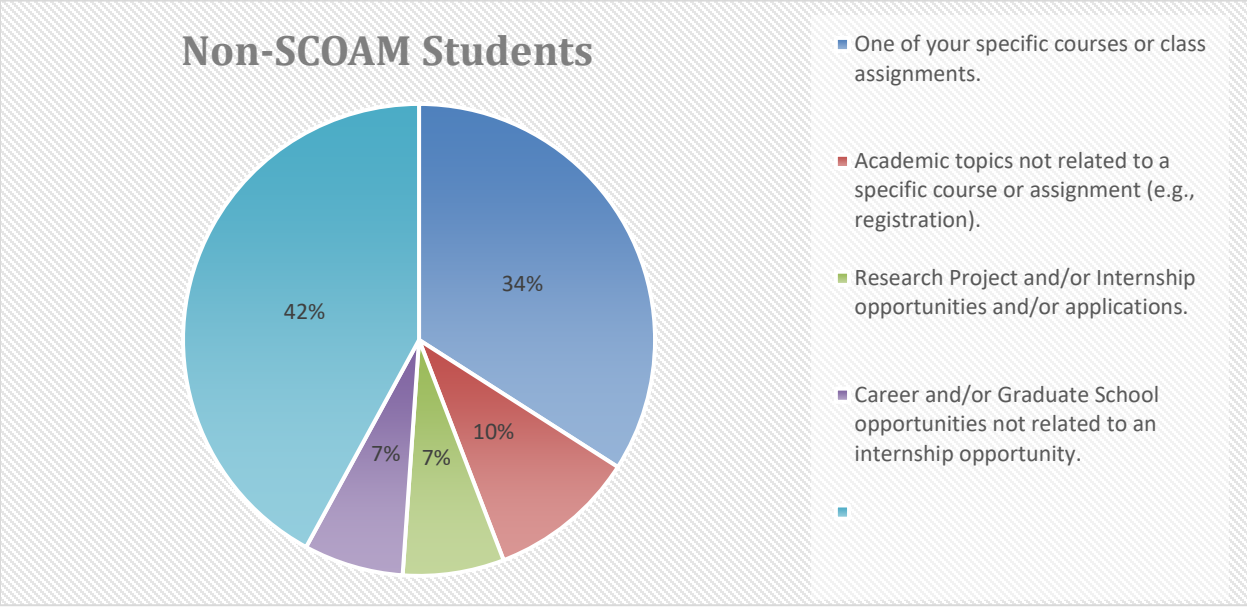


Figure 12. Fall 2021 conversation topics with non-SCOAM students.



Appendix E:
SCOAM Scholar Opinions about Online Learning Data

Table 28. Spring 2021 pandemic impact – course type

	Strongly Disagree		Disagree		Agree		Strongly Agree		Did not take	
	n	%	n	%	n	%	n	%	n	%
Learning is the same for me in an online lecture course as in a face-to-face lecture course.	6	27.3%	9	40.9%	4	18.2%	2	9.1%	1	4.5%
I have to learn on my own more in an online lecture class compared to a face-to-face lecture course.	2	9.1%	3	13.6%	7	31.8%	9	40.9%	1	4.5%
Learning is the same for me in an online lab course as in a face-to-face lab course.	1	4.5%	5	22.7%	2	9.1%	1	4.5%	13	59.1%
I have to learn on my own more in an online lab class compared to a face-to-face lab course.					5	22.7%	3	13.6%	14	63.6%

Table 29. Fall 2021 pandemic impact - motivation

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I found it easy to motivate myself to do my online coursework.	4	20.0%	5	25.0%	9	45.0%	2	10.0%
I found it difficult to organize my week to get all my coursework completed.	2	10.0%	10	50.0%	5	25.0%	3	15.0%
Face-to-face contact with a professor is necessary for me to learn.	3	15.0%	3	15.0%	9	45.0%	5	25.0%
I understand the content I was taught online as well as the content I was taught face-to-face.	3	15.0%	5	25.0%	9	45.0%	3	15.0%
I was persistent in asking my professor questions until I understood the content being taught.	3	15.0%	4	20.0%	11	55.0%	2	10.0%

Table 30. Fall 2021 pandemic impact – course type

	Strongly Disagree		Disagree		Agree		Strongly Agree		Did not take	
	n	%	n	%	n	%	n	%	n	%
Learning is the same for me in an online lecture course as in a face-to-face lecture course.	8	40.0%	5	25.0%	1	5.0%	1	5.0%	5	25.0%
I have to learn on my own more in an online lecture class compared to a face-to-face lecture course.	1	5.0%	3	15.0%	3	15.0%	6	30.0%	7	35.0%
Learning is the same for me in an online lab course as in a face-to-face lab course.	3	15.0%	2	10.0%			2	10.0%	13	65.0%

I have to learn on my own more in an online lab class compared to a face-to-face lab course.	1	5.0%	2	10.0%	1	5.0%	2	10.0%	14	70.0%

Table 31. Fall 2021 pandemic impact – course schedule preferences

	Strongly Disagree		Disagree		Agree		Strongly Agree		Did not take	
	n	%	n	%	n	%	n	%	n	%
I would have preferred to change my Fall 2021 schedule to avoid taking online LECTURE courses.	3	15.0%	1	5.0%			1	5.0%	15	75.0%
I would have preferred to change my Fall 2021 schedule to avoid taking a hybrid / online synchronous LECTURE course.	2	10.0%	1	5.0%	1	5.0%	1	5.0%	15	75.0%
I would have preferred to change my Fall 2021 schedule to avoid taking online LAB courses.	2	10.0%							18	90.0%
I changed my Fall 2021 schedule to avoid taking an online LAB or LECTURE course.	4	20.0%							16	80.0%
I would have preferred to change my Spring 2022 schedule to avoid taking any type of online LECTURE course.	3	15.0%	2	10.0%	2	10.0%	6	30.0%	7	35.0%
I preferred my Spring 2022 schedule avoid any online LAB courses.	2	10.0%			2	10.0%	3	15.0%	13	65.0%
I did NOT have the option of avoiding online courses for Spring 2022 because of the courses I was required to take.	6	30.0%	2	10.0%	2	10.0%			10	50.0%