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SCOAM Annual Report

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INDIANA UNIVERSITY OF PENNSYLVANIA (IUP)
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 2020 and Fall 2020, 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 fourth and fifth semesters of an overall 10-semester data collection effort. Data for all 5 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. Additional data was solicited from faculty about the spring transition to remote learning and from students regarding both the spring transition Fall 2020 semester to get a sense of the 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, 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 the overall program goals even during the unprecedented global pandemic.

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Introduction

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 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. 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.

This report is an annual external review for the Fall 2020 and Spring 2020 SCOAM semesters. It also includes the results from the Faculty COVID-19 Impact Survey and the additional student pandemic-related survey questions. 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 2020 SCOAM cohort consisted of 34 students; 2 of whom began in Spring 2020. Overall, there were 24 students who identified as White and 6 who identified as Black or African American students. Of the remaining students, 1 identified as American Indian or Alaskan Native and 3 students that identified as Hispanic or Latinx.

Of the 26 students completing the survey, 20 reported they were undergraduate and 6 were graduate students. Five undergraduate students in the cohort were freshman and the remaining 21 were upper classmen (7 sophomores, 4 juniors, and 4 seniors). There were 8 students who identified as female and 18 as male. Of the students completing the survey, 13 identified as mathematics majors and 13 as math minors. Five were first generation college students.

The Fall 2020 SCOAM cohort consisted of 41 students; 17 of whom started the program during the fall. The majority of students beginning the program in Fall 2020 identified as White (n = 14) with 1 student identifying as Black or African American, 1 student identifying as American Indian or Alaskan Native, and 1 student that did not report race. One student identified as Latinx. Additionally, two students reported having a disability.

Of the 41 new and continuing students, 30 (73%) completed the survey. Of the students returning the End of Semester survey, 24 were undergraduates (11 freshmen and 13 upper classmen) and 6 were graduate students. Additionally, 19 students identified as male and 11 as female. When reporting college major, 15 students identified as mathematics majors and 15 as math minors. Eight were first generation college students.

The faculty sample consisted of 33 STEM faculty. Twenty identified as male, ten identified as female, three chose not to report, and one respondent did not answer the question. Seventeen of the faculty identified as a mathematics or computer science faculty, nine identified as physics or chemistry faculty, and seven identified as biology, geoscience, or Earth science faculty. One faculty member did not identify a department affiliation. Twenty-three of the faculty reported they had been teaching at the post-secondary level for 15 years or more, five between 10 and 14 years, and six between 5 and 9 years. Most faculty (n = 32) had taught an online course prior to Spring 2020. However, two faculty reported that they had never taught an online course prior to the online transition. Specifically, ten faculty reported teaching at least 5 different online courses, eleven reported teaching 3-4 different online courses, and ten reported teaching 1-2 different online courses prior to Spring 2020.

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 small group activities, and a report generated 'in-house' that summarizes and evaluates the peer-led team learning sessions. Data for both the Spring 2020 and Fall 2020 semesters were used to compile this report. Additionally, for Spring and Fall 2020, 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 the 2019 and 2020 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 COVID-19, the 2020 surveys also contained questions about the impact of the pandemic on their educational and scholarship experiences for both semesters. Questions focused on opinions about remote learning, access to technology, communication with others, and the transitioning of cohort activities to the virtual environment.

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 descriptives for survey items while comments were subjected to a qualitative data analysis similar to that described below for the transcript data.

Social Group Activities

Students were also asked to participate in 3 small group activities each semester. 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.'

In Spring 2020, the global COVID-19 pandemic forced a transition to virtual meetings. For Fall 2020, social groups were given the choice of meeting face-to-face, virtually, or both depending on state guidelines and personal comfort levels.

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 2020, the Peer-Led Team Learning (PLTL) sessions were discontinued after the university moved to an online environment. In Fall 2020, the sessions were revived but were conducted online.

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 the 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 emerge 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.

Faculty COVID-19 Impact Survey

Faculty survey questions focused on the experiences of faculty as they transitioned and taught STEM courses in an online format during Spring 2020. For the purposes of this survey, 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 faculty survey was divided into four components:

- General Questions about Online Training and Teaching,
- Course Level Questions,
- Faculty Perceptions of Student Engagement and Learning,
- Demographic Questions

In turn, course level questions are divided into 3 categories:

- Lecture - course taught in a regular classroom with the primary aim of content delivery.
- Lab - course taught in a science lab or computer lab with the primary aim of skill development or a dual aim of content delivery and skill development.
- Other - any course, regardless of classroom type or primary aim, that does not easily fit into either the lecture or lab category.

It was possible to have a course in each of the categories depending on the type and number of courses taught in a semester. Faculty were asked only to answer questions about the types of courses they transitioned and taught in Spring 2020.

Items were positively and negatively worded 4-point Likert statements based on literature concerning faculty reactions to online teaching and learning and traditional myths surrounding online education in general. A few questions were based on faculty feedback provided to the PIs during casual conversations during the semester. For every course-level section, a series of open-ended comment questions was asked about obstacles encountered and lessons learned during the transition. Additionally, open-ended questions were also offered after the section related to student engagement to gather any additional information not conducive to selected-response items.

The survey data was collected through the Qualtrics survey package and the email link was sent to all STEM faculty at the university after receiving IRB approval for the study. Response data was downloaded directly from the Qualtrics site by the evaluator for analysis. Quantitative data analyses consisted of preparing descriptives for survey items while comments were subjected to a qualitative data analysis.

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.

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 small group activities. All of these activities were designed to promote connectedness among SCOAM students and/or between students and faculty within the math department. 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 2020 Workshops and Presentation: Survey results show that the Mathematica workshops, and Ashleigh Craig presentation helped some students to feel more connected to faculty within their department (65% and 63%, respectively) and other SCOAM students (89% and 75%, respectively). In addition, the workshops and presentation also helped motivate most students to work harder in their classes (71% and 100%, respectively) and continue in their program (89% and 75%, respectively) with 94% of participants believing the Mathematica workshops taught them a new skill beneficial for their future.

Four open-ended comments concerning the differences between the face-to-face and online presentation environment were submitted. Three of the four mentioned not being able to ask questions. Commenters remarked that the Ashleigh Craig did a good job anticipating questions students may have and offered to answer questions in her spare time and that Zoom would be a better platform for the presentation so students could ask questions during the presentation. One student remarked that the face-to-face presentation fosters connection better than the online environment.

Fall 2020 Workshops and Presentation: Responses suggest that the R programming workshops, and Dr. Sara Del Valle presentation helped about half of the students feel more connected to faculty within their department (57% and 63%, respectively) and other SCOAM students (83% and 63%, respectively). In addition, workshops and presentation also helped motivate most students to work harder in their classes (70% and 90%, respectively) and continue in their

program (83% and 84%, respectively) with 95% of participants believing the R programming workshops taught them a new skill beneficial for their future.

Six students offered open-ended comments concerning differences between face-to-face and online presentations. Four of the six students preferred the face-to-face presentations because of the atmosphere created by the interaction and connectedness. Additionally, two of these students mentioned it was difficult to concentrate being at home and listening to the presentation. The other two students did not have a preference between online and in-person presentations finding the experiences similar. One student did suggest finding a way to get students more involved in the presentations would improve the experience.

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 career options and motivating in their coursework.

Table 1. Trends in percent agreement for workshops and presentations

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020
Workshops	% Agree	% Agree	% Agree	% Agree	% Agree
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%
feel more "connected" to faculty members outside of my department.	40.0%	80.0%	82.4%	76.5%	73.9%
feel more "connected" to the students in the scholarship group	90.0%	53.3%	53.0%	88.2%	82.6%
feel more “connected” to other math and science students	100.0%	80.0%	76.5%	88.3%	87.0%
think about possible career options	70.0%	86.6%	82.4%	94.2%	91.3%
learn a new skill that will be beneficial in the future	100.0%	80.0%	70.6%	94.1%	95.7%
feel motivated to work hard in my classes	80.0%	80.0%	88.2%	70.6%	69.5%
feel motivated to continue as a mathematics major/minor	100.0%	93.3%	70.6%	88.2%	82.6%

Table 1 continued.

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020
Presentations	% Agree	% Agree	% Agree	% Agree	% Agree
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%
feel more "connected" to faculty members outside of my department.	50.0%	87.5%	88.9%	75.0%	79.0%
feel more "connected" to the students in the scholarship group	87.5%	75.0%	55.5%	75.0%	63.2%
feel more "connected" to other math and science students	100.0%	100.0%	66.6%	62.5%	78.9%
think about possible career options	87.5%	87.5%	66.6%	62.5%	84.2%
feel motivated to work hard in my classes	87.5%	100.0%	88.9%	100.0%	89.5%
feel motivated to continue as a mathematics major/minor	100.0%	100.0%	88.9%	75.0%	84.2%

Spring 2020 Social Group Activities and Monthly Meetings: Survey results suggested that most students felt the social group activities whether virtual or in-person helped them feel more 'connected' to their fellow SCOAM students (93% and 81%, respectively), were marginally successful in increasing their motivation to work hard in their classes (60% and 87%, respectively) or continue in their coursework (87% and 93%, respectively. Monthly meetings also helped students feel more 'connected' to their fellow SCOAM students (81%). According to these results, the monthly meetings also helped motivate most students to work harder in their classes (81%) and continue in their program (81%) while teaching them new skills they thought would be beneficial in the future (89%).

Twelve students provided feedback in the form of open-ended comments about virtual meetings, but three students did not have any suggestions for improvement stating the activities were fun and they could think of no way to improve them. Three students remarked that a timeframe for completion of the activity would be helpful. Three students commented that they liked the format and activity presented in the first meeting better than the format and activity presented in the second activity. Two students suggested activities for the meetings: puzzles, games, or logic problems. Finally, one student did not like the virtual environment.

Fall 2020 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 (90%), were successful in increasing their motivation to work hard in their classes (80%) and continue in their coursework (83%). Monthly meetings also helped students feel more 'connected' to their fellow SCOAM students (77%). According to these results, the monthly meetings also helped motivate most students to work harder in their classes

(97%) and continue in their program (90%) while teaching them new skills they thought would be beneficial in the future (97%).

Sixteen student provided comments. Three themes emerged from the comments: students are tired of meeting on Zoom all day long, students would like a list of possible/acceptable activities in which to participate, and it was difficult planning Zoom time around everyone's schedules. Three students liked the virtual group meetings and found it to be a good way to get to know other people.

COVID-19 Activity: For Fall 2020, the social groups were asked to select a paper related to COVID-19 to read and discuss during a monthly meeting. Students overwhelmingly liked this activity. On the survey, students were asked to share something new and/or interesting they learned from the presentations. Three topics seemed to resonate with students based on these comments: the differential impact of COVID depending on gender, ethnicity, or being a part of a special population *(e.g., prison), viral mutations, and the mental health effects of the virus. Some students commented on learning new information about mask-wearing, hand sanitizer, how decisions are made to close or open schools, and modeling the spread of the virus.

> *I learned a lot about the discrimination and disadvantages people of color and other minorities faced in these times. People in prison systems couldn't follow social distancing guidelines like the rest of society and, therefore, had a disproportional number of cases.*
>
> *- Fall 2020*

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). Opinions concerning the monthly meetings have remained fairly stable over the course of the program, the transition to remote learning in Spring 2020 notwithstanding. Students appear to struggle with feeling connected in the online environment.

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

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

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 2020: Responses showed that SCOAM students have a positive mindset towards their math abilities but less so of their science abilities. Students tended to; think they are good at math (97%), liked going to their math (96%) classes, believed others think they are good at math (89%), and believed they understand the relationships between different areas of math (97%). Students were confident in their ability to explain math (85%) concepts to others but were considerably less confident in their ability to explain science (65%) concepts to others. In general, students tended to be less confident in their science abilities compared to their math abilities. Finally, a little over half of the students 'used to think they were good at' math (62%) and science (58%). 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, but freshmen were much more positive in assessment of their science abilities compared to the entire SCOAM cohort and less confident in their ability to explain science concepts to others.

Fall 2020: Responses showed that SCOAM students seemed to have a similar positive mindset towards their math and science abilities. Students tended to; think they are good at math (90%) and science (93%), liked going to their math (83%) and science (77%) classes, believed others think they are good at math (97%) and science (83%), and believed they understand the relationships between different areas of math (97%) and science (90%). Students also were confident in their ability to explain math (87%) and science (80%) concepts to others. Finally, a large proportion of students 'used to think they were good at' math (83%) and science (90%). Again, freshmen data was analyzed separately. Patterns across freshmen mirrored the results of the overall survey, but freshmen enjoyed going to science class more and believed others thought they were good at science. But they enjoyed going to math class less and felt they did not understand the relationship among different areas of science as well as the entire SCOAM cohort.

Trends in Mindset Items: Trends across semesters are presented in Table 3 and 4. 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 fall 2020 cohort is beginning with a more positive math and science mindset compared to past cohorts. The trend for freshmen, however, is reversed with a less positive math mindset and a more positive science mindset compared to previous freshmen cohorts. Note specifically the 91% of freshmen in Fall 2020 that reported they used to believe they were good at math. Again, the impact of COVID-19 on this mindset is difficult to ascertain.

Table 3. Trends in mindset data – overall

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020
Mindset	% Agree	% Agree	% Agree	% Agree	% Agree
I am good at math.	95.2%	100.0%	90.3%	96.1%	90.0%
I enjoy going to my math classes.	100.0%	95.9%	93.6%	96.2%	83.3%
Others think I am good at math.	100.0%	100.0%	96.7%	88.5%	96.7%
I used to think I was good at math.	71.5%	75.0%	67.7%	61.6%	83.3%
I can explain math ideas to other students.	76.2%	91.7%	90.3%	84.6%	86.6%
Math will be useful for my future.	95.2%	100.0%	96.8%	96.2%	100.0%
I understand the relationship among different areas of mathematics.	85.7%	91.7%	93.5%	96.1%	96.7%
I am good at science.	85.7%	91.7%	80.6%	73.0%	93.4%
I enjoy going to my science classes.	76.2%	83.3%	74.2%	65.4%	86.7%
Others think I am good at science.	80.9%	83.3%	80.7%	76.9%	83.3%
I used to think I was good at science.	66.7%	58.3%	67.8%	57.7%	90.0%
I can explain science concepts to other students.	76.2%	70.8%	67.8%	65.4%	80.0%
Science will be useful for my future.	90.5%	91.7%	90.3%	88.5%	80.0%
I understand the relationship among different areas of science.	95.2%	87.5%	87.1%	77.0%	90.0%

Table 4. Trends in mindset data - freshmen only

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020
Mindset	% Agree	% Agree	% Agree	% Agree	% Agree
I am good at math.	100.0%	100.0%	85.7%	80.0%	81.8%
I enjoy going to my math classes.	100.0%	83.3%	85.8%	80.0%	72.8%
Others think I am good at math.	100.0%	100.0%	85.7%	80.0%	90.9%
I used to think I was good at math.	83.4%	83.3%	71.5%	60.0%	90.9%
I can explain math ideas to other students.	66.7%	100.0%	85.8%	80.0%	81.8%
Math will be useful for my future.	83.3%	100.0%	85.7%	80.0%	100.0%
I understand the relationship among different areas of mathematics.	100.0%	100.0%	85.8%	80.0%	90.9%
I am good at science.	83.4%	100.0%	85.7%	60.0%	100.0%
I enjoy going to my science classes.	66.7%	83.3%	57.2%	60.0%	100.0%
Others think I am good at science.	83.4%	100.0%	85.7%	60.0%	90.9%
I used to think I was good at science.	83.4%	66.7%	71.4%	40.0%	90.9%
I can explain science concepts to other students.	83.4%	66.7%	85.7%	40.0%	81.8%
Science will be useful for my future.	83.3%	100.0%	71.4%	80.0%	81.8%
I understand the relationship among different areas of science.	100.0%	100.0%	71.5%	80.0%	72.8%

End of Semester Survey – Transition Items

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

Spring 2020 Undergraduate: More than half of undergraduate students found college to be as expected (65%) and felt they fit in with other students in their major (70%). Most felt their high school classes were less challenging than their college classes (80%) and most agreed that they spent more time studying in college (95%) and had to teach themselves new information (75%). Only half of the students (50%) 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 (90%). On a positive note, students overwhelmingly felt they knew professors (90%) and students (85%) whom they could ask for help. Most students believed their professors were giving them sufficient reminders about due dates (95%) and believed their professors were interested in their academic progress in class (90%).

Spring 2020 Freshmen: 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.

Fall 2020 Undergraduate: Only half of undergraduate students found college to be as expected (50%) while a little more than half felt they fit in with other students in their major (67%). A large majority of the students believed their high school classes were less challenging compared to their college classes (80%), and most agreed that they spent more time studying in college (90%) and had to teach themselves new information (88%). Additionally, while students seemed to plan their week to get everything done (83%), they did not seem to spend time studying unless a test was upcoming (67%). Most students felt they knew professors (79%) and students (79%) whom they could ask for help and most students believed their professors were giving them sufficient reminders about due dates (67%) and were interested in their academic progress in class (54%).

Fall 2020 Freshmen: 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, freshmen tended to spend less time planning their week. Second, more freshmen noted that they do not know professors to whom they can go for help. Finally, a larger proportion of freshmen reported that their high school classes were less challenging than their college classed. In general,

freshmen seem to be struggling more with the transition from high school to college during this semester.

Trends in Undergraduate Transition Items: Trends across semesters are presented in Table 5. 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 and are more likely to struggle with due dates. Freshmen in 2020 particularly report difficulty with planning their week, carving out studying time, and remembering due dates. One notable trend across all semesters is the continuing decrease in percent of students who feel like they fit in with their peers.

Table 5. Trends in undergraduate transition items

Transition - Undergraduate	Fall 2018 % Agree	Spring 2019 % Agree	Fall 2019 % Agree	Spring 2020 % Agree	Fall 2020 % Agree
College is how I expected it to be.	73.3%	58.9%	66.7%	65.0%	50.0%
My high school classes were just as difficult as my college classes.	26.7%	41.2%	29.2%	20.0%	16.7%
I plan my week to make sure I get everything done.	93.3%	88.2%	87.5%	90.0%	83.3%
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%
My instructors do NOT remind me about due dates for assignments and tests enough.	13.3%	17.7%	12.5%	5.0%	33.4%
I have to teach myself new information for my classes.	86.7%	94.2%	75.0%	75.0%	87.5%
I have to spend more time studying than I did in high school.	93.3%	88.3%	95.8%	95.0%	91.6%
I feel like I fit in with the other student in my major.	80.0%	82.3%	79.1%	70.0%	66.6%
I know instructors I can ask for help.	100.0%	100.0%	83.4%	90.0%	79.2%
I know students I can ask for help.	93.3%	82.3%	91.7%	85.0%	79.2%
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%

Table 5 continued.

Transition – Freshmen	Fall 2018 % Agree	Spring 2019 % Agree	Fall 2019 % Agree	Spring 2020 % Agree	Fall 2020 % Agree
College is how I expected it to be.	83.4%	66.7%	57.1%	40.0%	45.5%
My high school classes were just as difficult as my college classes.	33.4%	66.7%	42.9%	40.0%	36.4%
I plan my week to make sure I get everything done.	100.0%	100.0%	100.0%	80.0%	63.7%
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%
My instructors do NOT remind me about due dates for assignments and tests enough.	16.7%	16.7%	28.6%	0.0%	45.5%
I have to teach myself new information for my classes.	83.3%	100.0%	42.9%	40.0%	72.7%
I have to spend more time studying than I did in high school.	100.0%	100.0%	85.7%	80.0%	90.9%
I feel like I fit in with the other student in my major.	83.4%	100.0%	85.7%	80.0%	54.5%
I know instructors I can ask for help.	100.0%	100.0%	57.2%	80.0%	63.6%
I know students I can ask for help.	83.4%	66.7%	85.7%	80.0%	72.7%
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%

Spring 2020 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 2020 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 6. 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 6. trends in graduate transition items

Transition - Graduate	Fall 2018 % Agree	Spring 2019 % Agree	Fall 2019 % Agree	Spring 2020 % Agree	Fall 2020 % Agree
College is how I expected it to be.	66.7%	85.7%	100.0%	100.0%	66.6%
My graduate classes were just as difficult as my undergraduate classes.	100.0%	100.0%	71.4%	66.7%	83.3%
I plan my week to make sure I get everything done.	50.0%	71.4%	42.9%	83.4%	100.0%
I schedule study time every day even if I don't have a test that week.	16.7%	28.6%	42.9%	33.4%	66.7%
My instructors do NOT remind me about due dates for assignments and tests enough.	0.0%	14.3%	42.9%	50.0%	50.0%
I have to teach myself new information for my classes.	83.4%	100.0%	85.7%	50.0%	83.3%
I have to spend more time studying than I did in undergraduate school.	33.3%	100.0%	85.7%	83.3%	83.3%
I feel like I fit in with the other student in my major.	66.6%	100.0%	100.0%	83.3%	100.0%
I know instructors I can ask for help.	100.0%	100.0%	100.0%	100.0%	100.0%
I know students I can ask for help.	100.0%	100.0%	100.0%	100.0%	100.0%
My college instructors are NOT as interested in how I am doing in their class compared to my undergraduate instructors.	83.3%	100.0%	85.7%	100.0%	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

Survey results suggested that some SCOAM students were participating in research conferences/ colloquia during the Spring 2020 semester (n = 1) and the Fall 2020 semester (n = 8). Three students from the Fall 2020 reported that they would not have participated in the research conference/colloquia if they were not in the SCOAM program.

Additionally, during the semester break, all students 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 2020 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 (38% to 72%). The lowest proportion of those conversations were with non-SCOAM students in their activity group (38%) and the highest proportions were with faculty in their department (72%), faculty mentors/advisors (64%), and faculty outside their department (53%). Conversations concerning research (9% - 17%) opportunities were somewhat similar between SCOAM students and all faculty and peer groups with the highest proportions being between SCOAM students and their faculty mentors/advisors or social group members (17% for both). For career opportunities, SCOAM students turned to all faculty and peer groups relatively similarly (11% - 13%).

Conversations between SCOAM students and SCOAM students not in their social activity groups were more balanced between academic and social topics (33% and 31%). SCOAM students report most of their non-academic conversations were with non-SCOAM students (40%), other SCOAM students (31%) SCOAM students in their social group (23%), and faculty outside of their department (27%). This was not the case for conversations with faculty mentors/advisors (6%) and faculty within their department (10%).

Fall 2020 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 (40% to 74%). The lowest proportion of those conversations were between SCOAM students in their social activity group (40%) and the highest proportions were with faculty mentors (74%), and faculty within their department (69%) and faculty outside of their department (63%). Conversations concerning research (6% - 16%) were somewhat similar between SCOAM students and faculty and peer groups with the highest proportions being between SCOAM students and students in their social activity groups (16%) or faculty outside of their department (15%). For career opportunities, students turned to all faculty and peer groups similarly (6% - 8%).

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%).

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

Trends in Conversation Data: trends across semesters in conversation data is presented in Table 7. There has been an increase in student conversations about academic topics with faculty in other departments and a decrease in student conversations about academic topics with students in their social groups. There has also been an increase in student conversations about other academic topics with their faculty advisor/mentor. Whether this is due to COVID-19 cannot be determined. Student conversations with faculty outside their department about non-academic topics has decreased dramatically. This could be due to COVID-19. Also, there has been an increase in non-academic conversations with SCOAM students whether in their social group or not in Fall 2020 despite the online environment.

Table 7. Trends in conversation topics among faculty and peers.

	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020
Courses or Assignments					
Faculty Mentor	32	36	39	36	37
Faculty in Department	58	48	55	57	55
Faculty Outside Department	29	41	15	34	43
SCOAM Students in Social Group	34	20	21	16	24
SCOAM Students not in Social Group	41	37	28	33	36
Non-SCOAM Students	27	32	32	24	36
Other Academic Topics					
Faculty Mentor	17	23	18	28	37
Faculty in Department	13	14	13	15	13
Faculty Outside Department	13	19	25	20	20
SCOAM Students in Social Group	14	17	19	32	16
SCOAM Students not in Social Group	12	17	16	16	15
Non-SCOAM Students	14	20	16	14	13
Research, Internships, Careers					
Faculty Mentor	43	32	32	31	18
Faculty in Department	16	26	19	19	17
Faculty Outside Department	33	17	29	20	23
SCOAM Students in Social Group	29	26	22	29	23
SCOAM Students not in Social Group	25	20	20	20	15
Non-SCOAM Students	21	20	17	22	12
Non-Academic Topics					
Faculty Mentor	8	10	10	6	8
Faculty in Department	13	13	13	10	14
Faculty Outside Department	25	22	30	27	15
SCOAM Students in Social Group	23	36	38	23	37
SCOAM Students not in Social Group	22	26	36	31	35
Non-SCOAM Students	38	29	35	40	39

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 COVID-19 pandemic forced the suspension of the PLTL sessions in Spring 2020, so no report is available. The following summary is from data for the end of Fall 2020 semester report. Sessions were conducted virtually during this semester.

The survey was sent to all students (n = 101) enrolled in selected math classes during the Fall 2020 semester. Thirty-two students completed the survey (32%). Of the responding students, 13 attended the learning sessions and 19 did not. Of the 13 participants, 9 were SCOAM students. Twenty-three of the respondents identified as science or computer science majors. SCOAM students attended roughly the same number of sessions than non-SCOAM participants with 3 attending 10 or more sessions and 4 attending 7-9 sessions (77% across both categories). Sixty-nine (69%) of non-SCOAM students attended 7 or more sessions while 31% (n = 4) attended 4-6 sessions compared to 22% (n = 2) SCOAM students who attended 4-6 sessions. No participants, regardless of scholarship status attended less than 3 sessions.

All students attending the sessions felt the PLTL session better prepared them for math class while most felt the sessions were a valuable resource (85%). A majority of students also remarked that the sessions increased their confidence to take exams and quizzes (61%) and helped them with completing homework assignments (69%) and improved their final exam performance (62%). A smaller percentage stated the sessions influenced how they prepared for exams and quizzes (30%). Overall participants were satisfied with their sessions' leaders (85%) and agreed that the leaders allowed them to express their opinions (77%). A majority of students suggested continuing to offer the learning sessions (85%) however, a smaller percentage of students stated the sessions encouraged them to seek out other peer-led opportunities (75%) or increased their willingness to seek out internship (30%) or research opportunity (31%) in math.

> *The most beneficial part of the PLTL sessions was learning different applications of the problems. We do not typically learn real life applications of calculus topics, so the peer lead sessions helped improve my overall understanding of the topics. I was able to understand why the topics are important and what they might be used for.*
>
> *- Fall 2020*

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. Most students (60%) would not change anything about the sessions. However, a few students asked for the packets to be sent earlier in the week while a few others asked for the pace to be slower and for more questions and answer opportunities. It is important to note that the PLTL sessions 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. Interestingly, two comments given by non-participants suggested that they also felt the

sessions were tutoring sessions that they did not feel the need to attend or found resources elsewhere.

As in the past, the survey items and open-ended comments seemed to suggest participating students believed the learning sessions were valuable in that they provided opportunities to apply and extend their mathematical understanding.

Peer-Led Team Learning Sessions – Peer Leader Perspective

The PLTL sessions were designed to help students, but to also providing 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 used the flipped model mentioned above during the sessions. The peer leaders enjoyed this model more than the teaching model used previously. All leaders remarked on the lack of attendance for the sessions but felt that there was a slight improvement over past semesters. All peer leaders enjoyed the teaching opportunity and felt that students were beginning to see the value of the application problems used in the sessions.

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 2020 Activities Data: End of the Semester Survey results suggested that the Mathematica workshops and Ashleigh Craig presentation helped students feel more connected to faculty outside their department (77% and 75%, respectively) and students outside of the SCOAM program (89% and 63%, respectively). Additionally, the workshops helped students to think about possible career options (94%) while the presentation, not as much (63%).

Fall 2020 Activities Data: Likewise, survey results suggested that the R programming workshops, and Dr. Sara Del Valle presentation helped students feel more connected to faculty outside their department (74% and 79%, respectively) and students outside of the SCOAM program (87% and 79%, respectively). Additionally, the workshops and presentation seemed to help students to think about possible career options (91% and 84%, 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 (Appendix D).

End of Semester Survey – Licensing and Graduate School Exam Data

Eleven students in Spring 2020 reported that had taken or would take the GRE, PRAXIS, or actuarial exams. Also, ten students in Fall 2020 reported they have taken or will take the GRE, PRAXIS or actuarial exam. Thirty-one students from Fall 2020 and fifteen students from Spring 2020 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 2020 semesters.

Most students provided one activity they felt was most helpful. Overwhelmingly students felt the social group activities. Monthly meetings, and Mathematica and R workshops were the most beneficial activities. During Fall 2020, COVID presentations were part of the required work for the social groups. These presentations were a big success with the students with almost half of the students reporting they were the most beneficial activity for the semester. Several students mentioned research opportunities and being able to present or participate in colloquia and conferences as advantageous. Also mentioned were the geo seminars, Cybersecurity Club, and an internship fair.

> *I think the way the activities were set up this semester was a good balance of learning how to work with others (SCOAM group activities), learning analytical skills (R workshops), and learning about things that other have done (Covid-19 talks).*
>
> *- Fall 2020*

Future activities, as suggested by the students in their open-ended survey comments, generally fall into 3 broad categories: career options, career preparation, opportunities for skill development, and ways to deepen their understanding of mathematics. Specific suggestions for presentations were bringing more alumni on campus to explain what they do, more career exploration presentations, engineering talks, and talks on computer and actuarial science. Career preparation specific suggestions involved resume, cover letter, and personal statement writing, research writing, mock interviews, and graduate school preparation. Finally, many students want more coding workshops and workshops about ways to apply mathematics.

> *Although it was an unconventional semester, I still feel like I got a lot out of S-COAM.*
>
> *- Spring 2020*

Students from Spring 2020 semester were positive in their comments (n = 9) reporting that participating in SCOAM was beneficial and kept them connected when everything else was shutting down. Two students in Fall 2020 felt students were not taking the experience seriously enough and wanted others to participate more. One student was clearly struggling and stated that they were overwhelmed by the additional SCOAM work. Most Fall 2020 students (n = 8 out 11), however, remained positive about their experiences in the SCOAM reporting that it was a wonderful experience and kept them connected during their remote learning experience.

SCOAM Scholar COVID-19 Impact Survey Results

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.

Impact of moving to an online environment on student learning was of particular interest. Several domains that had the potential to negatively impact student learning were identified: access to technology, comfort level with technology, changes in motivation, and difficulty in adapting to the remote learning environment. Also, 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. Finally, one goal of the SCOAM program is promoting connectedness among students and providing networking opportunities for students. It was hypothesized that these two aspects of the program would be negatively impacted by the transition to online learning. Data supporting the following narrative can be found in Appendix E.

Technology Access and Comfort

Spring 2020: A large majority of students were easily able to access the internet (85%) while half (50%) reported having to share internet time with at least one family member to complete their online courses. Almost all students were comfortable uploading (93%) and downloading (92%) documents and videos from the internet and using a learning management system (e.g., D2L, MyMatLab) to complete online assignments (93%). Additionally, students reported being comfortable communicating with classmates (85%) and their professors (81%) electronically.

Twelve students provided specific feedback about technological issues in the comment section. Eight students reported issues with slow and/or unstable internet access causing them to miss class or have difficulty completing assignments. Two mentioned the technology issues were with the faculty; two reported faculty internet issues that interrupted class and one reported faculty that were ‘scared’ of using D2L. One graduate student mentioned the Zoom platform would often ‘crash.’

Fall 2020: Students reported similar access and comfort with internet access (91%), sharing internet time with family members (36%), uploading (97%) and downloading (100%) from the internet, and using an online learning management system (94%) for completing assignments. Students were also comfortable communicating with classmates (78%) and their professors (85%) electronically.

Eighteen students provided feedback about technical issues in the comment area. By the most common issue was inconsistent internet access (n = 13). A few other miscellaneous issues plagued the students from Fall 2020:

- not having a computer with sufficient memory or a camera and microphone to participate effectively,
- Zoom 'crashing' multiple times,
- Apple-PC compatibility,
- Not being able to find the links to class.

Summary: Responses between semesters were similar regardless of whether transitioning mid-semester or beginning the semester remotely with two notable differences; a smaller proportion of students reported sharing internet time with others in their household and students seemed slightly less comfortable communicating with students electronically.

Student Reaction to Online Learning

Spring 2020: SCOAM students reported having difficulty motivating themselves to do their coursework (65%) and organizing their week to get their coursework completed (58%) after the transition to remote learning. Just over half of the students (54%) felt they needed face-to-face contact with their professor in order to learn the course content and did not feel they understood the content taught online as well as the content taught face-to-face (62%). Students, however, did report being persistent in asking questions to better understand the content taught online (62%).

SCOAM students reacted similarly when asked about learning in an online lecture course compared to an online lab course. For lecture courses, a large majority of students reported that remote learning was not the same for them compared to face-to-face instruction (83%), that they had to learn more on their own (92%) in remote courses, and they preferred taking lecture courses face-to-face (92%). For lab courses, almost all students (92%) reported that remote learning was not the same as learning face-to-face and that they had to learn on their own (100%) more in a remote setting. Only 13% of the students stated they preferred taking their lab courses online.

Fall 2020: SCOAM students also reported having difficulty motivating themselves to do their coursework (50%) and organizing their week to get their coursework completed (53%) even though remote learning was the expectation from the beginning of the semester. A majority of students (67%) felt they needed face-to-face contact with their professor in order to learn course content and did not feel they understood the content taught online as well as the content taught face-to-face (63%). Students, however, did report being persistent in asking questions to better understand the content taught online (63%).

SCOAM students again reacted similarly when asked about learning in an online lecture course compared to an online lab course. For lecture courses, students reported that remote learning was not the same for them compared to face-to-face instruction (76%), that they had to learn more on their own (64%) in remote courses, and they preferred taking lecture courses face-to-face (73%). For lab courses, a majority of students (65%) reported that remote learning was not the same as learning face-to-face and that they had to learn on their own (87%) more in a remote setting. Only 19% of the students stated they preferred taking their lab courses online.

For fall, students were also asked to provide feedback on their course schedule preferences. A small proportion of students (20%) stated they would have preferred to change their fall or spring schedules to avoid taking an online lecture (20%) or lab (38%) class and 8% reported they did change their Fall 2020 schedule to avoid taking online classes. A large majority (75%), however, reported they had no option of changing their schedule because of required courses.
Summary: Regardless of whether transitioning mid-semester to remote learning or beginning the semester with remote learning as the expectation, similar proportions of students experienced difficulties with motivation and organization. Likewise, similar proportions of students reported being persistent in asking questions to further their understanding of course content, needing face-to-face contact with their professors in order to learn, and not understanding the course content as well when learning remotely.

Communication and Connectedness

Spring 2020: In general, students felt less connected to their professors (65%) and classmates (69%) after the transition. SCOAM students struggled with feeling connected to students (40%) and faculty (51%) while learning remotely. Networking decreased during the spring semester as well. While a majority of students found it easy to communicate with their professors (64%), students reported they communicated less frequently about academic (54%) and non-academic topics (85%) and less with professors who were not their course instructors (77%).

Likewise, students found it easy to communicate with other students while learning remotely (64%), but also noted the frequency of communication with SCOAM scholars (50%) and non-SCOAM students (50%) before as after the transition was similar. A proportion of students, however, reported a decrease in frequency of communication concerning academic (49%) and non-academic (40%) topics.

Fall 2020: Again, about half of the students (47%) felt connected to their course instructor while only 33% felt connected to the other students in their class in their online courses. In general, a large majority of students felt disconnected from their professors (70%) and other students (73%) during the fall semester.

Networking was impacted by the online learning environment during the fall semester. While students found it easy to communicate with professors (66%), students again reported a decrease in frequency of communication about academic (52%) and non-academic (73%) topics and with professors other than their course instructors (55%).

To a lesser extent, some students (38%) reported a decrease in communication with their SCOAM peers about academic (38%) and non-academic (41%). A decrease in frequency of communication with non-SCOAM peers was also reported (51%).

Summary: The feeling of connectedness with faculty and students decreased as a result of moving courses to an online environment. Additionally, networking decreased with limited conversations with faculty focused on coursework and understanding content. Frequency of communication among students also decreased but to a lesser degree.

Open-Ended Comments about Online Learning

Spring 2020: Only seven students left open-ended comments concerning their online learning experiences this semester. Three mentioned they had difficulty staying motivated and focused. Two students mentioned the unexpected nature of the transition but given the situation, felt things turned out as well as they could. Two students mentioned their preference for synchronous Zoom classes.

Fall 2020: Eleven students provided specific feedback concerning their online learning experiences this semester. Comments suggested that students struggled for different reasons. Students reported finding it difficult to concentrate due to distraction at home and that online learning was more stressful for them. Others reported that their workload for the online classes was very high and they had trouble keeping up with the large number of assignments required.

Three students simply stated they preferred face-to-face classes without providing a specific reason while one student preferred online classes because it saved them money. Others favored face-to-face classes for a variety of reasons, such as:

- feels ‘more personal,’
- allows for discussion that is necessary for learning,
- it is easier to communicate with the faculty,
- it is easier to ask questions,
- allows for class lectures to be replayed (asynchronous).

Faculty COVID-19 Impact Survey Results

In Spring 2020, faculty were required to transition their face-to-face classes to an online environment during a 2-week period. It was suggested that student learning would be impacted by the transition to remote learning, especially for STEM students. Therefore, a survey was administered at the end of Spring 2020 to capture reactions from STEM faculty about their experiences transitioning their courses and their perceptions about student learning.

Experience with teaching online courses as well as preparation to teach online and using the learning management system were determined to be relevant and were of particular interest in determining the impact of the transition on student learning. Additionally, STEM curricula often feature a combination of lecture and lab courses. It was hypothesized that transitioning these two different types of course formats would present different and unique challenges. Therefore, reactions were captured separately. Data to support the following narrative is provided in Appendix F.

General Questions about Online Training and Teaching

Just over half of the faculty reported having sufficient training in online teaching (59%) and, specifically, training in using D2L to develop online courses (64%). Again, just over half the faculty (57%) reported accessing internal resources to assist with developing a course in D2L. An overwhelming majority of faculty reported that online courses take more time to develop and prepare (95%) and require more intervention to facilitate learning (92%). Additionally, a small proportion of faculty felt that the online lecture or lab course offered a comparable learning experience to the face-to-face lecture course (38%) and lab course (20%).

Course Level Questions

Questions concerning courses were divided into the following 3 categories:

- Lecture (course taught in a regular classroom with the primary aim of content delivery),
- Lab (course taught in a science lab or computer lab with the primary aim of skill development or a dual aim of content delivery and skill development), and
- Other (any course, regardless of classroom type or primary aim, that does not easily fit into either the lecture or lab category).

In addition to the general questions using a 4-point Likert scale, for each of the categories listed above, faculty were asked the following 3 open-ended questions:

- What was the biggest challenge in transitioning the course?
- What did you adapt or change to accommodate the online format?
- What would you do differently?

Responses are summarized below according to course category.

Lecture Courses (n = 33)

General Questions: A small proportion of faculty felt prepared to move their lecture course(s) online (46%) and found it easy to adapt the course (34%) to an online format. A smaller proportion of faculty preferred a synchronous format (43%) compared to an asynchronous format (57%) for their lecture course(s). A majority of faculty reported that access to online materials for their lecture course(s) were readily available (75%), but a smaller proportion reported covering the same content online as face-to-face (69%) and just over half reported maintaining the same student workload (51%) for the online course compared to the face-to-face course.

To accommodate the online format, only 43% of faculty reported being able to use the same assignments planned for the face-to-face course(s). A larger proportion of faculty reported adapting or replacing assignments (74%) or eliminating assignments (66%) to accommodate the online format. Likewise, for exams and assessments, a very small proportion of faculty reported using the same assessments (26%) for their online lecture course(s) while 57% replaced assessments with alternate assignments and 91% adapted assessments for the online environment. A large proportion of faculty (86%) stated they made changes to their course(s) to accommodate the online format rather than to accommodate the deadline for reopening the university or the lack of online materials (74%).

In general, faculty (71%) did not feel students were as well prepared taking the online lecture course(s) as they would have been if they had taken the face-to-face course(s). However, 81% of faculty would be willing to teach more STEM online lecture course(s).

Biggest Challenge: The most common challenge mentioned by faculty was course exams. Faculty were most concerned about cheating on exams (e.g., no way to proctor exams, keep students from using their notes). One faculty mentioned the challenge was to develop exams that did not require proctoring. The next most common challenge mentioned was working within the timeframe, whether the short turn around to start the semester or the ongoing development of the next set of materials in time to keep the course moving forward. Developing materials that would engage students in learning was also mentioned by several faculty. Concerns about students needing support were also mentioned (e.g., no ability to microteach, difficulty monitoring

> *I was not expecting, and did not adapt quickly enough, to the challenge of motivating my students. I am accustomed to motivating my students in a F2F format, and have a successful method. But I was stunned at how much my same students when working online would not do the most simple tasks. Just wouldn't do very simple straightforward assignments.*

struggling students, hands on lessons did not work online, and lack of one-on-one teaching ability).

Changes to Accommodate Online Format: The most common method of accommodating the online format was to record the course lectures and post them online for student viewing. Some faculty mentioned adapting all content, assignments, and assessments, but did not mention how they were adapted. Faculty reported replacing classwork with alternate assignments, using more frequent shorter exams, and making exams open book but harder. Other faculty provided the steps they took such as surveying student access to technology, preparing materials 'way in advance,' and decided the course would be asynchronous.

What would you do differently? There was little pattern to what faculty would do differently if they were required to teach online again. Comments mentioned:

- More synchronous coursework (n = 4)
- Find a way to secure exams (n = 4)
- Use more frequent graded assessments/assignments (n = 2)
- Provide more explicit expectations/instructions (n = 2)
- More asynchronous coursework (n = 2)
- More group work (n = 2)
- Spend more time developing materials (n = 2)
- Change to essay exams (n = 1)
- Provide more frequent feedback (n = 1)
- Use an online textbook (n = 1)
- Plan interactive activities (n = 1)
- Use more problem sets in class (n = 1)
- Nothing (n = 3)
- Not sure (n = 2)

Lab Courses (n = 21)

General Questions: A very small proportion of faculty felt prepared to move their lab course(s) online (29%) and found it easy to adapt the course (15%) to an online format. A very small proportion of faculty preferred a synchronous format (29%) compared to an asynchronous format (57%) for their lab course(s). About half of faculty reported that access to online materials for their lecture course(s) were readily available (48%) and an even smaller proportion reported covering the same content online as face-to-face (19%) and using a similar student workload (24%) for the online course compared to the face-to-face course.

To accommodate the online format, only 10% of faculty reported using the same assignments planned for the face-to-face course(s). A large proportion of faculty reported adapting or

replacing assignments (86%) or eliminating assignments (80%) to accommodate the online format. Likewise, for exams and assessments, a very small proportion of faculty reported using the same assessments (19%) for their online lab course(s) while just over half (58%) replaced assessments with alternate assignments and 100% adapted assessments for the online environment. A large proportion of faculty (95%) stated they made changes to their course(s) to accommodate the online format rather than to accommodate the deadline for reopening the university or the lack of online materials (58%).

In general, faculty (86%) did not feel students were as well prepared taking the online lab course(s) as they would have been if they had taken the face-to-face course(s) and only 57% of faculty would be willing to teach more STEM online lab course(s).

I thought that asynchronous delivery with recorded lectures and lab tutorials would be the best choice for the online transition. I now believe that blending this with a common meeting time in Zoom would be better able to encourage student engagement and provide opportunities for group interaction.

Biggest Challenge: The most common challenge mentioned was figuring out how to replace or adapt an actual lab experience in an online format (e.g., finding a simulation to replace in class experience, how to examine rock samples, how to do chemical reactions). Some faculty mentioned that students did not have home access to the software they needed to complete assignments.

Changes to Accommodate Online Format: Most science faculty replaced in person labs with found videos of experiments and simulations or made recordings of themselves doing the experiments. If these types of resources could not be found or created, the assignments were eliminated. For computer science labs, free software was substituted for preferred software when possible.

What would you do differently? Again, there was little pattern to what faculty would do differently if they were required to teach online again. Comments mentioned:

- Use a synchronous format (n = 3)
- Pay more attention to student engagement (n = 2)
- Finding 3-D samples to use (n = 1)
- Use Zoom breakout rooms to simulate hands on work (n = 1)
- Use essay exams (n = 1)
- Create their own lab experiences (n = 1)
- Use lab simulators (n = 1)
- Use typical household chemicals (n = 1)
- Split class between synchronous and asynchronous (n = 1)
- Make sure all students have necessary software loaded on their computer for home use (n = 1)

Other Course Types (n = 6)

General Questions: Half of faculty felt prepared to move this type of course(s) online (50%) and found it easy to adapt the course (50%) to an online format. A larger proportion of faculty preferred a synchronous format (67%) compared to an asynchronous format (33%) for this type of course(s). A large majority of faculty reported that access to online materials for their lecture course(s) were readily available (83%), but a smaller proportion reported covering the same content online as face-to-face (50%) and using the same workload (34%) for the online course compared to the face-to-face course.

Faculty reported using the same assignments (50%) for the face-to-face course(s), adapting or replacing assignments (50%), or eliminating assignments (67%) to accommodate the online format. Likewise, for exams and assessments, some faculty reported using the same assessments (67%) for their online course(s), replacing assessments with alternate assignments (50%), or adapting assessments (50%) for the online environment. Only 33% of faculty stated they made changes to their course(s) to accommodate the online format rather than to accommodate the deadline for reopening the university or the lack of online materials (83%).

In general, faculty (83%) did not feel students were as well prepared taking the online course(s) as they would have been if they had taken the face-to-face course(s) and only 50% of faculty would be willing to teach more of this type of STEM course online.

Biggest Challenge: The only response to this question was gauging student learning and enthusiasm.

Changes to Accommodate Online Format: The only response to this question mentioned shifting the class focus to class discussion and group projects.

What would you do differently? The only response to this question mentioned slowing the pace and creating more in-class assignments.

Student Engagement in the Online Environment

Overall: Faculty felt that students needed more support (78%) to complete an online course compared to a face-to-face course and most felt it was more difficult to track student progress (62%) and understanding (82%) in an online environment. Faculty also felt students were not as engaged (75%) and did not have the same understanding of content (69%) compared to face-to-face course(s). Less than half of faculty (41%) felt students were as well prepared taking online

course(s) and a majority of faculty (84%) did not believe that all students were suited to take online courses.

Undergraduate compared to Graduate (n = 6): Faculty teaching both undergraduate and graduate courses were asked to compare the student populations on engagement. A majority of faculty felt undergraduate students were as engaged (71%), had a comparable understanding of content (86%), performed as well (86%), and had as easy a time understanding content (57%) compared to graduate students. Although, more than half (57%) felt undergraduate students needed more faculty support to complete the course compared to graduate students.

Thirteen faculty provided additional feedback concerning student engagement. Almost all (n = 11) faculty noted a decided lack of student engagement in their course during Spring 2020. The second most common concern was cheating on exams (n = 2). Additionally, two faculty remarked that staying in close contact with students was necessary in an online environment and that students were less likely to reach out for help in an online class compared to a face-to-face class.

Need to be flexible and innovative; pay attention to feedback from students. Students in non-face-to-face environment can be much less focused on class work. Study skills for on-line courses seem to be different than for face-to-face courses.

Summary

Only half of faculty responding to the survey felt they were prepared to teach online. Most faculty felt online classes took more time to prepare and online teaching took more time to facilitate effectively compared to face-to-face classes. A large majority of faculty felt that online classes did not offer the same learning experiences as face-to-face classes, especially faculty teaching lab classes.

A majority of faculty reported adapting or replacing assignments and assessments to accommodate the online format. For lab classes, some assignments were eliminated. Comments concerning the elimination of lab assignments centered on the inability to find a simulation for the activity or being unable to record themselves conducting the lab. The biggest concern for faculty seemed to be monitoring cheating on exams, especially faculty teaching lecture classes. Also, of importance to faculty was monitoring struggling students and keeping students engaged. Faculty also reported having trouble developing content fast enough to stay ahead of the deadlines for posting the material for student use. If doing online classes again, the most common change would be a shift to more synchronous activities and finding a way to proctor exams. Lab instructors had a more difficult time determining what they would do differently.

Faculty were concerned about the lack of student engagement in online courses. They also felt that students did not understand the content as well as they would if taking the course face-to-face.

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, small 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 fourth and fifth 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 the COVID-19 pandemic and resultant move to online learning had on the college experience during the Spring and Fall 2020 semesters.

> *Particularly during the COVID-19 pandemic the support of the S-COAM community was pivotal to my mental health and social interactions. These virtual meetings and social group activities gave me and the other members of my group something to look forward to as the semester trudged on. It also encouraged us to seek other means of socializing through Zoom and other virtual environments.*
>
> – Fall 2020

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 'soft' skills such as learning to collaborate with others outside of their major, making presentations, and other 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. The biggest difference from previous years is the decrease in feeling connected to faculty mentors and faculty within and outside of the department. This is most likely due reliance on online activities due to the COVID-19 pandemic.

> *It was very beneficial this semester to be with S-COAM because, with the changes in learning, it kept me communicating with my S-COAM group members.*
>
> *– Spring 2020*

Mindset items from the End of Semester survey suggested that students in Spring 2020 had a positive view of their math abilities but were not as confident in their science abilities while the

students in the Fall 2020 held a positive view of their math and science abilities. The PIs report an increase in science majors among freshmen in Fall 2020 which may account for this observation. 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. Notably, freshmen in the Fall 2020 cohort did not enjoy going to math class and felt they did not understand the relationship among different areas of science as well as the entire SCOAM sample. Data from successive semesters suggests the results might be cohort specific depending on the proportion of math majors compared to math minors if not just fluctuations in data. Also, the notable differences for Freshmen for this report could be due to online learning environment. More in-depth analysis of this data is warranted.

One thing that stood out to me is how successful the guest speakers were and that they had a great passion for what they do. All, however, were a great inspiration to put in the hard work and chase your dreams.

-Fall 2020

I am so thankful to have been part of this group. I have learned so many things that I otherwise would have missed, and I met so many great people who take their education as seriously as I do.

- Fall 2020

Transition items from the survey suggested that few students find college or graduate school to be as expected. 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 did not participate in undergraduate research opportunities. Undergraduate students still did not carve 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 Fall 2020 reported much lower scores for college being as expected, feeling faculty had an interest in their progress and keeping them on track to complete assignments. They also reported lower scores for knowing faculty and students to whom they can go for help. It would appear that the remote learning environment necessitated by COVID-19 made the transition to college more difficult.

Our monthly meetings have and small group activities have given me the chance to make connections with other students. This is a very important aspect of the scholarship program and its benefits are clearly evident in todays world of zoom classes and isolation. having this network of likeminded individuals can has provided a sort of academic support group.

– Fall 2020

I feel more connected with my professors and even professors from other departments.

- Spring 2020

Transition items for graduate students did not show the same decrease as transition items for undergraduate students. Graduate students have

also steadily increased their perception of the need to set aside study time every day but believe that faculty do not remind them about due dates often enough.

> *I think this scholarship program has opened up opportunities in my field, as well as gotten me thinking about how to visualize that goal and pursue it effectively.*
>
> *– Spring 2020*

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 Fall 2020, conversations among SCOAM students tended to focus on non-academic more than in prior semesters. In general, faculty mentors and faculty in their departments tended to be academic resources with conversations with other students, SCOAM and non-SCOAM, and faculty outside their departments being more balanced between academic and non-academic topics. This is not unexpected since their faculty advisor would most often be the starting point for these conversations. For career advice, SCOAM students turn to faculty and students equally.

> *I learned a lot about Covid-19 and I also learned how to work with others who may not be in the same field as me and who have had different experiences than me.*
>
> *- Fall 2020*

> *Through this program and the requirements of attending different events/programs that are offered on and off campus, I have had the experience of being involved in activities I would not have done if it wasn't for this program.*
>
> *– Spring 2020*

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

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 especially during the COVID-19 pandemic. One student even remarked about the opportunity to connect with other women in the science field while others simply talk about the new friends they have made.

> *The S-COAM scholarship has taken away a huge financial strain away, I can peacefully concentrate on my studies without worrying where the next dollar will come from to cover my educational expenses.*
>
> *-Spring 2020*

For both the Spring 2020 and Fall 2020, 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 communication and collaborative skills they learn from participating in the program along with the confidence they gain to participate in research in math and science fields.

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.

> *The S-COAM scholarship has helped me hold myself to a higher standard. Because of the scholarship I have participated in more than twice as many events as last semester when I did not receive it. This has opened my eyes to the world of research and what is possible, it has made it seem more attainable for me. Having an extra set of eyes watching me has also made me strive to raise my grades to maintain a quality that is up to the standards of Dr. Kuo and Dr. Adkins.*
>
> *- Spring 2020*

The Fall 2020 semester was a particularly difficult one for students. All students addressed the impact of the COVID-19 pandemic on their experiences for the semester. Many remarked about the difficulties they faced in online only learning environment and the difficulty of keeping themselves focused and motivated to do their coursework and meet deadlines.

> *I have learned other soft skills, such as team working, leadership skills, and presenting skills, as I have presented now in front of many established professionals and have had to work on projects with others. I do not believe that I would have had the same experiences without having the confidence built in me from S-COAM.*
>
> *– Fall 2020*

Next Steps

Given that two years of consecutive data has been collected, next steps for the evaluation will be the longitudinal analysis of mindset data. If sample sizes and power are sufficient, general linear

models will be used to investigate; otherwise, trend analyses and/or nonparametric analogs will be used. Data will be disaggregated by gender and race to the extent possible given sample size constraints.

Recommendations

The following recommendations are offered for consideration:

1. Continue with the flipped model for the peer-led team learning sessions even after COVID-19 restrictions are lifted. This instructional method seems to resonate with both students and peer leaders. A few students did mention not knowing the sessions were being offered. Ideally, faculty are mentioning the sessions one more than 1 occasion in during the semester. Also, when possible, have a student who has attended the sessions speak to classes about the value of attending and learning how to apply the math they are learning to real world problems.
2. Continue to allow social groups to create their own events. While the attendance of one socially relevant event is noteworthy, the allowance for self-created events beyond the one required activity seems to be a hit with students. It appears to have made the social group activity more effective in building relationships.
3. Graduate students seem to be struggling more with the transition. Being a part of a 'multi-generational' social group seems to be of less benefit to these students compared to the undergraduate students. Consider breakout groups during monthly meetings that allow graduate students to meet as a group and talk about issues related to graduate school only.
4. All students would benefit from study and time management skills. Consider designing activities during part of the monthly meetings to help students develop these types of skills.

Final Comments

From an outside perspective, 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. 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 understand the value of these 'extra' experiences in preparing them for either graduate school or the workforce.

Responses from Spring 2020 and Fall 2020 generally mirror the responses from previous semesters in many ways. However, the impact of COVID-19 on learning is evident. Students have commented on the difficulty they have with learning in the online environment whether due to unstable internet service, faculty unfamiliar with technology, and/or distractions because they are home and surrounded by family members that do not understand that they are 'going' to school. Students also are frustrated with what they feel are higher workloads and less support because they cannot ask questions in class. Even under these circumstances, students acknowledge that the SCOAM program has kept them connected.

It is also notable that the PIs continued the SCOAM program activities online, making a fast transition to remote activities during the same interval that classes were also transitioning in Spring 2020. While the number of presentations had to be scaled back, monthly meetings, social group activities, and workshops continued in Spring 2020 and throughout Fall 2020 even incorporating current events to show how math and science were relevant to the pandemic that was the source of the dramatic change in their lives.

Appendix A:
End of Semester Survey - Activity Data

Table 8. Spring 2020 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	1	5.9%	5	29.4%	9	52.9%	2	11.8%
feel more "connected" to faculty members outside of my department.	1	5.9%	3	17.6%	11	64.7%	2	11.8%
feel more "connected" to the students in the scholarship group			2	11.8%	12	70.6%	3	17.6%
feel more “connected” to other math and science students			2	11.8%	14	82.4%	1	5.9%
think about possible career options	1	5.9%			14	82.4%	2	11.8%
learn a new skill that will be beneficial in the future			1	5.9%	9	52.9%	7	41.2%
feel motivated to work hard in my classes			5	29.4%	8	47.1%	4	23.5%
feel motivated to continue as a mathematics major/minor			2	11.8%	12	70.6%	3	17.6%

Table 9. Spring 2020 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	2	25.0%	1	12.5%	4	50.0%	1	12.5%
feel more "connected" to faculty outside of my department	1	12.5%	1	12.5%	4	50.0%	2	25.0%
feel more “connected” to the students in the scholarship group	1	12.5%	1	12.5%	5	62.5%	1	12.5%
feel more "connected" to other math and science students	2	25.0%	1	12.5%	2	25.0%	3	37.5%
think about possible career options	1	12.5%	2	25.0%	3	37.5%	2	25.0%
feel motivated to work hard in my classes					4	50.0%	4	50.0%
feel motivated to continue as a mathematics major/minor			2	25.0%	2	25.0%	4	50.0%

Table 10. Spring 2020 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	6.7%			13	86.7%	1	6.7%
think about possible career options	1	6.7%	5	33.3%	8	53.3%	1	6.7%
learn new skills that will be beneficial in the future	1	6.7%	5	33.3%	7	46.7%	2	13.3%
feel motivated to work hard in my classes	1	6.7%	5	33.3%	7	46.7%	2	13.3%
feel motivated to continue as a mathematics major/minor	2	13.3%			9	60.0%	4	26.7%

Table 11. Spring 2020 survey results for attending alternate virtual 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	3.8%	4	15.4%	15	57.7%	6	23.1%
think about possible career options	2	7.7%	6	23.1%	11	42.3%	7	26.9%
learn new skills that will be beneficial in the future	1	3.8%	5	19.2%	14	53.8%	6	23.1%
feel motivated to work hard in my classes	1	3.8%	5	19.2%	14	53.8%	6	23.1%
feel motivated to continue as a mathematics major/minor	1	3.8%	1	3.8%	16	61.5%	8	30.8%

Table 12. Spring 2020 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	3.7%	4	14.8%	16	59.3%	6	22.2%
think about possible career options	1	3.7%	3	11.1%	10	37.0%	13	48.1%
learn new skills that will be beneficial in the future	2	7.4%	1	3.7%	16	59.3%	8	29.6%
feel motivated to work hard	1	3.7%	4	14.8%	15	55.6%	7	25.9%
feel motivated to continue as a mathematics major/minor	1	3.7%	4	14.8%	15	55.6%	7	25.9%

Table 13. Fall 2020 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	2	8.7%	8	34.8%	10	43.5%	3	13.0%
feel more "connected" to faculty members outside of my department.	1	4.3%	5	21.7%	14	60.9%	3	13.0%
feel more "connected" to the students in the scholarship group	1	4.3%	3	13.0%	13	56.5%	6	26.1%
feel more “connected” to other math and science students	1	4.3%	2	8.7%	14	60.9%	6	26.1%
think about possible career options	1	4.3%	1	4.3%	13	56.5%	8	34.8%
learn a new skill that will be beneficial in the future			1	4.3%	14	60.9%	8	34.8%
feel motivated to work hard in my classes	1	4.3%	6	26.1%	7	30.4%	9	39.1%
feel motivated to continue as a mathematics major/minor	1	4.3%	3	13.0%	8	34.8%	11	47.8%

Table 14. Fall 2020 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	5.3%	6	31.6%	7	36.8%	5	26.3%
feel more "connected" to faculty outside of my department	1	5.3%	3	15.8%	9	47.4%	6	31.6%
feel more “connected” to the students in the scholarship group	1	5.3%	6	31.6%	8	42.1%	4	21.1%
feel more "connected" to other math and science students	1	5.3%	3	15.8%	10	52.6%	5	26.3%
think about possible career options	1	5.3%	2	10.5%	11	57.9%	5	26.3%
feel motivated to work hard in my classes			2	10.5%	9	47.4%	8	42.1%
feel motivated to continue as a mathematics major/minor			3	15.8%	7	36.8%	9	47.4%

Table 15. Fall 2020 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			3	10.0%	18	60.0%	9	30.0%
think about possible career options			14	46.7%	13	43.3%	3	10.0%
learn new skills that will be beneficial in the future			7	23.3%	18	60.0%	5	16.7%
feel motivated to work hard in my classes			6	20.0%	16	53.3%	8	26.7%
feel motivated to continue as a mathematics major/minor	1	3.3%	4	13.3%	16	53.3%	9	30.0%

Table 16. Fall 2020 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			7	22.6%	19	61.3%	5	16.1%
think about possible career options			3	9.7%	16	51.6%	12	38.7%
learn new skills that will be beneficial in the future			1	3.2%	18	58.1%	12	38.7%
feel motivated to work hard			1	3.2%	20	64.5%	10	32.3%
feel motivated to continue as a mathematics major/minor	1	3.2%	2	6.5%	12	38.7%	16	51.6%

Appendix B:
End of Semester Survey - Mindset Data

Table 17. Spring 2020 results from mindset survey items.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I am good at math.	1	3.8%			18	69.2%	7	26.9%
I enjoy going to my math classes.	1	3.8%			13	50.0%	12	46.2%
Others think I am good at math.	1	3.8%	2	7.7%	11	42.3%	12	46.2%
I used to think I was good at math.	3	11.5%	7	26.9%	10	38.5%	6	23.1%
I can explain math ideas to other students.	1	3.8%	3	11.5%	14	53.8%	8	30.8%
Math will be useful for my future.	1	3.8%			10	38.5%	15	57.7%
I understand the relationship among different areas of mathematics.	1	3.8%			16	61.5%	9	34.6%
I am good at science.	1	3.8%	6	23.1%	14	53.8%	5	19.2%
I enjoy going to my science classes.	2	7.7%	7	26.9%	9	34.6%	8	30.8%
Others think I am good at science.	2	7.7%	4	15.4%	14	53.8%	6	23.1%
I used to think I was good at science.	2	7.7%	9	34.6%	12	46.2%	3	11.5%
I can explain science concepts to other students.	2	7.7%	7	26.9%	13	50.0%	4	15.4%
Science will be useful for my future.	1	3.8%	2	7.7%	13	50.0%	10	38.5%
I understand the relationship among different areas of science.	1	3.8%	5	19.2%	12	46.2%	8	30.8%

Table 18. Spring 2020 results from mindset survey items – freshman only.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I am good at math.	1	20.0%			3	60.0%	1	20.0%
I enjoy going to my math classes.	1	20.0%			3	60.0%	1	20.0%
Others think I am good at math.	1	20.0%			2	40.0%	2	40.0%
I used to think I was good at math.	1	20.0%	1	20.0%	2	40.0%	1	20.0%
I can explain math ideas to other students.	1	20.0%			3	60.0%	1	20.0%
Math will be useful for my future.	1	20.0%			2	40.0%	2	40.0%
I understand the relationship among different areas of mathematics.	1	20.0%			3	60.0%	1	20.0%
I am good at science.	1	20.0%	1	20.0%	3	60.0%		
I enjoy going to my science classes.	1	20.0%	1	20.0%	1	20.0%	2	40.0%
Others think I am good at science.	1	20.0%	1	20.0%	3	60.0%		
I used to think I was good at science.	1	20.0%	2	40.0%	2	40.0%		
I can explain science concepts to other students.	1	20.0%	2	40.0%	2	40.0%		
Science will be useful for my future.	1	20.0%			2	40.0%	2	40.0%
I understand the relationship among different areas of science.	1	20.0%			3	60.0%	1	20.0%

Table 19. Fall 2020 results from mindset survey items.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I am good at math.			3	10.0%	18	60.0%	9	30.0%
I enjoy going to my math classes.			5	16.7%	15	50.0%	10	33.3%
Others think I am good at math.			1	3.3%	21	70.0%	8	26.7%
I used to think I was good at math.	2	6.7%	3	10.0%	19	63.3%	6	20.0%
I can explain math ideas to other students.			4	13.3%	19	63.3%	7	23.3%
Math will be useful for my future.					11	36.7%	19	63.3%
I understand the relationship among different areas of mathematics.			1	3.3%	20	66.7%	9	30.0%
I am good at science.			2	6.7%	20	66.7%	8	26.7%
I enjoy going to my science classes.	1	3.3%	3	10.0%	21	70.0%	5	16.7%
Others think I am good at science.	1	3.3%	4	13.3%	19	63.3%	6	20.0%
I used to think I was good at science.	1	3.3%	2	6.7%	22	73.3%	5	16.7%
I can explain science concepts to other students.			6	20.0%	16	53.3%	8	26.7%
Science will be useful for my future.			6	20.0%	12	40.0%	12	40.0%
I understand the relationship among different areas of science.			3	10.0%	16	53.3%	11	36.7%

Table 20. Fall 2020 results from mindset survey items – freshmen only.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I am good at math.			2	18.2%	6	54.5%	3	27.3%
I enjoy going to my math classes.			3	27.3%	4	36.4%	4	36.4%
Others think I am good at math.			1	9.1%	9	81.8%	1	9.1%
I used to think I was good at math.			1	9.1%	9	81.8%	1	9.1%
I can explain math ideas to other students.			2	18.2%	8	72.7%	1	9.1%
Math will be useful for my future.					4	36.4%	7	63.6%
I understand the relationship among different areas of mathematics.			1	9.1%	8	72.7%	2	18.2%
I am good at science.					8	72.7%	3	27.3%
I enjoy going to my science classes.					9	81.8%	2	18.2%
Others think I am good at science.	1	9.1%			8	72.7%	2	18.2%
I used to think I was good at science.			1	9.1%	10	90.9%		
I can explain science concepts to other students.			2	18.2%	7	63.6%	2	18.2%
Science will be useful for my future.			2	18.2%	6	54.5%	3	27.3%
I understand the relationship among different areas of science.			3	27.3%	4	36.4%	4	36.4%

Appendix C:
End of Semester Survey - Transition Data

Table 21. Spring 2020 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	5.0%	6	30.0%	13	65.0%		
My high school classes were just as difficult as my college classes.	6	30.0%	10	50.0%	3	15.0%	1	5.0%
I plan my week to make sure I get everything done.	2	10.0%			13	65.0%	5	25.0%
I schedule study time every day even if I don't have a test that week.	1	5.0%	9	45.0%	9	45.0%	1	5.0%
My instructors do NOT remind me about due dates for assignments and tests enough.	4	20.0%	15	75.0%			1	5.0%
I have to teach myself new information for my classes.	1	5.0%	4	20.0%	13	65.0%	2	10.0%
I have to spend more time studying than I did in high school.	1	5.0%			11	55.0%	8	40.0%
I feel like I fit in with the other student in my major.	3	15.0%	3	15.0%	11	55.0%	3	15.0%
I know instructors I can ask for help.	1	5.0%	1	5.0%	10	50.0%	8	40.0%
I know students I can ask for help.	2	10.0%	1	5.0%	10	50.0%	7	35.0%
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.	5	25.0%	13	65.0%			2	10.0%

Table 22. Spring 2020 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	20.0%	2	40.0%	2	40.0%		
My high school classes were just as difficult as my college classes.	2	40.0%	1	20.0%	2	40.0%		
I plan my week to make sure I get everything done.	1	20.0%			4	80.0%		
I schedule study time every day even if I don't have a test that week.	1	20.0%	2	40.0%	2	40.0%		
My instructors do NOT remind me about due dates for assignments and tests enough.	3	60.0%	2	40.0%	0	0.0%		
I have to teach myself new information for my classes.	1	20.0%	2	40.0%	2	40.0%		
I have to spend more time studying than I did in high school.	1	20.0%			2	40.0%	2	40.0%
I feel like I fit in with the other student in my major.	1	20.0%			3	60.0%	1	20.0%
I know instructors I can ask for help.	1	20.0%			2	40.0%	2	40.0%
I know students I can ask for help.	1	20.0%			2	40.0%	2	40.0%
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.	2	40.0%	3	60.0%				

Table 23. Fall 2020 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	4.2%	11	45.8%	10	41.7%	2	8.3%
My high school classes were just as difficult as my college classes.	6	25.0%	14	58.3%	4	16.7%		
I plan my week to make sure I get everything done.	1	4.2%	3	12.5%	14	58.3%	6	25.0%
I schedule study time every day even if I don't have a test that week.	2	8.3%	14	58.3%	4	16.7%	4	16.7%
My instructors do NOT remind me about due dates for assignments and tests enough.			16	66.7%	4	16.7%	4	16.7%
I have to teach myself new information for my classes.	1	4.2%	2	8.3%	14	58.3%	7	29.2%
I have to spend more time studying than I did in high school.	1	4.2%	1	4.2%	14	58.3%	8	33.3%
I feel like I fit in with the other student in my major.	3	12.5%	5	20.8%	14	58.3%	2	8.3%
I know instructors I can ask for help.	1	4.2%	4	16.7%	15	62.5%	4	16.7%
I know students I can ask for help.	2	8.3%	3	12.5%	15	62.5%	4	16.7%
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.	4	16.7%	9	37.5%	9	37.5%	2	8.3%

Table 24. Fall 2020 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	9.1%	5	45.5%	4	36.4%	1	9.1%
My high school classes were just as difficult as my college classes.	2	18.2%	5	45.5%	4	36.4%		
I plan my week to make sure I get everything done.	1	9.1%	3	27.3%	5	45.5%	2	18.2%
I schedule study time every day even if I don't have a test that week.	2	18.2%	5	45.5%	3	27.3%	1	9.1%
My instructors do NOT remind me about due dates for assignments and tests enough.			6	54.5%	2	18.2%	3	27.3%
I have to teach myself new information for my classes.	1	9.1%	2	18.2%	7	63.6%	1	9.1%
I have to spend more time studying than I did in high school.	1	9.1%			7	63.6%	3	27.3%
I feel like I fit in with the other student in my major.	3	27.3%	2	18.2%	6	54.5%		
I know instructors I can ask for help.			4	36.4%	7	63.6%		
I know students I can ask for help.	2	18.2%	1	9.1%	8	72.7%		
My college instructors are NOT as interested in how I am doing in their class compared to my high school teachers.	2	18.2%	4	36.4%	3	27.3%	2	18.2%

Table 25. Spring 2020 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%	4	66.7%
My undergraduate classes prepared me well for my graduate classes.			2	33.3%	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%	3	50.0%	1	16.7%	1	16.7%
My undergraduate classes were just as difficult as my graduate classes.			3	50.0%	2	33.3%	1	16.7%
I feel like I fit in with the other graduate students.			3	50.0%	1	16.7%	2	33.3%
I know how to plan my week to make sure l get everything done.			1	16.7%	3	50.0%	2	33.3%
I can teach myself new information easily.			1	16.7%	3	50.0%	2	33.3%
I know instructors I can ask for help.					3	50.0%	3	50.0%
I know students I can ask for help.					4	66.7%	2	33.3%
My college instructors are interested in how I am doing in their class.					6	100.0%		

Table 26. Fall 2020 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%	1	16.7%	2	33.3%	2	33.3%
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.					5	83.3%	1	16.7%
I participated in research activities as an undergraduate student.			2	33.3%	3	50.0%	1	16.7%
My undergraduate classes were just as difficult as my graduate classes.	1	16.7%	2	33.3%	2	33.3%	1	16.7%
I feel like I fit in with the other graduate students.	1	16.7%			2	33.3%	3	50.0%
I know how to plan my week to make sure l get everything done.			1	16.7%	2	33.3%	3	50.0%
I can teach myself new information easily.					4	66.7%	2	33.3%
I know instructors I can ask for help.					4	66.7%	2	33.3%
I know students I can ask for help.					4	66.7%	2	33.3%
My college instructors are interested in how I am doing in their class.					4	66.7%	2	33.3%

Appendix D:
End of Semester Survey - Student Conversations

Figure 1. Spring 2020 conversation topics with advisors and mentors.

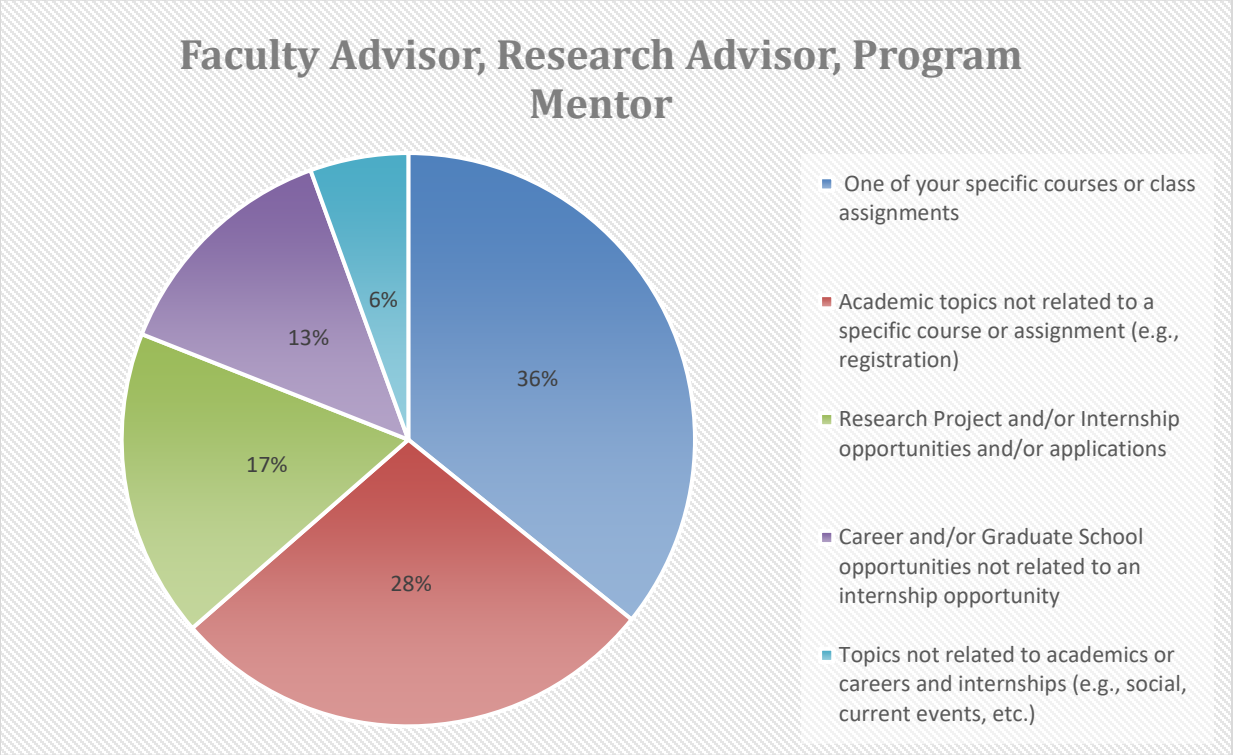


Figure 2. Spring 2020 conversation topics with faculty in the same department.

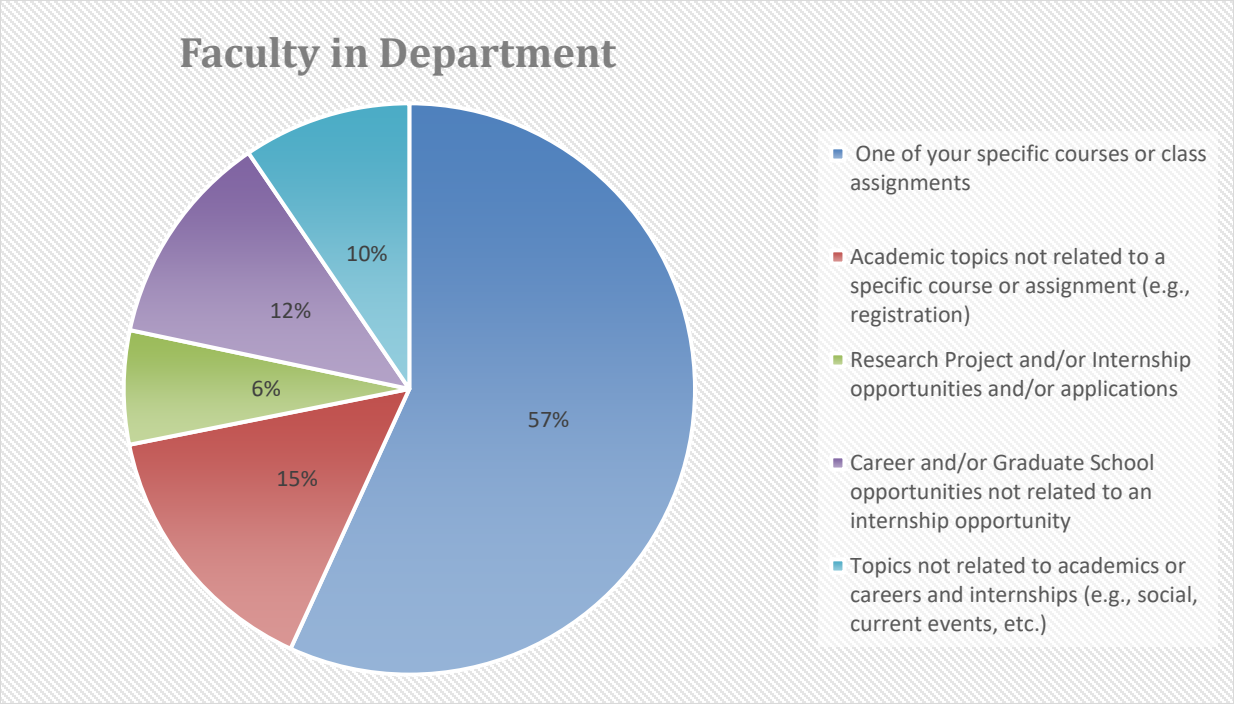


Figure 3. Spring 2020 conversation topics with faculty in other departments.

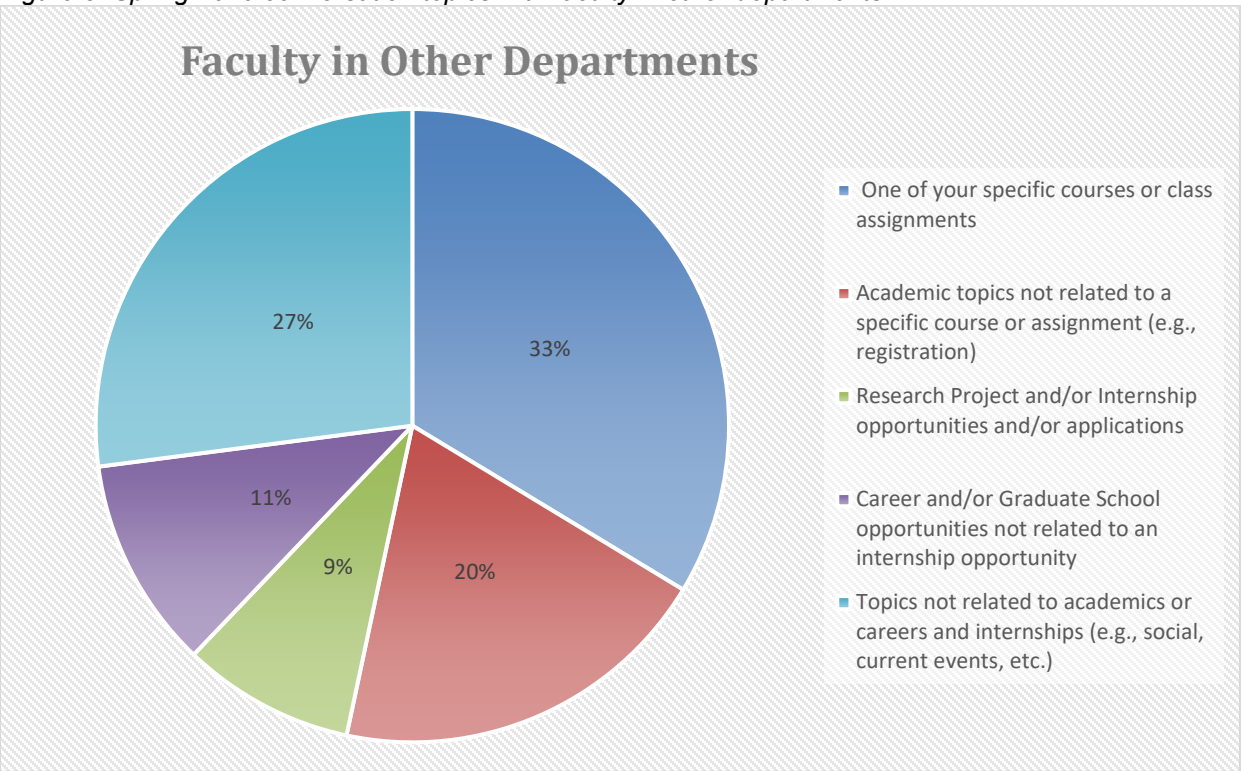


Figure 4. Spring 2020 conversation topics with SCOAM students in the same activity group.

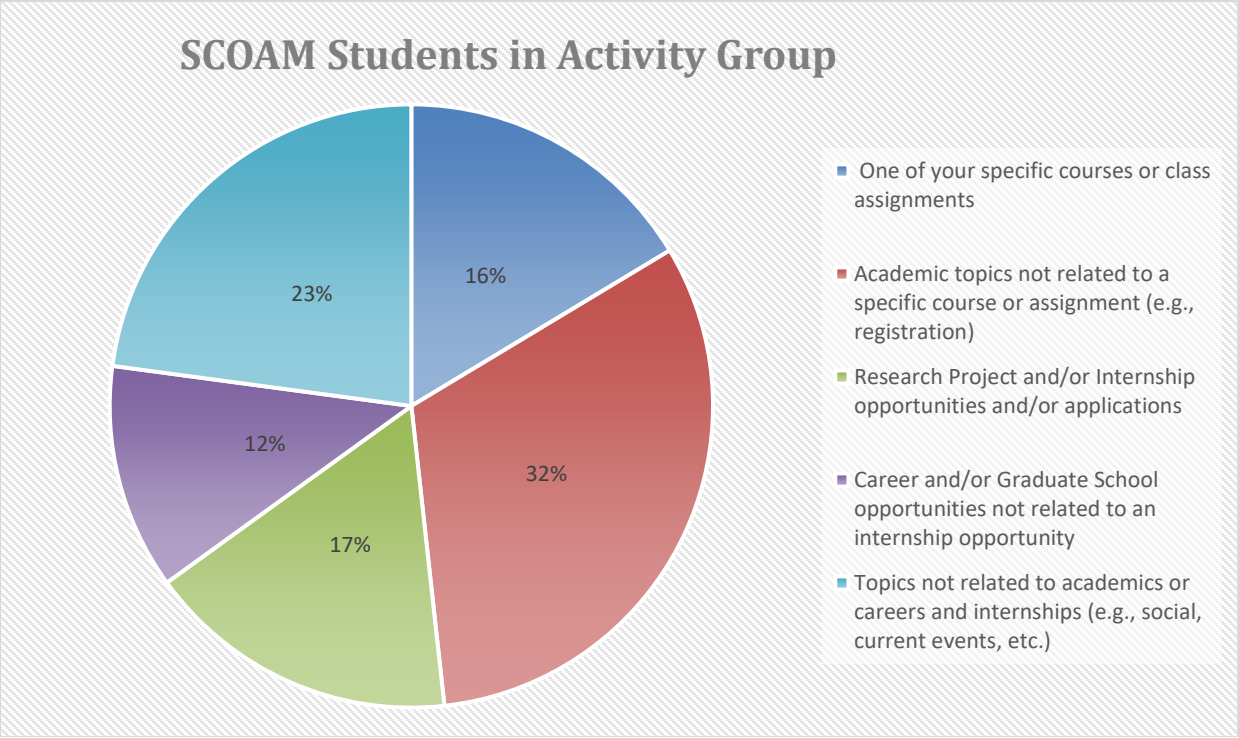


Figure 5. Spring 2020 conversation topics with other SCOAM students.

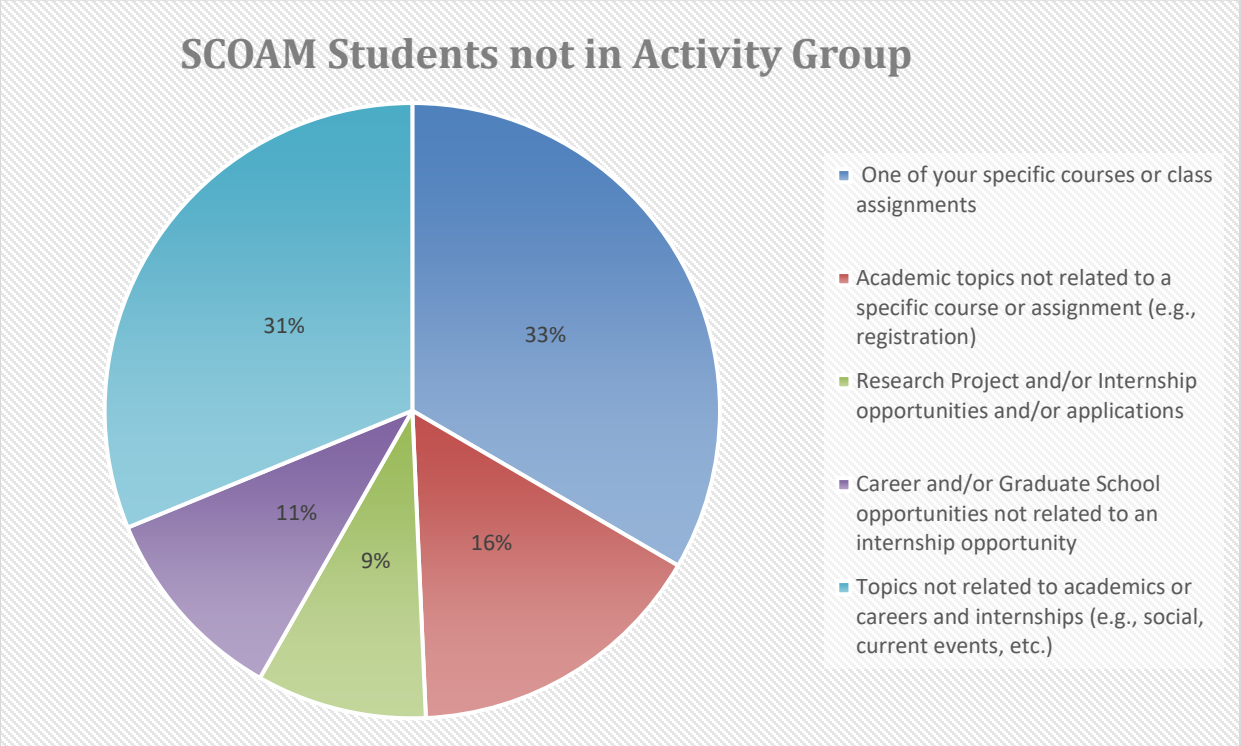


Figure 6. Spring 2020 conversation topics with non-SCOAM students.

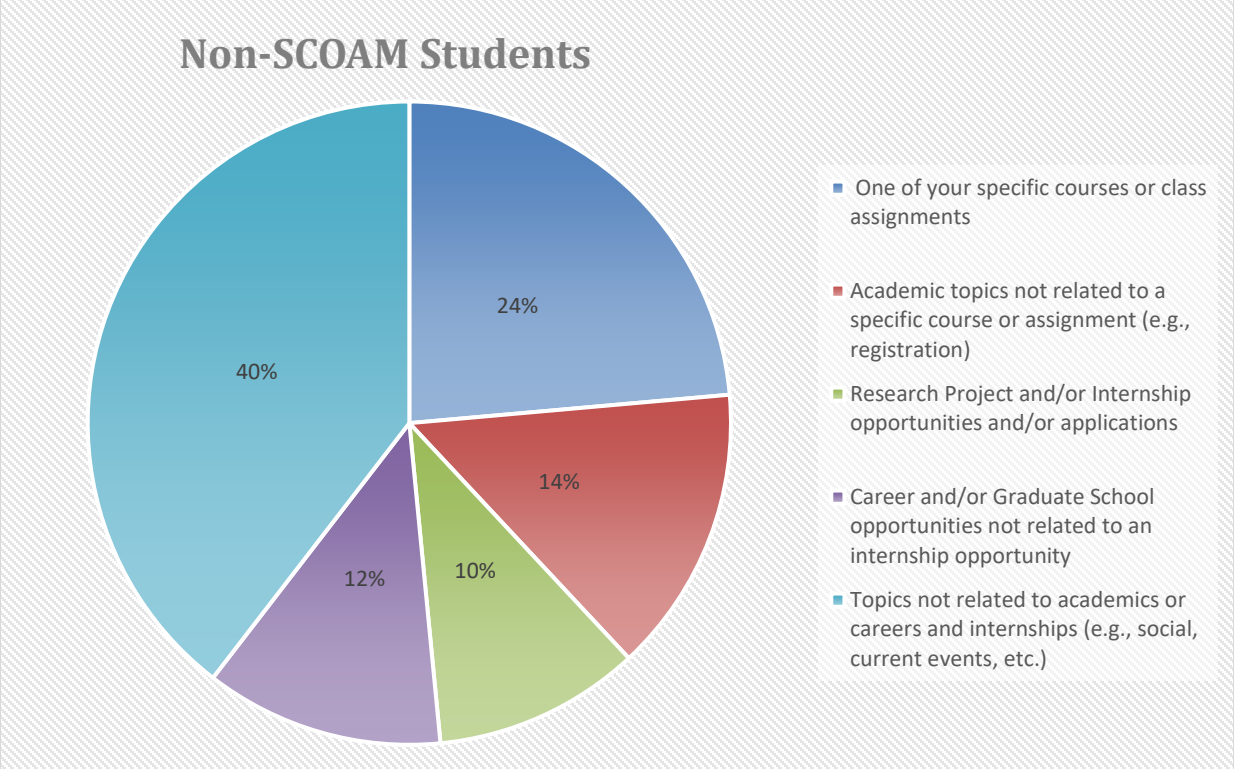


Figure 7. Fall 2020 conversation topics with advisors and mentors.

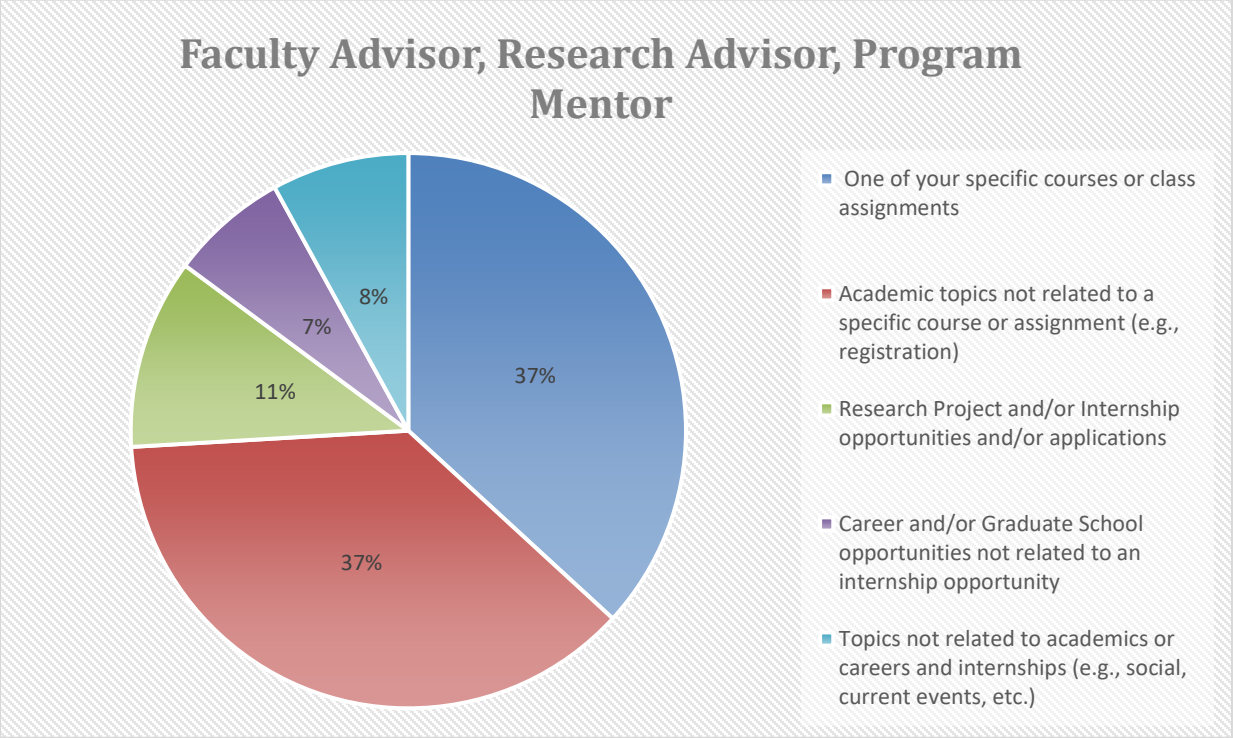


Figure 8. Fall 2020 conversation topics with faculty in the same department.

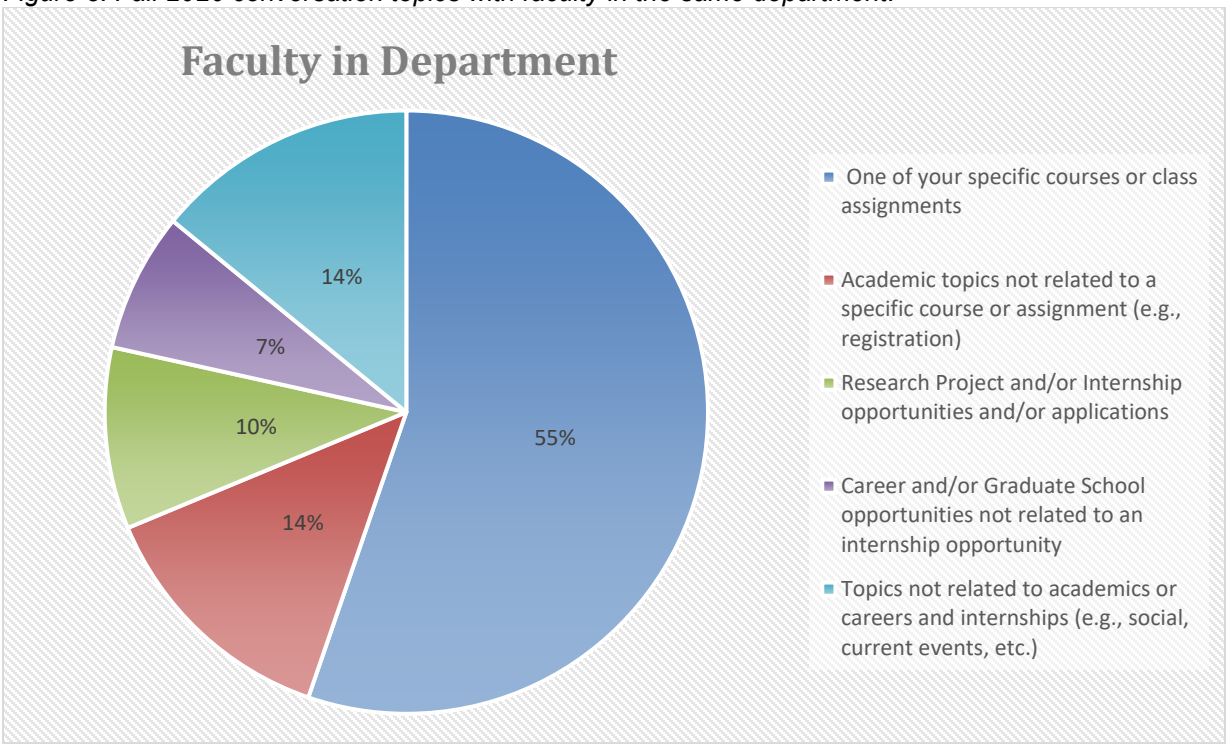


Figure 9. Fall 2020 conversation topics with faculty in other departments.

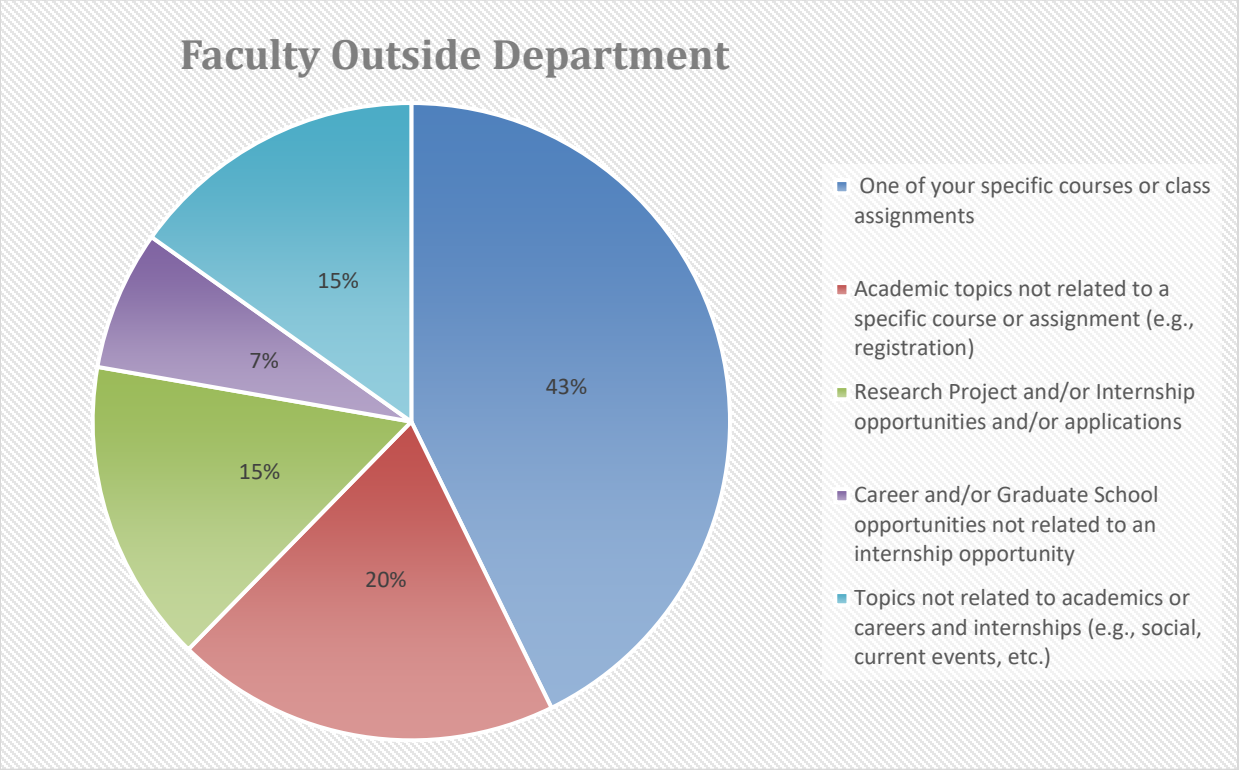


Figure 10. Fall 2020 conversation topics with SCOAM students in the same activity group.

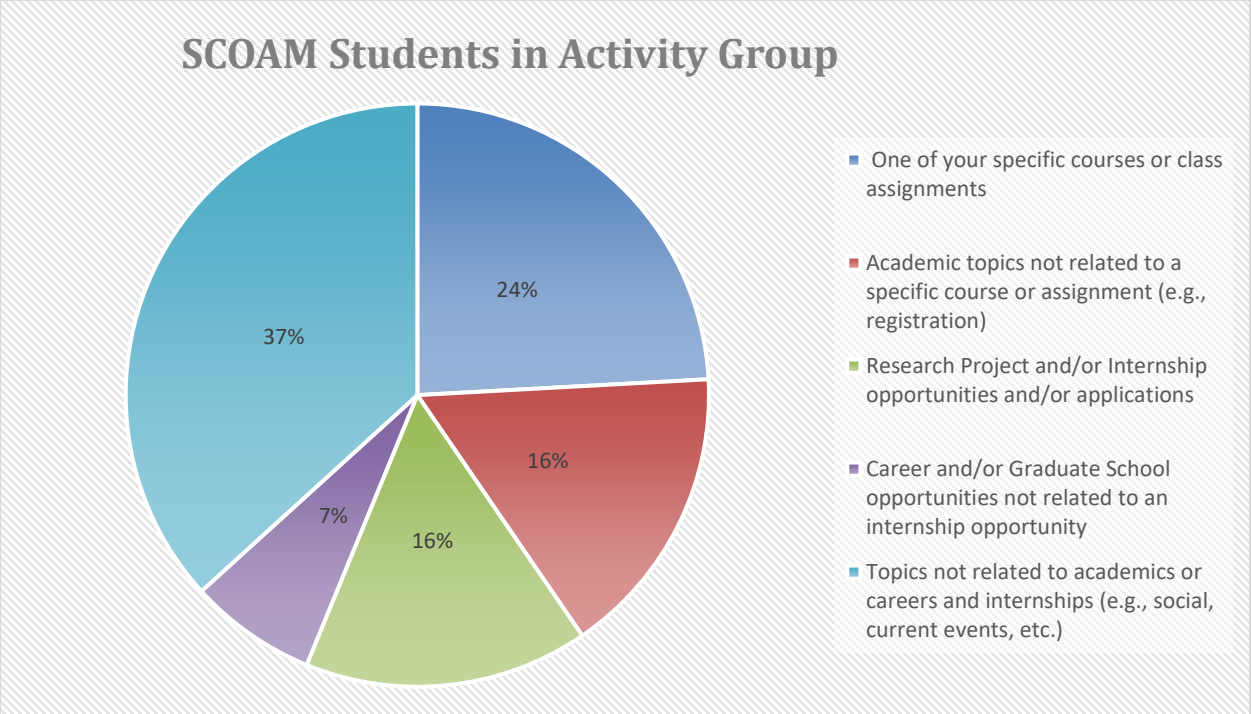


Figure 11. Fall 2020 conversation topics with other SCOAM students.

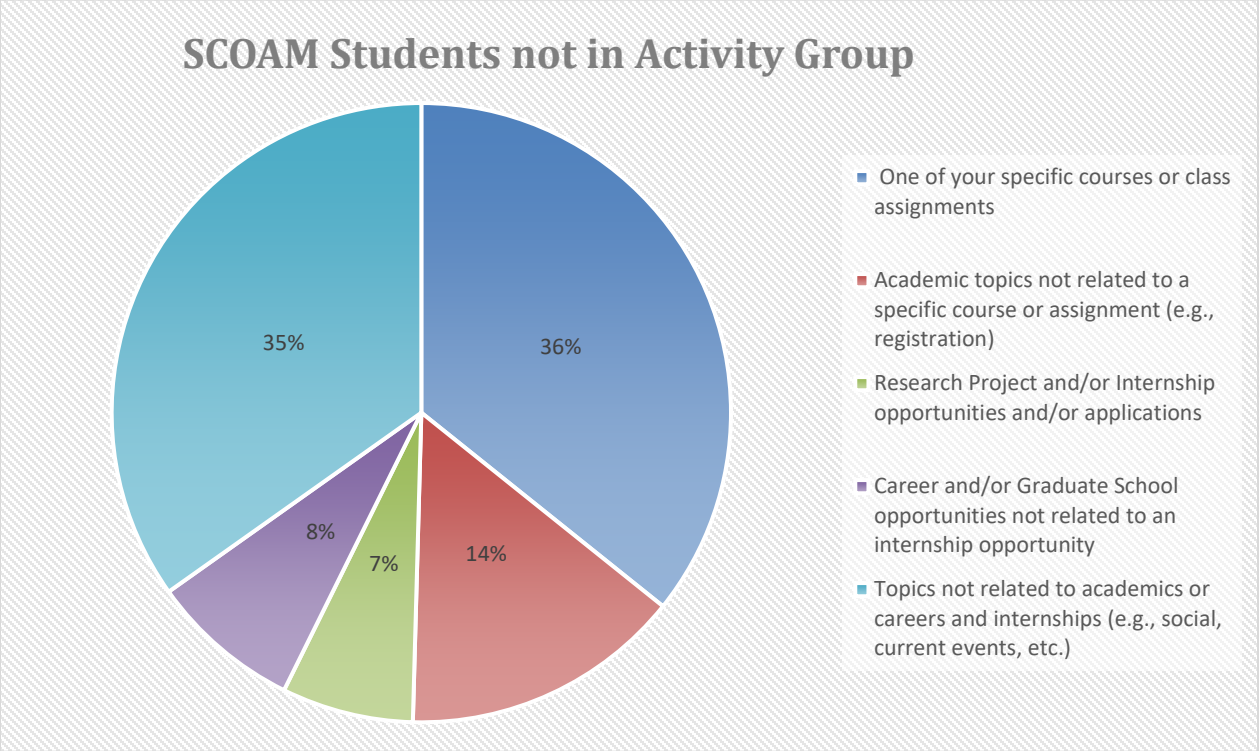
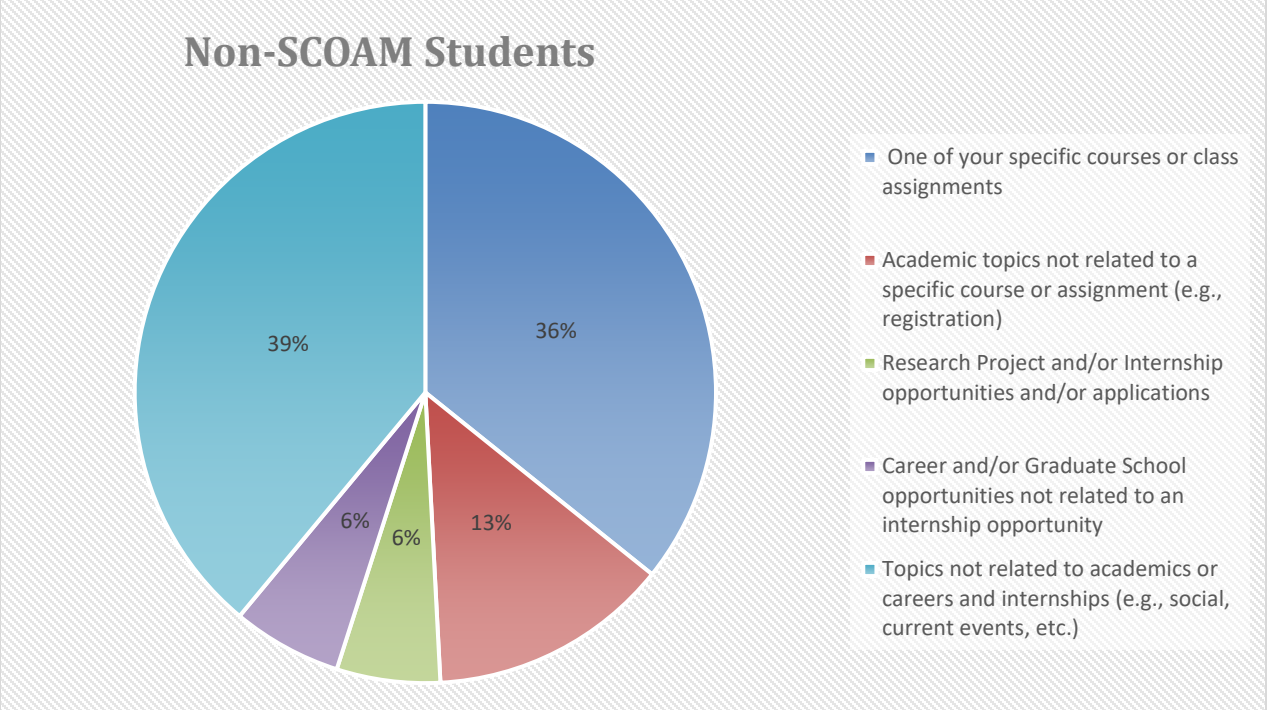


Figure 12. Fall 2020 conversation topics with non-SCOAM students.



Appendix E:
SCOAM Scholar COVID-19 Impact - Data

Table 27. Spring 2020 pandemic impact - technology

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I could access the internet easily to complete my coursework.	2	7.7%	2	7.7%	9	34.6%	13	50.0%
I had to share online time with others in my household.	5	19.2%	8	30.8%	7	26.9%	6	23.1%
I am comfortable uploading documents and videos to the internet.	1	3.8%	1	3.8%	14	53.8%	10	38.5%
I am comfortable downloading documents from the internet.	1	3.8%	1	3.8%	13	50.0%	11	42.3%
I am comfortable communicating with my classmates electronically.	1	3.8%	3	11.5%	11	42.3%	11	42.3%
I am comfortable communicating with my professors electronically.	1	3.8%	4	15.4%	11	42.3%	10	38.5%
I am comfortable using an online learning system (e.g., D2L, MyMathLab)	2	7.7%			10	38.5%	14	53.8%

Table 28. Spring 2020 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	15.4%	13	50.0%	6	23.1%	3	11.5%
I found it difficult to organize my week to get all my coursework completed.	3	11.5%	8	30.8%	12	46.2%	3	11.5%
Face-to-face contact with a professor is necessary for me to learn.	1	3.8%	11	42.3%	8	30.8%	6	23.1%
I understand the content I was taught online as well as the content I was taught face-to-face.	2	7.7%	15	57.7%	7	26.9%	2	7.7%
I was persistent in asking my professor questions until I understood the content being taught.	1	3.8%	9	34.6%	15	57.7%	1	3.8%

Table 29. Spring 2020 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.	7	26.9%	13	50.0%	2	7.7%	2	7.7%	2	7.7%
I have to learn on my own more in an online lecture class compared to a face-to-face lecture course.			2	7.7%	8	30.8%	14	53.8%	2	7.7%
I prefer to take my lecture courses online.	10	38.5%	9	34.6%	3	11.5%	2	7.7%	2	7.7%
Learning is the same for me in an online lab course as in a face-to-face lab course.	7	26.9%	4	15.4%	1	3.8%	1	3.8%	13	50.0%
I have to learn on my own more in an online lab class compared to a face-to-face lab course.					6	23.1%	7	26.9%	13	50.0%
I prefer to take my lab courses online.	7	26.9%	3	11.5%	1	3.8%	2	7.7%	13	50.0%

Table 30. Spring 2020 pandemic impact – connectedness

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I felt connected to my professors in my online courses.	9	34.6%	4	15.4%	10	38.5%	3	11.5%
I felt just as connected to my professors after the online transition as before the transition.	8	30.8%	9	34.6%	8	30.8%	1	3.8%
I felt connected to the other students in my online courses.	5	19.2%	11	42.3%	8	30.8%	2	7.7%
I felt just as connected to other students after the online transition as before the transition.	6	23.1%	12	46.2%	7	26.9%	1	3.8%

Table 31. Spring 2020 pandemic impact – networking

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I found it easy to communicate with my professors after the online transition.	1	4.5%	7	31.8%	12	54.5%	2	9.1%
I communicated with my professors about academic topics as frequently before the online transition as after the online transition.	2	9.1%	10	45.5%	6	27.3%	4	18.2%
I communicated with my professors about non-academic topics as frequently before the online transition as after the online transition.	3	13.6%	16	72.7%	2	9.1%	1	4.5%
I communicated with my professors other than my course professors as frequently before the online transition as after the online transition.	8	36.4%	9	40.9%	4	18.2%	1	4.5%
I found it easy to communicate with other students after the online transition.	2	9.1%	6	27.3%	12	54.5%	2	9.1%
I communicated with my fellow SCOAM scholars as frequently before the online transition as after the online transition.	4	18.2%	7	31.8%	11	50.0%		
I communicated with my fellow SCOAM scholars about academic topics as frequently before the online transition as after the online transition.	4	18.2%	7	31.8%	10	45.5%	1	4.5%
I communicated with my fellow SCOAM scholars about non-academic topics as frequently before the online transition as after the online transition.	3	13.6%	6	27.3%	12	54.5%	1	4.5%
I communicated with students other than my fellow SCOAM scholars as frequently before the online transition as after the online transition.	2	9.1%	9	40.9%	8	36.4%	3	13.6%

Table 32. Fall 2020 pandemic impact - technology

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I could access the internet easily to complete my coursework.			3	9.7%	16	51.6%	12	38.7%
I had to share online time with others in my household.	8	25.8%	12	38.7%	6	19.4%	5	16.1%
I am comfortable uploading documents and videos to the internet.			1	3.2%	17	54.8%	13	41.9%
I am comfortable downloading documents from the internet.					15	48.4%	16	51.6%
I am comfortable communicating with my classmates electronically.	1	3.2%	6	19.4%	13	41.9%	11	35.5%
I am comfortable communicating with my professors electronically.	1	3.2%	4	12.9%	14	45.2%	12	38.7%
I am comfortable using an online learning system (e.g., D2L, MyMathLab)			2	6.5%	14	45.2%	15	48.4%

Table 33. Fall 2020 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.	10	33.3%	5	16.7%	12	40.0%	3	10.0%
I found it difficult to organize my week to get all my coursework completed.	4	13.3%	10	33.3%	10	33.3%	6	20.0%
Face-to-face contact with a professor is necessary for me to learn.			10	33.3%	11	36.7%	9	30.0%
I understand the content I was taught online as well as the content I was taught face-to-face.	7	23.3%	9	30.0%	11	36.7%	3	10.0%
I was persistent in asking my professor questions until I understood the content being taught.	2	6.7%	9	30.0%	15	50.0%	4	13.3%

Table 34. Fall 2020 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.	11	36.7%	12	40.0%	5	16.7%	2	6.7%		
I have to learn on my own more in an online lecture class compared to a face-to-face lecture course.			10	33.3%	5	16.7%	13	43.3%	2	6.7%
I prefer to take my lecture courses online.	9	30.0%	13	43.3%	5	16.7%	3	10.0%		
Learning is the same for me in an online lab course as in a face-to-face lab course.	6	20.0%	5	16.7%	4	13.3%	2	6.7%	13	43.3%
I have to learn on my own more in an online lab class compared to a face-to-face lab course.			2	6.7%	6	20.0%	8	26.7%	14	46.7%
I prefer to take my lab courses online.	8	26.7%	5	16.7%	1	3.3%	2	6.7%	14	46.7%

Table 35. Fall 2020 pandemic impact – connectedness

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I felt connected to my professors in my online courses.	5	16.7%	11	36.7%	12	40.0%	2	6.7%
I felt just as connected to my professors after the online transition as before the transition.	9	30.0%	12	40.0%	7	23.3%	2	6.7%
I felt connected to the other students in my online courses.	13	43.3%	7	23.3%	9	30.0%	1	3.3%
I felt just as connected to other students after the online transition as before the transition.	13	43.3%	9	30.0%	7	23.3%	1	3.3%

Table 36. Fall 2020 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 2020 schedule to avoid taking online LECTURE courses.	7	23.3%	17	56.7%	5	16.7%	1	3.3%		
I would have preferred to change my Fall 2020 schedule to avoid taking online LAB courses.	4	13.3%	6	20.0%	5	16.7%	1	3.3%	14	46.7%
I changed my Fall 2020 schedule to avoid taking an online LAB or LECTURE course.	8	27.6%	14	48.3%	2	6.9%			5	17.2%
I would have preferred to change my Spring 2021 schedule to avoid taking an online LECTURE course.	7	24.1%	14	48.3%	5	17.2%	1	3.4%	2	6.9%
I would have preferred to change my Spring 2021 schedule to avoid taking online LAB courses.	5	16.7%	9	30.0%	4	13.3%	2	6.7%	10	33.3%
I did not have the option of changing my schedule(s) because of the courses I was required to take.	1	3.3%	6	20.0%	12	40.0%	9	30.0%	2	6.7%

Table 37. Fall 2020 pandemic impact – networking

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I found it easy to communicate with my professors after the online transition.	2	6.9%	8	27.6%	13	44.8%	6	20.7%
I communicated with my professors about academic topics as frequently before the online transition as after the online transition.	3	10.3%	12	41.4%	11	37.9%	3	10.3%
I communicated with my professors about non-academic topics as frequently before the online transition as after the online transition.	10	34.5%	11	37.9%	7	24.1%	1	3.4%
I communicated with my professors other than my course professors as frequently before the online transition as after the online transition.	10	34.5%	6	20.7%	11	37.9%	2	6.9%
I found it easy to communicate with other students after the online transition.	8	27.6%	7	24.1%	11	37.9%	3	10.3%
I communicated with my fellow SCOAM scholars as frequently before the online transition as after the online transition.	6	20.7%	5	17.2%	16	55.2%	2	6.9%
I communicated with my fellow SCOAM scholars about academic topics as frequently before the online transition as after the online transition.	6	20.7%	5	17.2%	16	55.2%	2	6.9%
I communicated with my fellow SCOAM scholars about non-academic topics as frequently before the online transition as after the online transition.	5	17.2%	7	24.1%	15	51.7%	2	6.9%
I communicated with students other than my fellow SCOAM scholars as frequently before the online transition as after the online transition.	6	20.7%	9	31.0%	10	34.5%	4	13.8%

Appendix F:
Faculty COVID-19 Impact Survey - Data

Table 38. Faculty preparation to teach online

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I have had sufficient training in online course development.	1	2.7%	14	37.8%	16	43.2%	6	16.2%
I have had sufficient training in using D2L for course development.	6	16.2%	9	24.3%	17	45.9%	5	13.5%
I used the online resources for D2L offered by IUP to help me in the transition.	10	27.0%	6	16.2%	12	32.4%	9	24.3%
Online courses take more faculty preparation time compared to face-to-face course preparation.			2	5.4%	12	32.4%	23	62.2%
Online courses take more faculty time to facilitate successfully compared to face-to-face course facilitation.			3	8.1%	14	37.8%	20	54.1%
Online lecture courses can offer comparable experiences to face-to-face lecture courses.	9	24.3%	14	37.8%	12	32.4%	2	5.4%
Online lab courses can offer comparable experiences to face-to-face lab courses.	19	52.8%	10	27.8%	5	13.9%	2	5.6%

Table 39. Online transition of lecture courses

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I was prepared to move this STEM lecture course online this semester.	6	17.1%	13	37.1%	14	40.0%	2	5.7%
It was easy to adapt this STEM lecture course to an online format.	7	20.0%	16	45.7%	11	31.4%	1	2.9%
An online format in which students were required to 'come' to class at a scheduled time would work best of this course.	7	20.0%	13	37.1%	10	28.6%	5	14.3%
An online format in which materials were posted and students worked at their own pace would work best for this course.	2	5.7%	13	37.1%	13	37.1%	7	20.0%
The materials for the course (e.g., software, textbook, manipulatives, chemicals) were readily available to students at home.	1	2.9%	8	22.9%	16	45.7%	10	28.6%
The online course content was the same as the face-to-face course content.	2	5.7%	9	25.7%	17	48.6%	7	20.0%
The online course workload was the same as the face-to-face course workload.	5	14.3%	12	34.3%	14	40.0%	4	11.4%
The online course assignments were the same as the face-to-face course assignments.	4	11.4%	16	45.7%	10	28.6%	5	14.3%
To accommodate the online format, course assignments had to be adapted or replaced.	2	5.7%	7	20.0%	14	40.0%	12	34.3%
To accommodate the online format, some assignments had to be eliminated.	5	14.3%	7	20.0%	13	37.1%	10	28.6%
The online exams and assessments were the same as the face-to-face course exams and assessments.	16	45.7%	10	28.6%	6	17.1%	3	8.6%
To accommodate the online format, course exams and assessments had to be replaced with alternate assignments.	4	11.4%	11	31.4%	15	42.9%	5	14.3%
To accommodate the online format, course exams and assessments had to be adapted.	1	2.9%	2	5.7%	20	57.1%	12	34.3%
Any changes made to the online STEM lecture course were made because of deadlines and NOT the online format.	10	28.6%	20	57.1%	5	14.3%		
Changes made to the course were because materials (e.g., software, textbook, manipulatives, chemicals) were NOT available for the online format.	11	31.4%	15	42.9%	7	20.0%	2	5.7%
The students are as well prepared taking this online STEM lecture course as they would be taking the face-to-face version.	7	20.0%	18	51.4%	9	25.7%	1	2.9%
In the future, I would be willing to teach more STEM lecture courses online.	3	8.8%	7	20.6%	18	52.9%	6	17.6%

Table 40. Online transition of lab courses

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I was prepared to move this STEM lab course online this semester.	7	33.3%	8	38.1%	4	19.0%	2	9.5%
It was easy to adapt this STEM lab course to an online format.	9	42.9%	9	42.9%	2	9.5%	1	4.8%
An online format in which students were required to 'come' to class at a scheduled time would work best of this course.	4	19.0%	11	52.4%	4	19.0%	2	9.5%
An online format in which materials were posted and students worked at their own pace would work best for this course.	3	14.3%	6	28.6%	11	52.4%	1	4.8%
The materials for the course (e.g., software, textbook, manipulatives, chemicals) were readily available to students at home.	7	33.3%	4	19.0%	6	28.6%	4	19.0%
The online course content was the same as the face-to-face course content.	6	28.6%	11	52.4%	3	14.3%	1	4.8%
The online course workload was the same as the face-to-face course workload.	8	38.1%	8	38.1%	5	23.8%	0	0.0%
The online course assignments were the same as the face-to-face course assignments.	7	33.3%	12	57.1%	1	4.8%	1	4.8%
To accommodate the online format, course assignments had to be adapted or replaced.	1	4.8%	2	9.5%	10	47.6%	8	38.1%
To accommodate the online format, some assignments had to be eliminated.	1	5.0%	3	15.0%	8	40.0%	8	40.0%
The online exams and assessments were the same as the face-to-face course exams and assessments.	9	42.9%	8	38.1%	3	14.3%	1	4.8%
To accommodate the online format, course exams and assessments had to be replaced with alternate assignments.	2	9.5%	7	33.3%	6	28.6%	6	28.6%
To accommodate the online format, course exams and assessments had to be adapted.					12	57.1%	9	42.9%
Any changes made to the online STEM lab course were made because of deadlines and NOT the online format.	11	52.4%	9	42.9%	1	4.8%		
Changes made to the course were because materials (e.g., software, textbook, manipulatives, chemicals) were NOT available for the online format.	2	9.5%	7	33.3%	6	28.6%	6	28.6%
The students are as well prepared taking this online STEM lab course as they would be taking the face-to-face version.	7	33.3%	11	52.4%	3	14.3%		
In the future, I would be willing to teach more STEM lab courses online.	5	23.8%	4	19.0%	11	52.4%	1	4.8%

Table 41. Online transition of other types of courses

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
I was prepared to move this type of STEM course online this semester.	2	33.3%	1	16.7%	1	16.7%	2	33.3%
It was easy to adapt this type of STEM course to an online format.	2	33.3%	1	16.7%	2	33.3%	1	16.7%
An online format in which students were required to 'come' to class at a scheduled time would work best of this course.	2	33.3%			1	16.7%	3	50.0%
An online format in which materials were posted and students worked at their own pace would work best for this course.	3	50.0%	1	16.7%			2	33.3%
The materials for the course (e.g., software, textbook, manipulatives, chemicals) were readily available to students at home.	1	16.7%					5	83.3%
The online course content was the same as the face-to-face course content.	2	33.3%	1	16.7%	1	16.7%	2	33.3%
The online course workload was the same as the face-to-face course workload.	3	50.0%	1	16.7%	1	16.7%	1	16.7%
The online course assignments were the same as the face-to-face course assignments.	2	33.3%	1	16.7%	1	16.7%	2	33.3%
To accommodate the online format, course assignments had to be adapted or replaced.	1	16.7%	2	33.3%			3	50.0%
To accommodate the online format, some assignments had to be eliminated.	2	33.3%			2	33.3%	2	33.3%
The online exams and assessments were the same as the face-to-face course exams and assessments.	2	33.3%			1	16.7%	3	50.0%
To accommodate the online format, course exams and assessments had to be replaced with alternate assignments.	1	16.7%	2	33.3%			3	50.0%
To accommodate the online format, course exams and assessments had to be adapted.	1	16.7%	2	33.3%	1	16.7%	2	33.3%
Any changes made to this type of online STEM course were made because of deadlines and NOT the online format.	3	50.0%	1	16.7%	2	33.3%		
Changes made to the course were because materials (e.g., software, textbook, manipulatives, chemicals) were NOT available for the online format.	3	50.0%	2	33.3%			1	16.7%
The students are as well prepared taking this type of online STEM course as they would be taking the face-to-face version.	2	33.3%	3	50.0%	1	16.7%		
In the future, I would be willing to teach more STEM courses of this type online.	1	16.7%	2	33.3%	2	33.3%	1	16.7%

Table 42. Student engagement in online environment

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
Students needed more faculty support to complete the online courses compare to the face-to-face versions.			7	21.9%	19	59.4%	6	18.8%
It was easier to track student progress in the online courses.	6	18.8%	14	43.8%	12	37.5%		
Students were as engaged during the online courses compared to the face-to-face versions.	10	31.3%	14	43.8%	8	25.0%		
Students had a comparable understanding of the course content from the online course as the face-to-face versions.	6	18.8%	16	50.0%	10	31.3%		
It was more difficulty to determine whether the students were understanding the materials in the online courses.	1	3.1%	5	15.6%	12	37.5%	14	43.8%
Not all students are suited to take online courses.			2	6.3%	11	34.4%	19	59.4%
Students performed as well in the online courses compared to the face-to-face versions.	3	9.4%	16	50.0%	13	40.6%		

Table 43. Graduate student engagement in online environment

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%
Undergraduate students needed more faculty support to compete the online courses compared to graduate students.			3	42.9%	4	57.1%		
Undergraduate students were as engaged in the online courses compared to graduate students.			2	28.6%	5	71.4%		
Undergraduate students and graduate students have a comparable understanding of the course content from the online course.			1	14.3%	6	85.7%		
Undergraduate students had a more difficult time understanding the material compared to graduate students.	1	14.3%	3	42.9%	3	42.9%		
Undergraduate students performed as well as graduate students in the online format.			1	14.3%	5	71.4%	1	14.3%