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Work-In-Progress: Mentoring and motivating first generation undergraduate students in engineering to conduct research and persist in STEM

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Abstract

This Work in Progress (WIP) paper aimed to create a pipeline for first generation undergraduate students to pursue a graduate STEM degree. The program is expected to increase participation in graduate enrollment among first-generation students and to motivate them to persist in STEM fields by conducting research. The students in the proposed undergraduate research program were recruited from student organizations and success programs at the University of Texas at Austin that predominately target first-generation and/or socioeconomically disadvantaged students. The program bookends the research experience with a lecture series at the start and a research conference at the end. The lectures are an instructional component designed to provide students with the skills to write a research question, create effective search strings, and communicate technical subject matter. The lecture series springboards students into a research experience where they are matched with a graduate student or faculty member that will mentor them on their research. Thus, this work also aims to encourage community-based participation by involving members of the campus community as mentors in the student research experience. The program ended by giving students the opportunity to attend and present their work in a poster session at an annual on-campus research conference or to their mentor. Several pre- and post-attitudinal surveys were used to evaluate the program, including the Patterns of Adaptive Learning Scales (PALS) and the Undergraduate Research Student Self-Assessment (URSSA). The results showed that student motivation toward STEM and their pursuit of graduate study decreased throughout the program despite the fact that the responses remained in the positive end of the scale. Future work will explore minimizing environmental pressures with program scheduling. Sense of belonging also showed a decrease, which was attributed to the reduced communication and lack of opportunities to meet with other students in the program. Student challenges within STEM were not affected, yet the common themes of “imposter syndrome” and “uncertainty about financial support” will be explored in future work. On the positive side, student attitudes toward STEM and their pursuit of graduate school showed a small improvement. This result is promising and corresponds to a small increase in participation among the students that completed the program. The results of the PALS and URSSA surveys further confirmed student’s willingness to persist in STEM and confidence in their ability to do scholarly research.

Keywords: first generation, undergraduate research, mentoring, motivation, persistence

Introduction

The National Science Foundation (NSF) has sought to broaden participation in STEM by developing programs that create opportunities for people of all socioeconomic backgrounds, like the Louis Stokes Alliances for Minority Participation program and many others [1]-[2]. First-generation students stand to benefit from these programs since they are primarily from a low socioeconomic status and/or from underrepresented groups (Black or African American, Hispanic/Latino, and Asian) [3]. A 2021 report by the National Center for Science and Engineering Statistics (NCSES) showed that graduate enrollment among Hispanic or Latino students was 15.2% (up from 8.0% in 2018) for Master's degrees and 12.1% (up from 5.8% in 2018) for Doctoral degrees in science and engineering [4]-[5]. The report also notes a 56% increase in enrollment of Hispanic students between 2017 and 2021 [4].

Programs with a focus on broadening participation in STEM and that use a pipeline model, typically rely on mentorship, research experiences, and community to support students. For example, [6] found that faculty mentorship as an environmental factor led to positive outcomes on a student's motivation to achieve. While mentoring is generally seen as a strategy in defining career pathways, it has also been used to encourage students to pursue research and provide mentorship throughout the experience [7]. In fact, the combination of mentoring and research experiences has been shown to increase a student's interest in both learning and STEM that is also sustainable [6][8]. The success of this pairing led to the emergence of minority training programs that are targeted at underrepresented groups with clearly defined objectives and student outcomes. By using mentoring and research experiences, the work by [9][10] has shown the positive effects in creating a diverse STEM workforce.

Despite the positive impact that NSF's initiatives are making, there are internal and external factors that create leaks in the pipeline. Several studies have investigated the origin of these factors and identified strategies to address the leaks that negatively affect students' pursuit of STEM degrees, especially among underrepresented groups [6][11][12]. For example, [6] explored the use of motivational theories and goal theory to understand why a student strives to achieve or why they do not. The authors demonstrated that student's goal orientations and self-identity impact their motivation to achieve.

Goal theory is used in educational spaces to understand a student's motivation to learn. The path that a student takes to achieve their goals and why they strive to achieve them can vary. Here, goal orientations offer an approach for establishing the connection between student achievement and the educational environment, such as a research class [13][14]. The Patterns of Adaptive Learning Scales (PALS) survey is an instrument commonly used to measure goal orientations and their effect on a student's motivation to achieve academically [15]. In [14], the mastery-approach and performance-approach goal orientations were used to measure the influence on a student's academic performance and academic outcomes. Since it is evident that motivation contributes to academic achievement and the pursuit of STEM fields, it is key to understand the factors that sustain motivation among students from low socioeconomic backgrounds [16].

In the sections that follow, the details of the proposed undergraduate research program will be discussed. This is followed by a description of the recruited students and their demographics.

Then, the different survey instruments used in this study will be presented, including a discussion of the results. The paper will conclude with the major findings from this work and identify avenues for future improvements of the proposed undergraduate research program.

Structure and goals of the research program

The undergraduate research program (UGRP) for first-generation students is designed similar to a minority training program. The program comprised three components: a lecture series, a research experience, and a research conference. The program aimed to increase participation in graduate enrollment among first-generation students and to motivate them to persist in STEM fields by pursuing a graduate degree. Thus, the research question can be stated as:

- What is the impact on motivation to pursue a graduate STEM degree for first-generation undergraduate students subjected to mentorship and research experiences?

Secondly, the program expected to build a peer network among the students and a professional network with their mentors. This network was fostered using social media tools (e.g., Slack), active learning strategies during the lectures, and enhanced by the communication with other student researchers across the university. A tertiary set of outcomes (not evaluated in this work) was for students to share the knowledge they acquire with fellow students and mentor them in research. Similarly, mentors can confidently recommend mentees for graduate school and share their mentor experiences with other colleagues in their department.

Lecture series

The lecture series acts as an instructional component in the program. It was designed as a short course version of a traditional introduction to research class. A total of eight lectures were taught across four weeks and delivered in a hybrid format with virtual and in-person options. The lectures were titled as follows:

- Lecture 1: What does it mean to conduct research? What are the types of research?
- Lecture 2: Identifying a research topic // Writing a research question
- Lecture 3: Literature searches // Creating effective search strings
- Lecture 4: Using research databases // Filtering search results
- Lecture 5: Types of research articles // Writing an abstract // Finding a research mentor
- Lecture 6: Parts of a research article // Writing a research article
- Lecture 7: Citing references // Citation styles // Contacting a research mentor
- Lecture 8: Effective communication // Presenting research

In the first four lectures of the series, each lecture was accompanied with homework to provide students the opportunity to practice the skills they were learning. This practice included student-specific feedback to support their identification of a research topic, writing a research question, constructing effective search strings, and performing a literature review. As students entered the second half of the lecture series, they were engaged in identifying a potential research mentor, facilitating the communication with that mentor, and establishing that relationship for the research experience to follow; thus, encouraging community-based participation by involving members of the campus community as mentors in the student research experience [17].

Research experience with faculty mentorship

The research experience occurred over a 10-week period. Each student and research mentor pair established a regular meeting schedule (e.g., once a week for 30-60 min. in-person). The meetings were intended for the research mentor to receive research updates, answer questions, and provide guidance on the direction of the research. The program also maintained communication with both the student and the research mentor to provide general support, ensure that the research experience was running smoothly, and to address any unforeseen issues. The research experience concluded with students either drafting research paper of their findings (or literature study) or delivering a final presentation to their research mentors.

Research conference

The research conference occurred near the end of the research experience. UT Austin holds an annual, internal research conference, which brings together undergraduate researchers across campus. Multiple poster sessions are organized where students present their research. The students in the program were encouraged to attend the conference as a group, especially the poster sessions. Students were not required or expected to participate in the poster session since it would rely heavily on their ability to produce, organize, and present research for the first time. However, the intent of attending the conference was to expose them to the structure of a research conference and sustain their motivation for research beyond the program.

Program participants

The current study focused on the goal orientations of undergraduate students that are first generation or socio-economically disadvantaged and majoring in a STEM field. A total of 103 students were initially recruited for the program. During the lecture series component, 10 students left the program due to their course workload, job responsibilities, and insufficient time available to continue with the program. The remaining 93 students represent 10 different engineering disciplines as shown in Fig. 1. Five students did not report their field of study.

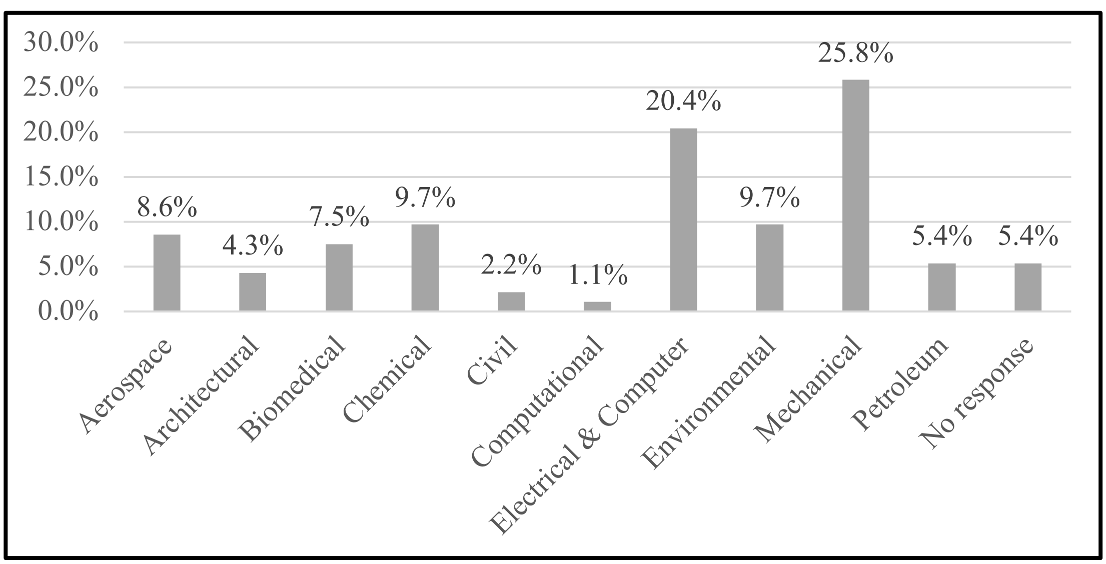


Figure 1. Distribution of engineering disciplines reported by program students ($N = 93$).

The academic performance of students was also surveyed to establish the range between low-achieving and high-achieving students. Here, high-achieving is considered having a GPA greater than or equal to 3.0, while low-achieving is below a 3.0. Figure 2 shows the distribution based on Cumulative GPA and Major GPA with some students electing not to disclose this data. An even smaller portion of students did not respond at all. Across the two reported GPA's, 69.9-74.3% of students are high-achieving, while 12.9-15.0% are low-achieving. This data is used to qualify the findings obtained from the survey instruments discussed in the following section.

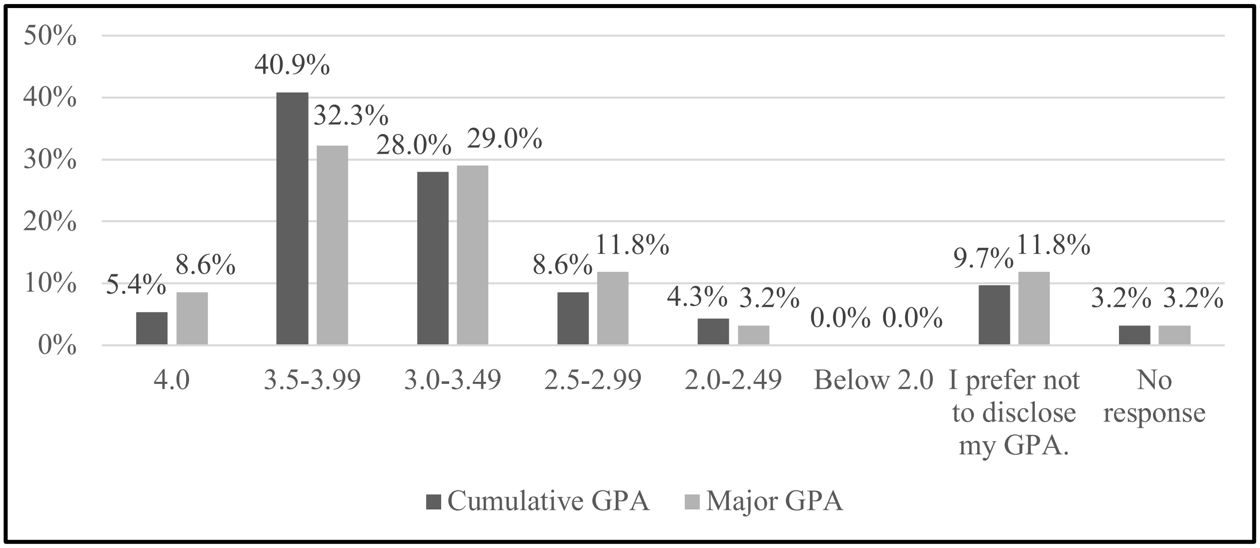


Figure 2. Distribution of students in the program based on their academic performance ($N = 93$).

Research design and program evaluation results

Attitudinal surveys help to assess student perceptions and how they change throughout an experience [18]. These perceptions can extend to include student attitudes about their learning style and their response to interventions used, such that they can be improved from a program level perspective. The attitudinal surveys administered in the present study focused on a student's motivation to remain in STEM, their pursuit of a graduate STEM degree, and their sense of belonging as a student. A copy of the survey questions is provided in the Appendix section and listed as instruments A1 and A2.

Attitudinal pre-survey results

At the start of the program and before the first lecture in the series, the attitudinal pre-survey established the student's reason for choosing to pursue a STEM degree, their level of interest in pursuing graduate study, and their state of community within the university. This included an understanding of their connections to student organizations and level of support from student success programs, which play a key role in a student's sense of belonging. A similar version of the attitudinal survey was administered as a post-survey immediately following the lecture series and at the conclusion of the program. The effect of the research conference was not assessed due to the lack of time and proximity to the end of the school semester. A different post-survey was administered after the research experience, which is discussed below.

Among the student motivations to pursue STEM, the common themes that emerged were: “STEM experience in high school”, “interest in how things work”, and “solving real world engineering problems”. The first theme demonstrated the opportunity to impact and/or reinforce a student’s pursuit of STEM, whereas the latter two themes demonstrated critical thinking and problem-solving skills that are instrumental for a STEM pathway, and possibly a graduate study pathway. In terms of student challenges to pursue STEM, the common themes were: “imposter syndrome”, “lack of mentorship”, and “uncertainty about financial support”. It's clear from the first theme that building a sense of community and belonging are critical to a student’s confidence, while the second theme adds further support for the involvement of faculty or graduate student mentors to ensure their STEM pursuit. The third theme highlights the importance of programs mentioned previously and possibly the need for more like them [1]-[2].

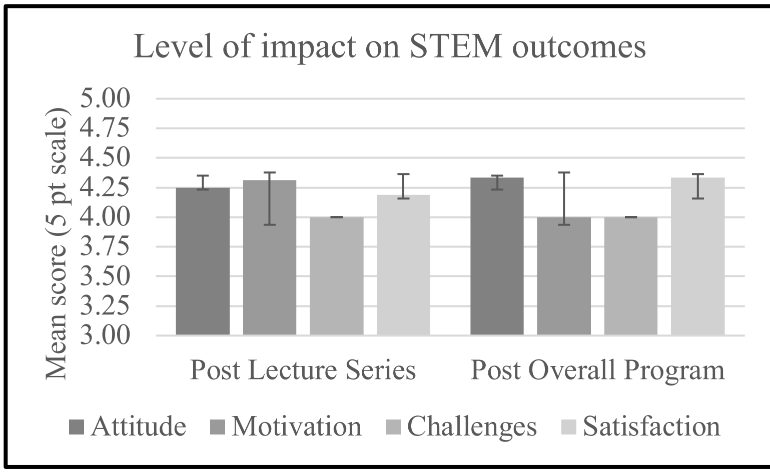
A total of 55 students responded to the attitudinal pre-survey, which represented about 59% of the students that started the program. Among this population, 87% responded as having a “positive” or “very positive” attitude towards STEM and 95% were “somewhat satisfied” or “very satisfied” with the STEM degree they chose. However, students were divided on their motivation and attitude towards graduate school; 51% for both questions as being “somewhat motivated” or “very motivated” and “positive” or “very positive”. It is worth noting that 78% of these students are involved in a student success program offered by UT Austin, which can increase the likelihood that they’ll succeed in a program, such as the proposed UGRP [9][10].

Attitudinal post-survey results

The post-survey asked students similar questions to evaluate the impact that the lecture series and program overall had on their pursuit of a STEM degree (attitude, motivation, challenges, and satisfaction) and their pursuit of graduate school (attitude and motivation). The responses were coded as follows: Not sure (1), Negative (2), Neutral (3), Positive (4), and Very positive (5).

The results for the impact of both the lecture series and the overall program on their pursuit of a STEM degree are shown in Fig. 3. While 55 students responded to the pre-survey, only 16 students responded to the post-survey after the lecture series and 5 students after the program conclusion. It is worth noting that the number of responses was lower than expected after the lecture series since 21 students engaged with the content and completed the homework activities.

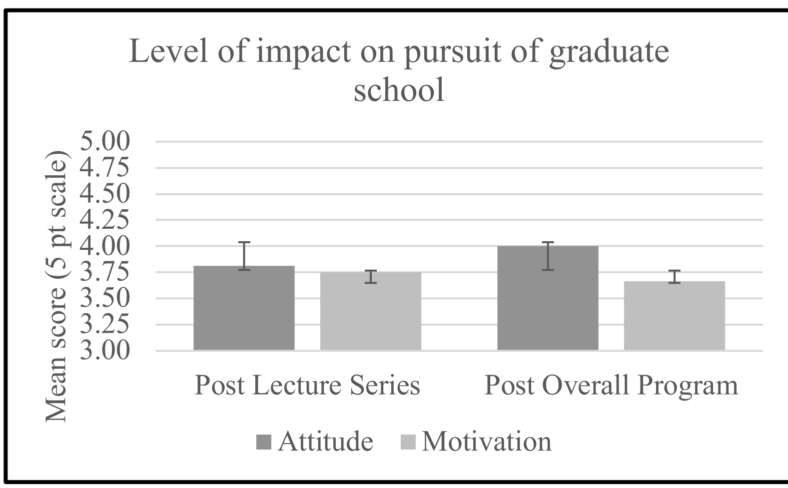
Across all four STEM outcomes, students maintained a positive response (> 4.00 score). For their attitude and satisfaction toward STEM, there was a small increase of 2.0% and 3.5%, respectively, between the lecture series and program conclusion. Even though their motivation decreased by 7.3% throughout the program, the mean score was still positive (between 4.00 and 4.31); their challenges remained constant. One possible reason for the former results can be due to stress and fatigue. The program concluded near the end of the semester when exams are underway and other coursework deadlines, so students might have been eager and motivated at the start of the semester, but that motivation gradually decreased. Also, any student challenges that they felt positive about from the program could have been influenced by their renewed sense of imposter syndrome or lack of support in their classes.



Q1. How did the [*component*] affect your current attitude toward STEM?
Q2. How did the [*component*] affect your motivation to continue your STEM degree?
Q3. How did the [*component*] affect the current challenges you're facing in your STEM degree?
Q4. How did the [*component*] affect how satisfied you are with the degree that you chose to study?

Figure 3. Attitudinal post survey results comparing STEM outcomes after the lecture series and overall program, $N = 16$ (Questions 1-4 in instrument A2).

As it related to a student's attitude and motivation to pursue graduate study, the results showed that their attitude increased by 4.9%, while their motivation decreased slightly by 2.2% (see Fig. 4). Despite the lecture series and overall program maintaining the student's positive outlook in both areas, it's possible that the lack of improvement in student motivation was due to the fact that the students that remained in the program had already decided that they were going to pursue graduate school. Thus, no motivation changes were observed.



Q5. How did the [*component*] affect your current attitude toward graduate school?
Q6. How did the [*component*] affect your motivation to pursue graduate school?

Figure 4. Attitudinal post survey results comparing students' pursuit of graduate school after the lecture series ($N = 16$) and overall program ($N = 5$) (Questions 5-6 in instrument A2).

The last outcome of the UGRP was to improve a student's sense of belonging, which was also identified as a common theme of student challenges. Table 1 summarizes the results and showed that sense of belonging decreased significantly by about 14.0%, showing a slightly lower than positive for both (< 4.00 score). A couple of reasons for these results can be attributed to the gradual decrease in the number of students in the program and reduced contact in the second half of the program. The program started with 93 students and ended with 6 students, so this drop could have had a negative effect in that student's felt they were losing parts of their community. In the second half of the UGRP, students began their research experience and communication was only maintained over email every two weeks. This heavily contrasted the hybrid format of the lecture series which met twice per week.

Table 1. Attitudinal post survey results comparing student's sense of belonging after the lecture series ($N = 16$) and overall program ($N = 5$) (Question 7 in instrument A2).

	Post lecture series	Post program
Mean	3.875	3.333
Std. dev.	0.696	0.471

Q7. How did the [*component*] affect your sense of belonging in the research group?

PALS survey

The Patterns of Adaptive Learning Scales (PALS) survey is demonstrated in the literature to accurately predict the motivation and persistence among students that engage in research experiences [15 ,11][19 ,18]. This instrument can assess the perceptions of student's goals, which include orientations that are classified as mastery (or task), performance-approach, and performance-avoidance. The revised scales were used in this study to reflect the adaptation of the PALS survey to measure goal orientations that represent achievement goals toward each of the lecture series and the overall program. The effect of the research conference was not assessed. A copy of the survey questions is provided in the Appendix section and listed as instrument A3.

The student response rates for the PALS surveys were the same as the attitudinal surveys; 55 responses to the pre-survey, and 16 and 3 responses to the post-surveys, respectively. Table 2 summarizes the results using calculated mean and standard deviation values across the three goal orientations. The respective PALS scale values are also included to assess the results. For reference, the responses were coded on a scale from 1 to 5 as follows: Not at all true (1), Somewhat true (3), and Very true (5).

Table 2. Pre ($N = 55$) and post ($N = 16$) results from the PALS survey.

Goal		PALS Scale Values	Pre-survey	Post lecture series	Post program
Mastery (or Task)	Mean	4.15	4.615	4.750	4.067
	Std. dev.	0.88	0.095	0.068	0.389
Performance-approach	Mean	2.46	2.482	2.788	3.067
	Std. dev.	1.15	0.739	0.678	0.249
Performance-avoidance	Mean	2.40	2.847	3.078	3.583
	Std. dev.	1.04	0.274	0.235	0.363

Mastery goals are shown to predict persistence with a positive outcome in a student's field of study in STEM [6]. Despite students starting with an increased level of mastery goals, the results showed that the lecture series had an impact on their persistence with a decrease by the end of the program, even though the mean value was still in the positive end of the scale. With regard to the performance-approach goal orientation, there was a steady increase showing that students were motivated by what they were learning and to do well. The possible reasons for these results can be that the lecture series subjected students to be with their peers (of high-achieving students), then were subjected to participate in research group meetings (with their mentor and graduate students). Similarly for the performance-avoidance goal orientation, the results showed a slightly larger increase, which is likely attributed to the same reasons as the performance-approach goal. Thus, students were motivated not to fail with respect to their peers.

URSSA survey

The Undergraduate Research Student Self-Assessment (URSSA) assesses the perceptions of a participant's own learning. The survey used includes four factors [20]:

- Thinking and Working Like a Scientist: understanding the process of scientific research and nature of scientific knowledge.
- Personal Gains: evaluates confidence, comfort, and self-efficacy with conducting research and working on a research team and in a lab.
- Skills: writing scientific papers, making oral presentations, and conducting observations in the lab or field.
- Attitudes and Behaviors: working in a scientific community and feelings of creativity, independence, and responsibility around working on scientific projects.

This survey instrument is shown in the literature to accurately validate a research experience program for undergraduates in STEM [20]. A copy of the survey questions is provided in the Appendix section and listed as instrument A4. The survey was administered only once after the research experience. Despite pairing 8 students with mentors for the research experience, only 6 students successfully completed the program (yet only 5 students completed the survey). Table 3 lists the results of the URSSA survey in comparison to data reported by [20] for BIO-REU and non-BIO-REU programs. Note that only 2012 results for BIO-REU are presented since it was found that the scores did not change significantly between 2010-2012.

Table 3. Results from the URSSA survey ($N = 5$).

Factor		2012 BIO-REU	2010-2012 Non-BIO-REU	Post research experience
Thinking and Working Like a Scientist	Mean	4.17*	4.0*	3.925
	Std. dev.	0.67	0.7	0.468
	Valid N	372	1119	5
Personal Gains	Mean	4.24*	4.1*	4.033
	Std. dev.	0.69	0.7	0.213
	Valid N	392	1115	5
Skills	Mean	3.91*	3.7*	3.450

	Std. dev.	0.76	0.8	0.561
	Valid N	392	1113	5
Attitudes and Behaviors	Mean	4.19*	3.9*	3.900
	Std. dev.	0.72	0.8	0.510
	Valid N	395	1105	5

* Indicates significantly different at $\alpha = .05$ level for comparison with other students.

For all factors, except the Skills factor, the reported mean scores were within acceptable values compared to the results in the BIO-REU and non- BIO-REU groups. It's been shown that the factors Thinking and Working Like a Scientist and Personal Gains are highly correlated, which is observed in the results for the UGRP. However, Skills is also highly correlated with those factors, yet the results in Table 2 show that students expressed that they did not gain as much in their skills from the research experience. One possible reason for this is because the 10 weeks for the research experience was not enough time to write a research paper or analyze data in a lab.

Conclusions and future work

This paper presented the details of an undergraduate research program designed to increase participation in graduate enrollment among first-generation students and to motivate them to persist in STEM fields by conducting research. The program consisted of three components comprising a lecture series, a research experience, and a research conference. Ultimately, the research conference was not evaluated since students were not able to attend because of coursework. Students maintained a positive response for all four STEM outcomes evaluated (attitude, motivation, challenges, satisfaction), showing a small improvement for both attitude and satisfaction toward their STEM degree. Even though the results showed that motivation decreased throughout the program, the mean score remained favorably positive. Plus, student motivations were demonstrated to exist based on the results of the performance-approach and performance avoidance goals from the PALS survey. The mastery goal orientation results were promising and further supported that students are likely to persist in STEM with an increased sense of the scholarly work that they are doing. It was also rewarding to observe that the URSSA survey showed that the research experience continues to be a key component towards student gains in scientific knowledge, personal feelings, skills, and attitudes towards research. Other positive improvements were observed in the student attitudes toward STEM and their pursuit of graduate school, which can point to small increase in participation among the students that completed the program. Future work will explore: (i) minimizing environmental pressures with program scheduling to avoid end of semester conflicts, (ii) student challenges with the themes of "imposter syndrome" and "uncertainty about financial support", and (iii) improving the frequency of communication during the research experience and scheduling more opportunities for students to meet together as a group.

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Appendix: Survey instruments

A1. Attitudinal pre-survey

1. What is your current attitude toward STEM?

Very negative	Negative	Neutral	Positive	Very positive

2. What motivated you to pursue a STEM degree? _____
3. What challenges do you face in your STEM degree? _____
4. How satisfied are you with the degree that you chose to study?

Very dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Very satisfied

5. What is your current attitude toward graduate school?

Very negative	Negative	Neutral	Positive	Very positive

6. How motivated are you to pursue graduate school?

Not sure	Not motivated	Neutral	Somewhat motivated	Very motivated

7. Are you involved in any first-generation student organizations or clubs on campus?
   - Yes
     i. Name them: _____
     ii. How would you rate the impact of the organization or club on your sense of belonging?

Very negative	Negative	Neutral	Positive	Very positive

   - No

8. Are/were you part of a first-year interest group (FIG) or student success program (Ramshorn)?
   - Yes
     i. Name them: _____
     ii. How would you rate the impact of the FIG or program on your sense of belonging?
        Very negative | Negative | Neutral | Positive | Very positive
   - No

A2. Attitudinal post-survey

1. How did the [lecture series, overall program] affect your current attitude toward STEM?
   Not sure | Negative | No effect | Positive | Very positive
2. How did the [lecture series, overall program] affect your motivation to continue your STEM degree?
   Not sure | Negative | No effect | Positive | Very positive
3. How did the [lecture series, overall program] affect the current challenges you're facing in your STEM degree?
   Not sure | Negative | No effect | Positive | Very positive
4. How did the [lecture series, overall program] affect how satisfied you are with the degree that you chose to study?
   Not sure | Negative | No effect | Positive | Very positive
5. How did the [lecture series, overall program] affect your current attitude toward graduate school?
   Not sure | Negative | No effect | Positive | Very positive
6. How did the [lecture series, overall program] affect your motivation to pursue graduate school?
   Not sure | Negative | No effect | Positive | Very positive
7. How did the [lecture series, overall program] affect your sense of belonging in the research group?
   Not sure | Negative | No effect | Positive | Very positive

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A3. Patterns of Adaptive Learning Scales (PALS)

The revised scales were used with the term substitutions: class = research, year = semester, my class = the research group, and teacher = mentor. For all questions, the choices given were:

1 (Not at all true) | 2 | 3 | 4 | 5 (Very true)

<u>Mastery goal orientation</u>

9. It's important to me that I learn a lot of new concepts this semester.
25. One of my goals in research is to learn as much as I can.
29. One of my goals is to master a lot of new skills this semester.
38. It's important to me that I thoroughly understand my research work.
49. It's important to me that I improve my skills this semester.

<u>Performance-approach goal orientation</u>

8. It's important to me that other students in the program think I am good at my research work.
26. One of my goals is to show others that I'm good at my research work.
41. One of my goals is to show others that research is easy for me.

45. One of my goals is to look smart in comparison to the other students in the program.
48. It's important to me that I look smart compared to others in the program.

Performance-avoid goal orientation
3. It's important to me that I don't look stupid in the program.
33. One of my goals is to keep others from thinking I'm not smart in research.
51. It's important to me that my teacher or mentor doesn't think that I know less than others in research.
55. One of my goals in research is to avoid looking like I have trouble doing the work.

A4. Undergraduate Research Student Self-Assessment (URSSA)

How much did you gain in the following areas as a result of your most recent research experience? For all questions, the choices given were:

1 (No gains)	2	3	4	5 (Great gains)

Thinking and Working Like a Scientist 1. Analyzing data for patterns. 2. Figuring out the next step in a research project. 3. Problem-solving in general. 4. Formulating a research question that could be answered with data. 5. Identifying limitations of research methods and designs. 6. Understanding the theory and concepts guiding my research project. 7. Understanding the connections among scientific disciplines. 8. Understanding the relevance of research to my course work.	Skills 9. Writing scientific reports or papers. 10. Making oral presentations. 11. Defending an argument when asked questions. 12. Explaining my project to people outside my field. 13. Preparing a scientific poster. 14. Keeping a detailed lab notebook. 15. Conducting observations in the lab or field. 16. Using statistics to analyze data. 17. Calibrating instruments needed for measurement. 18. Understanding journal articles. 19. Conducting database or Internet searches. 20. Managing my time.
Personal Gains 21. Confidence in my ability to contribute to science. 22. Comfort in working collaboratively with others. 23. Confidence in my ability to do well in future science courses. 24. Ability to work independently. 25. Developing patience with the slow pace of research. 26. Understanding what everyday research work is like.	Attitudes and Behaviors 27. Engage in real-world science research. 28. Feel like a scientist. 29. Think creatively about the project. 30. Try out new ideas or procedures on your own. 31. Feel responsible for the project. 32. Work extra hours because you were excited about the research. 33. Interact with scientists from outside your school. 34. Feel a part of a scientific community.