Board 22: A Multi-Tiered Mentoring Community Approach to Expanded Research Experiences for Local Students from Complex and Underrepresented Minority Backgrounds

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A Multi-Tiered Mentoring Community Approach to Expanded Research Experiences for Local Students from Disadvantaged and Underrepresented Minority Backgrounds

1. Introduction

The Membrane Applications, Science and Technology (MAST) center is a National Science Foundation (NSF) Industry-University Cooperative Research Center (IUCRC) that fosters partnerships between four universities and about 20 industry-leading membrane companies. The center specializes in biopharmaceutical manufacturing, water treatment, membrane fundamentals, and chemical separations research. Part of the center's mission is to provide unique membrane research opportunities for a variety of students. An opportunity exists to provide these research opportunities in addition to mentoring and career preparation to students local to the Northwest Arkansas (NWA) communities. A major component of this effort consists of expanded Research Opportunities for Undergraduates (REU) programs for students not enrolled in traditional four-year degree programs. This expanded research program is referred to as the Local Student Research and Mentoring (LSRM) program. This paper reports the structure of the MAST center LSRM programs that have been provided to students of a variety of ages and backgrounds. Two cohorts of local community college students and one cohort of high school students have successfully completed the program up to this point. While different in age, these students share the same goal of obtaining a four-year degree in STEM. To address this wide range of ages and backgrounds, the foundation of the LSRM program was to create a multi-tiered mentoring community that resulted in a highly collaborative environment that would provide the students with mentoring and representation within STEM necessary for a positive introduction to research. It was hypothesized that the formation of this multi-tiered mentoring community experience would aid in the development of the students' STEM identity, evidenced by their feedback and decisions to pursue additional research opportunities.

Students who achieve four-year degrees in STEM are typically White cisgender men with connections and resources that guide them through the process. Students outside of this demographic dealing with more complex circumstances tend to have more difficulty completing four-year STEM degrees. This group of students is referred to as "disadvantaged", and includes Underrepresented Minority (URM) students, first-generation college students, and students returning to school at an older age [1]. URM groups are defined by the NSF as "individuals of races or ethnicities whose representation in STEM employment and [Science and Engineering] education is smaller than their representation in the U.S. population. This includes Blacks or African Americans, Hispanics or Latinos, and American Indians or Alaska Natives" [2]. First-generation college students are defined as students without a parent who has obtained a bachelor's degree, and returning students are defined as students who spent a year or more away from school before returning to pursue their degree. It has been documented that these students are more hesitant to attempt research due to perceptions that they will not be able to balance research with other work or family commitments [3]. The formation of a multi-tiered mentoring community will provide these students with colleagues who are navigating similar issues as they are. This representation is key to demonstrating that STEM research can be accomplished in this environment with their unique circumstances and existing commitments.

Undergraduate coursework does not provide students with the specialized skills and relationships necessary to succeed in a STEM career. Experiential learning opportunities are much more effective means of providing students with these skills and relationships. It has been reported that URM, first-generation, and returning students perceive that differences in age, ethnicity, gender, and capabilities prevent them pursuing these experiential learning opportunities. As a result, these students do not pursue these opportunities as often as other students [4,5]. Direct mentoring relationships are a method of forming personal connections with these students that allow these apprehensions to be addressed. Collaboration and community building frequently emerge as effective strategies to improve STEM retention in four-year degree programs [6]. These mentoring relationships are most effective in a multi-tiered model where the student has mentoring relationships with peers, graduate students, and faculty advisors and can benefit from their specializations. This can be an excellent way to foster the development of a students' STEM identity and maximize the quality of the relationships formed in the process [7].

Experiential learning opportunities, such as research experiences, are particularly effective for URM, first generation, and returning students [1,4]. Students are able to experience hands on science and engineering outside of the classroom through these opportunities, often for the first time in the case of this demographic. This practical experience is much more impactful on the development of a student's STEM identity. The students have the time, resources, and guidance necessary to solve complex problems and demonstrate to them their own capabilities. Retention Theory describes how this process is a strong contributor to STEM retention [8]. This process promotes the development of persistence and resilience that are necessary to obtain a STEM degree, particularly when navigating complex circumstances often faced by this demographic [9,10]. Research experiences in particular have been reported as impactful toward the development of STEM identity and ultimately the completion of a STEM degree [11].

2. Program Design

The MAST Center formed partnerships with local NWA organizations to connect with students interested in the program. The program hosted students ages 16-32 from the Upward Bound program at the University of Arkansas and Northwest Arkansas Community College (NWACC) in high school and community college, respectively. This wide range of ages was a direct effort to add additional levels of mentoring to the eventual multi-tiered mentoring community. Further, these organizations both serve URM and first-generation students and allowed the program to connect with the target demographic. In the case of the high school students, the Upward Bound program hosted the students on the University of Arkansas campus and was able to coordinate their attendance as a group. The program sought to connect with students from different ages and backgrounds that showed interest in a STEM course as well as different careers in STEM when further prompted. A stipend was also given to the students to allow them to devote the necessary time to the program and act as a recruiting tool.

The programs were run in parallel: a Community College LSRM (CCLSRM) program supporting NWACC students, a High School LSRM (HSLSRM) for the upward bound students, and a ten-week summer Research Experiences for Undergraduates (REU) program hosting students from universities outside of Arkansas. The LSRM program mirrored the 10-week REU summer schedule with the addition of monthly mentoring sessions after the full-time summer

experience ended (Figure 1). This structure took advantage of the ability to maintain contact with the students after the program ended that traditional REU programs lack. These sessions were designed to extend the mentor-mentee relationships formed during the program and provide career awareness and professional development sessions. These sessions included presentations from speakers and tours of local industry planned with input from the students. The program expects that continuing to support the community and relationships formed will result in strong impact on the students' STEM identities [12].

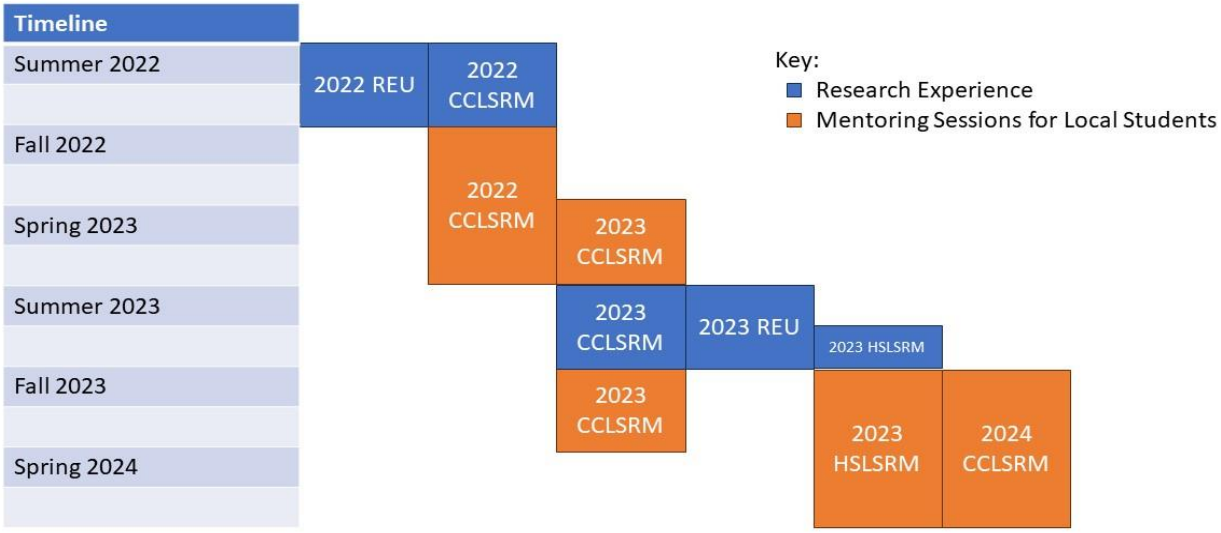

Figure 1 Outline of overlapping REU, CCLSRM, and HSLSRM programs. Research experiences (blue) were held during the summer and LSRM mentoring sessions (orange) occurred during the academic year. Programs were overlapped when possible to support the developing community.

The program focused on providing an introductory research experience that was accessible to the first-generation, returning, and URM students participating. Students from these demographics have an expectation the program will be inclusive and supportive [5]. For this reason, the program placed great emphasis on providing the students with a positive introductory experience to encourage them to pursue further STEM opportunities after completing the program. Therefore, the program's objectives centered around assessing the development of the multi-tiered mentoring community and the impact it had on the students' STEM identity development, the formation of mentor-mentee relationships between different levels of the community, skills needed to complete a STEM degree, and plans to seek additional STEM opportunities.

3. Materials and Methods

3.1 Mentor Training

The program's emphasis on mentoring relationships began with mentor training. The NSF research experiences and mentoring initiative provided mentor training to the PI and lead graduate students well in advance of students arriving for the program. This training focused on issues experienced by URM, first-generation and returning students and was passed by the PI and lead graduate students to the other graduate and faculty members in the program. The training included individual responses to and group discussions of complex circumstances often faced by the target demographic of students and how they relate to working in the lab and participating in the program in general. Online module resources were provided by the NSF following the first mentoring

training session prior to the program, and another in person session was hosted by the University of Wisconsin Madison in Fall 2022.

3.2 Undergraduate Research Experience

The peer mentoring component of the multi-tiered mentoring community was emphasized by organizing groups of students in the same labs when possible. When possible, based on the research interests of the students and faculty, CCLSRM students were paired with REU students in the same lab, otherwise the CCLSRM students were grouped together in the same lab. Students were also placed in the same lab as faculty with similar backgrounds when appropriate. After assigning the students an advisor it was left to the advisor to develop a project for the student that fit their background and research interests. The program remained involved outside the lab by engaging with the students weekly for weekly research meetings, hosting an industry visit, and connecting students to professional development dinner and dialogue sessions offered by the University of Arkansas for all REU programs on campus. The research meetings were an opportunity for the program leaders to monitor the students' progress by both connecting with them directly and asking them to present an update on their project in the form of a "quad" slide. The quad slide format is common in industry and academia and contains an introduction/innovation section, an approach section, a key results section, and lastly a conclusions/future work section [13]. The CCLSRM and REU programs alternated weekly, allowing the students time to obtain data between presentations and have the chance to observe other students' presentations. The industry tour involved visiting Eastman Chemical Company (Longview, TX, USA) and Invista (Longview, TX, USA).

3.3 High School Research Experience

The HSLSRM program schedule was developed in collaboration with Upward Bound and as a result only lasted five weeks based on the time Upward Bound was hosting the students on campus. The HS students were able to spend around 10 hours per week at the MAST center, including a weekly mentoring lunch. The projects were designed by the program leaders to provide a clear and visual introduction to membrane science and membrane separation processes. Of the three days the students attended the MAST center, the first day was spent giving the students background information and demonstrating the experiment in the lab. The students completed the experiment as outlined by the program leaders during the second day, and on the third day were given the chance to contribute to the project's design by choosing parameters to vary and observing the change in results. This way the projects exposed the students to the mindset researchers must have to think critically about the experiments and desired results. The program leaders monitored the students and guided them as needed through this process, including prompting them for a description of the expected outcomes and a hypothesis after the first and second days, respectively.

3.4 Local Student Mentoring Sessions Following the Summer Program

The mentoring sessions offered to the local students as a part of the LSRM program were crucial to maintaining the mentor-mentee relationships formed during the program. Extending these relationships allowed the program to provide resources valuable to the students' transition to completing a STEM degree in addition to the lab skills learned during the research experience. Community was emphasized during this period by connecting the programs whenever possible, including connecting the 2023 CCLSRM students to the 2022 CCLSRM students and connecting

the 2023 HSLRM students to as many of the CCLSRM students as possible. The HS students attended weekly research meetings when possible, including the final presentation session at the end of the summer program. Professional development activities were organized for both groups after the academic year resumed in the fall, providing workshops, speakers and trips relating to completing a STEM degree and STEM career awareness. MAST center alumni working in industry were recruited to describe their job and journey to reaching it to the students. Representatives from the University of Arkansas transfer office provided valuable information and guidance to the students regarding the process to transfer into a STEM program from NWACC. Workshops included discussing how to reflect on the research experience in such a way that it will be useful when applying to further opportunities and how to present the data they collected over the summer. A key outcome for the program relating to assessing the students' interest in pursuing future STEM opportunities was the desire of the students to present their research at a conference. Both regional meetings and national meetings were targeted as appropriate, including the Emerging Researchers Nationwide (ERN) conference that the NSF research experiences and mentoring initiative suggested. Outside of career preparation and skill development, a biannual family information session was hosted by the MAST center. Families have a particularly large impact on students' identity formation among the demographic of students in the program, including STEM identity, and as such these family sessions gave the families context that could help them understand the program's value [14].

3.5 Data Collection

The program participants completed a survey during the last week of the summer research experience (n=31). A Qualtrics survey was put together internally based on the objectives of the program and appropriate approvals were obtained. The data was analyzed for differences between programs using ANOVA as well as differences between group demographics (gender, race/ethnicity, first generation/non-first generation) using paired samples *t*-tests. The students were asked to rate themselves one to five on approximately 50 questions in relation to impacts participating in the program had. These responses related to *development of research identity, formation of quality mentoring relationships with graduate student research mentors, formation of quality mentoring relationships with faculty advisors,* and *preparation for a university STEM degree program*. A composite score was formed by combining the average scores of questions in each category and used to compare across programs. *Research identity* score included questions relating to the students' confidence and comfortability in lab, ability to perform experiments, and communicating their research or lab work to peers and mentors. Both categories assessing *mentoring relationships* included questions relating to the quality and quantity of relationships formed, and the impact those relationships may have on the students' desire to pursue future STEM opportunities. Questions relating to skills developed that will aid in the students' STEM coursework and are valued by industry (i.e., project management, problem solving, data analysis, etc.) were asked in the *preparation for a university STEM degree* section. The final section asked the students to describe their likelihood to pursue future STEM experiential learning opportunities. *Research identity* and *preparation for a University STEM degree* questions were scored using "great gain" (five), "good gain" (four), "moderate gain" (three), "a little gain" (two), and "no gain" (one). *Mentoring relationships* questions were scored on two scales depending on the type of question asked. General descriptions of mentoring relationships were scored with "excellent" (five), "very good" (four), "good" (three), "fair" (two) and "poor" (one), and statements were

responded to with “strongly agree” (five), “moderately agree” (four), “slightly agree” (three), “slightly disagree” (two), “moderately disagree” (one), and “strongly disagree” (zero).

4. **Results**

4.1 Student Demographics

The LSRM programs sought to construct a multi-tiered mentoring community that brought together URM, first-generation, and returning students in a manner that benefited each group. Each program contained six or seven students, an appropriate number for working with the students as a group and individually as needed. Both the REU and LSRM programs benefitted from strong URM participation (Table 2). URM included Women, Black or African American, Hispanic or Latino, and American Indians or Alaskan Natives. Women and Hispanic students were the most common URM background served by the program. Additionally, the program supported 14 first-generation and six returning students (self-identified). The heavy involvement of these demographics resulted in a diverse community that both exposed students to others with different backgrounds and allowed them to meet students with similar backgrounds.

Table 1 Summary of Participant Numbers and Demographics of Each Program

	2022 REU	**2022 CCLSRM**	**2023 REU**	**2023 CCLSRM**	**2023 HSLSRM**
Total Participants	**7**	**7**	**6**	**7**	**6**
URM	4	7	4	5	5
Women	4	5	4	4	4
Black or African American, Hispanic or Latino, and American Indians or Alaska Natives	1	4	2	1	3
Black or African American, Hispanic or Latino, and American Indians or Alaska Native Women	1	2	2	0	2
First Generation	1	4	1	3	5

Returning	0	2	1	4	**N/A**

4.2 Local Student Mentoring Sessions

Mentoring sessions provided for local students during the academic year were well attended by the students, including five of seven 2022 CCLSRM students, all seven 2023 CCLSRM students and all six 2023 HSLSRM students. A presentation detailing information regarding the transfer to the University of Arkansas was given to each CCLSRM cohort from a member of the University of Arkansas transfer department. The HSLRM students were connected to alumni of the Upward Bound program that continued on to pursue a STEM degree, including one member of the program who also participated in the CCLSRM program. Industry speakers were organized from MAST center companies such as Donaldson Membrane Solutions (Minneapolis, MN, USA), MilliporeSigma (Billerica, MA, USA), and Pel-Freez Biologicals (Springdale, AR, USA). Pel-Freez also hosted the students for a tour of their manufacturing facilities. Finally, the family sessions were effective at reaching the parents and other family members of the students. Each student brought at least one family member at both sessions, and second session hosted around 40 people, illustrating the size of the community created by the programs.

An important outcome of the post-program mentoring sessions was for the students to present their research at a regional or national conference. Students worked with their mentors shortly after the summer program ended to determine the best fitting conference for their work among the potential opportunities. These opportunities included the ERN conference, Arkansas IDeA Network of Biomedical Research Excellence (Arkansas INBRE), the 2023 Membranes for Viral Purification (MVP) Center annual meeting, and the 2023 MAST center annual meeting. Poster development and presentation practice sessions were held leading up to the conferences, also giving the students who planned to present later the chance to observe the process in advance. Four of the seven students in both CCLSRM cohorts presented their summer research at a conference after the program, and all six HS students presented their work at the ERN conference after the program concluded. In addition to the opportunity to present their work at a conference, a mentor was able to attend the conference with the students to provide guidance on how to make the most of the opportunity to meet new people and network within their field of interest.

4.3 Student Feedback

Combining the CCLSRM and REU programs clearly had a positive impact on the students based on the feedback they provided. The organic interactions that resulted from this pairing benefited both groups. The REU students were able to offer NWACC students perspective on the experience of pursuing a STEM degree at a four year university, and the NWACC students were able to introduce the REU students to the area. REU students typically do not have this type of introduction to the area, and it is likely this introduction helped the students feel comfortable with each other and within the program, providing a solid foundation for the peer mentoring community to grow on. The students also cited the industry visit as another helpful experience toward growing more comfortable with each other, especially since the trip spanned multiple days and was held early in the program.

Positive feedback was also received regarding the mentoring sessions. The conference presentation preparation sessions were mentioned given their anxiety about preparing the poster and navigating the large conference environment. 2022 CCLSRM students were greatly impacted by the conference, including one poster who won second place for best poster among other LSRM programs. Students were engaged in both the transfer department presentations and presentations from industry members. The students asked meaningful questions in both sessions and commented on feeling more confident after the presentations. The family sessions were also well received. Parents of one student from the 2023 CCLSRM program had told them they felt nursing was an ideal STEM career path but were more open to research-related careers after attending the family session. Overall, the students felt both the program and the mentoring relationships formed within were extremely valuable, saying "*I would not have been interested in, or had the [confidence] required to pursue [a subsequent research] opportunity with the experience of my summer internship, or the valuable mentorship*".

The MAST center research environment was clearly impactful on the HS students. They enjoyed traveling to the MAST center labs as well as the exposure to a professional environment outside of the HS environment they are used to. Unsurprisingly the students were intimidated at first but with the help of the mentors quickly became more comfortable. Toward the end of the program they started asking questions at the undergraduate research meetings. They also mentioned the lunch sessions specifically as enjoyable and helpful for getting advice on how to choose a STEM major and find the right career. Feedback after the program stated the students felt better prepared to pursue a STEM career and their "outrageous" goals seemed more achievable. This can also be evidenced by the fact that two students commented they were interested in STEM immediately following program, with one student soon vising the University of Arkansas College of Engineering on an informational visit.

4.4 Quantitative Survey Results

The survey data was compiled into composite scores for each program describing development of research identity, formation of quality mentoring relationships with research mentors, formation of quality mentoring relationships with faculty advisors, and preparation for a university STEM degree program (Figure 3). The scores were consistently positive, all at least 3.75/5. This is a good indicator that the program was able to provide a positive experience for all students, regardless of URM, first-generation, or returning status. The scores in each category were compared across programs without finding any significant differences between programs ($p<.05$). This means that the LSRM students had similar experiences to the REU students who visited from out of state. The 2022 CCLSRM scores tended to be highest, while the 2023 REU and CCLSRM programs seemed to be slightly lower. Examining the HSLSRM scores, it appears that the program was similarly effective for this demographic despite the differences in structure and ages of the students. This could be related to the highly structured mentoring of the HSLSRM program, particularly given the high mentoring scores obtained in both categories for the HSLRM program. Further, since the scores lack significant differences across programs, the data provides evidence for both the formation of a multi-tiered mentoring community given the differences in ages and background among the students in the different programs and the peer mentoring interactions between programs. This multi-tiered mentoring community also served each demographic well, proving to be an inclusive and welcoming environment for students who typically lack representation in STEM research.

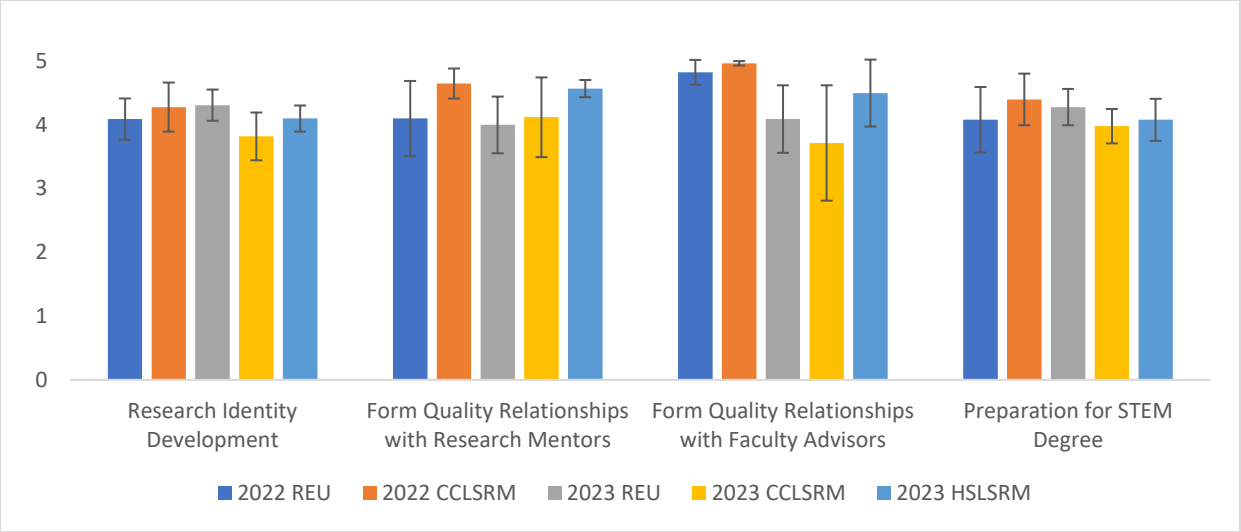

Figure 2 Composite scores formed from the post-program survey administered to the students at the end of the summer program. Scores describing the research identity development, formation of quality mentoring relationships with both research mentors and faculty advisors, and preparation for a STEM degree are reported (n=31).

Figure 4 reports the students' scores relating to their continued desire to pursue future research opportunities. The high scores reported related to general lab work (such as a subsequent REU program or a lab tech position) as well as pursuing advanced degrees suggest the program's positive impact on the students' perception of research. It is also notable that the HSLSRM students are also very high. This could be related to the age of the students, the students not having a strong understanding of research prior to the program, or the students' access to mentors who were able to offer them clear guidance. The obtained data was again compared across programs without discovering any significant differences in the scores received ($p<.05$).

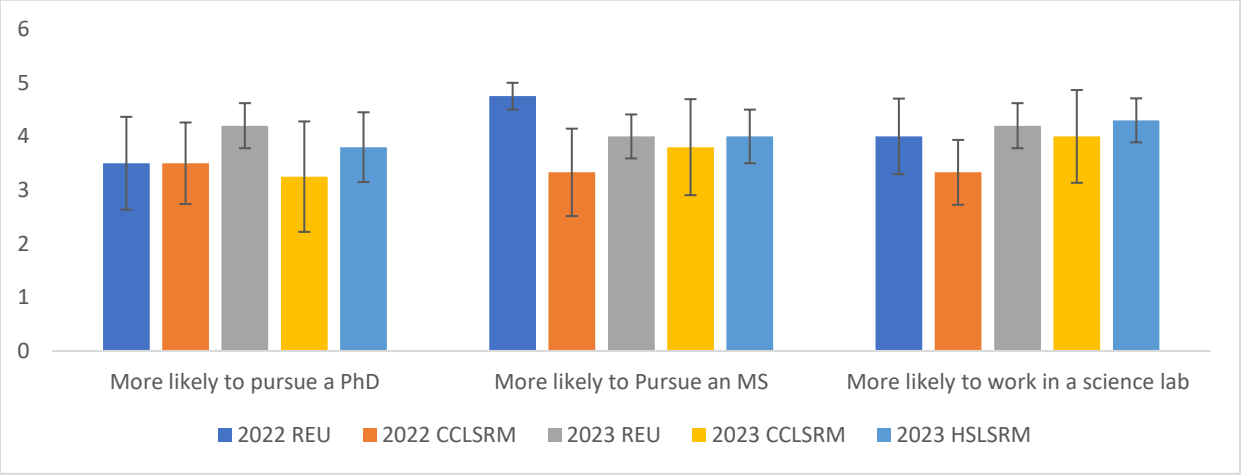

Figure 3 Scores describing the desire of the students to pursue additional research opportunities after completion of the program. Both pursuing a research-related degree and other research opportunities were assessed (n=31).

The survey results were also used to discern the experience URM and first-generation students had in the program. More specifically, the results obtained from men and women were compared, and results obtained from students who identified as White and students who identified

as Black or African American, Hispanic or Latino, and American Indians or Alaskan Natives were compared. Females scored significantly higher than males in mentoring relationships formed with advisors, scoring 4.63 and 4.16 ($p=0.01$). This was the only category found to be significantly different from each other. No other significant differences were found between females and males, and no significant differences were observed overall comparing White students and Black or African American, Hispanic or Latino, and American Indians or Alaskan Natives students. Further, no significant differences were found between first generation and non-first generation.

In addition to the scores collected in the survey, the program checked in with the students directly for its annual check in during September 2023. Table 4 reports the results from the students who replied, five of the seven 2022 CCLSRM students and all seven of the 2023 CCLSRM students. Questions asked related to the student's current pursuit of a STEM degree, participation in additional experiential learning activities (such as research, internships, STEM-related extracurricular activities, etc.), and goals related to a future STEM career. All five 2022 CCLSRM students that responded indicated they were pursuing STEM degrees at the University of Arkansas, four had given a conference presentation, four held research positions after the program, and three were seriously interested in graduate school. Of the seven 2023 CCLSRM students, five had enrolled in the University of Arkansas for the Fall 2023 semester, and the other two were in the process of transferring for either the following Spring or Fall. Five of the seven expressed interest in presenting at a future conference, though one ended up backing out. Four students also had continued on to additional lab work and a fifth had taken a leadership role in a professional society. Across both programs, eight of the ten LSRM students who engaged with the post-program mentoring continued to achieve another research opportunity, which is a very successful outcome for the program as a whole.

Table 4 Summary of LSRM Student Responses to Annual Program Check in

	2022 CCLSRM (n=5)	2023 CCLSRM (n=7)
Presented at Conference After Program	4	5
Continuing to Pursue a STEM Degree	4	7
Participating in Additional Research, Internship, or Experiential Learning Opportunities	4	5
Considering Attending Graduate School	3	7

5. **Discussion**

The LSRM program was intended to be a positive introductory experience to research and potentially STEM. As such, the program focused more on what the students gained from their participation rather than the results obtained from the lab. The program was able to expose the students to a wide range of career paths through STEM, including insights on how they worked together and different potential points of entry to fields they may be interested in. The high survey scores and positive feedback indicate that participation in the program was valuable for the students, even if it only made them more confident in pursuing their area of interest. It was not the goal of the program to recruit students to engineering, so this outcome is still considered successful. It is notable that engineering research was found to be effective at introducing students to both industry and the research process, even if the students were not interested in engineering

directly. This could be related to the students working through a complex research problem and making meaningful associations with the projects that contributed to their STEM identity development.

The development of the multi-tiered mentoring community was also considered a successful outcome for the program. Student feedback and mentoring relationship scores demonstrate the formation of this community. It is very likely the formation of this community was related to the high scores received for the development of both a STEM identity and skills related to the completion of a STEM degree. It was also a goal of the program that the STEM identity development of the students translated to them presenting their research at a conference. The strong participation in these presentations without additional incentive demonstrates the impact that the program had given the students understood the importance of presenting their work and followed through. It was noted that the 2023 REU and CCLSRM programs rated mentoring relationships lower on average. Written feedback from the students does show the formation of quality relationships, though more structure between the students and their mentors could improve the experience for the students. In addition, the program was able to deliver an impactful experience to students from different ages, backgrounds, and locations given the lack of significant differences between groups. This is further evidence of the formation of a diverse, multi-tiered mentoring community within the program that impacted URM, first-generation and returning students as intended.

5.1 Study Limitations and Future Opportunities

A key improvement to this study will involve increasing the sample size by continuing to track the progress of students as they complete the program and other post program activities. Limited interest and spaces in the University of Arkansas labs present difficulties in increasing the number of students participating each year. This will place added importance on careful post program tracking procedures and limiting personnel turnover. Another measure to obtain quality data is the implementation of a presurvey. This presurvey will particularly strengthen the impact of the program by providing clearer data relating to the initial awareness and confidence of the students. Mentoring relationships will continue to be improved through additional mentor training for the faculty and graduate students working directly with students. This may include a formal individual development plan to be completed in collaboration with the students and their faculty mentor. Lastly, additional improvements can be made to the clarity and structure of the HSLSRM experimental designs.

In addition to internal improvements, the program aims to grow by connecting with similar LSRM programs and institutions hoping to offer similarly structured programs. Through events such as the ERN conference and national LSRM program training sessions, the program hopes to form a national network of LSRM programs that can offer assistance to other programs and share job opportunities among interested researchers. Online tools such as Linkedin and Slack can be utilized to provide platforms for these networks. The program also hopes to work with other LSRM programs to put together regional meetings that provide more opportunities for networking and students to present their work.

6. Conclusion

This report details the structure of the LSRM programs targeted toward providing a positive introduction to research, particularly for URM, first generation and returning students. The program accomplished this by creating a multi-tiered mentoring community between students of different ages, backgrounds and locations that combined students with similar goals and concerns about reaching them. The structure of the program focused on providing both a quality research experience as well as meaningful mentor-mentee relationships to all students during the summer, then supporting the local students with additional mentoring sessions during the academic year. This additional mentoring during the academic year is not possible with traditional REU programs and was found to be very impactful on the CCLSRM students, particularly supporting them to present their research at a conference. The students commented on feeling more confident about pursuing the areas of STEM that interested them and completing a STEM degree after completing the program. This is evidence that the program had a major impact on the students' STEM identities and skills that will contribute greatly to their future career prospects. The students embraced the formation of the multi-tiered mentoring community, and everyone benefitted as a result. It is clear that mentoring in combination with experiential learning experiences such as research opportunities is an effective strategy toward enabling students who may not otherwise pursue STEM research to achieve goals they otherwise would find unreachable in relation to completing a degree in STEM and ultimately a career in STEM.

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