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# Faculty perspectives on research mentoring across a multi-level statewide LSAMP Alliance

Tokesha Warner
*Tennessee State University*, twarner3@tnstate.edu

Shaniqua Nixon
*Tennessee State University*, snixon@tnstate.edu

Terrance McNeil
*Tennessee State University*, tmcneil3@tnstate.edu

Denise Green
*Tennessee State University*, dgreen@tnstate.edu

JOHN T. ROBINSON
*Tennessee State University*, jrobinson@tnstate.edu

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## Cover Page Footnote

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## Introduction

The LSAMP Alliance studied is comprised of eight, four-year institutions and two community colleges that vary on several characteristics including, geographic location, academic ranking, student and faculty characteristics, and academic degree programs. The Alliance has been recognized as providing an infrastructure that connected institutions with shared concerns regarding the overall status of underrepresented students in STEM from recruitment to retention, to graduation. The Alliance has channeled resources to implement numerous activities to address these issues. Across the Alliance, mentoring as an intervention and retention strategy has been routinely implemented (TLSAMP Impact Report 2015).

Mentoring is pedagogically defined as a relationship between an individual with potential and an individual with expertise. It is a two-way, developmental relationship defined by individual interactions involving guidance, support, advice, and encouragement (Crumpton-Young and Elde, 2014). Included among the research-based retention strategies utilized by this LSAMP program are faculty mentoring (TLSAMP Impact Report 2015). While the general application of mentoring approaches for under-represented in STEM has been well documented, less is known in terms of the Alliance about the characteristics of the mentoring approaches deployed by partner institutions or the mechanisms that underlie the successful mentoring relationships at the critical retention to graduation transition stage.

## The National Science Foundation (NSF)

In 1991, the National Science Foundation (NSF) congressionally mandated the creation of the Louis Stokes Alliances for Minority Participation (LSAMP) to increase the number of underrepresented students completing undergraduate degree programs. LSAMP established a program to provide mentors and introduce research to undergraduate STEM students encouraging a pathway to post-baccalaureate STEM degrees among underrepresented student

groups. Since that time other programs have emerged to increase access, retention, and graduation of underrepresented minority students in STEM fields. Based on the Tinto model for student retention, (Tinto, 1994, 1997, 2010) LSAMP programs throughout the nation have been funded to provide essential support for addressing disparities in the attainment of undergraduate degrees in STEM.

According to the National Science Foundation (NSF), underrepresented minorities (URM) include 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 (US National Science Foundation (NSF), 2017). The National Science Foundation defines "underrepresented" as students who are historically marginalized in STEM disciplines, which includes "African Americans, Hispanic Americans, American Indians, Alaska Natives, Native Hawaiians, and Native Pacific Islanders" (*Louis Stokes Alliances for Minority Participation*, 2020).

The LSAMP model coordinates state-wide STEM alliances between institutions of higher education. These alliances create pathways to STEM graduate and doctoral degrees for underrepresented minoritized populations. The LSAMP program, in many iterations, is built upon a mentoring framework. The mentoring opportunities and execution vary by institution-type and discipline-specific research engagement. Despite over 30 years of LSAMP programs minoritized individuals are still underrepresented in the STEM workforce. The most significant impact of underrepresentation falls within the computing and engineering fields (Fry et al., 2021).

A 2023 report from the National Science Foundation revealed that disparities have decreased in racial, ethnic, and gender representation in the STEM workforce. However, the

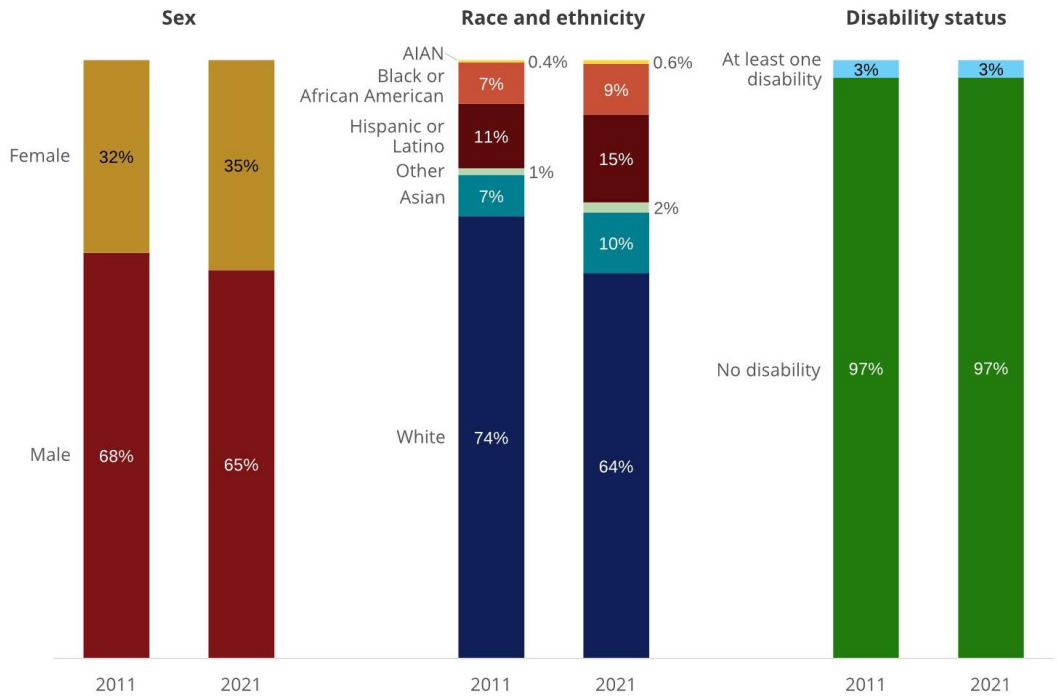
retention, graduation, and pathways to STEM careers are still elusive for many minoritized populations. Figure 1 shows the progress made over a 10-year period towards the goal of diversifying the STEM workforce.

*Figure 1: Characteristics of the STEM workforce ages 18 - 74: 2011 – 2021.* (National Science Foundation, 2023)

National Center for Science and Engineering Statistics | NSF 23-315

**Figure 2-3**

**Characteristics of the STEM workforce ages 18–74: 2011 and 2021**




AIAN = American Indian or Alaska Native; STEM = science, technology, engineering, and mathematics.

**Note(s):**
Civilian noninstitutionalized population plus armed forces living off post or with their families on post. Hispanic or Latino may be any race; race categories exclude Hispanic origin. Other includes Native Hawaiian and Other Pacific Islander and more than one race. Respondents can report more than one disability. Those who reported difficulty with one or more functionalities were classified as having a disability. Due to rounding, percentages may not sum to 100 or subgroup totals.

**Source(s):**
Census Bureau, Current Population Survey, Annual Social and Economic Supplement.

Faculty engaging undergraduate STEM students in research is a cornerstone of the LSAMP program. This model is intended to improve retention, matriculation, degree attainment, and attainment of advanced degrees for underrepresented undergraduate students. LSAMP

utilizes faculty engagement to address the workforce disparities that exist in STEM fields. Within the LSAMP program, students often worked with faculty as research assistants to gain additional expertise and mentoring, which provided additional insights on career paths.

The study was designed to explore and describe the perceptions, successes and challenges of mentoring practices used within the LSAMP partner institutions for engaging and motivating underrepresented STEM students. According to Tinto (2011), the elements of access and support have been essential to building more equitable systems for underrepresented students.

The NSF also provided funding for the STEM Talent Expansion Program in 2006, with a focus on the retention of STEM majors (Dagley et al., 2016). The implementation of this program at the University of Central Florida focused on high school seniors and included components in residential, social, and curricular. Residential and social components included block housing, social events (for faculty and students), and a faculty-mentored research experience (Dagley et al., 2016). For the curricular component, cohorts were paired with a graduate teaching assistant who mentored them throughout the program. The utilization of peer mentoring, faculty mentoring, research experience, and social support mirrors the LSAMP program.

## Mentoring

Research published by Tinto (Engstrom & Tinto, 2008; Tinto, 1975, 2010) and Flynn (Flynn, 2014) indicates a direct correlation between students' success beyond the critical retention to graduation phase. Additional correlations show the level of engagement that students experience within their institution and their programs. Tinto suggested that "the more students are academically and socially engaged, the more likely they are to persist and graduate," (p. 7).

Exposure to undergraduate research and mentoring benefits all students (Flynn, 2014; Tinto, 1975, 2010; Engstrom & Tinto 2008). Research has proven that students participating in undergraduate research achieve better grades, have a better understanding of research, have more confidence in their coursework, and higher interest and motivation to graduate and attend graduate school. These benefits are even greater when paired with mentoring (Moghe et al., 2021). Moghe (2021) conducted a study on the positive effect of research mentors on female undergraduate STEM students. This study highlighted the role that female mentors had a higher significance of contribution to the research experience for undergraduate students, for both male and female students.

Hernandez, et al. (2017). report that "Mentoring, particularly same-gender and same-race mentoring, is increasingly seen as a powerful method to attract and retain more women and racial minorities into science, technology, engineering, and mathematics (STEM) education and careers", in an analysis of mentorship quality among faculty-student dyads of African American undergraduates. URM STEM retention and graduation increased because of implementing mentoring; however, the larger impact needed for significant improvement on graduation rates and workforce diversity has not increased (Frueh, 2021).

**Purpose and Theoretical Framework**

In the fall of 2018, the research team began a study to examine the factors involved in and the impact of mentoring underrepresented students in STEM who are at the critical retention-to-graduation academic stage) methodology information. The guiding framework for NSF's LSAMP program has been Vincent Tinto's theory of student engagement and persistence (Tinto, 1975, 1997, 2003, 2012). While access has been foundational, Tinto states, "access without support is not opportunity" (2011). Building equity in higher education has required creating

support mechanisms for underrepresented students. Tinto posited that the key element of a successful educational experience promotes and sustains student success, sets lofty expectations, provides students with frequent feedback about learning, and creates opportunities to share experiences from the classroom and life with others (Tinto, 1997, 2010). Furthermore, Tinto indicated that a faculty mentor can be the conduit that integrates life experiences, ambitions, and desires, with classroom experiences in a supportive relationship (Tinto, 2008). Overall, the Tinto framework exemplified a central focus on academic and social integration for the successful retention of students.

**Research Design**

The mixed-method exploratory sequential design was used to characterize and delineate the underlying mechanisms of mentoring. Examining the engagement and impact of faculty and underrepresented students in STEM at the critical retention to graduation transitional academic stage. Mills and Gay (2016) noted that an exploratory sequential design is appropriate when attempting "to understand a phenomenon more fully than is possible using either quantitative or qualitative designs alone" (Mills & Gay, 2018). This two-stage design began with a qualitative component, followed by a **quantitative component.**

**Research Questions and Study Participants**

(1) What are the characteristics of mentoring across the LSAMP Alliance that support the critical retention to graduation transition of underrepresented groups in STEM? (Qualitative)

(2) What mechanisms underlie mentoring across the LSAMP Alliance that supports the critical retention to graduation transition of students involved in STEM research? (Quantitative). This question is not addressed in this manuscript.

This manuscript focuses on the faculty research question and examines the themes that emerged and the perspectives of the faculty mentors on mentoring. What are the transformative, value-added mentoring practices used within the Alliance that faculty mentioned or recommended?

There are ten institutional partners in the state-wide LSAMP Alliance, three private and seven public institutions, two are associate degree-level (community college), two master's level, and six doctoral-level institutions. Six institutions were Carnegie classified as Research One (2) or Research Two (4). Three of the institutions are designated as historically black colleges and universities (HBCUs); of those, two are private and one is public.

Two sample frames of relevance, one represented the faculty research mentors and the second the student mentees. The sampling criteria for a mentor was that they are currently or have previously been engaged in a formal faculty mentoring relationship that involved research with a student mentee(s). The mentor and mentee sampling frames were provided by the principal investigator or campus lead administrator at each partner institution.

**Quantitative Survey**

The faculty survey was developed, piloted, and sent via Qualtrics to a total of forty-five faculty members at the ten partnering Alliance member institutions. Out of the forty-five recipients the survey was distributed to, one email failed, and two emails were duplicates. The total number of faculty who received the survey was forty-two. We received twenty-seven responses for a response rate of sixty-four percent.

**Qualitative Interviews and Focus Groups - Round 1**

Forty-four STEM faculty were invited to participate in focus groups with a total of forty LSAMP faculty participating across eight institutions. A total of nine focus groups were conducted, with forty-five faculty members participating.

**Qualitative Interviews and Focus Groups – Round 2**

Forty LSAMP faculty across ten institutions were invited to participate in focus groups. A total of twenty-four faculty members across eight institutions participated in the focus groups conducted. Faculty invited in this round were limited to STEM faculty at an LSAMP-partner institution, with a paired LSAMP-supported STEM student.

**Data collection**

The Study-PI sent an email requesting the PI at each institution create a list of faculty mentors and student mentees who met the inclusion criteria. Data were collected from two separate cohorts of faculty mentors and student mentees during the study's second and third years, allowing for inclusion of new mentors and mentees. Due to the COVID-19 pandemic, face-to-face focus groups and interviews were forced to an online platform. Face-to-face zoom interviews were scheduled with each campus partner PI or proxy. The Study-PI and the post-doctoral fellows conducted interviews and hosted the focus groups that were recorded and transcribed. Informed consent was secured prior to the interviews and focus groups.

Round 1 focus groups consisted of STEM faculty who teach, conduct research, and mentor STEM students at each of the Alliance institutions. Faculty participants were selected by institutional PI and campus coordinators, who submitted names and email addresses to the research team. Email invitations were sent to individual faculty members to schedule a time for each focus group/ institution to meet with 1 or more members of the study team at a time convenient for them.

Round 2 focus groups were limited to faculty members who had mentoring relationships with Level 1 LSAMP students. Level 1 indicates students who receive a stipend or financial assistance from the LSAMP grant through their institution. Institutional PI and campus coordinators submitted faculty-student (mentor-mentee) pairs of names to the research team for focus group interviews. Email invitations were sent to individual faculty members to schedule a time for each focus group/ institution to meet with 1 or more members of the study team at a time convenient for them. Faculty focus groups were conducted by members of the research team via Zoom, guided by a PowerPoint presentation displaying each question, to focus the conversation. Interviews were recorded in Zoom and transcribed by Rev.com.

**Instrumentation**

The team utilized MAXQDA 2022 (VERBI Software, 2021) for data analysis of round 2 data and MAXQDA 2021 (VERBI Software, 2021) for data analysis of round 1 data. The IBM Statistical Package for the Social Science (SPSS) Statistics for Windows was used to analyze the quantitative data collected from both mentors and mentees (IBM Corp., 2020), via survey.

De-identified data from the ten partner institution interviews of administrative leaders, faculty mentors, and student mentee focus groups were transcribed and analyzed using MAXQDA. The narrative data was coded to facilitate the development of themes, assigning of attributes, and interpretation on data. The Study-PI and the post-doctoral students coded the data separately and together to ensure its reliability and replicability.

An interview guide was developed with questions cultivated to define mentoring and to guide a comprehensive evaluation of the mentoring design and delivery at each institution. The guide included 6 campus leadership/ administrator questions, 5 faculty questions, 5 student questions, and 13 general exploring questions. The guide was utilized to evaluate mentor and mentee characteristics; mentoring elements (traditional vs. non-traditional, formal vs. informal, single vs. multiple; mentor role; primary vs.

secondary mentor); mentor and mentee role expectations; infrastructure, expectations, training, preparation, exit strategies, and institutional supports. Additionally, the interview protocol served as a reference from the lead institution (Hairston-Green & Smith, 2016) and was utilized for the interview process.

## Findings

Round 1 focus groups included faculty members representing agriculture and environmental sciences, biology and biological sciences, chemistry, biomedical engineering, physics, mathematics, STEM, arts and language, music, and life sciences. Round 2 focus groups included a multidisciplinary group of faculty members representing the fields of psychology, natural sciences and mathematics, biochemistry, engineering, physics, chemistry, and biology. Based on the analysis of comments from the focus groups and the online survey, eight themes emerged to reflect the faculty perspectives on mentoring.

### Faculty mentoring support and development

Faculty participants ranged from all career stages. Higher education faculty are not formally trained as mentors at any point during their doctoral process or faculty onboarding. Higher education institutions do not typically provide mentorship training. Faculty first addressed characteristics of a mentor and were then asked how they could develop their mentoring knowledge and skills. Table 1 presents faculty responses regarding receipt of mentorship training in faculty development, utilization of peer-to-peer mentoring of faculty and need for more consideration of mentoring responsibilities in their academic workloads.

*Table 1: Faculty reporting receiving mentoring support and development.*

| | **Frequency** |
|---|---|

| | Focus Group R1 | Focus Group R2 |
|---|---|---|
| | n = 45 | n = 24 |
| Faculty development | 18 | 3 |
| More time to mentor/ workloads | 11 | 0 |
| Peer-to-peer mentoring | 5 | 16 |

**Setting expectations**

The faculty stated that clarity and setting expectations on what the mentoring relationship would look like, was helpful in providing a foundation for the mentoring relationship. Programs with an LSAMP coordinator emphasized how their coordinator was helpful in shaping and defining mentoring and mentoring expectations. Table 2 reflects faculty members' understanding of the LSAMP program, and the role of an LSAMP faculty member.

*Table 2: Impact of faculty understanding their role as a mentor.*

| LSAMP positive impact student career and academic plans | | | | | |
|---|---|---|---|---|---|
| | | Neither Agree or Disagree | Somewhat Agree | Agree | Total |
| Understood LSAMP Mentor Role Clearly | Yes | 1 | 5 | 11 | 17 |
| | No | 3 | 2 | 0 | 5 |
| Total | | 4 | 7 | 11 | 22 |

The impact of faculty understanding their mentoring role was more prevalent at bachelors-degree-granting institutions and higher, than at community colleges, and highest at R1 and R2 ranked institutions. Institutions with research infrastructure offered more structured opportunities for undergraduate students. Setting tangible guidelines allows faculty members and students to have a clear set of expectations and deliverables.

***Faculty perspectives on characteristics of mentoring***

Faculty were asked to describe the characteristics of a mentor and of a strong mentoring relationship. Faculty members described their own mentors, whether the relationship stemmed from their own academic or professional journeys. Mentor role models were an important pathway for the faculty participants to be comfortable and successful as research mentors.

*Table 3: Faculty reporting characteristics of mentorship*

| | **Focus Group R1** | **Focus Group R2** |
|---|---|---|
| | n = 45 | n = 24 |
| Growth mindset | 3 | 0 |
| Listener | 3 | 0 |
| Motivated | 3 | 2 |
| Sharing personal experiences/ interpersonal relationship | 4 | 2 |
| Social-emotional support | 4 | 23 |
| Flexibility | 0 | 3 |
| Know students personally | 15 | 2 |
| Caring and empathy | 4 | 0 |

Faculty with a direct mentorship role (R2) reported higher frequency of providing emotional support to URM STEM students. Faculty members expressed the need for caring and empathy to be adaptable and capable of tailoring solutions to the needs of individual students. Some faculty expressed a need to be vulnerable with students, sharing experiences and conducting honest conversations to establish trust. Faculty seemed intentional about getting to know students personally so they could better understand their needs.

### Student peer mentoring

Undergraduate to graduate peer mentoring was most successful but was limited to research institutions with graduate and doctoral programs. Table 4 reflects the faculty members who utilize peer-to-peer mentoring of undergraduate students.

*Table 4: Student peer-to-peer mentoring.*

| | **Focus Group R1** | **Focus Group R2** |
|---|---|---|
| | n = 45 | n = 24 |
| Student Peer-to-peer mentoring | 11 | 16 |

Faculty reported more productive mentoring relationships with groups of students that included more senior students mentoring the more junior students (i.e., seniors mentoring sophomores, graduate students mentoring undergraduates, doctoral students mentoring graduate and/or undergraduate students, etc.).

***Campus LSAMP Coordinators***

A significant resource for students and faculty members was the LSAMP Campus Coordinator. Several Alliance partners have a half-time or full-time LSAMP coordinator, who serve as a resource, advisor, and mentor to STEM students in the program. Not all institutions were fortunate enough to have a designated, full-time position for this role. The Campus LSAMP Coordinators served as network-builders for students, by connecting them to on-campus resources, and introducing them to coordinators at other institutions to facilitate their pathway to advanced degrees. Institutions with formal LSAMP coordinators reported more interaction between LSAMP students, as the coordinators would organize monthly workshops, social events for students, and networking activities for students and faculty. LSAMP coordinators were also able to connect students with other campus activities, student organizations, and communities of interest.

### Networking activities and opportunities

LSAMP programs have several inter-institutional programs to provide support, community, and resources for URM STEM students. Table 5 represents the LSAMP activities that faculty were aware of and/or participated in with LSAMP students.

*Table 5: Frequency of faculty knowledge of networking activities of URM STEM students*

| | **Focus Group R1** | **Focus Group R2** |
|---|---|---|
| | n = 45 | n = 24 |
| Academic advisement | 15 | 12 |
| Book costs | 10 | 1 |
| Competitions | 3 | 0 |
| Annual state-wide LSAMP conference | 3 | 11 |

Further, LSAMP coordinators are the grassroots campus liaisons offering multiple perspectives, resources, and activities at the institutional level. This allows them to have some foresight and historical context within situations that faculty and students may not have. Therefore, LSAMP coordinators are intentional in their pairing of students with faculty that meets certain unspoken needs a student may have.

### Faculty building research engagement

Regarding social integration, engagement of URM in regular meetings with faculty, peer-to-peer relationships, and student organizations was tied to academic success. Faculty from doctoral-granting institutions conducted laboratory research and spoke of creating a mentoring culture between the multiple levels of students working in the labs. Table 6 reports faculty who intentionally paired higher-level students with peer mentors who would guide new students through their initiation and training.

*Table 6: Faculty building a mentoring relationship with URM STEM students.*

| | Focus Group R1 | Focus Group R2 |
|---|---|---|
| | n = 45 | n = 24 |
| Faculty building the research engagement for students | 6 | 12 |

Faculty in a mentoring pair reported higher levels of research engagement from their undergraduate and graduate students. They admitted to the necessity of structuring labs and research projects to embed peer mentoring relationships, particularly for onboarding and skill-building of undergraduate students. This was reported as an informal process for the institution, but a formal process for the individual faculty members.

**Informal student support networks foster a culture of belongingness**

Faculty reported students finding that STEM-focused student organizations offered a sense of community and improved retention. Their mentees reported student organizations they participated in, and faculty mentioned the engagement with these organizations being an emotional support to the students. The faculty reported the importance of URM student groups as giving students a sense of belonging at predominantly white institutions. Table 7 shows the number of faculty who reported that their LSAMP students were involved in non-LSAMP student organizations. Faculty reported that students were more comfortable and engaged after joining these student organizations.

*Table 7: Faculty reporting of students informal (non-LSAMP) support networks.*

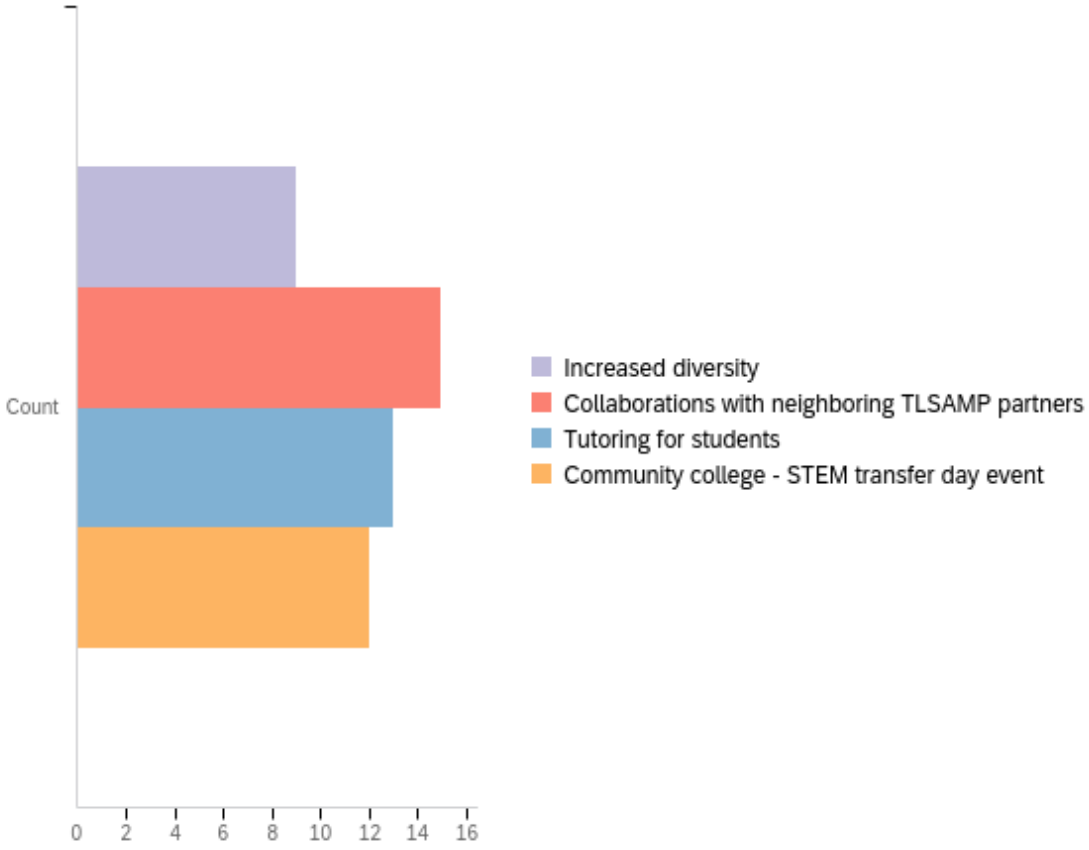
| | Focus Group R1 | Focus Group R2 |
|---|---|---|
| | n = 45 | n = 24 |
| Informal support networks (student organizations) | 3 | 14 |

Organizations mentioned included the National Society of Black Engineers, Society of Women Engineers, Black Student Organization, and the Society of Hispanic Professional Engineers. Faculty mentors reported the observation that students who were engaged in student organizations, particularly STEM-related student organizations, were more motivated to advance to graduate. Student organizations provided social support and fostered a sense of belonging to a group of like-minded or similar-interest students. Research faculty acknowledged that this culture was fostered within their labs.

### Institutional limitations

Our findings revealed the impact of institutional limitations, such as funding or other structural boundaries (i.e., lack of lab space), on the engagement of URM in mentorship and research. Results suggest that cross-institutional participation could strengthen opportunities for students and make up for the programmatic limitations at any singular college/ university (see Figure 2). Furthermore, the research indicates that, particularly at predominately white institutions, having an LSAMP coordinator with a similar background as the students has helped create more access to available resources for student participants as shown within multiple institutions within the alliance. For clarity, the HBCU participating institutions all have a coordinator already and/or have a smaller more nuclear program that allows for holistic support of academic, social-emotional, and general advisement.

*Figure 2: Faculty Recommendations for Improving LSAMP*




The faculty also recommended LSAMP tutoring services for students, which are provided for STEM students at each Alliance institution. A STEM transfer day event was held between the community colleges and the universities, which created a pathway many of the community college students were not aware of and gave the students a sense of joining a STEM community when accessing the pathway. Regarding academic integration, URM STEM students involved in research projects as undergraduates may have a direct correlation to enrollment in graduate school or opportunities for other professional opportunities.

## Conclusion and Recommendations

The purpose of this multilevel study was to analyze the role of mentoring among underrepresented student groups at the critical retention to graduation phase of undergraduate studies as STEM majors. The Louis Stokes Alliance for Minority Participation (LSAMP) was created to directly respond to concerns about the underrepresentation of minority populations within STEM fields.

The timing of this study, with its focus groups launched in Spring 2020, also coincided with a seismic shift in higher education. Due to the COVID-19 global pandemic, a sudden shift to online teaching, learning, and engagement that was unprecedented, forced faculty, administrators, and students to rethink how to engage one another, engage students with the course materials, engage students with research, and many other facets of higher education.

Mentorship falls within both formal and informal activities. The higher education environment is mired in tradition and slow to change. Faculty members are increasingly pressured to teach, develop courses and curricula, conduct research, serve at the institutional, college, and department levels, publish, and mentor students. The combinations of these tasks are prioritized based on individual institutions and their leadership. Evaluation of the programs' operations, recruitment, engagement, and successes must be analyzed at multiple levels to glean successes however small. Success should be shared, promoted, and developed into larger victories.

Findings from the research were presented at the annual LSAMP conference in an abbreviated "*Best practices for maximizing your LSAMP experience*" presentation given by the study principal investigator. Findings were presented to campus leads and faculty members as a research report, although updates of study progress were presented at quarterly meetings of the

Alliance institutions. The data suggested that more effort could be made to engage undergraduate students in research.

The LSAMP Executive Report was provided to the program administrators in September 2022. The report indicated that research activity, as reported across the alliance, is highly concentrated at a few institutions. Yet there was a global finding across all students and faculty that research experience and projects were one of the highest impacts on student success, retention, graduation, and interest in graduate school. This finding was second only to the LSAMP Conference, which is the annual gathering of LSAMP students, faculty, and administrators. The conference combines all themes found throughout this research (social-emotional support, engagement in activities, and faculty research mentorship best practices). For student researchers, the conference is the culmination of a research project, where they present their findings in an oral or poster presentation.

According to the responses from faculty, research engagement is often an institutional limitation due to funding or other structural boundaries. It is also worth noting that COVID impacted the ability to conduct research in labs in a more traditional sense. However, some institutions were able to navigate and create alternate opportunities to continue research. This would be a great example of how future cross collaboration on ideas and research opportunities could service the entire alliance in great ways. Further, quantitative data determined that faculty's greatest area of interest to better LSAMP programming is through cross-institutional research, sharing of resources, ideas, and engagement for greater participation and success for students.

The immediate benefit of this project is the interaction of the institutional multidisciplinary faculty in the focus groups, discussing what mentoring looked within their

institution. Within each institution, STEM faculty from different colleges and departments, sharing successes, campus resources and developing opportunities for collaboration. Faculty also shared the significant role that LSAMP coordinators play within their institutions, college, and student body. The conversations and the communications allowed institutional leaders to see best practices within their own body of faculty, and to share those successes with other members of the Alliance.

## Discussion

Analysis of existing programs on underrepresented undergraduate students in STEM provides a beneficial framework to examine the role of mentoring and mentorship programs on retention to graduation. Faculty members and campus LSAMP coordinators have unique insights into the everyday lives of students and the institution. They assist students with navigating the administration of organizations, courses, events, networks, and projects that interest and motivate students to persevere. The discussion is guided by the main themes shown above.

### Peer Mentoring

The larger R1 and R2 institutions have graduate and doctoral students, allowing them to implement multi-lever peer mentoring opportunities. They also have research projects to engage undergraduate students in the research industry. Both students and faculty indicated that student peer mentoring is an important aspect of retention for minoritized students. The faculty also indicated being overwhelmed by the number of requests for mentorship or lab placement, and not having time, space, and capacity to accept more students into their research enterprise.

Faculty were also willing to praise their graduate and doctoral students for their roles in mentoring and recognized that their institutions often overlooked this essential role. Faculty were willing to share their successful approaches with other faculty members from within their

institution, though it seemed like the focus groups were the first such conversations between many of them.

### Faculty Development Training on Mentorship

Peer mentoring was mentioned by faculty as an opportunity to engage their academic colleagues and learn how to mentor students better. While faculty mentoring relationships are often formal for new faculty, mid-career faculty reflected on more informal internal and external peer relationships with their institutions. Faculty members reflected on their mentoring relationships to shape their mentoring style. Institutions would benefit from faculty development opportunities on mentoring and cultural sensitivity for connecting with students from various ethnic, racial, religious, gender, gender identity, and economic backgrounds. Mentor training has been proven effective in mentorship initiatives (Stelter et al., 2021).

### Social Support and Networking

Providing opportunities for introductions to research for students, allows faculty to engage students in building a social network of support of classmates with similar interests (Majka et al., 2023). Faculty members also find different ways to engage students when they participate as faculty advisors to student groups on campus or introduce research into their introductory courses. Engaging students within the classroom fosters an informal cohort of like-minded students, who often support one another outside of the classroom. These social support networks foster a sense of belonging among students and faculty(Johnson et al., 2020).

Junior faculty may also benefit from faculty development focused on growing their research portfolio, building a research team, managing groups of students, project management, and grant writing (Zambrana et al., 2015). Faculty development would also grow a culturally competent, socioeconomically aware pool of faculty members, prepared to respond to the multilevel needs of students. Diversity, inclusion, and belonging goals in the STEM workforce

must be cultivated in an inclusive environment for all students, faculty, and staff (Suiter et al., 2024).

**Engagement**

The faculty identified many of the same engagement successes that students mentioned, such as conferences, student workshops, and research forums, as opportunities to engage with their underrepresented STEM students. The introduction to student research projects was a motivation for younger students' research interest and engagement. Faculty highlighted the need to introduce the concept of research early and often, so students feel comfortable stepping into a research role. Several faculty members mentioned doing mini-research projects in their class to get all students familiar with research and confident in their understanding, thus removing the fear and trepidation.

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## Appendix A: Faculty Survey Questions (Round 1)

1. Name
2. Institution
3. Department
4. Title
5. Race/ Ethnicity
6. Gender/ Gender Identity
7. Have you ever served as a faculty LSAMP mentor? (Y/N)
8. Did you receive training to be a mentor? (Y/N)
9. Have you taught LSAMP students? (Y/N)
10. How well prepared are LSAMP students for the coursework in your class(es)?
11. Do LSAMP students in your classes seem to be appropriately placed?
12. What do you see as the main problems encountered by LSAMP participants in your classes?
13. Do you feel that the LSAMP program has helped to mitigate those problems?
14. What do you see as the main strengths of LSAMP?
15. How has your involvement with LSAMP affected your teaching?
16. What effects has the LSAMP project had on student participants?
    a. Are student participants more likely to do better in their coursework?
    b. Do you think student participants are more likely to graduate?
    c. Do you think student participants are more likely to attend graduate school?
17. What recommendations do you have for improving the overall LSAMP program?
18. What recommendations do you have for improving the mentorship program?
19. Do faculty involved in LSAMP interact or collaborate across partner institutions within the Alliance?
20. As an LSAMP mentor, how many times per month do you meet with your mentees?

## Appendix B: Faculty Focus Group questions (Round 1)

1. Introductions (Name, department)
2. In general, what kind of students are LSAMP participants?
3. How would you describe the typical LSAMP participant?
4. If you have been engaged with students in LSAMP through a particular research mentoring relationship
5. What do you believe are the characteristics of a good mentor?
6. What are your expectations for mentees?
7. What effects has the LSAMP project had on student participants?
8. Based on your experience, are LSAMP participants more likely to do better in their coursework?
9. What would you say has been the impact of the LSAMP project on these underrepresented students?
10. Definition of mentoring (for this project)
11. What types of mentoring relationships exist at your institution i.e., peer to peer, faculty, research, etc.?
12. How do your mentor relationships generally evolve?

13. Are these relationships more from a formal sense in terms of you have a project and you're looking for a research assistant or they've been formally or informally introduced?
14. Does your institution or program offer any support to faculty to build mentoring skills?
15. Do you have assigned LSAMP mentees?
16. How frequently are in contact with your mentees?
17. How long do some of these mentor relationships last, even beyond graduation? Could you speak to the depth of your mentor relationships in terms of longevity.
18. How many of you have published with your students?
19. More specifically, what effects do you think the mentorship program has had on participants?
    a. In terms of helping them graduate.
    b. Go on to graduate school in STEM?
20. Do you feel that student participants are more likely to attend graduate school in a STEM field because of their LSAMP experience?
    a. Why or why not?
21. What recommendations do you have for improving your mentorship program?

## Appendix C: Faculty Focus Group questions (Round 2)

1. Introductions (Name, department)
2. Are you currently involved in research with an LSAMP student(s)?
3. Why aren't more undergraduate students involved in research?
4. What do you do with students in their first year when you know they are struggling (or not on par with their peers)?
5. Definition of mentoring (for this project)
6. What characteristics make a great mentor?
7. What types of mentoring relationships exist at your institution i.e., peer to peer, faculty, research, etc.?
8. What interventions do you think have been most successful in your mentoring operation?
9. Do you have assigned LSAMP mentees?
10. What is the size of your mentee group (i.e., how many mentees)?
11. How frequently are in contact with your mentees?
12. More specifically, what effects do you think the mentorship program has had on participants?
    a. In terms of helping them graduate.
    b. Go on to graduate school in STEM?
13. Do you feel that student participants are more likely to attend graduate school in a STEM field because of their LSAMP experience?
    a. Why or why not?
14. Based on your experience, are LSAMP participants more likely to do better in their coursework?
15. What recommendations do you have for improving your institution's mentorship program?
16. How has COVID impacted the delivery of research and engagement between faculty and undergraduate students?

17. Could you assist our efforts to recruit 4-7 students for a similar focus group?