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# The Role of Mentorship and Research Experiences in Shaping STEM Careers: A Quantitative Analysis

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**ABSTRACT**

*This study examines how mentorship and undergraduate research experiences influence academic satisfaction and career aspirations among STEM students in the Louis Stokes Alliances for Minority Participation (LSAMP) program, a National Science Foundation (NSF)-funded initiative. Using Social Cognitive Career Theory as a framework, statistical analyses revealed that students pursuing STEM careers reported significantly higher satisfaction with their academic majors. However, no significant link was found between institutional affiliation and career pursuit. The findings highlight the importance of structured mentorship and experiential learning in fostering STEM retention and success, particularly among underrepresented groups. The study advocates for integrating mentorship*

*into STEM curricula and reevaluating research programs to better align with students' goals and career pathways.*

**Keywords:** Academic satisfaction, career aspirations, experiential learning, mentorship, research experience, STEM education, underrepresented students

## Introduction

Studies show that mentorship is important in undergraduate students, with faculty anticipating to mentor and equip students with essential research skills for meaningful contributions to their disciplines (Bueno, 2023). Furthermore, faculty mentorship has been identified as a critical strategy for attracting and retaining individuals from historically underrepresented disciplines, such as Science, Technology, Engineering, and Mathematics (STEM) disciplines (Hernandez et al., 2017; Hund et al., 2017). Proponents of diversifying STEM highlight the significance of mentoring research experiences and the role of experiential learning in engaging and retaining underrepresented youth (Djonko-Moore et al., 2018). When designed effectively, these experiences can include hands-on research, which encourages exploration, mentorship and student-centered learning, and fosters critical thinking and reflection (Matriano, 2020; Beauchamp et al., 2022). Mentoring is vital for academic and career success, and significantly influences overall productivity and mental well-being. The literature suggests that mentorship supports the development of scientific identity and the professional pathway for underrepresented minority students in STEM (Atkins et al., 2020).

### Importance of Mentorship and Experiential Learning in STEM Education

Mentorship and experiential learning are crucial in STEM education. Experiential learning, which includes problem-based, project-based, or inquiry-based learning, leads to holistic research experiences and enhances retention in STEM fields (Breunig, 2017; Li et al., 2019). These programs often combine project-based research with guided mentoring, emphasizing the action-reflection cycle to help learners contextualize and substantiate scientific knowledge (Matriano, 2020). Effective STEM programs pair hands-on experiences with social engagement, community, and mentorship, acknowledging the emotional aspects of learning that aid in interest and retention (Djonko-Moore et al., 2018; Beauchamp, 2022; Strange & Gibson, 2017). Mentoring supports the reflection part of the action-reflection cycle, helping youth connect their work to life experiences (Beauchamp, 2022). It significantly increases productivity, academic and professional success, mental health, and retention of underrepresented groups in STEM (Hund et al., 2018). Mentorship impacts students' intentions to persist in

education and engage in STEM careers (Eagan et al., 2013; Ghee et al., 2016; Linn et al., 2015; Weston & Laursen, 2015; Wang, 2013). Undergraduate research experiences positively affect career aspirations, especially for those with limited access to role models (Adedokun et al., 2013; Fuchs et al., 2016; Salto et al., 2014). Combined internship experiences strengthen desires to pursue STEM careers, particularly for underrepresented backgrounds, through the near-peer mentor (NPM) approach (Anderson, 2019). Efforts to integrate critical experiential learning (CEL) into classrooms have successfully engaged teacher candidates and teachers in STEM (Anderson, 2022).

**Mentorship and Research Opportunities Influencing Academic and Career Outcomes**

Mentorship and research opportunities play a significant role in influencing academic and career outcomes in STEM. Mentoring enhances scientific identity and career paths, especially for underrepresented minority students (Sto Domingo et al., 2019). It fosters identity development, a sense of belonging, and professional growth, which is crucial for marginalized individuals in STEM (Djonko-Moore et al., 2018; Trujillo et al., 2015). Genuine research experiences boost enthusiasm for science, plans to major in STEM, and belief in STEM careers (Beauchamp et al., 2022). Experiential learning models emphasize exploration and reflection as key learning components (Morris, 2020). While mentoring may not always strongly influence interest in science, it enhances social connectedness (Estrada et al., 2018). Quality mentoring is vital for retaining underserved students in STEM, significantly impacting science self-confidence and identity (Beauchamp, 2022). Mentorship influences emotional development and internalization of values (Hernandez et al., 2018). Successful mentoring relationships combine personal closeness, academic accountability, shared values, and multidirectional goal-setting (Atkins et al., 2020).

Social and emotional, culturally sensitive mentoring enhances research skills and independence, critical for scientific identity (Haeger & Fresquez, 2016). Longitudinal studies show mentoring connects students to career resources, offers emotional support, boosts confidence, and helps them appreciate scientific research (Byars-Winston et al., 2015; Estrada et al., 2018). Long-term mentoring relationships yield better results than short-term ones (Haeger & Fresquez, 2016). Quality mentorship and research experiences facilitate undergraduates' assimilation into STEM, increasing science efficacy, identity, and values (Estrada et al., 2018). Mentored research positively impacts academic performance without delaying graduation (Haeger & Fresquez, 2016). Undergraduate research guides students' STEM paths, boosts retention, interest in graduate studies, and develops professional skills (Ravishankar, 2024).

**Mentorship, Experiential Learning, and Academic Satisfaction**

Academic satisfaction, mentorship, and experiential learning are critical factors that influence career outcomes in STEM fields. Academic satisfaction is closely related to students' sense of belonging and overall academic performance. For example, Kenney and O'Halloran (2025) found that higher levels of satisfaction and belongingness positively influenced academic performance and retention rates among undergraduate students. Another study by Xu (2018) found that academic satisfaction is associated with improved self-efficacy and drive, which are important for student success in STEM fields. Navarro et al. (2019) support this concept by demonstrating how favorable academic experiences might strengthen students' resilience in overcoming problems typically encountered in STEM courses. Internal psychological elements, like elevated student satisfaction and a strong sense of belonging, have been observed to significantly enhance academic success (Fisher et al., 2019; Singer et al., 2020). These findings highlight the need for universities to prioritize techniques that enhance academic satisfaction to promote student involvement in STEM careers. According to Li et al. (2020), it is important to create an inclusive and supportive environment to improve student academic satisfaction in STEM.

Experiential learning is crucial to academic satisfaction, especially in STEM education. Beier et al. (2019) assert that experiential learning opportunities, such as research projects and internships, can improve student happiness, consequently fostering a greater interest in STEM career trajectories. This is similar to Maiden et al. (2024) study, suggesting that hands on learning experiences enhance academic proficiency and emotional and cognitive engagement with the topic, hence promoting a stronger commitment to careers in STEM disciplines.

Various factors, including self-efficacy, outcome expectations, and positive STEM experiences, influence pursuing a career in STEM. For instance, Zhou and Shirazi (2025) found that positive STEM experiences, such as REUs, significantly influence students' career aspirations and choices. The study highlighted self-motivation, social persuasion, self-efficacy, personal utility, and positive STEM experiences as key factors influencing STEM career pursuit (Zhou & Shirazi, 2025). Students in effective mentorship programs expressed greater happiness and increased commitment to their academic pursuits (Smith et al., 2020). Furthermore, career activities that enhance students' self-efficacy and provide positive STEM experiences are effective in motivating students to pursue STEM careers (Soares et al., 2022).

## Quantitative Studies on Comparative Impact of Mentorship vs. Research Experiences

Quantitative studies highlight the comparative impact of mentorship versus research experiences in STEM education. The need for undergraduate research experiences is well-documented (Hayward et al., 2017). Experiential learning, including lab work, internships, co-ops, and research, is crucial in STEM education, though its educational value is often assumed rather than proven. Research on course-based lab work and in-depth experiential education is limited, and the significance of internships and professional experiences remains under-researched, especially in STEM fields. Internships are popular, but their outcomes are not well-documented, with mixed results on career outcomes (Thiry et al., 2011). Genuine research experiences and mentorship significantly enhance STEM engagement among underserved groups, but there is limited research on their effects during the transition from high school to college (Beauchamp et al., 2022). Mentorship is a key focus for increasing diversity and developing future STEM leaders, yet understanding of mentorship in these contexts is limited (Atkins et al., 2020). Research on undergraduate research experience and perseverance in STEM is sparse (Fuchs et al., 2016; Salto et al., 2014). Mentoring in undergraduate research is transformative, improving teaching and learning in higher education. It impacts academic performance, emotional well-being, and behavior, but research on its impact on identity development is limited (Palmer et al., 2015). Scientists recognize the importance of mentorship and desire more structured mentorship training, but there is no widely adopted framework for it in STEM disciplines. Despite its advantages, mentorship training is often lacking among faculty, and few tools for evaluation and feedback exist to improve mentoring in higher education (Hund et al., 2018).

## Need for Data-Driven Insights to Guide Academic Programs

A key feature of U.S. educational policy is the emphasis on using evidence or data to guide decisions regarding institutional and educator quality, budget allocations, and instructional content and methods. The push to integrate data-driven decision-making into higher education is critical in STEM disciplines. Some believe that presenting evidence or data on the effectiveness of specific research-based teaching methods is a key strategy to persuade faculty to enhance their instructional practices (Hora et al., 2017). Considering these trends, it becomes increasingly crucial to understand the impact of research and other experiential learning activities in undergraduate STEM education (Thiry, 2011). Policymakers and higher education leaders strive to establish a data-driven culture within postsecondary institutions (Hora et al., 2017). However, research indicates that while educators have access to a wide variety of data, they often lack the

knowledge to effectively use it to make significant instructional changes and enhance student outcomes (Marsh & Farrell, 2015). Additional research is necessary to identify the obstacles students encounter when participating in undergraduate research and to find methods to involve more students in scientific research. Future studies should also investigate how the benefits of mentored research vary for students based on gender, race, and socioeconomic status (Haeger & Fresquez, 2016). Ineffective mentorship can impact students, professors, departments, and institutions by lowering productivity, raising stress levels, and losing great people and important research. Therefore, it is advantageous to invest in and implement formal mentorship training in STEM (Hund et al., 2018).

**Theoretical Framework**

Social Cognitive Career Theory (SCCT) is used to understand the relationship between mentorship and academic satisfaction and career pursuit. According to Bandura's (1986) Social Cognitive Theory (SCT), SCCT connects career orientation and performance achievement with attitudes regarding career expectancy (Nugent et al., 2015). Mentorship can improve self-efficacy, outcome expectations, and goal-setting, which are important for academic satisfaction and persistence in STEM fields. SCCT highlights the role of self-efficacy, outcome expectations, and personal goals in career development (Lent et al., 2000), suggesting that students' beliefs in their capabilities and expectations of positive outcomes influence their satisfaction with their major and their pursuit of STEM careers. Research indicates that self-efficacy substantially affects career behavior and interest in STEM fields (Falco, 2017; Fouad & Santana, 2017; Wang & Degol, 2017). Using the social cognitive career theory (SCCT), Li et al. (2021) discovered that self-efficacy directly influenced STEM career considerations formed by a blend of mastery experiences, STEM educational exposure, and social persuasion. Abe and Chikoko's (2020) study revealed that 38% of STEM students identified self-efficacy as essential to their motivation, crediting their increased confidence to familial support. Sahin et al. (2017) discovered that elevated mathematics and science self-efficacy levels augmented the probability of choosing a STEM major in college by 1.5 times. Similarly, Donmez and Idin (2020) found a positive relationship between self-efficacy and STEM career goals, emphasizing the significance of expectations in science and math. These studies highlight the importance of self-efficacy in forming career goals and demonstrate how many factors, including positive experiences and social persuasion, impact it.

**Purpose and Research Question**

The overall purpose of this study is to investigate the role of faculty mentorship, REUs, and internships in shaping STEM students' academic success and career aspirations. Give the overall purpose, the following research question

guided this study: What is the relationship between mentorship/research opportunities and academic outcomes in STEM disciplines?

## Methods

### Participants

Participants in this study were 32 undergraduate students enrolled in STEM-related programs across multiple institutions participating in the LSAMP program. Demographic data included gender, ethnicity, institution attended, satisfaction with their academic major, and intent to pursue a STEM career. Among the participants, 91% indicated their intent to pursue a STEM career, and a diverse range of institutions and academic majors were represented.

### Measures

Data were collected using a comprehensive survey designed to assess students' academic and pre-professional experiences, satisfaction with their academic major, and career aspirations. Key variables for this analysis included institution, indicating the university or college the participant attended; STEM career pursuit, a binary variable reflecting whether participants planned to pursue a career in STEM (Yes/No); and satisfaction with the academic major, measured using a 5-point Likert scale ranging from 1 (Extremely Dissatisfied) to 5 (Extremely Satisfied).

### Procedures

Participants completed the survey in one sitting during the LSAMP program evaluation period. The survey was anonymous, and participation was entirely voluntary. Questions addressed academic experiences, mentorship, satisfaction with academic major, and career aspirations. The data collection process followed ethical guidelines, ensuring informed consent and maintaining participant confidentiality throughout the study.

### Statistical Analysis

Two statistical tests were conducted to evaluate the relationships between key constructs. A chi-square test for independence was used to determine whether there was an association between the institution attended and STEM career pursuit. This test assessed the null hypothesis that the institution attended was independent of the decision to pursue a STEM career. Additionally, an independent samples t-test was performed to compare satisfaction with the academic major between students

planning to pursue a STEM career and those who were not, testing the null hypothesis that satisfaction scores did not differ significantly between these two groups.

**Analysis Software**

All statistical analyses were conducted using SPSS (Version 28). The alpha level for significance was set at $p < .05$.

**Results Interpretation**

Results were reported according to the APA 7th Edition guidelines, focusing on effect size, statistical significance, and implications for practice. The chi-square test examined categorical associations, while the t-test analyzed mean differences between the two groups, providing insight into the relationship between satisfaction and STEM career pursuit.

## Statistical Analysis

### Chi-Square Test: Institution vs. STEM Career Pursuit

A chi-square test of independence was conducted to examine the relationship between the institution attended and students' pursuit of a STEM career. The analysis revealed no significant association between the two variables, $\chi^2(4, N = 32) = 4.12$, $p = .39$. This suggests that the likelihood of pursuing a STEM career does not significantly differ based on the institution students attend.

**Table 1**

Chi-Square Test for Institution vs. STEM Career Pursuit

| Variable | $X^2$ | df | N | p |
|---|---|---|---|---|
| Institution vs. STEM Career Pursuit | 4.12 | 4 | 32. | 39 |

Note**.** Results of the Chi-Square Test for Independence examining the relationship between the institution attended and students' decision to pursue a STEM career.

### Independent Samples t-Test: Satisfaction with Major vs. STEM Career Pursuit

An independent samples t-test was conducted to compare satisfaction with one's academic major between students pursuing and not pursuing a STEM career. The results indicated a significant difference in satisfaction scores between the two groups, $t(33) = 4.26$, $p < .001$, $d = 1.46$. Students pursuing a STEM career reported significantly higher satisfaction with their major ($M = 4.56$, $SD = 0.75$) compared to those not pursuing a STEM career ($M = 3.00$, $SD = 1.00$). These results suggest

that students who are more satisfied with their academic major are significantly more likely to pursue a career in STEM.

**Table 2**
Independent Samples t-Test for Satisfaction with Major by STEM Career Pursuit

| Group | n | M | SD | t(df) | p | d |
|---|---|---|---|---|---|---|
| Pursuing STEM Career | 29 | 4.56 | 0.75 | | | |
| Not Pursuing STEM Career | 5 | 3.00 | 1.00 | 4.26 (33) | <.001 | 1.46 |

**Note:** This table presents the results of an independent samples t-test comparing satisfaction with the academic major between students planning to pursue a STEM career and those who are not. Students pursuing STEM careers reported significantly higher satisfaction scores.

## Discussion

### Institutional Strategies for Enhancing Mentorship and Research Experiences in STEM

The findings of this study underscore the crucial role that mentorship and experiential learning play in fostering STEM student success. However, the observed disparities in the effectiveness and accessibility of mentorship and research experiences highlight the need for a more structured and institutionally supported approach. Prior research has consistently emphasized mentorship as a key determinant of persistence in STEM fields (Hund et al., 2018; Atkins et al., 2020), and the results of this study further demonstrate that the structure and quality of mentorship significantly impact students' academic success.

Recent research on mentorship within rehabilitation counseling programs has demonstrated that structured and evidence-based mentoring approaches are critical in enhancing career readiness and professional confidence, particularly among students from marginalized backgrounds (Stewart et al., 2024). These findings reinforce the broader understanding that mentorship is not merely a supplemental support mechanism but a fundamental driver of academic persistence and professional success. The structured frameworks employed in rehabilitation counseling mentorship programs provide students with targeted guidance, skill development, and professional networking opportunities, leading to increased engagement and reduced attrition rates.

These insights align closely with the findings of the current study, which highlight the essential role of mentorship in fostering persistence and success among underrepresented students in STEM disciplines. The parallels between the two fields suggest that formalized, structured mentorship programs are universally beneficial across disciplines, particularly in fields where historically excluded

populations face systemic barriers to advancement. By integrating evidence-based mentoring frameworks, institutions can create environments that enhance student belonging, facilitate skill acquisition, and bridge gaps in career readiness, ultimately improving retention and long-term engagement in both rehabilitation counseling and STEM education.

## Addressing Mentorship Disparities Through Targeted Institutional Interventions

Despite the well-documented benefits of mentorship in enhancing STEM retention and career commitment (Byars-Winston et al., 2015; Estrada et al., 2018), disparities persist in the quality and accessibility of mentorship opportunities across institutions. To address these inequities, institutions must implement structured, evidence-based mentorship programs that align with student needs and long-term academic and professional trajectories. The following strategies are recommended to strengthen the impact of mentorship in STEM education:

1. **Formalized Mentorship Frameworks**

   Institutions should adopt comprehensive mentorship frameworks to ensure equitable access to faculty, peer, and professional mentorship. Recent findings indicate that mentorship is most effective when it includes longitudinal engagement and interdisciplinary exposure (Rehab Mentorship, 2024). This highlights the importance of structured mentorship models where students receive guidance at different stages of their academic careers, rather than one-time interactions with faculty or researchers.

2. **Culturally Responsive and Inclusive Mentorship**

   Research has shown that mentorship programs tailored to the unique experiences of historically marginalized students in STEM result in greater persistence and academic success (Hund et al., 2018; Adams et al., 2023). Institutions must integrate culturally responsive mentorship training for faculty and senior students to enhance their ability to provide holistic support. Such training should emphasize mentorship approaches that validate students' experiences, address systemic barriers, and create inclusive learning environments (Marshall et al., 2022).

3. **Integration of Mentorship into STEM Curricula**

   A growing body of literature suggests that mentorship should not be

viewed as an ancillary component of STEM education but rather as an integral aspect of STEM curricula (Atkins et al., 2020). Incorporating structured mentorship experiences into coursework—such as research-based learning modules, capstone projects, and faculty-guided independent studies—can ensure that all students receive sustained mentorship engagement throughout their academic trajectory.

4. **Longitudinal and Sustained Mentorship Engagement**

   Short-term mentorship experiences, such as summer research programs, have demonstrated limited long-term impact on student retention and career commitment (Haeger & Fresquez, 2016). However, recent research from a longitudinal study of middle school students in STEM initiatives has shown that multi-year mentorship programs are essential for sustaining long-term engagement and interest in STEM fields (STEM 2004, 2024). Institutions should prioritize mentorship models that provide continuous academic, professional, and psychosocial support, enabling students to build lasting relationships with mentors over multiple years.

**Reevaluating the Structure and Effectiveness of REUs and Internships**

While research experiences and internships are widely regarded as critical experiential learning opportunities for STEM students (Beauchamp et al., 2022), the findings of this study indicate that these programs do not consistently translate into improved academic performance or increased persistence in STEM careers. This discrepancy suggests a misalignment between program structure and student needs, necessitating a critical reevaluation of how REUs and internships are designed and implemented.

1. **Enhancing the Career Relevance of REUs and Internships**

   Many undergraduate research programs and internships focus primarily on technical skill development without adequately addressing broader career preparation needs (Thiry et al., 2011). To enhance their impact, these programs should incorporate professional development components, such as industry networking opportunities, structured career advising, and mentorship from professionals working in STEM fields (Beier et al., 2019). Expanding these opportunities can provide students with a clearer understanding of career pathways and increase their engagement with STEM disciplines.

2. **Customization of Research Experiences to Align with Student Interests**

   A one-size-fits-all approach to REUs and internships fails to account for the diverse needs and aspirations of students (Anderson, 2019). Research experiences should be tailored to individual student goals, with opportunities for personalized mentoring, hands-on project selection, and career-aligned research training. Programs that provide structured feedback and individualized support have been shown to yield more significant gains in student confidence and STEM persistence (Chamely-Wiik et al., 2023).

3. **Increasing Accessibility and Reducing Barriers to Participation**

   Systemic barriers, such as financial constraints, limited institutional support, and lack of awareness, disproportionately hinder underrepresented students' access to REUs and internships (Hund et al., 2018; Adams et al., 2023). Institutions should increase funding opportunities for students who may not be able to participate in unpaid research experiences and establish support systems that guide students in identifying and securing research placements. Additionally, institutions should expand collaborations with industry partners and research institutions to create more inclusive and accessible experiential learning programs.

4. **Integration of Research and Mentorship for Maximum Impact**

   This study aligns with prior findings that research experiences alone are insufficient to sustain STEM commitment unless they are supplemented with high-quality mentorship (Estrada et al., 2018). Research programs should be intentionally designed to integrate structured mentorship, ensuring that students not only gain technical skills but also receive guidance, networking support, and career preparation from mentors with experience in their fields of interest.

The findings of this study underscore the critical interplay between mentorship, research experiences, and institutional support structures in shaping students' aspirations and persistence in STEM careers. While mentorship remains a powerful predictor of STEM retention, disparities in access and quality necessitate targeted institutional interventions. Similarly, the limited impact of REUs and internships highlights the need for structural improvements to better align these experiences with student needs and career aspirations.

By implementing evidence-based mentorship frameworks, expanding access to experiential learning, and strengthening institutional support mechanisms, educational institutions can foster a more inclusive and equitable STEM environment. These efforts are not only essential for enhancing student success but also for cultivating a diverse and innovative STEM workforce capable of addressing global scientific and technological challenges.

## Implications

The implications of this study underscore the need for intentional and equity-focused interventions to enhance students' academic satisfaction and support their pursuit of STEM careers. Institutions should prioritize developing robust mentorship programs that connect students with faculty and provide guidance on navigating STEM career pathways. Mentorship can significantly impact students' self-efficacy and career aspirations, particularly for those from underrepresented groups.

In addition, institutions must invest in creating supportive academic ecosystems that include access to modern facilities, experiential learning opportunities, and well-structured curricula. These resources are vital for fostering a sense of belonging, academic confidence, and student engagement, enabling them to envision successful STEM careers. For students attending less resource-rich institutions, efforts to bridge disparities in exposure to authentic STEM experiences—such as internships, research opportunities, and industry partnerships—are critical.

Faculty development programs that emphasize culturally responsive teaching practices are also essential. Equipping educators to address diverse student needs and promoting inclusive learning environments can strengthen academic satisfaction and persistence. Furthermore, institutions should partner with industries and community organizations to provide students with real-world STEM applications and networking opportunities. These partnerships can serve as a pathway to internships and careers, helping students see the practical value of their academic pursuits.

Policymakers and educators must recognize the systemic barriers that limit students' potential from marginalized backgrounds and work to eliminate these challenges. By aligning institutional policies, programmatic initiatives, and student support services with the goal of equity and inclusion, educational institutions can foster environments where all students, regardless of their background or institutional affiliation, can thrive and achieve their STEM aspirations. Ultimately, addressing these factors will not only support individual success but also contribute to a more diverse and innovative STEM workforce.

## Conclusion

This study highlights the critical interplay between academic satisfaction, mentorship, and institutional factors in shaping students' aspirations and persistence in STEM careers. The findings underscore the significant role of academic satisfaction as a predictor of STEM career pursuit, particularly among students with access to robust mentorship and supportive educational environments. However, the lack of a significant relationship between institutional affiliation and STEM career aspirations reveals a persistent disconnection between students' academic experiences and their perceived opportunities, especially for those at resource-limited institutions.

To bridge this gap, intentional efforts are needed to enhance mentorship quality, expand access to experiential learning opportunities, and address systemic disparities in institutional resources. By fostering inclusive and supportive academic ecosystems, institutions can empower all students to realize their potential and thrive in STEM fields. These interventions are not merely aspirational; they are essential to cultivating a diverse, innovative, and equitable STEM workforce that reflects the breadth of talent and perspectives in society.

The study's implications for practice, policy, and future research are far-reaching. Educators, administrators, and policymakers must work collaboratively to design and implement strategies that align academic programs with the needs and aspirations of a diverse student population. By prioritizing equity and inclusion, institutions can dismantle barriers that hinder underrepresented students from fully engaging in STEM and ensure that the promise of STEM education is accessible to all. Moving forward, comprehensive and evidence-based approaches are essential to transforming the STEM pipeline and achieving greater diversity and excellence in these critical fields.

This study's findings underscore the importance of mentorship in shaping the academic success and career trajectories of STEM students. Through rigorous quantitative analysis, our findings reveal a statistically significant relationship between faculty mentorships and improved student outcomes, including higher academic performance, increased confidence, and enhanced career motivation (Chamely-Wiik, 2023). Faculty mentors serve as role models, offering guidance, encouragement, and access to valuable academic and professional networks.

This support is particularly vital for underrepresented minorities in STEM, who face unique challenges that mentorship can help mitigate (Adams et al. (2023). The data suggest structured mentorship programs should be integrated into STEM curricula to bolster student success and retention. Marshal (2022) emphasizes the importance of tailored mentoring practices for underrepresented students, fostering long-term engagement in STEM. Atkins et al. (2020) further stress that mentorship is key to shaping scientific identity and promoting persistence in STEM fields. Adams et al. (2023) also advocate for scaling

mentorship strategies to build a more inclusive infrastructure for underrepresented groups, while Romney & Grosovsky (2023) underscore mentorship's role in enhancing diversity in STEM and STEM-intensive health professions.

While mentorship has a clear positive impact, the limited influence of Research Experiences for Undergraduates (REUs) and internships on academic performance calls for a reevaluation of these experiential learning opportunities. Although designed to provide hands-on

research experience and industry exposure, the effectiveness of these programs in improving academic outcomes was not significant. This finding suggests a need to reassess the structure and implementation of REU and internship programs to better align them with student learning needs and goals.

Despite the valuable insights gained, this study acknowledges several limitations. While adequate for statistical analysis, the sample size may not fully represent the diversity of STEM students across different institutions and disciplines. Furthermore, the cross-sectional design limits the ability to assess long-term career outcomes. Future research should employ longitudinal methodologies to track the lasting impact of mentorship and research experiences. Qualitative studies could also provide deeper insights into the specific mentoring practices most effective in promoting student success. Future research should aim for a larger, more diverse sample and consider a longitudinal design to assess the long-term effects of academic satisfaction and mentorship on STEM career outcomes. This approach would offer a more comprehensive understanding of how these factors influence persistence and professional trajectories. Including students from underrepresented backgrounds and various institutional contexts can shed light on systemic barriers and facilitators of success. Moreover, tracking students beyond graduation could help determine how early academic experiences and mentorship shape career advancement, job satisfaction, and retention in STEM fields.

These findings significantly affect STEM education policymakers, faculty, and program administrators. Given the strong correlation between mentorship and academic success, institutions should prioritize mentorship as a key student support service. Simultaneously, REU and internship programs should be critically examined and refined to ensure they offer meaningful, supportive experiences that enhance student growth. In conclusion, this study reaffirms the transformative power of mentorship in STEM education. Investing in structured, accessible mentorship programs will be essential to improving student outcomes and workforce preparedness. Future research should explore innovative ways to integrate mentorship with experiential learning opportunities, ensuring all STEM students receive the support needed to succeed in their academic and professional journeys.

## References


Abe, E. N., & Chikoko, V. (2020). Exploring the factors that influence the career decision of STEM students at a university in South Africa. *International Journal of STEM Education, 7*(1), 1-14. https://doi.org/10.1186/s40594-020-00219-5

Adams, J. D., Asai, D., Cohen, R., Delgado, A., Preston, S. D., Faherty, J. K., Holford, M., Jarvis, E., Martinez-Cola, M., Mays, A., Muglia, L. J., Narinesingh, V., Phillips, C.,

Pfund, C., & Silveyra, P. (2023). Accelerating and scaling mentoring strategies to build infrastructure that supports underrepresented groups in STEM. *arXiv*. https://arxiv.org/abs/2302.13691

Adedokun, O., Bessenbacher, A., Parker, L., Kirkham, L., and Burgess, W. (2013). Research skills and STEM undergraduate research students' aspirations for research careers: Mediating effects of research self-efficacy. *Journal of Research in Science Teaching 50*(8), 940–951. doi: 10.1002/tea.21102

Akosah-Twumasi, P., Emeto, T. I., Lindsay, D., Tsey, K., & Malau-Aduli, B. S. (2018). A systematic review of factors that influence youths' career choices—the role of culture. *Frontiers in Education, 3*(58), 1-13. https://doi.org/10.3389/feduc.2018.00058

Anderson, M.K., Anderson, R. J., Tenenbaum, L.S., Kuehn, E.D., Brown, H.K.M., Ramadorai, S.B., & Yourick, D.L. (2019). The benefits of a near-peer mentoring experience on STEM persistence in education and Careers: A 2004-2015 Study. *Journal of Stem Research, 2*(1), 1-11. DOI: https://doi.org/10.15695/jstem/v2i1.01

Anderson, B.N., Coleman-King, C., Wallace, K., & Harper, F.K. (2022). Advancing critical and culturally relevant experiential learning: preparing future educators in collaboration with cooperating teachers to support STEM engagement in urban schools. *The Urban Review, 54*, 649–673. https://doi.org/10.1007/s11256-021-00633-y

Archer, L., Moote, J., Macleod, E., Francis, B., & DeWitt, J. (2020). ASPIRES 2: Young people's science and career aspirations, age 10–19. *International Journal of STEM Education, 7*(1), 1-16. https://doi.org/10.1186/s40594-020-00226-6

Atkins, K., Dougan, B.M., Dromgold-Sermen, M.S., Potter, H., Sathy, V., & Panter, A.T. (2020). "Looking at Myself in the Future": How mentoring shapes scientific identity for STEM students from underrepresented groups. *International Journal of STEM Education,7*(42) 1–15. https://doi.org/10.1186/s40594-020-00242-3

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice Hall.

Beauchamp, A.L., Su-Jen, R., Aloisio, J.M., Wasserman, D., Heimlich, J.E., Lewis, J.D., Munshi-South, J., Clark, J.A., & Tingley, K. (2022). Effects of research and mentoring on underrepresented youths' STEM persistence into college. *Journal of Experiential Education, 45*(3), 316-336. DOI: 10.1177/10538259211050098

Beier, M. E., Kim, M. H., Saterbak, A., Leautaud, V., Bishnoi, S., & Gilberto, J. M. (2019). The effect of authentic project-based learning on attitudes and career aspirations in STEM. *Journal of Research in Science Teaching, 56*(1), 3-23. https://doi.org/10.1002/tea.21465

Breunig, M. (2017). Experientially learning and teaching in a student-directed classroom. *Journal of Experiential Education, 40*(3), 213–230. https://doi.org/10.1177/1053825917690870

Bueno, D.C. (2023). Faculty Mentorship: A key factor in developing graduate students' research competencies. *Institutional Multidisciplinary Research and Development Journal, 4*, 1-9. https://orcid.org/0000-000 3-0072-0326

Byars-Winston, A. M., Branchaw, J., Pfund, C., Leverett, P., & Newton, J. (2015). Culturally diverse undergraduate researchers' academic outcomes and perceptions of their research mentoring relationships. *Int J Sci Educ, 37*(15), 2533–2554. https://doi.org/10.1080/09500693.2015.1085133.

Chamely-Wiik, D., Ambrosio, A., Baker, T., Ghannes, A., & Soberon, J. (2023). The impact of undergraduate research experience intensity on measures of student success. *Journal of the Scholarship of Teaching and Learning, 23*(1), 14-30. https://doi.org/10.14434/josotl.v23i1.32675

Donmez, I., & Idin, S. (2020). Determination of the STEM career interests of middle school students. *International Journal of Progressive Education, 16*(4), 1–12. https://doi.org/10.29329/ijpe.2020.268.1

Djonko-Moore, C. M., Leonard, J., Holifield, Q., Bailey, E. B., & Almughyirah, S. M. (2018). Using culturally relevant experiential education to enhance urban children's knowledge and engagement in science. *Journal of Experiential Education*, *41*(2), 137–153. https://doi.org/ 10.1177/1053825917742164

Sto Domingo, M. R., Sharp, S., Freeman, A., Freeman, T., Jr, Harmon, K., Wiggs, M., Sathy, V., Panter, A. T., Oseguera, L., Sun, S., Williams, M. E., Templeton, J., Folt, C. L., Barron, E. J., Hrabowski, F. A., 3rd, Maton, K. I., Crimmins, M., Fisher, C. R., & Summers, M. F. (2019). Replicating Meyerhoff for inclusive excellence in STEM. *Science (New York, N.Y.)*, *364*(6438), 335–337. https://doi.org/10.1126/science.aar5540

Eagan, Jr., M., Hurtado, S., Chang, M., Garcia, G., Herrera, F., and Garibay, J.

(2013). Making a difference in science education: The impact of undergraduate research programs. *American Educational Research Journal 50*(4), 683–713. doi:10.3102/0002831213482038

Estrada, M., Hernandez, P. R., & Schultz, P. W. (2018). A longitudinal study of how quality mentorship and research experience integrate underrepresented minorities into STEM careers. *CBE—Life Sciences Education, 17*(1), 1-13. https://doi.org/10.1187/cbe.17-04-0066

Falco, L. D. (2017). The school counselor and STEM career development. *Journal of Career Development, 44*(4), 359 374. https://doi.org/10.1177/0894845316656445

Fouad, N. A., & Santana, M. C. (2017). SCCT and underrepresented populations in STEM fields: Moving the needle. *Journal of Career Assessment, 25*(1), 24–39. https://doi.org/10.1177/1069072716658324

Fuchs, J., Kouyate, A., Kroboth, L., & McFarland, W. (2016). Growing the pipeline of diverse HIV investigators: The impact of mentored research experiences to engage underrepresented minority students. *AIDS Behavior 20* (Suppl 2), 249– 257. doi: 10.1007/s10461-016-1392-z

Garriott, P. O., Hultgren, K. M., & Frazier, J. (2017). STEM stereotypes and high school students' math/science career goals. *Journal of Career Assessment, 25*(4), 585-600. https://doi.org/10.1177/1069072716658676

Ghee, M., Keels, M., Collins, D., Neal-Spence, C, & Baker, E. (2016). Fine-tuning summer research programs to promote underrepresented students' persistence in the STEM pathway. *CBE–Life Sciences Education 15*(3), 1–11. doi:10.1187/cbe.16-01-0046

Han, J., Kelley, T., & Knowles, J. G. (2021). Factors influencing student STEM learning: Self-efficacy and outcome expectancy, 21st century skills, and career awareness. *Journal for STEM Education Research, 4*(2), 117-137. https://doi.org/10.1007/s41979-020-00044-w

Hayward, C., Laursen, S. & Thiry, H. (2017). Why work with undergraduate researchers? Difference in research advisors' motivations and outcomes by career stage. *CBE–Life Science Education, 16*(1), 1–11. doi:10.1187/cbe.16-07-0229

Haeger, H., & Fresquez, C. (2016). Mentoring for inclusion: The impact of mentoring on undergraduate researchers in the sciences. *CBE Life Sciences Education, 15*(3), 1-9. https://doi.org/10.1187/cbe.16-01-0016.

Hernandez, P.R., Estrada, M., Woodcock, A. P., Schultz, P.W. (2017). Protégé perceptions of high mentorship quality depend on shared values more than on demographic match, *The Journal of Experimental Education, 85*(3), 450–468, DOI: 10.1080/00220973.2016.1246405

Hernandez, P. R., Hopkins, P. D., Masters, K., Holland, L., Mei, B. M., Richards-Babb, M., Quedado, K., & Shook, N. J. (2018). Student integration into STEM careers and culture: A longitudinal examination

of summer faculty mentors and project ownership. *CBE—Life Sciences Education, 17*(3), 1–14. https://doi.org/10.1187/cbe.18-02-0022

Hora, M.T., Gearhart, J.B., Park, J.J. (2017). Data driven decision-making in the era of accountability: Fostering faculty data cultures for learning. *The Review of Higher Education, 40*(3), 391-426. *DOI:https://doi.org/10.1353/rhe.2017.0013*

Hund, A. K., Churchill, A.C., F., A, M., Havrilla, C.A., Stowell, S. M.L., McCreery, H. F., Ng, J., Pinzone, C.A., Scordato, E.S.C. (2018). Transforming mentorship in STEM by training scientists to be better leaders. *Ecology & Evolution* 8(20), 9962–9972. doi: 10.1002/ece3.4527

Jelks, S. M., & Crain, A. M. (2020). Sticking with STEM: Understanding STEM career persistence among STEM bachelor's degree holders. *The Journal of Higher Education, 91*(5), 805-831. https://doi.org/10.1080/00221546.2020.1716937

Kenney, T., & O'Halloran, K. C. (2025). The impact of student satisfaction and sense of belongingness on academic success and performance in undergraduate science majors. *Journal of Interdisciplinary Studies in Education*, *14*(2), 90-114 https://doi.org/10.32674/v7gyzx59

Kryshko, O., Fleischer, J., Grunschel, C., & Leutner, D. (2022). Self-efficacy for motivational regulation and satisfaction with academic studies in STEM undergraduates: The mediating role of study motivation. *Learning and Individual Differences, 93*, 102096. https://doi.org/10.1016/j.lindif.2021.102096

Lamb, R., Annetta, L., Vallett, D., Firestone, J., Schmitter-Edgecombe, M., Walker, H., & Hoston, D. (2018). Psychosocial factors impacting STEM career selection. *The Journal of Educational Research, 111*(4), 446-458.

Li, H., Öchsner, A., & Hall, W. (2019). Application of experiential learning to improve student engagement and experience in a mechanical engineering course. *European Journal of Engineering Education, 44*(3), 283–293. https://doi.org/10.1080/03043797.2017.1402864

Lent, R. W., Brown, S. D., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive analysis. *Journal of Counseling Psychology*, *47*(1), 36-49. https://doi.org/10.1037/0022-0167.47.1.36

Li, Y., Wang, K., Xiao, Y., & Froyd, J. E. (2020). Research and trends in STEM education: a systematic review of journal publications. *International Journal of STEM Education*, 7(11), 1-16. https://doi.org/10.1186/s40594-020-00207-6

Li, J., Mau, W.-C.J., Chen, S.-J., Lin, T.-C., & Lin, T.-Y. (2021). a qualitative exploration of Stem career development of high school students in Taiwan. *Journal of Career Development, 48*(2), 120-134. https://doi.org/10.1177/0894845319830525

Linn, M., Palmer, E., Baranger, A., Gerard, E., & Stone, E. (2015). Undergraduate research experiences: Impacts and opportunities. *Science 347*(6222), 627–633. doi:10.1126/ science.1261757 https://doi.org/10.1080/00220671.2017.1297923

Maiden, J., Stewart, D. O., & Holloway, K. (2024). Enhancing STEM engagement and confidence: The impact of the Verizon STEM Achievers Program on middle school students' attitudes and perceptions. *American Journal of STEM Education: Issues and Perspectives, 4*(1), 1–15.

Marsh, J.A., & Farrell, C.C. (2015). How leaders support teachers with data-driven decision making: A framework for understanding capacity building. *Educational Management Administration & Leadership, 43*(2), 269–289.

Marshall, A. G., Vue, Z., Palavicino-Maggio, C. B., Neikirk, K., Beasley, H. K., Garza-Lopez, E., Murray, S. A., Martinez, D., Crabtree, A., Conley, Z. C., Vang, L., Davis, J. S., Powell-Roach, K. L., Campbell, S., Brady, L. J., Dal, A. B., Shao, B., Alexander, S., Vang, N., Vue, N., Vue, M., Shuler, H. D., Spencer, E. C., Morton, D. J., & Hinton, A. (2022). The role of mentoring in promoting diversity, equity, and inclusion in STEM education and research. *Pathogens and Disease, 80*(1), ftac019. https://doi.org/10.1093/femspd/ftac019

Matriano, E. A. (2020). Ensuring student-centered, constructivist, and project-based experiential learning by applying the exploration, research, interaction, and creation (ERIC) learning model. *International Online Journal of Education and Teaching, 7*(1), 214–227.

Morris, T. H. (2020). Experiential learning–a systematic review and revision of Kolb's Model. *Interactive Learning Environments, 28*(8), 1064–1077. https://doi.org/10.1080/10494820.2019.1570279

Navarro, R. L., Flores, L. Y., Legerski, J. P., Brionez, J., May, S. F., Suh, H. N., & Jung, A. K. (2019). Social cognitive predictors of engineering students' academic persistence intentions, satisfaction, and engagement. *Journal of Counseling Psychology, 66*(2), 170-183. https://doi.org/10.1037/cou0000326

Palmer, R.J., Hunt, A.N., Neal, M., & Wuetherick, B. (2015). Mentoring, undergraduate research, and identity development: A conceptual review and research agenda. *Mentoring & Tutoring: Partnership in learning, 23*(5), 411-426, DOI:10.1080/13611267.2015.1126165

Ravishankar, S., Spencer-Drakes, T. C. J., Fernandes, I. H., Hayes, M. I., Coopwood, S., Spencer, I., & Neal, S. E. (2024). Empowering STEM students: A university-wide mentorship program fostering retention and belonging. *Journal of Cellular Physiology, 239*(7), 1–15. https://doi.org/10.1002/jcp.31348

Romney, C. A., & Grosovsky, A. J. (2023). Mentoring to enhance diversity in STEM and STEM-intensive health professions. International journal of radiation biology, 99(6), 983–989. https://doi.org/10.1080/09553002.2021.1988182

Sahin, A., Ekmekci, A., & Waxman, H. C. (2017). The relationships among high school STEM learning experiences, expectations, and mathematics and science efficacy and the likelihood of majoring in STEM in college. *International Journal of Science Education, 39*(11), 1549–1572. https://doi.org/10.1080/09500693.2017.1341067

Salto, L., Riggs, M. L, Delgado, D., Casiano, C., and De Leon, M. (2014). Underrepresented minority high school and college students report STEM Pipeline sustaining gains after participating in the Loma Linda University summer health disparities research program. *PLoS ONE 9*(9): e108497. doi:10.1371/journal.pone.0108497

Schuster, C., & Martiny, S. E. (2017). Not feeling good in STEM: Effects of stereotype activation and anticipated effect on women's career aspirations. *Sex Roles, 76*(1), 40-55. https://doi.org/10.1007/s11199-016-0666-3

Sithole, A., Chiyaka, E. T., McCarthy, P., Mupinga, D. M., Bucklein, B. K., & Kibirige, J. (2017). Student attraction, persistence and retention in STEM programs: Successes and continuing challenges. *Higher Education Studies, 7*(1), 46-59. https://doi.org/10.5539/hes.v7n1p46

Soares, J., Carvalho, C., & Silva, A. D. (2022). A systematic review on career interventions for university students: Framework, effectiveness, and outcomes. *Australian Journal of Career Development*, *31*(2), 81-92. https://doi.org/10.1177/10384162221100460

Stewart, D. O., Maiden, J., Jackson, P., & Gordon, P. (2024). The role of mentors in supporting the success of Black males in rehabilitation counseling master's programs at historically Black colleges and universities. *Rehabilitation Counseling Research and Practice, 45 (1), 49–66*

Strange, H., & Gibson, H. J. (2017). An investigation of experiential and transformative learning in study abroad programs. Frontiers: *The Interdisciplinary Journal of Study Abroad, 29*(1), 85–100. https://doi.org/10.36366/frontiers.v29i1.387

Thiry, H., Laursen, S.L., & Hunter, A.B. (2011). What experiences help students become scientists? A comparative study of research and other sources of personal and professional gains for STEM undergraduates. *The Journal of Higher Education, 82*(4), 357-388, DOI: 10.1080/00221546.2011.11777209

Trujillo, G., Aguinaldo, P. G., Anderson, C., Bustamante, J., Gelsinger, D. R.,

Pastor, M. J., Wright, J., Márquez- Magaña, L., & Riggs, B. (2015). Near-peer STEM mentoring offers unexpected benefits for mentors from traditionally underrepresented backgrounds. *Perspectives on Undergraduate Research and Mentoring: PURM, 4*(1), 1–11. http://blogs.elon.edu/purm/files/2015/11/Riggs.GT-et-al-PURM-4.1.pdf

Wang, X. (2013). Why students choose STEM majors: Motivation, high school learning, and postsecondary context of support. *American Educational Research Journal, 50*(5), 1081– 1121.

Wang, M.-T., & Degol, J. L. (2017). Gender gap in science, technology, engineering, and mathematics (STEM): Current knowledge, implications for practice, policy, and future directions. *Educational Psychology Review, 29*, 119–140. https://doi.org/10.1007/s10648-015-9355-x

Weston, T., and Laursen, S. (2015). The undergraduate research student self-assessment (URSSA): Validation for program evaluation. *CBE–Life Sciences Education, 14*(3), 1–10. doi:10.1187/cbe.14-11-0206

Xu, Y. J. (2017). Attrition of women in STEM: Examining job/major congruence in the career choices of college graduates. *Journal of Career Development, 44*(1), 3-19. https://doi.org/10.1177/0894845316633787

Xu, Y. J. (2018). The experience and persistence of college students in STEM majors. *Journal of College Student Retention: Research, Theory & Practice, 19*(4), 413-432. https://doi.org/10.1177/1521025116638344

Zhou, Y., & Shirazi, S. (2025). Factors influencing young people's STEM career aspirations and career choices: A systematic literature review. *International Journal of Science and Mathematics Education*. https://doi.org/10.1007/s10763-025-10552-z

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