

Empowering Undergraduates Through Developmental Networks: Career Mentoring Initiative

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In the evolving landscape of education, mentoring is no longer a one-dimensional relationship; it is a dynamic, developmental network that fosters wellbeing, growth, and institutional transformation. We have implemented Career Mentoring Initiatives that exemplify this multidimensional approach. These initiatives support a diverse student population, approximately 50% of whom identify as Hispanic, American Indian, or other underrepresented minorities, and serve as strategic levers for individual empowerment and organizational advancement. The model is grounded in the concept of developmental networks, which emphasize multiple mentoring relationships that collectively support an individual's academic, personal, and professional growth. This approach aligns with research highlighting the role of mentoring in improving retention, fostering inclusive educational environments, and promoting a sense of belonging. The integration of reflective exercises, peer mentoring, and structured career planning reinforces self-efficacy and agency, consistent with social cognitive career theory and models of inclusive excellence. Serving a diverse undergraduate population within a biomedical education setting, the Career Mentoring Program integrates professional development and career seminars, career-focused assignments, and reflective surveys. These components are designed not only to support individual students but also to build a sustainable culture of mentorship within the department and across the institution. One-year post-participation, 100% of students advanced academically or professionally, 79% conducted research, and 37% earned awards. Feedback showed strong satisfaction, and 58% maintained mentoring relationships. Students credited structured support with improving communication, clarifying career goals, and boosting adaptability. These findings highlight the power of developmental mentoring networks to promote wellbeing, career readiness, and institutional growth.

Keywords: Career mentoring, peer mentoring, developmental networks, professional development

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Introduction

In recent years, mentoring in higher education has shifted beyond traditional, hierarchical models to include developmental networks, a multidimensional framework of diverse relationships and strategies that promote personal growth, career readiness, and institutional transformation. This new model highlights the interactive and complementary roles of various individuals, each contributing unique perspectives, resources, and support mechanisms (Higgins & Kram, 2001; Seery et al., 2021). This transformation is particularly significant in contexts serving diverse student populations, as a mentoring strategic tool for promoting equity, inclusion, student success, and empowering students, particularly among underrepresented populations in STEM disciplines. Within this new model, mentoring is embraced as a rich, multidimensional practice that nurtures

reflective learning and empowers students through structured career planning.

The ÉLITE Career Mentoring Program, implemented within the Department of Biochemistry and Molecular Biology at the University of New Mexico (UNM), a Hispanic-Serving Institution (HSI), exemplifies this approach. The program supports a diverse student population, approximately 50% of whom identify as Hispanic, American Indian, or from other historically underrepresented groups. These mentoring initiatives aim to strengthen students' professional identity, foster self-efficacy, encourage proactive engagement in their academic and career development, and cultivate a strong sense of belonging in the educational environment.

Literature Review

The value of mentoring in higher education,

particularly within the sciences, is well established. Traditional mentoring models, typically characterized by hierarchical, one-to-one relationships between senior and junior individuals, have historically emphasized academic guidance and research apprenticeship (Jacobi, 1991). These models have laid the groundwork for many successful mentoring relationships and have been associated with improved retention, academic performance, and postgraduate outcomes, especially among students from underrepresented backgrounds (Byars-Winston et al., 2015). However, critiques of this model highlight its limitations in addressing the broader psychosocial and career development needs of an increasingly diverse student population.

In response to these limitations, the concept of developmental networks has emerged as a more inclusive and adaptive framework. Developmental networks encompass a variety of mentoring relationships—including peers, faculty, and professionals— and diverse strategies that collectively support an individual's academic, personal, and professional growth (Dickson et al., 2021; Dobrow et al., 2012; Higgins & Kram, 2001; Seery et al., 2021; Ynalvez & Aviles, 2021). This model reflects a shift toward mentoring as a collaborative and student-centered process that fosters agency, self-efficacy, and resilience (Rhodes & DuBois, 2008). It also aligns with sociocultural theories of learning and identity formation, which emphasize the situated nature of development within social and institutional contexts. Importantly, developmental networks empower students to seek mentorship tailored to distinct domains of their development, thereby promoting autonomy and adaptability (Dobrow et al., 2012). These networks are critical for students from historically marginalized backgrounds, who often face barriers to accessing informal mentoring and academic role models (Higgins & Kram, 2001).

In this context, culturally responsive mentoring emphasizes cultivating a sense of belonging, an empirically supported predictor of persistence and success in STEM disciplines (Estrada et al., 2018). Social cognitive career theory (SCCT) offers a robust theoretical lens through which to understand the mechanisms by which mentoring influences career development. SCCT emphasizes the roles of self-efficacy, outcome expectations, and goal setting, while also accounting for the influence of contextual supports and barriers (Lent et al., 2002). This theory is relevant for mentoring programs that serve diverse student populations, as it underscores the importance of structured, supportive environments (Rhodes & DuBois, 2008). Structured mentoring initiatives that incorporate career-focused seminars, reflective practices, and career-focused assignments, such as those implemented in our program, have been shown to enhance students' professional identity, expand their support networks, and strengthen their confidence in pursuing scientific careers (Estrada et al., 2018). When implemented through a culturally responsive lens, such programs can

also mitigate impostor syndrome, foster resilience, and reinforce a sense of belonging in science. When embedded within academic curricula, these initiatives further normalize mentorship and career planning as integral components of undergraduate education (MacDonald et al., 2024). The Career Mentoring Program aims to create a sustainable culture of support that benefits all students while providing benefits for those historically excluded from STEM pathways.

Collectively, this body of literature provides strong empirical and theoretical support for our approach. It affirms the value of developmental networks, reflective practices, and structured mentoring in advancing student success and promoting institutional equity. By addressing both cognitive and affective dimensions of learning, these initiatives offer a holistic mentoring experience that is responsive to the evolving needs of today's diverse student populations.

Method

Program Design

The ÉLITE Career Mentoring Program was developed using a developmental network framework, which emphasizes the value of multiple sources of mentorship, including faculty and professionals, and different mentorship strategies. The program aimed to enhance student career exploration, decision-making, and professional identity formation. Central to the program's mission is the promotion of student success through the cultivation of professional growth, interdisciplinary connections, and a supportive environment in which students feel empowered to articulate and pursue their career aspirations.

Participants

Participants included 35.3% junior and 64.7% senior undergraduate students enrolled in the Biochemistry major. The program engaged a total of 22 students across two cohorts during consecutive fall semesters, each lasting 12 weeks. Approximately 50% of participants identified as Hispanic, American Indian, or from other historically underrepresented backgrounds in STEM. Speaker Mentors were drawn from a diverse pool, including departmental faculty, Biochemistry alumni, and professionals affiliated with the Biochemistry and Molecular Biology Department. These mentors were available for guidance and support throughout the duration of the program.

Procedures

The ÉLITE Career Mentoring Program integrated a series of in-person weekly seminars designed to provide students with exposure to a broad range of career pathways within and beyond biochemistry. These interactive sessions featured mentor speakers who shared insights into academic, research, entrepreneurial, and non-traditional careers, while

also addressing topics such as career exploration, CV development, science communication, and professional networking. In addition, the sessions emphasized the development of communication and interpersonal skills essential for professional success.

Following each seminar, students completed reflective surveys to articulate how the session's content informed their career development. These reflections served as a mechanism for reinforcing learning, clarifying expectations, and fostering a growth-oriented mentoring environment. A key component of the program was the creation of individualized Career Development Plans. Students were guided in formulating SMART goals and articulating short-, medium-, and long-term career objectives. These plans were iteratively refined throughout the program based on feedback and new insights gained from mentoring interactions. The program culminated in oral presentations, during which students shared their revised career plans, highlighted transferable skills acquired, and reflected on their personal and professional growth. These presentations provided an opportunity for students to synthesize their learning and engage in peer-to-peer knowledge exchange.

Instruments

To evaluate the program's impact, both quantitative and qualitative data were collected:

- Career Readiness and Mentoring Impact Survey: A 4-Likert-scale survey administered at the end of the semester and one-year post-program. The survey assessed domains such as career reflection, access to support and resources, satisfaction, perceived impact, and confidence in career planning.
- Student Reflections: Reflections yielded qualitative data on engagement, relational dynamics, and perceived mentoring value, analyzed through thematic coding.
- Career Development Plans: Students submitted detailed plans outlining SMART

- goals, career timelines, and skills to develop.
- Data Analysis: Quantitative data were analyzed to determine the average rating score and standard deviation for each component. Qualitative data were analyzed using thematic analysis.

Results

Assessing the effectiveness of the Career Mentoring Program is crucial to ensuring its success and continuous improvement, as it provides valuable insights into the program's impact on students' professional development and career trajectories. To evaluate the effectiveness of the Career Mentoring Program, we employed a comprehensive assessment strategy that included weekly surveys to gauge each session's impact, a final survey to gather overall program feedback, and a follow-up survey administered one year after program completion. At the completion of the ÉLITE Career Mentoring Program, the students are requested to fill out a final survey to evaluate the mentoring activities, outcomes, and effectiveness. The response rate for this survey was 81%.

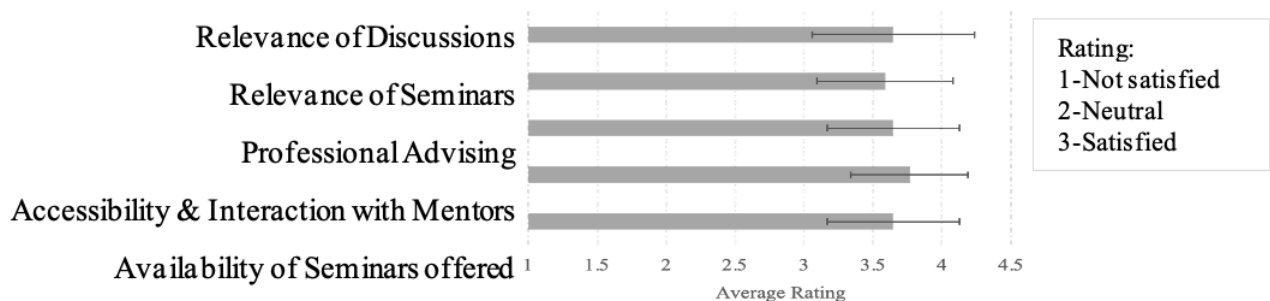
Mentoring Activities Satisfaction

Mentoring activities were evaluated based on: (1) accessibility and interaction with mentors, (2) satisfaction with professional advising received, (3) relevance of seminars and discussions, (4) availability of seminars offered, and (5) post-seminar mentor engagement. A total of 59% of participants reported being "very satisfied" with mentor accessibility and interaction, while 41% were "satisfied". Regarding satisfaction with professional advising, 65% were "very satisfied" and 35% were "satisfied". No participants selected "neutral" or "not satisfied" in either category (Figure 1). We had excellent participation in our mentoring seminars, with an average weekly attendance of 82%.

Additionally, all participants reported contacting

Figure 1.

Student Satisfaction Across Mentoring Program Components. The bar graph measures the students' satisfaction on a 4-point scale.



up to three mentors after attending the mentoring seminars. Overall, these results indicate that participants experienced the mentoring program as highly relevant and supportive, with particularly strong responses in areas of seminar content and professional advising.

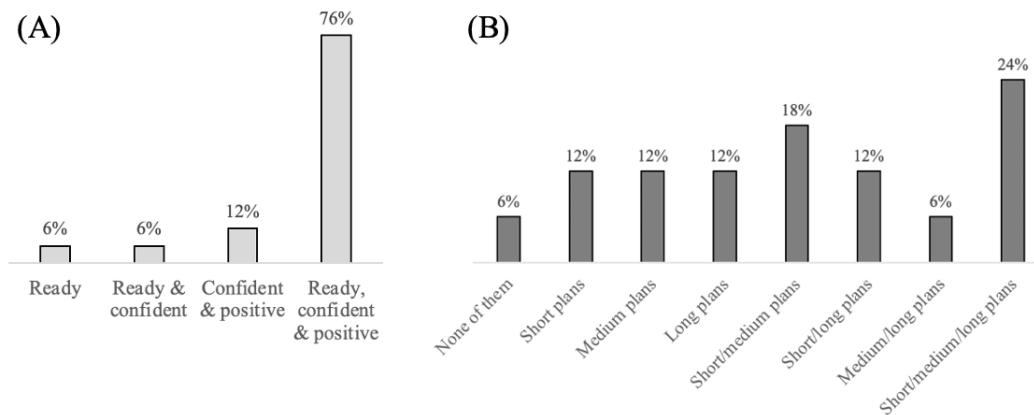
Program Impact

The program’s impact on students was assessed across four dimensions: (1) overall experience and likelihood of recommending the program to peers, (2) perceived benefits gained from participation, (3) effect on readiness, confidence, and positive outlook toward professional careers, and (4)

whether students adjusted their short-, medium-, or long-term career plans. Results indicated that 94% of participants rated their overall experience as “excellent”, 100% stated they would recommend the program to peers, and 76% of respondents strongly agreed and 24% agreed that the program was beneficial to their personal and professional development. In terms of professional preparation, 76% reported that the program helped them feel ready, confident, and positive about their future careers (Figure 2A). All participants adjusted or changed some part of their career plans after participating in the program (Figure 2B).

(A) The bar graph depicts the percentage of

Figure 2.
Career Mentoring Program’s Impact.



students who perceived the effectiveness of the program in enhancing students’ preparedness, confidence, and positive outlook regarding their future professional careers.

(B) The bar graph displays the percentage of students who reported modifying or redefining their short-, medium-, and/or long-term career plans following their participation in the program. All data were obtained from responses to the final program survey.

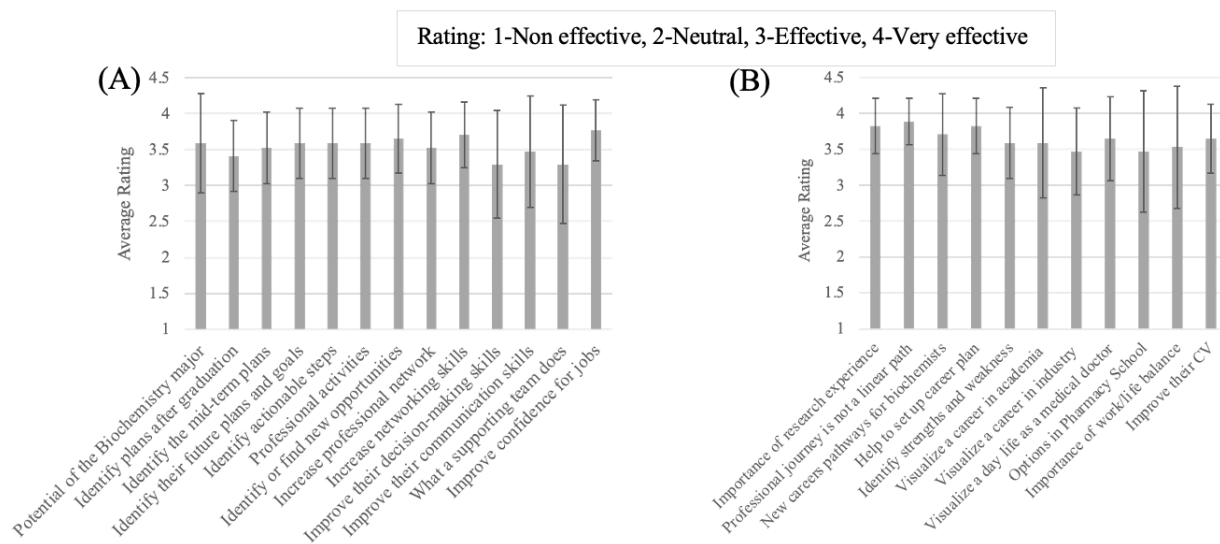
Program Outcomes

The ÉLITE Career Mentoring Program

demonstrated strong effectiveness in supporting students in achieving their individual career goals. As shown in Figure 3A, all participants rated the program as either “effective” or “very effective” in helping them progress toward these goals, including increased confidence, greater clarity in career direction, and enhanced networking skills. Additionally, Figure 3B illustrates the program’s positive impact across multiple dimensions of career development and exploration, such as creating a career plan, recognizing the value of research experiences, and understanding that professional pathways are often non-linear.

Figure 3.

Outcomes of the Career Mentoring Program. (A) The chart evaluates the extent to which the program supported students in achieving their individual goals. (B) The chart assesses the program's impact on different dimensions of students' career development and exploration.



One-Year Follow-Up

A one-year post-program survey was conducted to assess its impact. All respondents reported continuing their education, with many advancing in their majors, enrolling in professional schools (including medical and graduate schools), or securing positions within the biochemistry field. Among them, 79% engaged in research projects, 37% received academic awards, and 58% maintained ongoing relationships with mentors. Additionally, 42% participated in mentorship programs, clubs, or professional networks, with several holding leadership roles in organizations such as the ASBMB Student Chapter, the Neuropsychology Organization, and the Premedical Society. Alumni responses indicated that the program made strong perceived contributions to their confidence, peer and professional engagement, and overall professional and personal development. Alumni reflections identified five specific areas of positive impact: (1) discovering the potential of a biochemistry major, (2) improved networking skills, (3) greater confidence in applying to professional schools or job opportunities, (4) clearer and more mature career goals, and (5) enhanced decision-making abilities.

Discussion

The results of this study underscore the impact of the Career Mentoring Program on undergraduate biochemistry students' academic development, professional readiness, and short-term career

planning. The high levels of satisfaction with both mentor accessibility and professional advising, 100% of students reported being either "satisfied" or "very satisfied," mirror prior findings that emphasize the value of structured mentorship in fostering student engagement and development (Byars-Winston & Rogers, 2019).

Importantly, the finding that all participants contacted mentors after seminar sessions reflects strong mentor-mentee rapport and program integration. This aligns with the developmental networks framework, which emphasizes the importance of multiple mentoring connections across diverse contexts (Higgins & Kram, 2001). The program's effectiveness in encouraging students to refine or adjust their career plans illustrates the influence of intentional reflection and structured goal-setting, key elements of social cognitive career theory (Lent et al., 2002).

The one-year follow-up revealed an important impact on alumni success: 100% continued in education or professional engagement, and 79% participated in research. These outcomes not only confirm the program's academic and professional efficacy but also suggest it nurtures attributes that are critical for persistence in STEM—confidence, clarity of goals, and community connection (Estrada et al., 2018). The fact that 58% of alumni maintain ongoing relationships with their mentors suggests that the program has successfully fostered a sustained culture of mentorship, amplified its impact, and reinforced the role of mentoring as a catalyst for systemic transformation.

Despite its strengths, this study is limited by

its single-department scope and reliance on some self-reported data and a short, one-year evaluation window. Future research should adopt longitudinal, mixed-method designs to better assess long-term impacts and scalability. For effective and equitable mentoring, programs must be embedded in departmental culture, supported institutionally, and regularly evaluated. Integrating career mentoring into the curriculum, particularly at underrepresented-serving institutions, can help close opportunity gaps and promote inclusive excellence in education.

Conclusion

This study demonstrates the transformative impact of structured, career-focused mentoring programs, such as our Career Mentoring Program, on biochemistry undergraduates, particularly those from underrepresented backgrounds. The program significantly enhances students' professional readiness, confidence, and ability to make informed academic and career decisions. Students reported overwhelmingly positive experiences, with 100% indicating they would recommend the program to peers, and many making meaningful adjustments to their career plans as a result. The program supports students at a pivotal stage in their development (junior and senior undergraduate level), fostering clarity, resilience, and preparedness. It provides access to professional mentors and career development seminars, enriching students' networking skills and strengthening their sense of professional identity.

Beyond individual success, structured developmental mentoring programs play a pivotal role in promoting institutional inclusivity and cultivating a culture of mentorship, particularly within Hispanic-Serving Institutions. By embedding these programs into undergraduate curricula and ensuring sustained resources and culturally responsive mentor training, institutions can advance equity in education, close opportunity gaps, and strengthen diverse STEM communities. Looking ahead, the integration of developmental mentoring networks as a high-impact practice holds significant promise: empowering students to achieve academic and professional success, fostering leadership and confidence beyond the classroom, and enhancing mentor-mentee relationships. To ensure effectiveness and scalability, policies must support ongoing engagement and implement longitudinal evaluations.

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