

Abstract

There is clearly a retention issue in science, technology, engineering, and math (STEM) for underrepresented groups (Estrada et al., 2016; Sithole et al., 2017). Although students leave STEM for many reasons (Bonous-Harmmath, 2000; Estrada et al., 2016; Gasiewski et al., 2012; Hurtado et al. 2011), one underlying and well documented cause is lack of attention to effective mentoring and student well-being, especially in graduate school (Becker et al., 2002). The paper presents a National Science Foundation sponsored mentoring program that prepares graduate students to become effective mentors while simultaneously providing them the necessary tools to advocate for themselves as mentees. In addition to mentoring, the program emphasizes the importance of mental and physical well-being. Evaluation results conclude that the program has improved students' sense of belonging on campus and provided them with support for navigating graduate school and socializing into careers.

A Structured Mentoring Program Addressing Graduate Student Challenges, Well-Being and Success

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There is clearly a retention issue in science, technology, engineering, and math (STEM) for underrepresented groups (Estrada et al., 2016; Sithole et al., 2017). Although students leave STEM for many reasons (Bonous-Harmmath, 2000; Estrada et al., 2016; Gasiewski et al., 2012; Hurtado et al. 2011), one underlying and well documented cause is lack of attention to effective mentoring and student well-being, especially in graduate school (Becker et al., 2002). Students who do not feel as if they belong in graduate school are more likely to leave as are students who are unable to develop a trusting, supportive relationship with faculty (Estrada et al., 2016; Wilson et al., 2015). Mentoring For Life (M4L) is an NSF funded program that reimagines what it looks like to mentor STEM graduate students for success. Grounded in graduate student socialization (Weidman et al., 2001) and social cognitive career theories (Lent et al., 2002), M4L is designed to provide graduate students with the tools and resources needed to advocate for themselves as mentees, become effective mentors, and sustain good mental health and well-being. By equipping graduate students with the tools they need to maintain or improve their well-being, advocate for themselves as mentees, and develop into effective mentors, the program strives to change how future generations of STEM students will experience mentoring in STEM fields.

Mentoring

Mentoring is based on the rationale that more experienced individuals can assist the less experienced in transitions, be that graduate school or learning in the context of a new discipline. Retrospective studies have shown that mentoring is beneficial across all of the stages of

socialization. For example, students who receive mentoring tend to be more engaged with faculty and institutions than those who are not mentored (Atkinson et al. 1991; Clark et al., 2000; Dixon-Reeves, 2003; Tenenbaum et al., 2001). This appears to be especially true for students in STEM (Davidson & Foster-Johnson, 2001; Tenenbaum et al., 2001). STEM students who engage in effective mentoring relationships perform better academically (Kendricks, et al. 2013) and have greater sense of belonging, academic self-efficacy (Apriceno et al., 2020) and scientific identity (Atkins et al., 2020).

Mentoring comes in many forms. Academic and instrumental mentoring are the most common forms of mentoring provided to STEM students by traditional advisors (e.g., Byars-Winston et al., 2020). Academic mentoring (e.g. assistance with assignments) focuses on the relationship between the mentee and schooling, and explicitly on success in the academic setting. Instrumental mentoring moves beyond the classroom and focuses on career success, and might include assistance with resumes, opportunities to present work in professional meetings, and advice about the job search. Although academic and instrumental mentoring are important, scholars increasingly identify psychosocial mentoring as vital for retention, persistence and success of diverse students (Gasiewski et al., 2012; Griffin, 2013).

Psychosocial mentoring focuses on the individual needs of diverse mentees. A psychosocial mentor shows concern for the mentee's life or recognizes when emotional needs may override academic needs. Underrepresented students often need more psychosocial mentoring than majority students, especially where academic settings are primarily white, male, and middle-class (Blickenstaff, 2005; Gasiewski et al., 2012). Underrepresented students report a sense of not fitting in, sexual and racial harassment, and experiences with microaggressions within STEM departments and the larger college community more than their white counterparts. (Burt et al., 2018; Burt et al., 2016; Williams & Williams-Morris, 2010). Thus, psychosocial mentoring is essential for keeping underrepresented students in STEM fields.

Graduate Students' Well-Being

The importance of student well-being for graduate student success is evidenced by a growing mental health crisis among today's graduate students (Hyun et al., 2007; Turner & Berry, 2000). In a recent study, as many as 40% of graduate students reported negative emotional well-being; this rate is six times that of the general population (Pain, 2018). The structure of graduate school, including stressful courses and work expectations, can exacerbate emotional well-being (Hyun et al. 2007; Kausar, 2010). Graduate school norms, including work-life conflict, isolation, academic work, finances, graduate assistantships, jobs, and funding, have been identified as causing stress among graduate students (Grady, et. al., 2014; Oswalt, 2007). Graduate school is also often emotionally, psychologically and physically taxing (Djokic & Lounis, 2012). For many very bright students, graduate school can also be the first experience with academic challenges that invoke stress, anxiety and depression (Djokic & Lounis, 2012). In turn, a decline in well-being can impact graduate students' academic performance, retention and graduation rates. Current research suggests that cognitive-behavior interactions – negative thoughts associated with important relationships like that of an advisor and a graduate student – are at the core of most students' anxiety (Mahmoud et al., 2015). Graduate students rely heavily on academic advisors/mentors, and this relationship plays a large role in student success (Rosenthal et al., 2006). Students who have a negative advisor relationship are increasingly susceptible to stress

and anxiety (Rosenthal et al., 2006). Thus, effective mentoring becomes an important tool to decrease declining well-being.

Conceptual Framework

Graduate Student Socialization and Social Cognitive Career Theory

Socialization in graduate school refers to the processes through which individuals gain the knowledge, skills and values necessary to successfully move through graduate programs and enter into professional careers. Grounded in theories of professional and undergraduate student socialization (Tierney & Rhoades, 1994; Weidman & Stein, 2003; Weidman, 1989; Van Maanen & Schein 1979), theories of graduate student socialization argue that 1) socialization is developmental and changes across a graduate career; and 2) socialization is linked to the development of identity and commitment to a discipline (Liddell et al., 2014). Graduate school socialization occurs in four primary stages (Weideman et al., 2001). Regardless of the stage, socialization primarily occurs through mentoring:

- (1) *Anticipatory*: occurs primarily when students first enter a graduate program and need to learn new roles. Students become aware of behavioral, attitudinal and cognitive expectations of the program. Adaption to these expectations are necessary for students to become integrated and successful in graduate school.
- (2) *Formal*: occurs within the training context. Students observe and are given formal instruction about the knowledge one must have to successfully integrate into the profession;
- (3) *Informal*: occurs as students move through professional spaces, such as conferences. Students learn of the informal expectations in the field through behavioral cues and observed acceptable behavior; and
- (4) *Personal*: occurs later in the graduate career. Students accept their new role as members of a profession, letting go of any old ways of being that are misaligned with professional or graduate school expectations.

Social Cognitive Career Theory (SCCT) provides a framework for understanding career development (Lent et al., 2002). SCCT posits that personal, social and environmental factors have an influence on learning as well as on an individuals' motivation, affect and behavioral responses (Lent et al., 2002). SCCT suggests that students' career interests and choices are an outcome of personal and social influencers, including their perceptions of their ability to succeed in performing a given task and achieving desired outcomes and goals (Lent et al., 2002). SCCT therefore provides the framework through which we can make predictions about the impact of M4L on students.

Mentoring 4 Life

Mentoring 4 Life (M4L) is an NSF-funded, co-curricular academic program that helps graduate students from a variety of STEM-based disciplines understand how to take control of their own mentoring experiences, engage in effective mentoring practices, and embark on successful careers where they mentor others as well as advocate for themselves as mentees in professional mentoring relationships. In addition to focusing on mentoring, M4L's participants engage in reflective activities that focus on their mental health and well-being. Graduate school can be an incredibly stressful time (McCauley & Hinojosa, 2020). M4L provides students with resources and coping skills to help them manage their stress (Rosenthal et al., 2021), persist toward

graduation (Oducado et al., 2021), and learn how to manage a successful career in their discipline (Pyhältö et al., 2012) to eventually serve as mentors themselves.

The program offers three components spread evenly over two academic semesters: (1) Six skill-based, interactive workshops focused on career-development and mentoring; (2) Small Growth Group meetings every two weeks which allows students to reflect on workshop content and focus on their mental health and well-being; and (3) One-on-one mentoring with a professional in their chosen field. Students who actively engage in all three components of the program earn a Graduate School endorsed micro-credential archived in Credly.

A. Mentoring Workshops. Workshops focus on the *formal stage* of graduate student socialization. Each workshop is approximately two hours and facilitated by someone with extensive expertise in the subject matter. Three workshops are conducted in the Fall and three in Spring semesters. Workshops generally consisted of a brief introduction to the topic through lecture or discussion, group activities, and opportunities for participants to practice new skills.

1. **Student Services:** This workshop reviews the array of student services available to graduate students on most college campuses and how those services can contribute to STEM graduate student success. In the workshop students work together to identify services on their campus that specifically address the needs of STEM students. They conclude by discussing how mentorship can help students value and utilize these institutional services.
2. **Emotional Well-Being:** The workshop discusses the epidemic of poor wellbeing in graduate school and the stigma associated with it. Students learn: 1) how to identify when they or someone else are struggling emotionally; 2) a common language to utilize when discussing emotions; and 3) resources on campus to support wellbeing.
3. **Self-Awareness:** Students reflect on their own mentoring and well-being needs. Through interactive activities, Students explore how self-reflection (Who am I?; How do I behave?; How do I see myself?; How do others see me?) may impact how they are viewed as a mentee and a mentor. Students also learn about unconscious bias and creating new relationships.
4. **Mentoring Plans:** Fellows will create a detailed mentoring plan that outlines knowledge and resources needed for them to develop effective mentoring relationships. Fellows will also develop a workbook to use with mentees as they build mentoring relationships.
5. **STEM Careers:** Students interact with a diverse group of panelists from different workforce sectors (academic, industry, government, etc.). Panelists share their experiences as mentors and mentees and will also participate in the networking workshop.
6. **Networking:** Students will learn how to connect with a mentor and conduct informational interviews. The workshop covers norms of STEM networking in multiple settings (e.g. conferences, job fairs, etc.); communication etiquette; professional boundaries; and social media.

B. Growth Groups. Growth Groups provide opportunities for students to engage in the *informal* and *personal stages* of graduate student socialization. A Growth Group is a space where the members explore and develop interpersonal communication skills, personal goals related to self and others, and assessment of personal values (Masson & Jacobs, 1980). Highly utilized in fields such as counseling, social work and psychology, growth groups have been found to foster a sense of belonging and to create a climate that supports individual growth (Corey & Corey, 2006). Individuals participating in growth groups report an increase in personal self-awareness

and understanding of the risk-taking behavior some students may engage in when needs are not being met (Zhu, 2018). Some of the key growth factors reviewed for group members include vicarious modeling where participants' witness and learn from other member behaviors and experiences; universality, through recognizing shared similarities of experience across members; validation and acceptance having value as a member of the group; facilitator interventions that are helpful for personal growth and awareness; and conflict resolution that can help build transferable skills in dealing with conflict outside the group (Kiweewa et al., 2013).

M4L students meet in growth groups for one hour twice a month during Fall and Winter semester. The Growth Groups are designed and facilitated by a licensed professional counselor with experience in graduate student support groups. Growth groups focus on developing peer support networks that have been shown to be effective for addressing emotional well-being (Marcotte & Levesque, 2018)

C. One-On-One Mentoring Participants are paired with a professional currently working in the participant's field of interest for three mentorship sessions in the Winter semester. The M4L team reviews each participant's application and academic/professional interests in the Fall semester in order to determine what each participant would benefit from in a Mentorship pairing. Those themes are taken to the M4L administration team, and the administration team solicits professional networks to find mentors. Mentors are given a small stipend for their participation

Methods

Over 100 students from a variety of racial, ethnic, cultural, and disciplinary backgrounds have participated in M4L since its inception in 2019. Participants completed a pre-survey at the start of the program as well as a post-survey at the end of the program (nine months later). In addition, each workshop was evaluated through observation and post-workshop surveys containing Likert-type items and open-ended prompts. Workshop surveys provided insight into participant perspectives in individual components with observations used as secondary support for findings. Pre/post survey responses were analyzed via descriptive statistics and nonparametric means comparisons.

Results

Evaluation evidences the impacts of workshops and growth groups on students as well as the overall benefits of M4L as a program. We provide below a general overview of evaluation findings in the context of M4L components and related to graduate students' sense of belonging, socialization, and career trajectories.

Workshops and Growth Groups

In general, all workshops were well-received and viewed as impactful by students as they navigated mentoring relationships. For all workshops, Likert-type questions asked participants to rate workshop components as well as the overall workshop. Ratings ranged from 1 (very poor) to 4 (very good). As an example, Table 1 provides average rating for workshop content and overall for workshops conducted in the 2020-21 academic year. Findings for the 2021-22 year of M4L are similar. Overall, participants found both the workshop content and the workshop overall to be good to very good.

Table 1. Averages and standard deviations for workshops (2020-21).

	Average ± S.D.
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Item	Career Mentoring	Networking	Emotional Wellbeing	Mentoring Plan	Self-Awareness	Student Support Services
Content	3.71 ± .61	4.00	3.4 ± .63	3.74 ± .45	3.56 ± .51	3.78 ± .42
Overall workshop	3.57 ± .65	3.77 ± .44	3.27 ± .80	3.37 ± .60	3.38 ± .58	3.59 ± .57

Written responses to open-ended prompts provided deeper insight into participants' experiences. Participants indicated that:

- 1) M4L provided knowledge vital for participants' own success as well as success in mentoring others. For examples:
 - *I did not know that EMU had so many services...I can now better help my students who may find some of the services important or helpful.*
 - *I learned more about student services and can now direct a student to the appropriate office when in need of help.*
 - *The main takeaway for me during this workshop was learning about...different types of mentoring...as well as learning what types of mentoring I was better at than others. I also learned that it is ok for mentors not to know everything and every mentee should be mentored with a personal mentoring plan catered to them individually.*
- 2) Participants gained new recognition of, or reinforced existing knowledge of, the importance of different aspects of mentoring in future career success.
 - *I didn't know how important networking is. This was a very helpful session!*
 - *Reestablished the idea that success comes from mentoring, and that mentoring is important for the future of your field.*
 - *My take away was that having goals and a plan to achieve those goals are key to a successful mentoring relationship.*
- 3) Growth Groups and one-on-one mentoring experiences were particularly impactful against the background of workshops. Growth Groups provided a vital opportunity to build connections with other graduate students and voice difficulties, particularly during the 2020-2021 virtual pandemic year. In particular, Growth Groups offered a space for participants to build trust with other students, share challenges and opportunities, and build supportive relationships vital for student success. As one student put it: *This group offer[ed] a level intimacy and understanding that I never experienced in such [a] setting. I really appreciate that.* One-on-one interactions with professionals provided insight into work and careers not typically available within graduate programs. These impacts are detailed further below.

Benefits of M4L

Participants were overall positive about their M4L experiences. Analysis of aggregate pre/post results from the first two years of M4L is ongoing with initial data suggesting increases in many constructs, including sense of belonging and discipline self-efficacy. Open-ended post-program responses reinforced individual workshop evaluation findings and provided insight into the impacts of M4L as a whole. In particular, participants identified three particularly valuable program aspects:

- 1) Relationship-Building. M4L offered an opportunity for graduate students to meet and connect with other students outside of their disciplines. The opportunity to share struggles and emotions helped many students recognize they were not alone and that being able to share vulnerabilities can be an important part of gaining confidence in a profession.
 - *The most impactful part was building the connections I did with the people in my growth group. I think we all communicated and got along really well. I felt like I fit it because a lot of us shared similar feelings with where we are in life. I think it put reality in perspective for me...I'm not the only one feeling the way I do!*
 - *I also was able to have conversations amongst other M4L members. It was nice knowing there's other people that have the same goals/challenges as me.*
 - *I felt like my feelings of graduate school as a whole were justified when I met with others who were experiencing similar challenges.*
 - *I felt like I built a connection with the people specifically in my growth group. Speaking to them every week and being vulnerable. I unexpectedly but gladly learned that im not alone and there are people that do in fact share my feelings in terms of academic/professional life*
- 2) Resource and Mentoring Expertise. Graduate students expressed valuable increases in their knowledge around navigating graduate school and becoming mentors themselves:
 - *I really enjoyed the seminars when we learned about self-awareness and different topics. I found those to be very helpful and insightful.*
 - *Workshop on EMU resources led me to reach out to the Dean of Student Services when a family crisis arose during the past semester. Without her help and the support of my professors, I would not have completed the semester (or mentorship program).*
- 3) Connecting with Mentors. Each M4L participant was paired with a professional (typically non-academic) with related interests. These mentors connected in real-time (in-person, video) and via email with participants answering questions, providing resources, and offering insight about careers. These connections surprised many participants:
 - *My mentor became a wonderful resource and a champion for me.*
 - *I was able to meet an amazing professional in my field which was unexpected.*
 - *My mentor was EXCELLENT! They let me know of a job opening and even sent the link to me in case I was interested in applying. I connected with my mentor multiple times and felt comfortable and accepted during each meeting. I really enjoyed getting to know my mentor!*

Conclusion

The M4L program combined knowledge- and skills-based workshops (academic mentoring) with small growth groups (psychosocial mentoring) and connections to career professionals (instrumental mentoring). This purposeful combination of knowledge sharing and relationship building provided diverse graduate students in STEM fields with skill sets they needed to gain a sense of belonging and support for navigating graduate school and socializing into careers.

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