Programmatic Mentoring:
Going Beyond Mentor/Protégé Pairs

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Introduction

For many years, federal and private agencies in the United States and beyond have funded training programs designed to help students from groups underrepresented in STEM fields succeed in their undergraduate and graduate studies and progress to the next level of their education. A major component of many of these programs is mentoring. In many cases, this mentoring is expected to be provided primarily by a principal investigator in the student's research lab or other designated individual with whom the student has regular contact. We would suggest, however, that in many cases there is, or could be, more mentoring occurring beyond the single mentor/protégé pair.

How "mentoring" is defined can vary considerably, and what is called mentoring can take many different forms (Girves et al., 2005). A common definition that incorporates the vast majority of what is termed "mentoring" classifies it as any relationship where someone (the mentor) provides advice or other assistance to another (the protégé) toward meeting their goals (usually academic or career goals) within a longer-term personal relationship where the mentor cares about the protégé's success (Van Emmerik, 2004). Thus, a number of relationships are included, such as those between peers who provide each other with mutual assistance. Other sources of assistance, such as impersonal advice provided by a lecturer or found on the web, are not mentoring.

Mentoring has been shown to be important in enhancing the likelihood that students will succeed in their STEM education and continue to pursue STEM careers (see Pfund et al., 2016, for an overview of the literature). Mentoring also can provide a wide range of other favorable behavioral, attitudinal, health-related, relational, motivational, and career outcomes (see Eby et al., 2009). The benefits of mentoring have been shown to be particularly important for students from underrepresented backgrounds who may not be able to draw upon their existing networks for support (Byars-Winston et al., 2015; Daley eta al., 2006; Thomas et al., 2007), especially if the mentor comes from a background similar to that of the protégé (Figueroa & Rodriguez, 2015).

The bulk of research on mentoring has focused on the effect of individual mentoring relationships, i.e., the impact of single mentors on single protégés. While the importance of these relationships cannot be overstated, individual mentors' knowledge is limited. Because of this, the gaps in their knowledge may limit their ability to provide the whole scope of support that protégés may need to be as successful as they are capable of being in their pursuit of STEM education and careers (DeCastro et al., 2013; Johnson & Huwe, 2002). Moreover, there is significant variation in the mentoring skills possessed by different mentors. Because of this, protégés often have to seek support from sources other than the person designated as their mentor.

In 1985, Kram introduced the concept of developmental relationships. She defined these as relationships that contribute to individual growth and career advancement and saw mentoring as one example of such (Kram, 1985). Developmental relationships can be held with many different people, and individuals can have multiple concurrent relationships. Among these, peer relationships were seen as particularly important as alternatives to traditional mentoring (Kram & Isabella, 1985; Allen & Finkelstein, 2003). Using developmental relationships as a starting point, the idea of what mentoring can be has expanded, moving from the examination of only traditional

mentor/protégé dyads to include multiple developmental relationships that may extend beyond functional, organizational, and geographic boundaries (Debrow et al., 2012; Whiting & de Jansz, 2004).

Within their network of developmental relationships, individuals may have several people who fill the role of mentors, and the people who fill these roles can vary at the different stages of individuals' progressions through their careers or education (Peluchette & Jeanquart, 2000). Research by Van Emmerik (2004) suggests that the size and range of the network providing mentoring is associated with greater impacts on success, with more and more in-depth mentoring yielding better results.

Many training programs have, either purposefully or through happenstance, created situations where mentoring is provided by multiple sources within the context of the program. We call this situation "programmatic mentoring," and believe that the purposeful installation of programmatic mentoring has the potential to more comprehensively provide students with the assistance they need to succeed rather than relying on traditional mentor/protégé pairs.

A Definition of Programmatic Mentoring

We have observed aspects of programmatic mentoring at numerous institutions we have worked with over the years.[1] A common path to its development has been the incorporation of new interventions over time that involve adopting or adapting practices that increase opportunities for students to experience mentoring in many forms. In this paper, we suggest that programmatic mentoring can be a deliberate construct. Building on our preliminary research into how programmatic mentoring has manifested at San Francisco State University (SFSU), we suggest the following as key components of programmatic mentoring:

1) There must be sense of mutual trust between the students and the program. The program needs students to meet the success goals it has laid out to maintain funding, and in turn the students agree to meet these goals in exchange for support. Through this understanding, the participants in the program develop the trust that mentoring will be given and received when it is given.

2) There must be numerous opportunities to receive mentoring that are built into the program experience. Program-sponsored mentoring cannot occur in only one circumstance such as within the research labs, but should instead be incorporated into a range of experiences and activities.

3) The individuals providing mentoring must buy into a set of common goals, usually the success goals of the program.

4) Because of these common goals, the mentoring provided by the different people is synergistic.

5) There is an expectation in the community created by the program that all members will act as mentors at some point, including students.

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[1] Much of this work was initiated as part of the NIH MORE Research and Evaluation of Students Using Long-Term Studies, NIH grant RFAGM-03-011, an R0–1 research grant from the National Institutes of Health to examine the efficacy of various NIH-funded programs for the support of underrepresented minority (URM) students at three different institutions: California State University Los Angeles, New Mexico State University, and San Francisco State University.

6) The mentoring opportunities continue beyond the time in which the student is actually funded by the program.

Below we describe how we have experienced programmatic mentoring at a single institution, San Francisco State University, and what we think are its outcomes. Having observed other institutions that also make use of programmatic mentoring or something very similar, at the end of this Letter we suggest a research agenda for developing a broader understanding of this model.

Programmatic Mentoring at San Francisco State University

At San Francisco State University, programmatic mentoring, which may include coaching and advising (Sorkness et al., 2017; Williams et al., 2016a; Williams et al., 2016b; Williams et al., 2017), occurs within the context of a group of programs funded by NIH[2] and other federal and private funds. These programs support underrepresented students at the undergraduate and master's degree levels with paid research experiences and other academic and social opportunities. The programs are collectively coordinated by the Student Enrichment Opportunities (SEO) office, a single organization created on campus by combining funds from various grants over time, and share the common goal of enhancing the students' likelihood of earning PhDs and successfully pursuing biomedical research careers. Because they are managed together, students can move between one program and another, allowing for continuity of support often beyond the two years typically allowed by individual grants. Moreover, the mentoring relationships developed within a specific program extend through the academic career of the student. And because the programs share a common purpose, the mentoring also has the goal of helping the students progress toward their doctoral degrees.

Mentoring is built into the program experience in a number of places. It begins at the time of recruitment when students come into the SEO office for an interview. There they meet with the program director and discuss not only whether or not they are a good fit for the program, but also what their ambitions are, what their options are for achieving their ambitions, and identifying what other opportunities are available to them. As the program director seeks to get to know the student, s/he tries to provide the direction the student needs, even if that does not ultimately result in program admittance.

From there, accepted students are enrolled in a program. They become part of a research lab, become immersed in their major, and take part in weekly program-specific meetings. At this stage, mentoring occurs in many forms beyond that provided by the research advisor. In the lab, mentoring may not only be provided by the principal investigator but also by other scientists and fellow student researchers, both at the graduate and undergraduate level. Mentoring may occur in the classes, both from professors and fellow students, many of whom are also in a program. Finally, in the program-specific meetings, the students receive mentoring from the meeting leader on future educational and career options, but they may also receive mentoring from faculty recruiters from other schools and their fellow students who have already gone through what they are currently experiencing. Although the program only assigns relationships with research advisors, other relationships are strongly encouraged and more experienced students are expected to act as mentors for newer ones.

As the students approach the end of their undergraduate years, mentoring about next steps increases. This comes from research advisors, program directors, professors, and other students. It also occurs as students attend research conferences and meet representatives from other campuses, meetings that are often facilitated by the program directors. In addition, it may come from program

[2] Within the National Institutes of Health, the most important source, these come from the National Institute of General Medical Sciences Training and Workforce Development grants.

alumni, many of whom continue to feel a connection to the program after graduation and who can inform the current students about their own experiences in pursuing their goals. Finally, as they near the end of their studies at SFSU, students are more likely to have accrued the experiences they need to successfully mentor their peers.

Mentoring continues into graduate school for those students who stay at SFSU to pursue a master's degree. Graduate students new to SFSU also enter the programs at this time and begin mentoring experiences akin to those of the undergraduate students.

Eventually, students graduate from SFSU and move on. This does not mean, however, an end to the mentoring they receive from SFSU. Many program alumni maintain connections with the program, and both program directors and research advisors often maintain communication with their former students, continuing to offer advice and support long after the student has left the institution.

Along with the changes in mentoring opportunities, we have observed that many students change their responses to mentoring. They develop an appreciation for the benefits they receive from these interactions and become more likely both to seek out and take advantage of additional mentoring opportunities. In addition, their realization of the value of mentoring leads them to take on mentoring roles themselves, passing along the benefits they received. This occurs at SFSU in their role as peer mentors and continues after graduation as they act as mentors to others while pursuing their careers.

Evidence that Programmatic Mentoring is Occurring

Much of the experience detailed above has been verified through surveys and focus groups of current and former students. Here we present a selection of these data, but for a more thorough description see Bayliss et al. (2018).

The data presented here come from surveys conducted between 2013 and 2017. To help understand the scope of the SEO programs, in the 2016-2017 academic year there were 34 undergraduate and 39 graduate participants across two undergraduate programs[3] and four graduate programs.[4] Undergraduate students typically started a program in their junior year and graduate students typically started at the beginning of their graduate studies, though some had previously been funded by programs at SFSU or other schools. All students were drawn from racial/ethnic groups traditionally underrepresented in the biomedical and behavioral sciences. Among the 49 students who provided racial/ethnic information on the annual survey for that academic year, 39% self-identified as being Hispanic, Latino, or Chicano, 22% as belonging to multiple races/ethnicities, 18% as being from various Asian groups including Filipino, Cambodian, Laotian, and Vietnamese, 16% as African American or Black, and 2% each as being American Indian/Native American and Native Hawaiian/Pacific Islander.

In addition to presenting data from current students, we also present data from a survey of program alumni in 2013 and 2017. The group invited to participate in the 2017 study consisted of over 1400 former SFSU students who had been funded by SEO programs, starting as early as 1992. The 2013 study included all of the same former students who had graduated prior to that year. Some of the prior SEO programs, now defunct, supported students who were not from underrepresented

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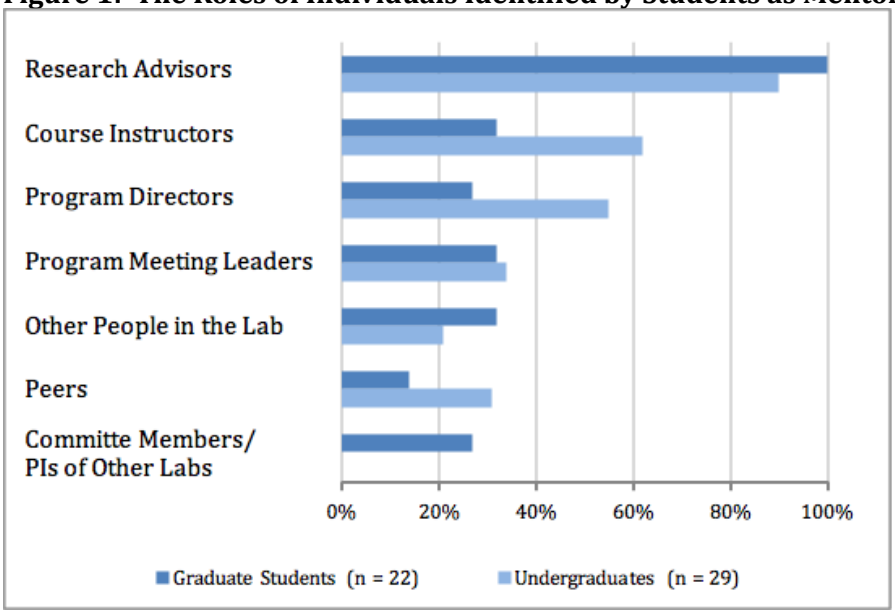
[3] The NIH-funded Maximizing Access to Research Careers: Undergraduate Student Training in Academic Research (MARC) and Research Initiative for Scientific Enhancement (RISE) programs.

[4] The NIH-funded Research Initiative for Scientific Enhancement (RISE) and Bridges to the Doctorate programs, the National Science Foundation-funded Science and Technology Center program, and the privately-funded Genentech Scholars program.

minority groups but who demonstrated need in some other way, making for an even more diverse sample than the current SEO population. Records of the race and ethnicity of those who were invited to participate are incomplete, but for the 864 for whom we do have data from institutional records, 33% were identified by SFSU as being Hispanic, Latino, or Chicano, 25% as being African American or Black, 15% as being White, 14% as being Pacific Islander (including Filipino), 6% as Asian, 3% as Southeast Asian, and 4% as American Indian or Native American. For an overview of the history of program funding at SFSU, see Bayliss et al., 2009.

These data provide initial evidence that students see themselves receiving mentoring from a variety of sources. In a survey specifically focused on the mentoring experience,[5] conducted with 51 of the 73 students in the program during the spring semester of 2017, SEO students were asked what roles the people who they saw as mentors filled. These were assigned to categories, as shown on Figure 1. Although most students identified their research advisors, a number of other individuals also filled that role. Of importance to our conception of programmatic mentoring were the substantial number who identified program directors, program meeting leaders, other people in the lab, and peers as mentors.

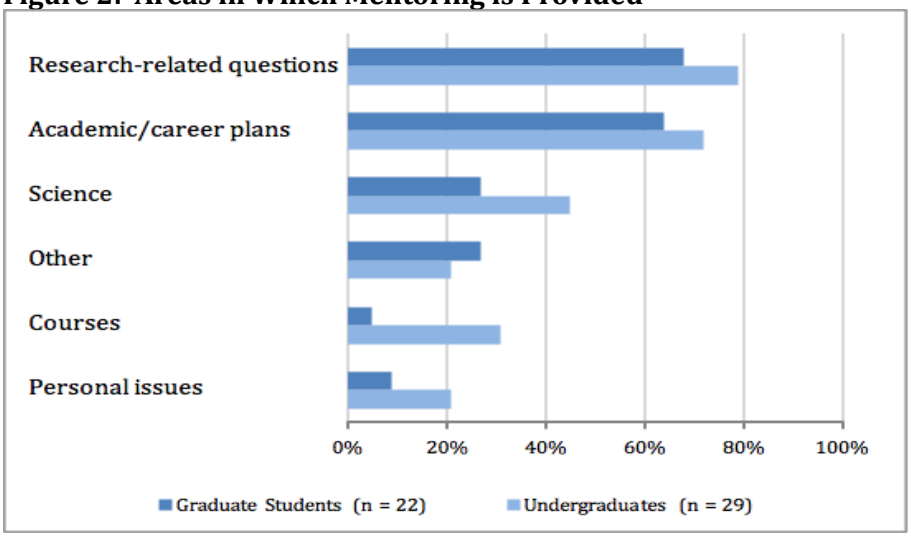
Figure 1: The Roles of Individuals Identified by Students as Mentors



On the same survey, the students identified the areas in which mentoring occurred, which were then categorized into a number of different areas (Figure 2). A lack of response does not necessarily indicate that mentoring was not available in an area; it may instead mean that the student did not require or desire that kind of mentoring or merely did not mention it.

[5] This survey can be accessed at http://sagefoxgroup.com/dev/wp-content/uploads/2018/08/Mentoring-and-Community-Survey.pdf.

Figure 2: Areas in Which Mentoring is Provided

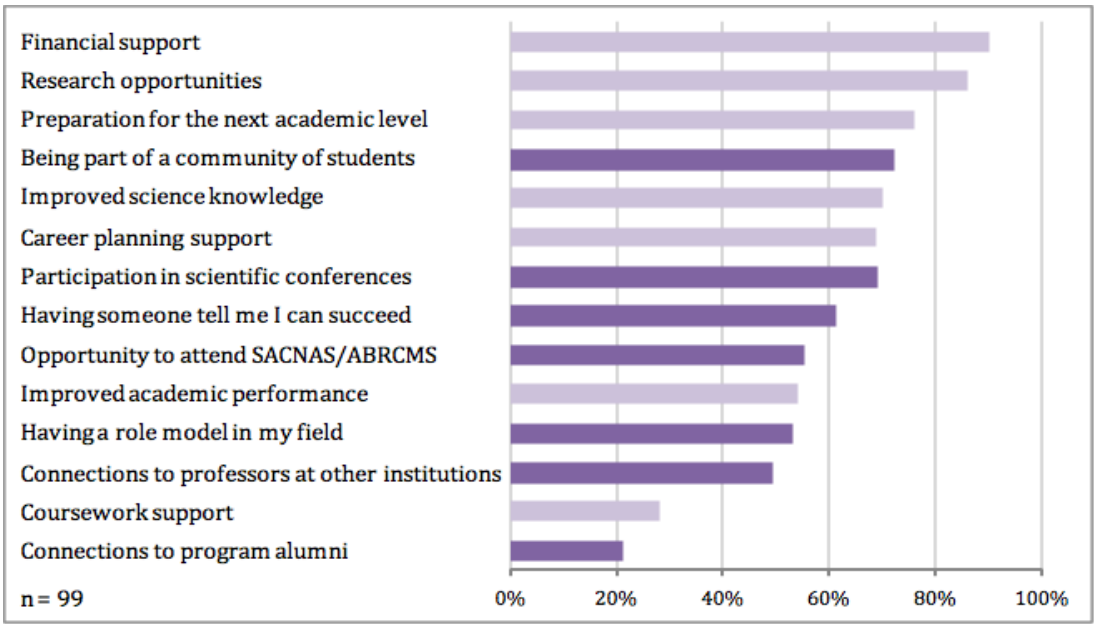


In the survey of program alumni given in the summer of 2013[6] and completed by 99 of the more than 1000 alumni at that time,[7] the respondents were asked on a checklist what benefits they received from participating in the program. Their responses are shown on Figure 3, with the responses we think are related to programmatic mentoring in a darker color. Although not all respondents checked all of the highlighted benefits, it is clear that being part of a community and having someone provide direct support were important aspects of the experience to most.

[6] This survey can be accessed at http://sagefoxgroup.com/dev/wp-content/uploads/2018/08/SFSU-Alumni-Survey-2013.pdf.

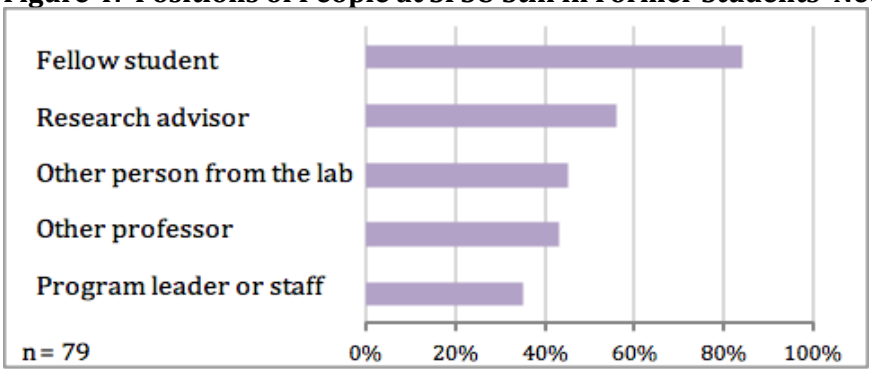
[7] We have always had difficulty getting high response rates on alumni surveys for a couple of reasons. First, we have not always been able to stay in touch with former students, and as they change email addresses and other contact information we can can no longer invite them to take surveys. Second, we do not have the budget to offer incentives so we are reliant entirely on their both noticing the survey invitation and feeling some interest in taking it. Because of this, it is never clear how representative the respondents are of the total population of alumni.

Figure 3: Benefits of Participating in SEO Programs, as Identified by Program Alumni[8]



There is also evidence from a more recent alumni survey given in 2017[9] that former students continue to include many of the people whom they met at SFSU in their STEM networks (Figure 4). The survey responses by 79 of the more than 1400 former students who were alumni at the time show that the majority still counted fellow students in their networks, as well as individuals from other positions.

Figure 4: Positions of People at SFSU Still in Former Students' Networks

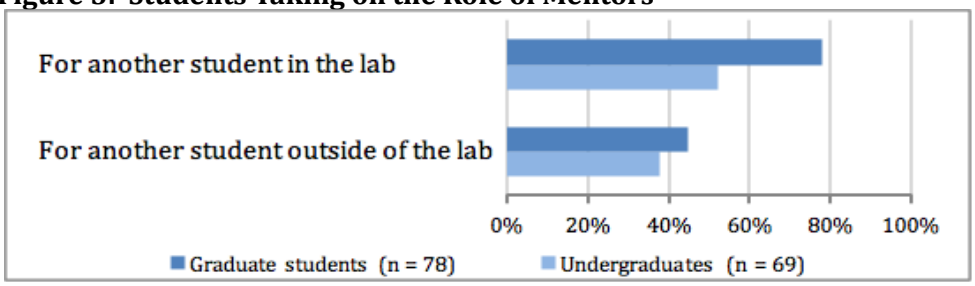


[8] For those unfamiliar with the acronyms, SACNAS refers to the Society for the Advancement of Chicanos/ Hispanics and Native Americans in Science and ABRCMS to the Annual Biomedical Research Conference for Minority Students. Both organizations host annual research conferences where students can present their work and network with scientists, recruiters, and students from other schools.

[9] This survey can be accessed at http://sagefoxgroup.com/dev/wp-content/uploads/2018/08/SFSU-Alumni-Feedback-Survey-2016.pdf.

Finally, from surveys given to current students in the spring semesters of 2015, 2016, and 2017,[10] we know that a number of students do take on the role of mentors, both within the lab and outside of it (Figure 5). These surveys were responded to by 46 of the 64 students supported by the program in 2015, 51 of the 62 supported in 2016, and 50 of the 73 supported in 2017, and then aggregated. Unsurprisingly, mentoring is more commonly provided by students with more program experience.

Figure 5: Students Taking on the Role of Mentors



We thus have some compelling preliminary evidence that much of what we have described as programmatic mentoring does occur at SFSU in the SEO programs. Just as clearly, student mentoring experiences vary despite programmatic commitment to ensuring that all students have access to multiple sources of mentoring. This illustrates an important component of all mentoring —it cannot be forced but must be engaged in willingly by both parties. Investigating the details of the mentoring relationships and teasing apart what is actually occurring in each stage beckons for future research.

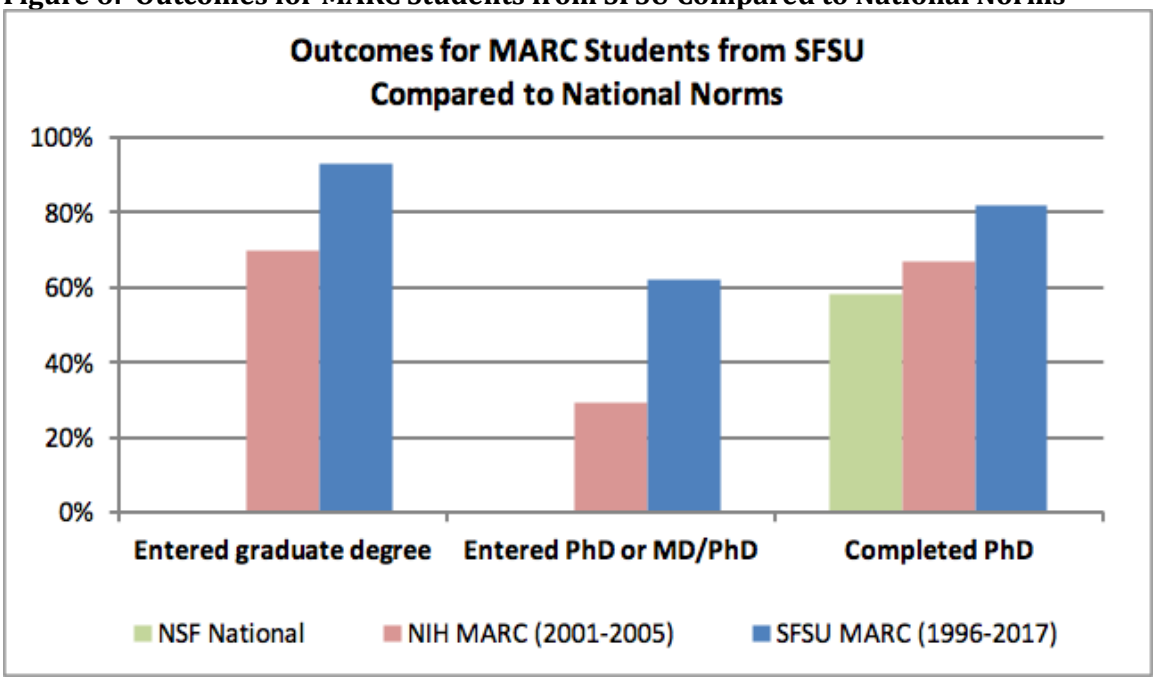
Evidence of the Benefits of Programmatic Mentoring

At this point, all evidence of the benefits of what we are calling programmatic mentoring is either anecdotal or indirect. In large part, this is because programmatic mentoring is only one of many aspects of the SEO programs at SFSU (again see Bayliss et al., 2009). Since all students in these programs experience both programmatic mentoring and other key program initiatives such as funded research experiences and program meetings, it is nearly impossible to tease out the effects of any one intervention without examining multiple training programs at different institutions—a subject for potential additional research.

What we can say with confidence is that the SEO programs at SFSU have been quite successful at helping funded students achieve the goals of the program (entering and finishing PhD degree programs in the biomedical sciences). From what others have found in their research, we believe that a major part of this success is attributable to programmatic mentoring. As an example of the SEO programs' success, Figure 6 compares the outcomes for the 142 undergraduate students funded by one of the programs at SFSU, NIH MARC, since 1996 to those from the national MARC norms as laid out by Hall et al. (2016) examining 1810 MARC alumni appointed between 2001 and 2005, and against national data for completion of PhDs from Jaschik (2008). The MARC outcome data reflect efforts impacted by programmatic mentoring. Unfortunately, similar outcome data at the national level are not yet available for the other SEO programs.

[10] This survey can be accessed at http://sagefoxgroup.com/dev/wp-content/uploads/2018/08/Student-Survey-Spring-2017-SFSU-SEO-Programs.pdf.

Figure 6: Outcomes for MARC Students from SFSU Compared to National Norms



Limitations of Programmatic Mentoring

With its focus on providing multiple avenues of mentoring support toward a particular program-based goal, we believe that programmatic mentoring is a highly effective way of achieving that goal. It is in large part responsible for why the SEO programs at SFSU have been able to surpass national norms for the production of PhD degrees among its graduates. This focus may, however, have a downside. What happens if a student comes into a program and decides that pursuing a PhD is not the right path for her/him, which appears to be the case for a substantial portion of the MARC students shown on Figure 6?

One answer is that the network created through programmatic mentoring does not have to provide assistance solely targeted toward achievement of the PhD, but can help students in their pursuit of other educational and career goals. While we know this occurs in some cases, it is also true that others feel pressured to stay on the PhD path and are not provided with much help toward other options.

This is a challenging issue. Programmatic mentoring is by its nature designed to assist protégés in meeting program goals, not goals at odds with them. Furthermore, funding agencies are generally opposed to providing money to students who have already made the decision to choose a path other than the stated goal of the program. As such, students who want to take a different path are often counseled to leave the program, thus depriving them of the continued benefits of program-sponsored mentoring. Moreover, the conflict between wanting to take the path better suited to them and the desire to retain funding, prevents many students with non-sanctioned goals from sharing their decisions, making it difficult for mentors to know that they should be providing a different kind of mentoring.

In the end, the great majority of students in the SEO programs do intend to continue to the next phase of their education and the mentoring provided is focused on assisting them in getting there. As such, we feel that the benefits of programmatic mentoring in helping students achieve this goal

outweigh the issues associated with providing less-than-optimal support to those who wish to take different paths.

Conditions

From our experiences at SFSU, there are a number of circumstances that we think may be necessary for programmatic mentoring to happen and happen efficaciously:

1) A shared programmatic focus or goal so that mentoring is aiming at something specific and shared.

2) Time for the culture of community-based mentoring to develop and spread across the individuals involved in the program.

3) Sufficient resources to support this mentoring, with a continuity of this support over time.

4) Support from the institution for mentoring of this sort.

5) A will on the part of the program leadership to make it happen.

6) A commitment on the part of the program leadership to continuous improvement.

Conclusions and Questions

In this Letter, we have described a model of programmatic mentoring and how that manifests at a single institution. This examination is only in its initial stages, and we have yet to look into the actual experiences of protégés and mentors to understand how programmatic mentoring affects individuals and how differences in what is experienced relate to differences in outcomes. We see this paper as an initial foray into this topic, one which merits serious research. As such, we propose a series of questions that would benefit the interventions community should research be undertaken to answer them.

1) *How is programmatic mentoring manifested at different institutions and how is it experienced by different students at these institutions?* Programmatic mentoring would not be expected to look the same in all places. There are undoubtedly differences in who the mentors are, how they are chosen, and what sorts of mentoring they provide, along with the extent to which the protégés make use of the offered mentoring and how that mentoring fits into the program context.

2) *How do differences in the experience of programmatic mentoring relate to differences in student outcomes?* Undoubtedly, even within a single program employing programmatic mentoring, some protégés will have different mentoring experiences than others. Do the differences in how mentoring is experienced lead to differences in outcomes? If so, what does this tell us about how programmatic mentoring should be implemented and sold to potential protégés?

3) *Do students become more adept at and motivated to avail themselves of mentoring opportunities over time?* As benefits accrue from successful mentoring relationships, are students more likely to seek out and take advantage of a multitude of mentoring opportunities? Does this create a more active consumer for programmatic mentoring? Does this result in students who are more likely to become mentors themselves?

4) *What is the role of community and how does it support individuals and help them succeed?* In programmatic mentoring, mentoring takes place in a broader community environment rather than in a single mentor/protégé pairing. What is the role of this broader community in what

mentoring is made available and taken advantage of, and what role does it have in ultimately supporting the individuals?

5) *How does successful programmatic mentoring affect faculty members and departments?* Student protégés are not the only people who might potentially benefit from programmatic mentoring. How does it impact the faculty members providing the mentoring (or receiving mentoring themselves)? How does its presence affect those who are not directly involved? How does it change the dynamics in the department as a whole?

6) *How does successful programmatic mentoring fit into building institutional capacity?* What effects does programmatic mentoring have at the institutional level? Does its presence allow an institution to accomplish things that it was not able to accomplish before? Does it help build the capacity to provide additional support to students?

7) *How can a successful programmatic mentoring model be transferred to other institutions?* What are the key components that make for successful programmatic mentoring, and how can those components be transferred to a different institutional context? Is it even possible to isolate a particular set of key components, or is what works so context-dependent that no clear best model emerges? On a different note, what structures need to be in place for programmatic mentoring to be adopted at a different institution?

There are certainly other questions of interest. We hope those above spark a deeper conversation around examining mentoring not merely as a pairing of one mentor with one protégé but as a greater, community-based effort.

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