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Recruitment Strategy Development for First Generation, Underrepresented, and Low-Income Masters Students

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Abstract

Recruitment and academic success at the Master of Science (MS) degree level is an often-overlooked line of inquiry. The Stellar Engineering Students Graduate Program Scholarship (SEnS GPS), a National Science Foundation S-STEM funded program at Boise State University, is beginning to bridge this gap in our knowledge of masters-level students. Boise State is a medium-sized, metropolitan, rural serving institution in the mountain west with a large population of typically underserved student groups.

SEnS GPS is investigating the experiences of computer science and engineering MS students from pre-decision and recruitment to graduation. This project is working to determine if best practices in the areas of recruitment, retention, and persistence to degree at the undergraduate level translate successfully to the MS level, looking specifically at low-income, academically talented, first-generation, and generally underrepresented students in the science, technology, engineering, and math (STEM) disciplines.

SEnS GPS is currently in its second year and has just graduated its first cohort of 10 students in May 2022. Sixteen students have participated in the program as scholars (scholars are defined as receiving NSF-sponsored scholarships) and 18 as general, non-scholar participants. All students received pre-decision and application mentoring, graduate program culture and expectations programming, cohort building activities, and staff support beyond the faculty advisor.

Initial research has identified the pre-recruitment process as a critical juncture for college students when deciding to pursue an MS degree in a STEM discipline. This paper will discuss research-based pre-recruitment strategy development and initial qualitative data related to strategy successes and challenges encountered in the program over the last two years. An overview of significant self-reported education progression decision-making factors gathered from college seniors, and current graduate students will also be discussed.

Introduction

The decision-making process surrounding enrollment in a STEM-based Master of Science (MS) degree program is multifaceted. It can be challenging, especially for students who identify as first-generation, academically talented, low income, or generally underrepresented in STEM fields. Due to the complexities of the pre-decision making process and perceived barriers to student degree attainment, many students enter the workforce after finishing an undergraduate degree instead of considering an MS degree.

In its efforts to increase competitiveness on a global scale, the US government has identified recruitment to and graduation from tertiary STEM programs to be critical [1]. Some of the most “untapped” populations to pursue MS degrees in STEM, and contribute to national innovation in STEM, are those who identify as first-generation, BIPOC, and women [1]. Black and Hispanic workers make up 27% of the US workforce, but only 13% of this group is part of the STEM workforce with a bachelor's degree or higher [2]. Many students who pursue science and engineering degrees leave STEM fields [3]. It has been shown that the likelihood of a person

staying in the field of engineering increases as education levels rise [3], so it can be posited that increased access to MS education will increase the number of workers who remain in a STEM field long-term.

While degree attainment beyond the bachelor's degree is growing, an MS degree is still considered “additional.” This means recruiting students into MS programs can be especially difficult. Students have many barriers to overcome but understanding these barriers, how to negate them, and receiving institutional support early on in an undergraduate’s career puts MS degrees on the table as an option for many underrepresented students. The SEnS GPS program explores all realms of the MS level experience. This paper will focus on MS student recruitment strategy development and supporting students in their decision-making process.

Framework

A simple search makes it apparent there have been few comprehensive pre-decision mentoring and recruitment strategies developed for MS programs. A review of available academic research reveals barriers to pursuing an MS program are prevalent and overlap significantly with barriers to entry for both undergraduate and doctoral students. Research and recruitment strategies focus on creating an undergraduate pipeline and then jumping directly to the Ph.D. pipeline. Programs such as the Meyerhoff Scholars program (MYS) at the University of Maryland [4] and the McNair Scholars Program at Boise State University are prime examples of pipelines to masters (MS) and Ph.D. work. Still, these programs are limited to small groups of students identified and targeted before they begin their first year of college. This leaves many students who would benefit from further education in the STEM fields without access to a support system.

MS terminal and Ph.D. terminal students usually have different motivations for continuing their studies. Ph.D. students are often motivated by academic or research-based career aspirations. In contrast, MS students are more likely to be focused on job training and an increase in pay or career level [5]. This means two similar support systems are required for each population, and institutions do not always have the resources to create two systems. While there is no formal research available, anecdotal evidence from faculty and professional staff interviews suggests several factors for the gap in recruitment at the MS level: (a) Faculty demand is low for MS students as faculty are more likely to be productive faster and for more extended periods working with a doctoral student; (b) most state institutions are focused on increasing undergraduate populations which has a direct correlation with state institutional funding; (c) Return on investment at the college level is lower for MS level students than Ph.D. level students due to the cost of funding an MS student and teaching MS courses relative to research output.

SEnS GPS defines the pre-decision timeframe as before a decision has been made to either enter the workforce or continue with post-secondary education beyond a bachelor's degree. Academic capital formation theory gives us a framework to plan our initial pre-decision recruitment strategy for MS-level STEM students. This theoretical area discusses barriers to progress and interventions which help first-generation, low-income, and students of color persist through obstacles. Academic capital is defined as “social processes that build family knowledge of educational and career options and support navigation through educational systems and professional organizations” [6]. St. John et al. argue that academic capital allows

underrepresented students to break down barriers to success and opens up opportunities they would not usually have access to in higher education [6].

Gardner [7] discusses barriers to attaining a degree beyond a bachelor’s, related to pre-decision strategy. These relevant barriers include: (a) not understanding the graduate college application and entry process; (b) a general knowledge gap of graduate life/culture and expectations of a graduate student, which causes hesitation; and (c) not understanding what support they need/will need, what support is available and how to access that support and having the academic capital to feel confident they will be “allowed” to access the support.

To address the barriers discussed by Gardner, St. John et al. [6] suggested there are four areas where interventions can take place to have the most significant impact: (a) financial aid guaranteed by the government or other trusted organizations to cover the cost of tuition or make the cost manageable; (b) trusted mentors, teachers, and community members transmit information about college and general entry processes which helps to ease fears about the higher education system; (c) academic preparation takes place and advanced courses are taken before college entry with family support, affirming a student’s, their teacher’s and their family’s knowledge of personal ability; (d) engaged learning helps students gain better self-understanding and leads to giving back to family, community, and society.

In addition to the guidance provided by St. John and colleagues, Espinoza’s [8] pivotal moments framework has also guided the SEnS GPS pre-decision strategy and helped build out the approach suggested by St. John et al. [6]. Espinoza states early and ongoing intrusive advising interventions, system navigation through academic and social support, encouraging institutional reforms, and making financial aid available are all pieces of pivotal, decision-making moments that will influence a student’s choice to attend college.

For a brief overview of the framework and its connection to recruitment strategy specific to SEnS GPS, the reader is referred to Table 1. These frameworks can be directly applied to MS-level students and their decision to attend graduate school. Still, they must be carefully navigated and significant attention paid to the cost-benefit analysis for students, particularly for low-income and first-generation students. Financial factors (income, debt, need to provide family support) and social factors (family, distance from home, pride in starting a career) must all be considered with the student as a partner, mainly a student who has or will soon be attaining their bachelor’s degree.

Table 1: Intervention Strategies Relative to Framework

Framework Area to Be Addressed	SEnS GPS Intervention / Strategy
(a) Financial aid and funding [7], [8]	<ul style="list-style-type: none"> • Scholarships for participants in the amount of \$10,000 [6], [7], [8] • Assistance applying for college, university, and industry-level scholarships. [6], [7], [8] • Goal of moving students from SENS GPS funding to assistantships [6], [7], [8]

(b1) Trusted mentors and trusted, timely information [7] (b2) Need to understand the graduate application and entry process [7] (b3) Understanding of support networks and their utilization [5]	<ul style="list-style-type: none"> • Program Coordinator / Advisor [7] • Sharing information early w/ stakeholders [7] • Creating faculty connections early [8] • Pre-decision, informal cohort [8] • Intrusive Advising [8]
(c1) Advanced academic preparation and acknowledgment of ability [7] (c2) General knowledge gap of graduate life/culture [5]	<ul style="list-style-type: none"> • Promotion of accelerated MS program [6] • Regular meetings with coordinator and faculty before decision [8]
(d) Engaged Learning [6]	<ul style="list-style-type: none"> • Connecting students with undergraduate research opportunities [6], [7] • Connecting students with faculty through student organizations [8] • Connecting BS to MS students early [6]

** Note: Interventions are described in more detail below.

Strategy

With these frameworks in mind, the following strategies were implemented as part of the SEnS GPS pre-decision strategy:

Program Overview

The Stellar Engineering Students Graduate Program Scholarship (SEnS GPS) is an NSF S-STEM funded project aimed at the recruitment, retention, and persistence of graduate students in STEM fields. SEnS GPS aims to recruit and support low-income, academically talented, first-generation, and generally underrepresented students. The primary research goal of SEnS GPS is to determine if recruitment, retention, and support strategies utilized at the undergraduate level are also effective at the MS level. This research serves the NSF and US government goal of increasing higher education STEM program graduates [1]. While SEnS GPS makes program admission decisions based on financial needs and academic talent, recruitment strategies aim to provide support for *all* students.

SEnS GPS provides scholarships in the amount of \$10,000 per year (income dependent), covering the cost of graduate tuition at Boise State University. This funding is for full-time students enrolled in nine credit hours of coursework apart from the last semester before graduation, where students may be registered in five credit hours. The program provides staff support in bi-monthly student check-ins and a non-faculty advisor students may connect with outside of their faculty advisors. Lastly, the program has a cohort structure of educational and social programming.

Early Graduate Education Expectation Setting

One of the first strategies employed is discussing the benefits of an MS program and the admission process and what graduate life is like with students in the first year of their undergraduate career. Faculty at Boise State teaching entry-level engineering courses have either

allowed SEnS GPS staff to speak to their classes or added pieces about graduate education to their course content. In addition, information about graduate education and the accelerated MS programs (students may take engineering electives at the graduate level and count these electives towards both undergraduate and graduate requirements) have been added to undergraduate summer orientations to ensure family members, or the appropriate stakeholders, are aware of the opportunities/benefits and the resources available to students who want to enter these programs.

Targeted Recruitment Messaging

Recruitment messaging is sent to students early in the junior year before fall break when conversations about a student's future intentions occur. This allows time for information gathering and puts resources into students' hands to enable them to answer questions and feel confident while having conversations with family members. These emails are designed to be congratulatory and give students a sense of accomplishment at being identified as academically talented students. The timing of this messaging is critical for STEM students as many students will be hired for internships after fall break, and companies will want to keep them as interns until they can make a full-time offer at graduation. Once students begin hearing this rhetoric from employers, they no longer feel the need to consider graduate education, and the timeframe has passed mainly in which students are willing to take time to consider another path. Messaging is also put out before spring break of the junior year and before the career fair season begins for seniors.

Recruitment messaging includes targeted emails, SEnS GPS staff speaking in junior-level courses, intrusive advising for all juniors and seniors, and targeted students (those expressing interest) receiving outreach from faculty in the area they are interested in pursuing.

Providing an Approachable and Trusted, One-Stop Point of Contact

SEnS GPS chose to utilize an academic advisor as the general program coordinator. This has made it simple to identify potential MS students and for students to ask questions about graduate school regularly throughout their undergraduate careers to feel knowledgeable and in control of the process. The advisor/coordinator is a professional outside of the faculty circle, making them a more accessible contact for student communication. They are responsible for institutional and programmatic knowledge and developing relationships with faculty to help connect students. Finally, the advisor/coordinator has also been identified in web pages and to all College of Engineering faculty/staff as the person to send students to as the first point of contact if they are interested in graduate study.

The advisor/coordinator plays a significant role in graduate student support once students are in an MS program. Due to these dual roles, pre-decision students can identify a trusted person who will be with them through each step of their program. This adds a layer of perceived security to their potential future as graduate students. The program encourages informal meetings with current graduate students to help students understand what they are undertaking and the support in place. The advisor/coordinator also helps students through the application process and identifies faculty mentors and faculty advisors early to begin developing connections.

Graduate Information Nights

In collaboration with academic departments, SEnS GPS hosts graduate information nights for all engineering and computer science students to attend. These nights are structured in two parts: (a) overview of opportunities, admissions, funding sources, faculty research, outcomes/benefits/drawbacks, and what it is like to be a graduate student; (b) a panel of faculty industry professionals, and current graduate students. Originally these nights were hosted by faculty alone, but students reported feeling intimidated and that the experiences of faculty were aimed at an academic career, not a career in industry which is where most students see themselves after degree attainment. It should also be noted that a range in ages is significant as both academia and industry have changed over time, and various viewpoints are needed for students to feel trust in information presented and identify with an experience.

Financial Aid / Funding

SEnS GPS provides scholarships to twelve scholars each year. Scholars may not utilize both SEnS GPS and graduate assistantship funds. Students may participate in SEnS GPS programs and support without receiving a scholarship (termed *non-scholars* in this study). The scholarship consists of \$5,000 each semester, which covers the cost of tuition for a full-time graduate student (\$4,819/semester) with a little to spare towards books. The scholarships are placed on a student's university account to speed up tuition payments and alleviate anxiety around paying for school. Students can choose to pay their tuition with alternate funds (we actively engage students in applying for scholarships outside SEnS GPS), and remaining SEnS GPS funds are sent directly to the student in the first two weeks of school in the form of a university check. SEnS GPS encourages faculty advisors to write MS students into their grants if they want to work with a SEnS GPS student. This encourages matching funds for students who do not have assistantships to help pay for housing and other critical necessities.

Accelerated Masters Program Recruitment and Programming

An accelerated master's program (AMP) allows academically talented students (3.25 GPA minimum) to take nine credits of graduate-level course work and count those credits towards both their undergraduate and graduate degree requirements. When AMP students graduate, they have one semester of graduate coursework completed. These programs help students commit and transition into graduate school early, ease the financial burden of a graduate program, demonstrate personal ability and aptitude for graduate study, and identify students in their junior year so intrusive advising and support may be offered to targeted students.

Boise State University's College of Engineering has six different AMPs. Before SEnS GPS, students outside of computer science (one of the largest graduate programs in the College of Engineering at Boise State) were applying to AMPs at meager rates, if at all. It was found that most students were unaware of the existence of these programs or found out about them too late. In its recruitment of graduate students, SEnS GPS is heavily advocating for completing an AMP program as a part of the combined undergraduate/graduate journey. Advocacy takes place in educating engineering academic advisors, requesting lists of students who have shown interest, email campaigns, faculty education about the programs, and talking to families about the programs early and often throughout the academic life cycle. SEnS GPS has also created AMP cohorts and included AMP students in graduate student programming.

Simplification of Program Application Process

Many scholarship programs require a lengthy or complicated process for admission. SEnS GPS requires an application that takes approximately 20-30 minutes, a completed FAFSA on file with the institution, and a brief, low-stakes informative conversation with the advisor/coordinator. Program admission and scholarship decisions are then based on need and potential program impact.

The simple design of this application eliminates a time and energy barrier for targeted students. We intentionally chose not to include letters of reference as their procurement requires a large amount of academic and social capital many of our targeted students do not have or do not know how to utilize. The brief meeting with the advisor/coordinator allows information gathering and prompting in a non-intimidating setting. It also introduces the advisor/coordinator as a collegial contact with information that can be trusted during a student's time as a program participant.

Institutional Change

When developing this program, we found that one of the most critical factors in student choice to participate in a graduate program was program curriculum intimidation. Many students had trouble picturing themselves completing an MS thesis. Many students choose industry over a graduate program due to the time, energy, and writing skills needed to complete a thesis. The SEnS GPS program has participated in conversations at the department level about graduate program curriculum changes. These conversations have not been fruitful in some areas, but some conversations have resulted in significant shifts to capstone experiences. One program entirely redesigned the range of options available for MS capstone experiences. Students now have the opportunity to complete a thesis, a project with their employer, or case studies. These changes are already showing dividends in the number of students interested in pursuing an MS degree but and applying to graduate programs. Students for whom financial burdens are notable have anecdotally noted that these changes allow them to feel more comfortable in the time allotment for capstone work and, in some cases, made balancing school and work easier as their employers have buy-in through project work.

A second institutional change is starting recruitment and making faculty connections early. Faculty are receiving education on mentoring both graduate and undergraduate students and helping them consider graduate study. SEnS GPS is also making it easier for faculty to recruit students who may not have the confidence or knowledge of how to find undergraduate research opportunities by being the first stop for recruitment announcements and making formal introductions (with behind the scenes academic capital building for students) for students with interest in a faculty member's area of expertise.

Methods

The SEnS GPS program's overarching goal is to investigate which (if any) recruitment, retention, and persistence strategies at the undergraduate level also work at the graduate level. For this sub-study on pre-decision activities, a qualitative approach was taken. We utilize the framework of academic capital formation to identify and address general MS level barriers to entry and university and student population-specific information based on pre-program entry surveys. Before the SEnS GPS program began, a general questionnaire addressing decision-making factors in post-undergraduate plans was sent to all seniors in the College of Engineering

at Boise State. These surveys are also sent at the beginning of each semester to all new MS students in the college. The MS-level focuses on post-undergraduate plan decision-making factors and an evaluation of the support and mentoring students received during the application and admission process for graduate school. Student information is also tracked by the program coordinator/advisor at each student touchpoint.

Preliminary Takeaways

The following findings are being defined as takeaways as the young nature of the SEnS GPS program only allows for preliminary findings in year two. However, several takeaways could prove helpful to programs looking to support the recruitment of graduate students who identify as academically talented, low income, or first-generation.

Introduce Students to Graduate Work and Life Early

One of the best recruitment methods has been utilizing AMPs. These programs address several barriers to entry for graduate students. Stakeholders see them as having good financial value and helping students transition smoothly and quickly from undergraduate to graduate work and right into the workforce. These programs also allow students to begin working on capstone projects early, and students have noted relief from some of the anxiety surrounding the culture of graduate studies. These programs help students see they have the personal capacity to succeed in graduate work. Looking at one academic program, once recruitment and mentoring began, the department saw the highest graduate numbers in its history. This is primarily attributed to AMP students; 83% of students participating in this AMP at Boise State have entered the MS or MEng programs.

Stakeholder Support is Key

Support from key stakeholders - family and faculty in particular - is invaluable to helping students feel confident about pursuing graduate study. Utilizing a 4-point Likert scale (1=not at all a factor; 4=a significant factor), students stated that family (3.09) and faculty (3.17) support were some of the most important factors motivating them to pursue a graduate degree ($n=46$).

Financial Support and Program Flexibility Aid in the Pre-Decision Process

Financial support was the most significant decision-making factor for students and their families. Providing support through scholarships, assistantships, and faculty research grants are some of the best ways to attract a diverse student population and keep that student population. Funding was the most significant barrier for students when deciding to begin an MS program. On a 4-point Likert scale (1=not at all a factor, 4=a significant factor), financial difficulties rated at 2.37 for students in pre-program entry survey data ($n=46$).

Program flexibility and the ability to treat each student as an individual allow an extensive range of students to participate in graduate programming. Carlton notes that a significant factor in deciding to forgo an MS degree is not only academic workload but also heavy undergraduate financial burdens that can be alleviated by choosing industry [9]. Scholarships are essential but building a graduate curriculum that allows students to be employed in industry at the same time and spread capstone work throughout the program, graduate study can be much more manageable and feel more achievable to students who need to work to support families, pay off debt, and are not comfortable with not having an income. On a 4-point Likert scale (1=not at all a

factor, 4=a significant factor), program inflexibility/too many hours rated at 1.85 for students in pre-program entry survey data ($n=46$).

Students, Colleges, and Programs Need a “Go-To” Person with Capacity

Internal college support is a critical factor in student recruitment. Universities often neglect MS recruitment at the institutional level, small colleges have limited resources, and faculty are often already stretched thin. Utilizing a non-faculty advisor/coordinator who can be present and genuinely support graduate programs beyond the administrative needs is critical. We found that advisor workload was important. Many advisors in US colleges have high caseloads and have little time to devote to activities outside of their traditional sphere. A good time evaluation tool is made available by the *Council for the Advancement of Standards in Higher Education (CAS)*. This self-assessment [10] used in tandem with the National Academic Advising Association (NACADA) guidelines for caseload assessment can help colleges and universities determine if an advisor has the time to devote to this arena of student success.

This advisor/coordinator can help identify potential MS candidates, provide trustworthy and timely information to help students overcome barriers to entry, and support students through the admission and application process. In SEnS GPS, this has dramatically increased the number of graduate students in targeted departments. One program that has been struggling to build its graduate population saw an increase from 8 to 23 students during the outreach period for SEnS GPS. Much of this success can be attributed to students receiving outreach and having a low-stakes professional to discuss options and their personal needs.

Conclusion

The United States is pushing to maintain its role as a leader in Research & Development and historically recruited populations in the STEM fields are no longer able to fully serve the needs of the U.S. in terms of the number of professionals, but also in terms of a diversity of backgrounds and experiences that have the ability to drive innovation at the highest levels. Many students would benefit from pursuing an MS degree, and institutions, educational and governmental, are pushing students, particularly in the STEM fields, to pursue education beyond the bachelor's degree as understanding the research process is critical to advancement. To make graduate study more attainable and common, universities, colleges, and individual programs must talk about graduate school early, provide student support and adapt to changes in student needs through curriculum. Programs like SEnS GPS are impactful but mostly temporary due to temporary grant funding. Developing institutional structures and culture to address student needs and support students from the pre-decision-making process to degree attainment is one of the best ways to increase the student population equitably.

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