
AC 2011-963: FACTORS INFLUENCING CAREER CHOICES OF UNDER-REPRESENTED STEM PHD GRADUATES

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Anne Donnelly has served as the Director of the South East Alliance for Graduate Education and the Professoriate Program since 1997. This program has directly assisted an interdisciplinary group of 49 STEM PhD graduates in 15 departments. She has also been the Education and Outreach Director of the NSF Particle Engineering Research Center. She has conducted numerous program evaluations for NSF REU's, CCLI, and GK-12 projects. She is currently the Director of the Center for Undergraduate Research at the University of Florida.

Factors Influencing Career Choices of Underrepresented STEM PhD Graduates

Background

The participation of minority students in Science, Technology, Engineering, and Mathematics (STEM) has received national attention for more than a decade. As the population of the country becomes increasingly diverse, there is concern that if groups that have historically been underrepresented in these fields do not become part of the technology enterprise the country will lose its preeminence in invention and innovation. In 1991, The National Science Foundation (NSF) sought to address this issue by awarding the first grant of a program now called the Louis B. Stokes Alliances for Minority Participation (LSAMP). This program is aimed at increasing the quality and quantity of students successfully completing STEM baccalaureate degree programs and increasing the number of students who continue to graduate school. In the first 14 years of the program more than 225,000 bachelor's degrees were awarded to minorities participating in LSAMP. More than 200,000 students are now enrolled in programs across the country, graduating approximately 25,000 students per year.¹ Although LSAMP and other national programs such as the Ronald E. McNair Post-baccalaureate Achievement Program have resulted in a pool of minority students earning bachelor's degrees in STEM fields, there has not been a proportional increase in the number of underrepresented minority (URM) students pursuing advanced degrees in STEM. It is believed that this is due in part to a lack of diversity in the nation's STEM faculty. At major research institutions it is possible for a student to earn a degree and never have a faculty member of color.

To address this issue, NSF developed a complementary program to prepare minority students for academic careers. The NSF Alliance for Graduate Education and the Professoriate (AGEP) program is designed to increase the number of U.S. students receiving doctoral degrees in STEM fields, especially for URMs, which include African Americans, Alaskan Natives, Native Americans, Hispanic Americans and Native Pacific Islanders. This goal is achieved by developing an infrastructure that substantially changes the graduate school experience for URM students by preparing them for academic teaching and researching positions thereby catalyzing institutional change. AGEP was established in 1997 and to date consists of 21 Alliances that represent over 80 institutions. While several studies have looked at a variety of factors that may influence career choice² this study focused specifically on a group being groomed for academic careers.

Quantitative Results

To determine the effect of participating in such a program with respect to career choices, one AGEP conducted an explanatory case study of 29 AGEP program alumni to attempt to explain the reasons behind their career choices. The goal of the project was to identify areas that may impact the academic career decision to help future professorial preparation programs address key areas. The demographics of the study participants are listed in Table 1.

Table 1. Case study participant demographics

Field of Graduate Study	Number of Participants	Black	Native American	Hispanic
Engineering	15	13	1	1
Biological Sciences	7	4	0	3
Physical Sciences	6	3	0	3
Mathematics	1	0	0	1

A telephone survey with both Likert scale questions and open ended questions was developed and administrated to South East AGEP (SEAGEP) alumni from the University of Florida (UF). Thirty-seven of the total 42 alumni were located and invited to participate in the survey. Twenty-nine out of the 37 responded for a 78% participation rate. All of the interviews were tape recorded and the tapes were coded and analyzed by the interviewer. Interviews lasted between 10-20 minutes. The open ended interviews were analyzed as described by Strauss (1987)³.

The Likert scale questions differed according to the career position of the participant. All participants were asked to rank 6 factors that might influence their career choice. Those already in academic positions or post-docs that expressed an interest in pursuing a career in academia were also asked to rank the importance of opportunities for higher education leadership and the ability to do independent research. Participants that were in industry, government, or post-docs that expressed an interest in pursuing a non academic career were asked to rank the influence of undergraduate and graduate debt on their decision.

The analysis showed that of the 42 alumni, 15 are currently pursuing academic careers and 13 of these participated in the interview. The highest ranked factor for pursuing an academic career choice was the opportunity to work with students and secondly to conduct independent research. The lowest ranked factor was location (Fig. 1).

Salary and life style were ranked as the most important career influences for nonacademic participants (Figure 2).

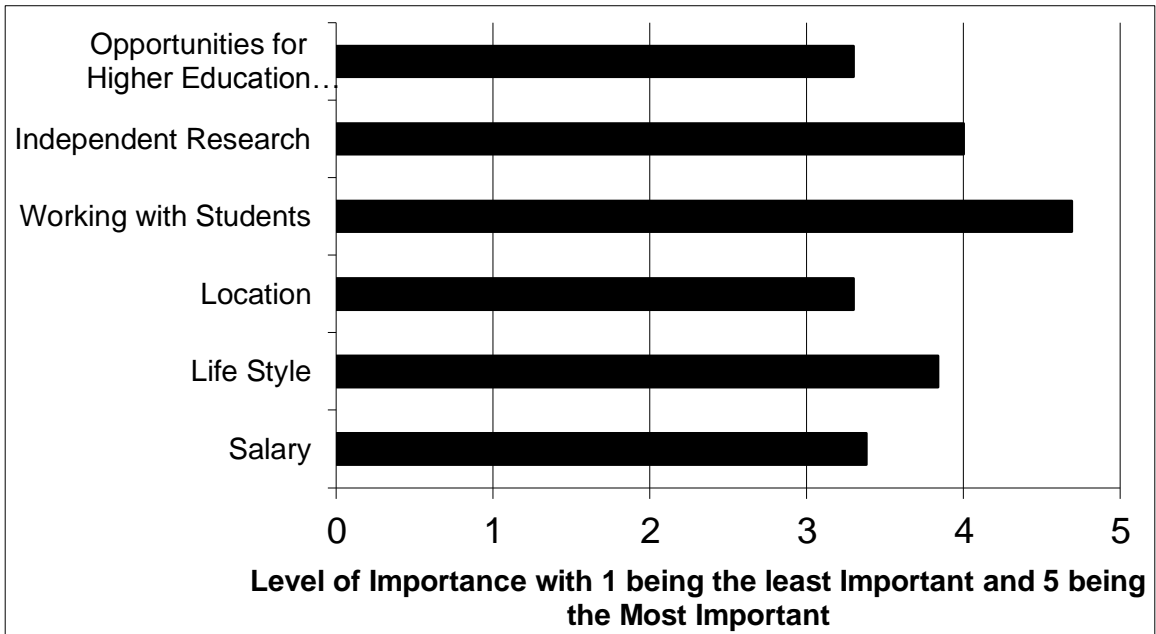


Figure 1. Factors influencing academic career choices

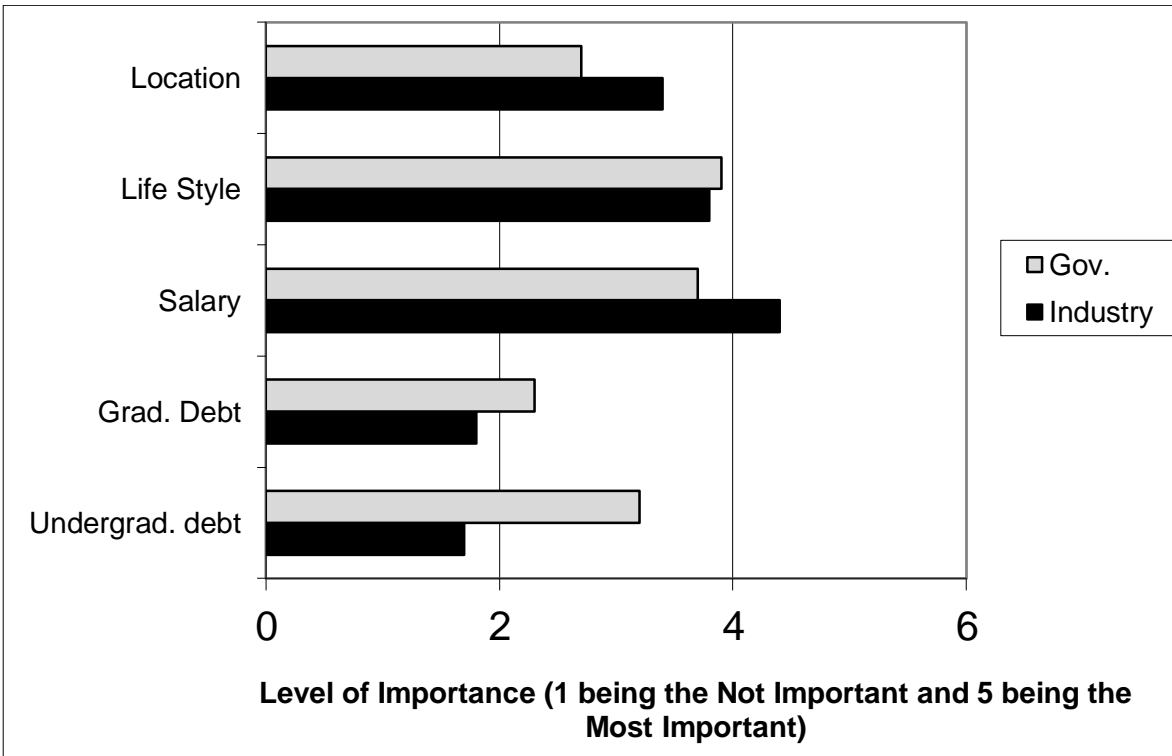


Figure 2. Factors influencing nonacademic career choices.

Those who chose nonacademic jobs were also asked to rank factors that discouraged them for pursuing this career path and the rankings are shown in Figure 3.

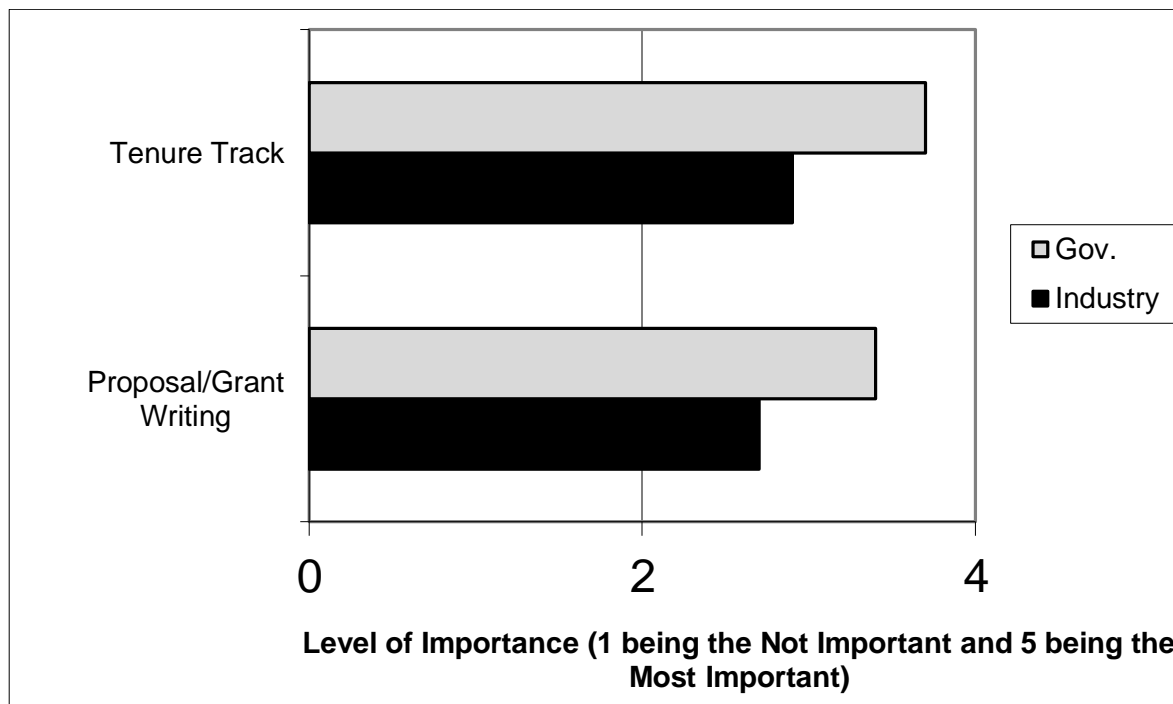


Figure 3. Ranking of several factors that may discourage an academic career choice.

Life style was important to all groups (3.84 for participants interested in academia, 3.86 for those interested in industry, and 3.89 for those interested in governed positions). These values indicate that for all groups lifestyle was an important factor, but what this means is different for each group. The students clearly held different perceptions of the life styles of the three different career choices and chose the one that most closely matched their personal preference.

Qualitative Results

The use of quotes is considered a common part of qualitative research reporting⁴ and as they are accepted as a way to describe findings and themes⁵, they are presented here to support the conclusions and subsequent recommendations of this study.

The open ended and short answer questions that were followed by probing were:

- When did you decide that you wanted to obtain an advanced degree?
- What career did you envision when you started your advanced degree?
- Did you search for an academic position (Post Doc/faculty)?
- How did you choose your immediate position after graduating?
- Did you participate in any graduate preparation programs?
- (If not in academia) Do you see yourself going back to academia in the future?

This paper focuses on the qualitative results from the case study.

When did you decide to pursue an advanced degree?

The largest proportion of the 29 respondents stated that they decided to pursue an advanced degree as an undergraduate student (14) or shortly after completing the undergraduate degree (7). Some of the responses were:

One year prior to finishing my B.S., when I started doing research.

During my undergraduate at the university...In our department we have senior research...I found that I loved research and I wanted to pursue a master's degree.

I knew I wanted to go for at least a Master's probably when I was in my junior year of undergrad, but I didn't anticipate continuing on for the Ph.D. probably until the first year of grad school.

Several alumni stated that they made the decision after completing the undergraduate degree, with some indicating difficulty in finding a job or lack of job fulfillment as reasons for going back for an advanced degree:

I originally wanted to stop right after undergraduate simply because I was tired of school and I wanted to go ahead and start making money. But, because of lot of companies had hiring freezes due to 9/11, I stayed in school...So it was really just the circumstances at the time that convinced me to go for the advanced degree.

I decided I wanted to go back to graduate school about the first year after my degree. I was working in industry and felt like something was missing career-wise...At that time I was very young and I knew that going back to school was a very good decision for me.

Five alumni indicated that they made the decision at an early age. Three stated that they “always” knew they would obtain an advanced degree.

The responses from this group suggest that most students do not begin to consider graduate school until they are in college and that exposure to research as an undergraduate can influence this decision.

What career did you envision when you started your advanced degree?

Almost half (13) of the study group initially envisioned themselves going into academic careers after completing graduate school. Some of the responses were:

I always wanted to be a professor.

I envisioned being an assistant professor when I started...I just enjoyed the fact that I could pose questions and then pursue answers to them.

I thought I was going into academia. I wanted to be a professor, have a research lab and teach.

Of the 13 who initially intended to go into academic careers, only nine were working in academia either as Post Docs (5), adjunct faculty/instructors (2) or assistant professors (2) at the time of the interviews. The majority of academically focused alumni are still in postdoctoral positions, but six have moved into a second position. Of these six, three moved from academic to non academic positions. Thirteen of the 29 alumni initially envisioned careers in private sector companies (11) or in government (2) (e.g. national lab, NASA). Three of the alumni were unsure about their career goals when they began their advanced degree.

Did you search for an academic position (Post Doc/faculty)?

Although only 13 students initially indicated an interest in academia, of the 29 students interviewed, 26 did look for academic placements after graduation. Only 17 successfully achieved either an academic post doc or faculty position (including 3 non-tenured lecturers.)

How did you choose your immediate position after graduating?

Of the nine respondents who did not enter academia, 5 accepted positions in government and 4 in the private sector. Reasons for choosing government jobs included:

- Advisor helped find a position in government agency
- Low salary in academia
- Received offer from government
- Liked the resources and research at national lab
- Earned a prestigious government Post Doc

Reasons for entering industry included:

- Received good offer in preferred region
- Type of research matched interests
- Had a family and couldn't wait for an academic job offer

This last comment is consistent with reports that family issues can lead students into nonacademic careers³. Programs such as AGEP emphasize the importance of networking. Nine of the 29 students found their first position following graduate school through friends, family, or other personal contacts.

It is often assumed that female PhDs have a harder time making career decisions due to family concerns but in this group, the first post grad job decision was influenced by family concerns both female (3) and male (2) students. One female student who did obtain an Assistant Professor position cautioned that:

...it is still very difficult for females in general.....I was asked if I was married, what my husband did, and if I planned to have kids. I was very caught off guard. AGEP helped because I asked that in the professional development sections and asked what I should have said.

Did you participate in any graduate preparation programs?

Although it was expected that most of the students who entered the AGEP program would have come through graduate school preparation programs such as the NSF LSAMP, only 13 of the 29 students interviewed participated in at least one graduate school prep program. The majority of respondents did not participate in any pre graduate school training programs.

Conclusions

While only 13 entering students envisioned an academic career when they began their graduate studies, 26 sought an academic position upon graduation. This indicates that participation in the SEAGEP program increased their interest in academia, which points to the achievement of one of the program's principle goals. It is clear however, that many of the students in this case study who were interested in and pursued academic Post Docs or faculty positions were unable to find a suitable placement and therefore moved into government or private sector positions. Of the 15 alumni who elected not to immediately pursue an academic career or were unsuccessful in finding an academic job, 10 indicated a definite interest in transitioning into academia at a later date and 5 said that they would consider it. This is particularly true of the engineers, some of whom believe they would be better professors if they have some industry experience first. For example one respondent said:

I think going into industry then, later on in life becoming a professor, would provide real world experience. To me, in order to advise students it would be great to have experience in industry and academia so I can see the pros and cons from both.

Thirteen of the participants spontaneously offered that the AGEP program was a key factor in their ability to graduate. Again, this indicates that SEAGEP is also fulfilling its mission to not only recruit, but to effectively retain and graduate minority PhD students. Also, while grad prep programs were utilized by some students, many students succeeded without the benefit of prior preparation.

When considering the results by gender, both men and women made career decisions at similar times in their lives. Nine of 15 male students entered the program expecting an academic career, while only four of the 14 women indicated an interest in academia. Overall, five females and nine males ultimately entered academia. Both men and women cited that family/personal issues influenced their career choices and at near to equal rates.

A difference in career choice is seen between engineering and other sciences and mathematics, as illustrated in Table 2.

Table 2. Career choice differences between engineering and other STEM PhD graduates

Discipline	Academia	Government	Private Sector
Engineering	6	5	6
Other STEM	8	3	1

Recommendations

1. It is clear that specific programming such as AGEP can influence a student’s interest in academic careers, therefore these programs should continue to be offered.
2. Specific programming to encourage women in STEM to pursue academic careers may be advised as fewer females in our group initially envisioned an academic career and ultimately chose one.
3. Once generated, for many, interest in an academic career did not translate to an academic placement due to the lack of suitable Post Doc/faculty opportunities. In order for professoriate preparation programs to succeed, placements must be made widely available.
4. Since many of the engineering respondents who went into the private sector indicated an interest in returning to academia once they gained experience, it would be useful to continue to follow up with these alumni and make them aware of opportunities to move into academia from industry.

Together, the qualitative and quantitative data gathered on the AGEP alumni in this case study sheds light on some of the factors both inside and outside the control of such programs to produce the desired increase in the diversity of the nations STEM faculty. It is clear that these programs play a vital and supportive role and increase interest in pursuing academic careers for many students. It is equally clear however that the lack of post graduation placements will result in students moving into industry and government positions.

References

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