Examining the Intersection of Graduate Student Funding, Mentoring and Training as a Mechanism of Success for Peer Mentors and their Mentees

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Introduction

Over the last two decades, mentoring at all levels of education, from students in elementary school to professional and graduate schools to staff at universities, has been proven to be an effective tool for improving retention at schools, increasing self esteem and self efficacy, and developing improved professional skills such as communication and organizational skills for both mentor and mentee.[2,9,11,3,1,5,7] Utilizing mentoring to its fullest potential is of dire importance in graduate schools given the high attrition rates in the United States (US). Whereas attrition rates at graduate schools vary from department to department and program to program, it is estimated that the average attrition rate of graduate schools in the US is about 50 percent.[5] In times of crisis concerning the diminishing number of individuals from diverse populations entering graduate degree programs, especially in the fields of science, technology, engineering and mathematics (STEM), [12] the high attrition rates may be more costly to the security of the US and its position as a world leader in STEM than are the costs of developing and maintaining programs that increase retention and reduce attrition rates. In addition to these benefits, it has been demonstrated that for university staff, mentoring "increased employee productivity and encouraged people to engage in more activities that enhanced the institution's reputation."[3] It is easy to imagine the return on investment for increased mentoring programs at the graduate level, and thus our focus here will be on mentoring in graduate school.

Several factors have been correlated to student success in graduate school such as having a sense of connectedness to peers, faculty, and the department. Other factors include having a knowledgeable advisor, good communication with professors, and professors that assist with developing the student's belief in their own success. The quality of the academic program and its social-personal aspects such as faculty turnover and program requirements may also contribute to student success. Mentoring addresses several of these factors. Financial aid has also been attributed to graduate student success, and therefore, we will streamline our discussion to focus on mentoring students through the process of obtaining funding for STEM graduate education.[1, 8]

Background

There are several characteristics that can be attributed to a good mentor such as being genuine, empowering, and encouraging towards the mentee, creating a climate of trust, connecting the student to the faculty, the environment, the department and other peers, being a role model for the student by demonstrating personal and professional ethics, and being accessible and non-judgmental. For faculty mentors, it is important to be in a capacity to help build the mentee's professional network.[5,6] For underrepresented minority students, having a mentor that is willing to understand factors that may be attributed to societal mores, associated with the student's culture and/or gender, that could influence the mentee's academic success is important.[12] However, a good mentor-mentee relationship tends be reciprocal and consists of mutual respect, shared values, and good communication. There tends to be a personal connection between the parties involved beyond the scope of the task for which mentorship is sought and an understood

commitment of time that will be apportioned to the relationship.[10]

On the other hand, in some cases, mentor-mentee relationships can go awry. This tends to occur when there is perceived (or actual) competition, conflict of interest, personality differences, or poor communication.[10] Mentors who have a patronizing attitude, demand uncompromising use of their methods (without discussion) instead of assisting mentees as they find their own way, or have a lack of commitment or genuine interest in the mentee's success beyond the student role have been found in this category.[6]

Mentoring is most often viewed as a hierarchical relationship between an experienced mentor and a novice mentee wherein the mentor aids in the development of the mentee to be successful in an area of expertise of the mentor. The relationship may be formal or informal. More recently mentoring has been described as a process whereby "one guides, leads, supports, teaches, and challenges other individuals to facilitate their personal, educational, and professional growth and development through mutual respect and trust."[12] A Multiple Mentor Model requiring at least 5 different types of mentors for success in graduate school has been identified as helpful for minority graduate students whose attrition rates are much higher than the norm.[12] One of the expanded mentor relationships suggested by this model is the Peer Mentor.

Peer mentoring in graduate school typically occurs between a senior graduate student who would impart practical advice and encouragement to a novice graduate student. The mentor would help the mentee navigate the environment and feel more connected to the graduate program and their peers, two factors that have been identified for student success.[1] Given the changing scope of education where more and more students are taking courses online, and where students are more technologically savvy but have less social interaction, the importance of feeling connected to the program is more important than ever.[5] One report mentioned that providing online faculty mentoring was crucial to student success.[8] Another university in the United Kingdom reported success using e-mentoring where senior students were asked to leave voice messages for incoming first year students for their online introduction to nursing course. Although there were no empirical results, the student mentees in the study responded favorably to the e-mentoring.[7]

The definition of peer mentoring above describes a hierarchical relationship that is similar to the mentoring relationship between a faculty mentor and his/her advisee, with one obvious exception. The major difference is that student peer mentors have a more equal relationship because the future career success of the mentee is not in the hands of the mentor. Nevertheless, in a study where 54 medical professionals involved in faculty peer mentoring were interviewed, it was observed that an unsatisfactory faculty peer mentoring relationship could have a negative influence on faculty promotion, retention, or academic productivity, suggesting that peer mentoring at the faculty level could be affected by an unequal relationship in terms of seniority in the department; however, research to support such a claim was not found in the mentorship literature.[10]

A second definition of peer mentoring describes a slightly different relationship that emphasizes a more equal relationship among the participants. Peer mentoring is a "specialized type of group mentoring in which each individual functions both as a mentor and a mentee to other individuals emphasizing mutual interdependence among the members."[13] Below are the words of a group of

five tenure track female professors who peer-mentored one another through the process of tenure, which best capture the spirit of group peer mentoring. The professors range in age from 37 to 62, were in different stages of the tenure process, and in different fields. Despite this variability, they came together to write and develop as scholars for 14 months. Together they wrote an article on navigating the tenure process, which included the following statement:

> *Initially, mentoring focused on helping each peer develop as an individual agent for her own productivity. As time went on, however, the group itself became an object of agency and we developed a collective voice. An outcome of this agency was collaborative action. As we tested our perspectives together and on one another, we learned how to merge our representational frameworks and worldviews into a common understanding of our shared experiences ... First, we learned to mentor each other as trusted and valued peers, using our developing assets as university professors in the area of writing and cultural knowledge. Second, we moved from solitary work into collaborative work, in which we learned to write together, depending on each other in quite different ways, and how to negotiate meaning and interpretation of shared, albeit differently experienced, events. Finally, we developed individually an understanding of self, other, and environment by understanding these differently experienced events and shared and differing interpretations. This allowed us to become independent scholars in our own right.*[4]

In the current study, the mentoring that we describe is a combination of both of these types of peer mentoring: hierarchical and group. First, the first and second authors serve as the peer mentors with expertise in applying for and receiving graduate funding and provide hierarchical mentoring during workshops on graduate funding. Later, in the workshop, since we have empowered our peers to understand what they need to do to fund their graduate education, they empower each other through group peer mentoring as they discuss their experiences, interests, and research to develop possible essay topics. The remainder of this paper is dedicated to explaining our methods. We also evaluate the workshop and its contribution to several factors for student success such as empowering students to a) acquire financial aid, b) feel connected to a community that is pursuing the same goal, and c) increase their belief that they can raise money to fund their graduate education. This kind of peer mentoring would not have been possible if not for our faculty mentor, the third author, who thought about ways in which we could share our success with our peers, and thereby empowering and encouraging us through her faculty mentoring to create the workshop in the first place.

In the literature, we were not able to find papers about funding workshops or the evaluation of funding workshops, but we were able to find two extremely useful resources online that we would like to share. The first resource was Dr. Robin Walker's GRFP Essay Insights Website at the University of Missouri (http://grfpessayinsights.missouri.edu/). At this website, we found a rubric for students to self-evaluate the quality of their essays that we plan to incorporate to our future workshops. The second resource is hosted on the website of Kappa Delta Pi, the International Honor Society in Education. It is a presentation by the Director of Retention and Recruiting at Texas A&M University, Megan Palsa, and can be found at the following website: http://www.kdp.org/teachingresources/pdf/podcast/Palsa_HowtoFundYourGraduateStudies.pdf.

Graduate Funding Workshop Series

The University of Maryland, Baltimore County (UMBC) has notably created a suite of graduate student support and professional development seminars, known as Success Seminars, and other interventions that include annual graduate funding workshops that have been sustained and expanded since 2007. The Success Seminars and other programs are largely funded by a National Science Foundation (NSF) Alliance for Graduate Education and the Professoriate (AGEP) grant. The Maryland AGEP's formal name is PROMISE. Recent PhD recipients who were NSF Graduate Research Fellowship Program (GRFP) recipients and PROMISE peer mentors while pursuing their doctorates co-developed and continue to facilitate the funding workshops.

The workshops, which began as a two-hour seminar conducted on one day in the fall semester, have expanded to include a range of formats: a three day (2-hours per day) workshop series, a one day (3-5 hour) workshop, and short panel presentations with other participants who provide financial information from their particular departments or organizations. In addition to encouraging the students to utilize advice from their faculty research mentors and peers, the workshop facilitators in our project served as experienced graduate fellowship recipients and reviewed students' personal and research statements. The workshops have been deemed effective, and the facilitators have since been invited (separately and as a team, during doctoral pursuit and even after receiving the PhD) to present graduate funding information and workshops during summer programs and fall semesters at the University of Houston, the University of Puerto Rico, the Massachusetts Institute of Technology, Harvard University, NSF's Historically Black College and University (HBCU-UP) conference, and AAAS's Emerging Researchers National Conference. The workshop provides participants with access to a Blackboard site that provides interactive communication and resources such as sample essays, tips, and advice from previous fellowship recipients. The site is updated annually.

The multi-day or two-hour workshop formats included the following information:

- Overview of types and lists of graduate funding opportunities
- Getting organized to successfully apply for several fellowships simultaneously
- Approaching faculty for strong recommendations
- Advice on how to reflect on one's experience to write an award-winning Personal Statement
- Examples of how to apply for the NSF Graduate Research Fellowship (GRFP), aimed at exposing future scholars to apply for funding from any organization and encouragement to consider NSF funding later in their careers
- An introduction to the NSF GRFP application requirements (e.g. the three essays required), broader impacts, and intellectual merit review criteria
- Hands-on NSF Fastlane proposal submission software orientation

The workshops provided professional development for both participants and facilitators by increasing knowledge of and engagement within each student's respective academic discipline, and improving their overall writing, presentation, and proposal/grant writing abilities. Most importantly, workshop participants and facilitators received NSF GRFP awards and other

competitive fellowships. Since 2007, we are aware of sixteen workshop participants who have received NSF GRFP awards and/or honorable mentions, as well as other graduate funding in fields ranging from engineering, computer science, physics, as well as social science fields.

Data and Methods

For this study, we present data from a fall 2012 one-day workshop at UMBC enhanced with data obtained from a variety of workshop formats between 2007 and 2012. While some informal data has been collected from workshops conducted at other campuses, it is important to note that the data for this study is from workshops conducted at the founding campus only. Since inception of the workshop in 2007, the facilitators have collected qualitative data in the form of testimonials from workshop participants. As a result, participants who both received and did not receive a fellowship provided statements about the benefits of the attending the workshop and using the information to submit fellowship applications.

To better demonstrate workshop effectiveness, and to explore whether the workshop increases participants' knowledge of and ability to successfully apply for graduate funding, the workshop facilitators developed three surveys to administer during the fall 2012 session, a five-hour version of the workshop, on UMBC's campus. The workshop included the formal funding presentation in the morning, a working lunch with peer group discussions, and a hands-on session where participants received in-depth introductions to FastLane, individualized feedback on how to develop winning research proposals and personal statements, and began their NSF applications. Seminar participants, who attended the morning formal presentation, were not required to attend the afternoon hands-on workshop, which impacted the design, implementation, and analysis of the surveys for this study.

We designed three surveys, which included a pre- and post-survey (subsequently referred to as the post1-survey) for attendees of the morning formal presentation. Participants who attended the afternoon hands-on workshop also completed a second post-survey (subsequently referred to as the post2-survey). Both the pre-and post1-surveys included eleven questions addressing students' expectations for the workshop, five questions about students' previous funding exposure and experience, and twelve questions to assess students' knowledge, skills, and abilities related to applying for graduate funding. The post2-survey repeated the twelve questions to assess students' knowledge, skills, and abilities and included seventeen questions evaluating specific aspects of the afternoon, hand-on workshop. Repeating the knowledge, skill, and ability questions on all three surveys allowed us to test for improvements for participants who attended all components of the workshop. Responses to the survey questions were captured on a 4-point Likert scale (Not At All, Somewhat, Mostly, Completely).

Results and Discussion

For the fall 2012 workshop that we evaluated, thirty-three students attended the morning formal seminar and thirty of these participants completed the pre-survey for a response rate of ninety percent (Table 1). Twenty-six participants completed the post1-survey, and twenty-one participants completed the post2-survey for responses rates of seventy-eight and eight-seven percent, respectively (See Table 1). Table 2 contains descriptive statistics of the seminar and

workshop attendees. The majority of attendees were underrepresented minority graduate students in the first year of STEM graduate programs, which was the target population for the workshop.

Table 1. 2012 seminar and workshop attendance with survey responses and rates

	Number of participants	Response Rate
Fall 2012 Seminar attendance	33	
Completed pre-survey	30	90.9%
Completed post1-survey	26	78.7%
Fall 2012 Seminar & workshop attendance	24	
Completed post2-survey	21	87.5%

Table 2. Descriptive statistics of 2012 seminar and workshop attendees (N=30)

Characteristic	Category	Percentage
Major	STEM	70%
Class Level[a]	Graduate	79%
	1st Year	50%
	2nd Year	39%
	5th Year	4%
	Undergraduate	9%
	4th Year	67%
	5th Year	33%
Female		61%
Ethnicity[a]	African American	52%
	White	18%
	Hispanic	9%
	Other	3%

[a]These categories do not add to 100% because some respondents did not answer these questions on the survey.

Pre-survey results

Based on the small size of our sample, our analysis for this study included measures of central tendency in terms of the percentage of the sample responding to a particular question as well as paired sample t-tests and chi-square tests comparing the pre-, post1-, and post2-suvey responses. The combination of these analyses allowed both a detailed look at the data as well as illustration of outcomes such as improvements in knowledge about graduate funding after attending the workshop. We will provide and discuss t-test and chi-square test results for statistically significant differences in the pre and post-survey responses.

For the eleven questions on students' expectations in attending the workshop, more than fifty percent responded that they want to learn more about funding, which indicates the workshop attendees were students motivated to learn more about funding their graduate education. While attendees of the funding seminar and workshop shared views on reasons for attending, the survey items on whether the attendees were funded presently as well as knowledge about graduate funding varied. Several questions addressed students current funding status for which twenty-seven percent did not have graduate funding at all and slightly less than fifty percent are

completely funded. Among those who were funded, only forty-two percent had graduate funding from their university or department. Fifty-five percent of the workshop participants did not have external graduate funding, illustrating a need to conduct the workshop from student, university and funding agency perspectives.

While attendees generally attended for similar purposes, the pre-survey results suggest more variation in responses to questions related to student's knowledge, skills, and abilities about funding opportunities and the application process. As a result of this increased variation, we will focus on results from the knowledge, skill, and ability questions from our surveys and expect the post1- and post2-survey results to reveal improvements in students' knowledge of and ability to apply for graduate funding. Results from both post surveys do suggest such improvements, which we discuss and illustrate in the series of graphs and tables below.

Post1-survey results and discussion

Figure 1 shows that prior to the seminar, seventy-three percent of attendees reported "Mostly" or "Completely" knowing about different types of fellowships. In contrast, approximately one-quarter of the attendees report having little (Not At All or Somewhat) knowledge in this area. However, following the workshop, all respondents reported high (Mostly and Completely) levels of knowledge about different types of fellowships. These results support our considerations for conducting the workshop earlier, prior to matriculation in graduate school, and focusing on increasing the knowledge of senior undergraduates and early career graduate students regarding different types of graduate funding and fellowships.

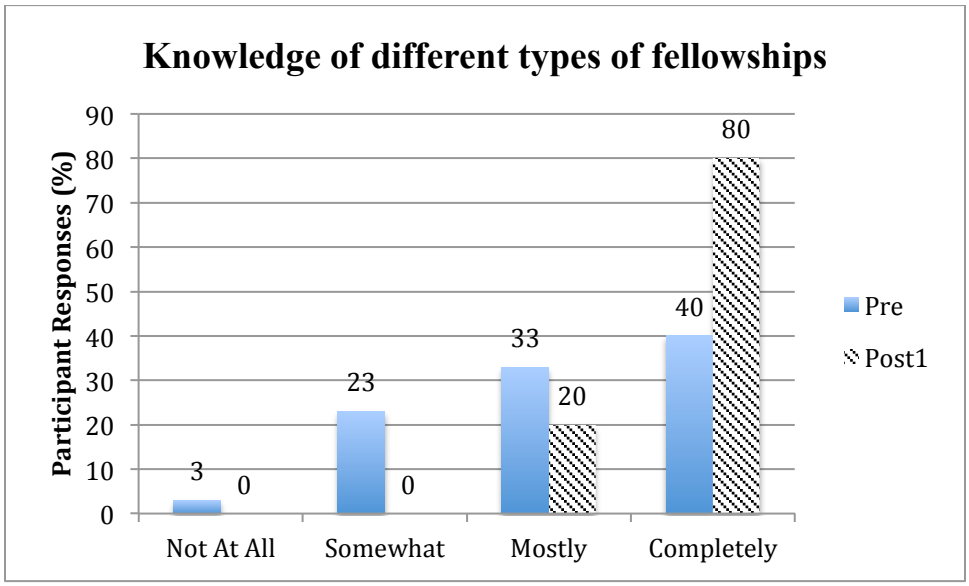

Figure 1. Respondents' knowledge about different fellowship types

Figure 2 depicts variation in participants' responses regarding finding funding opportunities. On the pre-survey, responses on the knowledge scale for "finding fellowships" show bell-curve results: seventeen percent (Not At All), forty-seven percent (Somewhat) and thirteen percent (Completely). This broad range of knowledge amongst the participants suggests the importance of directly informing students of government agencies, web sites, and private organizations that

have funding opportunities. Providing this information to the seminar attendees resulted in the majority of the seminar attendees reporting "Mostly" or "Completely" (forty-two and fifty percent) to this area on the post1-survey.

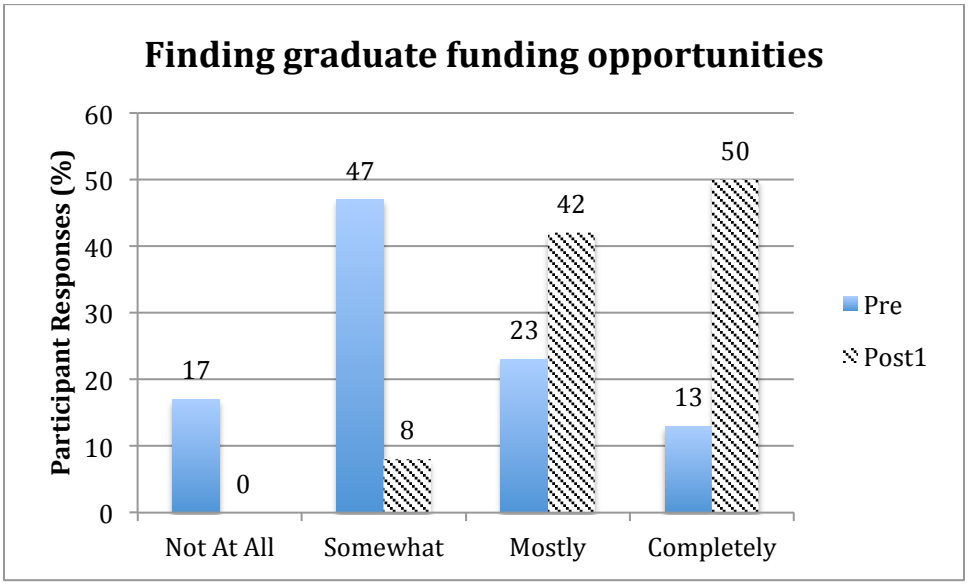

Figure 2. Respondents' knowledge about finding funding opportunities

Figure 3 shows that more than eighty percent of respondents report having little to no strategy for applying for fellowships prior to the attending the seminar. However, following the seminar, all respondents now have a strategy and over eighty percent responded "Mostly" or "Completely" about having a strategy for finding fellowships.

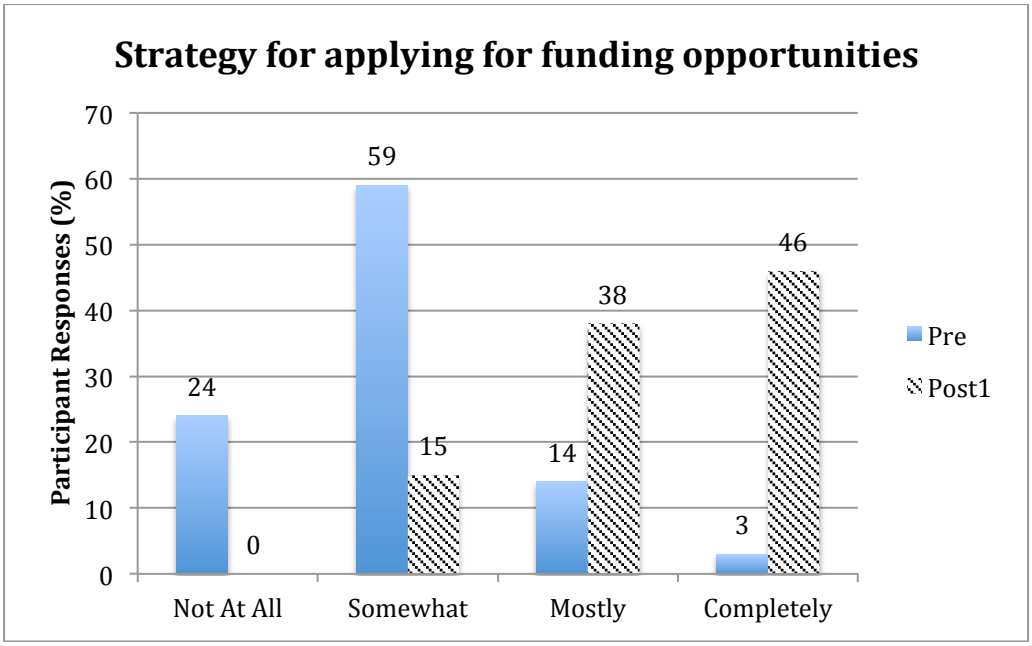

Figure 3. Respondents with a strategy for applying for graduate funding

While providing information to increase knowledge of, sources for, and application strategies about different types of fellowships are important, graduate students may also obtain this information from other venues (e.g. graduate school webpages, personal searches, and departmental announcements). We believe that the next set of results pertaining to requesting recommendations, writing winning essays, and understanding NSF's review criteria are areas where peer mentoring is especially beneficial because the information provided is typically not available in other venues. Additionally, the hierarchical and group mentoring previously described provides students with both knowledge and empowerment, which may explain the increases that we see in Figures 4-7.

We observe changes between pre- and post1-survey results when we examine responses about requesting appropriate recommendations in Figure 4. These changes, before and after the seminar, are greatest in the twenty-three percent of respondents who responded having some understanding in this area. After the seminar, only four percent of respondents report having some knowledge of how to request appropriate recommendations, which results in slight increases in the number of respondents reporting "Mostly" and "Completely" understanding this task.

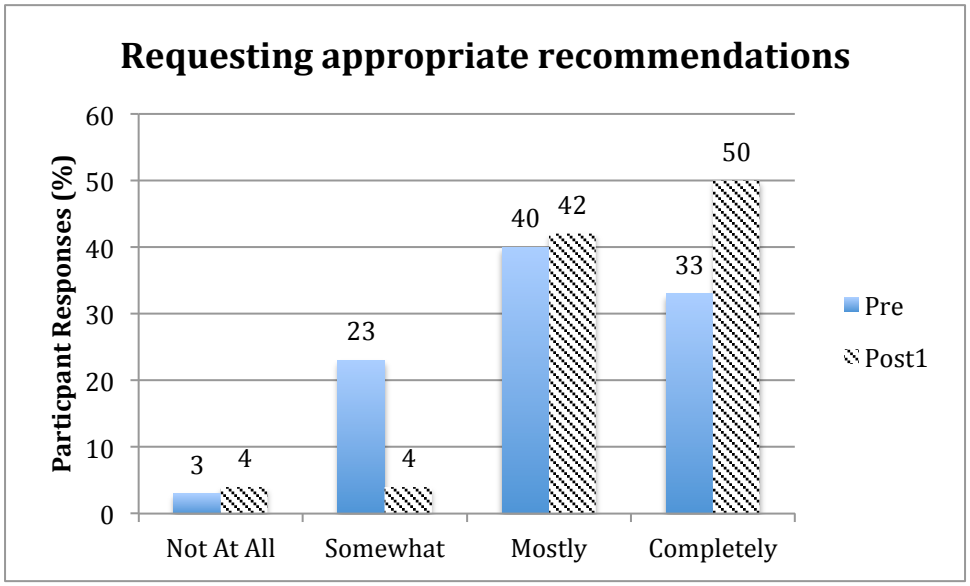

Figure 4. Respondents' knowledge about requesting appropriate recommendations

In response to questions about writing winning research proposals, personal statements, and other application essays, over eighty percent answered that they had little or some understanding of the requirements to write these essays on the pre-survey (Figure 5). Following the seminar, the majority of respondents (more than seventy percent) shifted to being "Mostly" and "Completely" able to write winning essays. Figures 6 and 7 shows that ninety-four percent responded "Not At All" or "Somewhat" to preparing both winning fellowship applications and winning NSF GRFP applications while in the post1-survey more than eighty percent report "Mostly" or "Completely" to these questions.

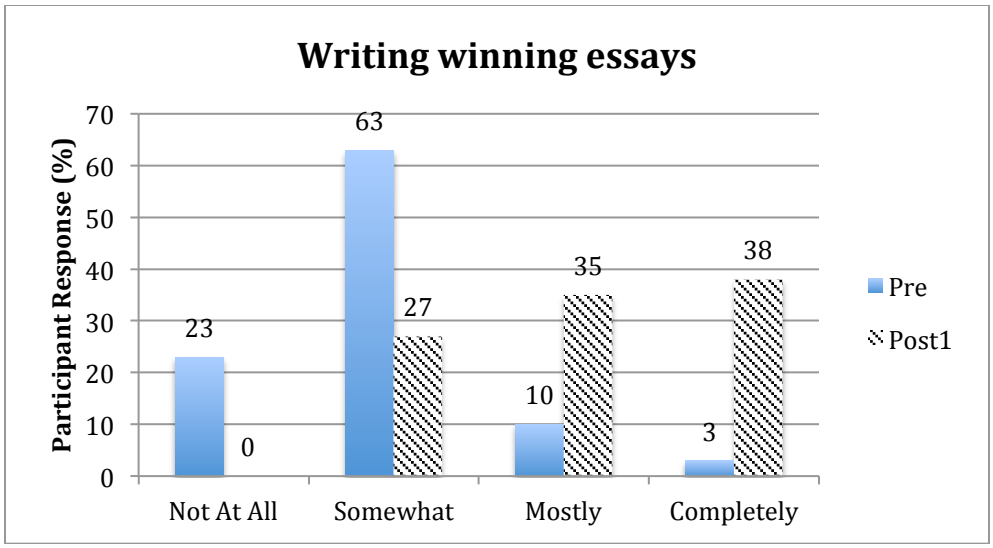

Figure 5. Respondents' understanding of requirements for writing a winning essay

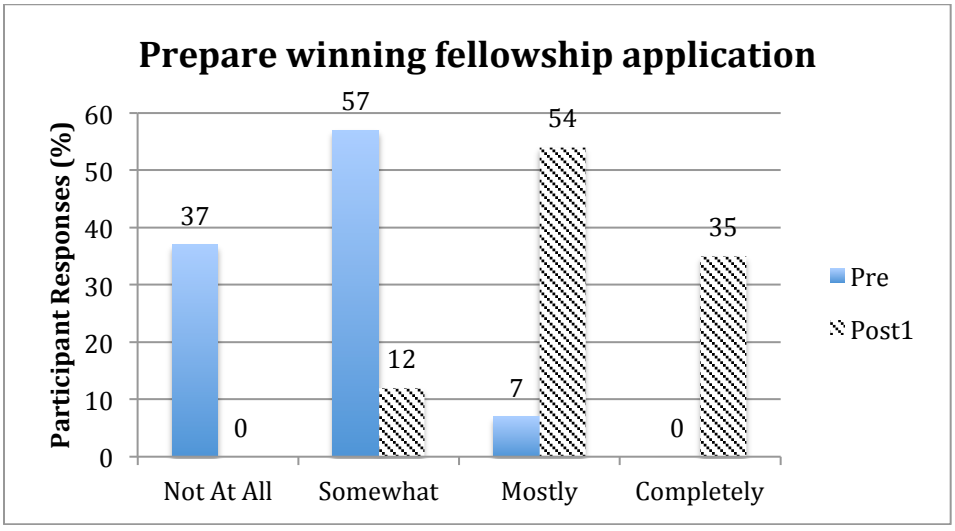

Figure 6. Respondents' knowledge of preparing a winning fellowship application

Participants' responses to questions relating to preparing winning fellowship applications suggest that the workshop may build self-efficacy, which deals with one's judgment of his/her capabilities to execute specific skills.[14, 15] One hypothesis is that the participants' belief in self or self-confidence is present when they attend the workshop, however, the exposure to the specific skills needed to apply for graduate funding as well as vicarious learning through peer mentoring may increase self-efficacy. This increase in self-efficacy in the area of graduate funding could be attributed to the workshop.

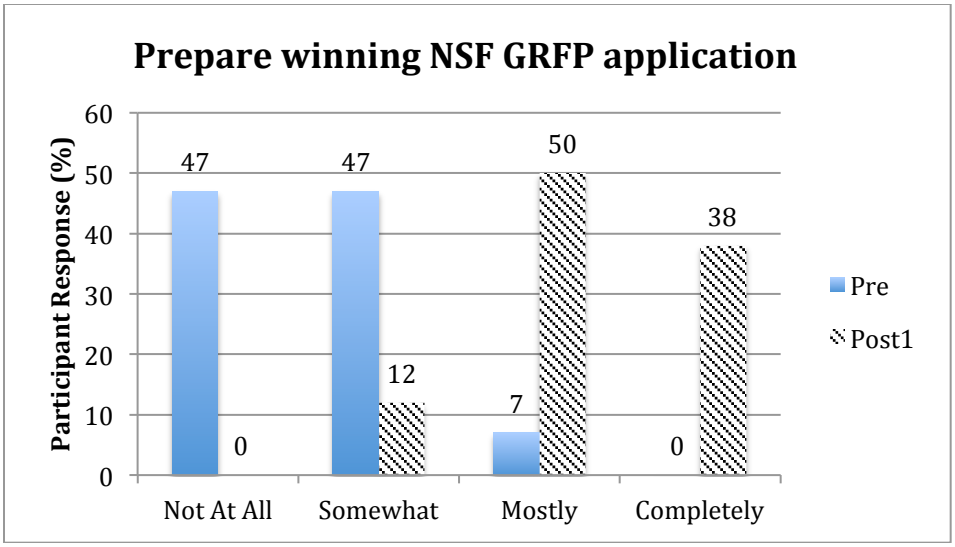

Figure 7. Respondents' knowledge of how to preparing a winning NSF GRFP fellowship application

As shown in Table 3, t-test results suggest substantial changes in workshop participants' knowledge from pre-post1 for all of the areas discussed above. However, the discrete nature of the Likert scale items suggest that parametric inferential statistics may not be appropriate to examine pre to post-test differences.[16] As a result, chi-square tests, non-parametric inferential statistics, used more often with discrete data, were also conducted on all of the items described above.

Table 3. Comparison of post1 to pre-survey responses: Paired samples t-test

Post1-Pre	Paired Differences					Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	t	df	
Fellows differences	.680	1.03	.21	3.3	24	.003
Finding graduate school opportunities	1.04	1.15	.23	4.6	25	.000
Strategy for finding opportunities	1.40	.913	.18	7.67	24	.000
Requesting appropriate recommendations	.346	.79	.16	2.21	25	.036
Writing winning essays	1.19	.89	.18	6.79	25	.000
Preparing winning fellowship (general) application	1.58	.58	.11	13.92	25	.000
Prepare winning GRFP application	1.69	.55	.11	15.71	25	.000

The chi-square test results suggest substantial changes in workshop participants' knowledge about requesting appropriate recommendations after attending the workshop ($\chi^2(9, n = 26) = 30.49$, $p = 0.00$) and are displayed in Tables 4 and 5. Chi-square tests were conducted on both the preparing winning fellowship applications, in general, and more specifically, winning NSF GRFP applications; however, significant differences in pre and post-survey responses resulted for the preparing winning NSF GRFP applications only ($\chi^2(4, n = 26) = 10.63$, $p = 0.03$).

Table 4. Cross tabulation of pre and post1 items for requesting appropriate recommendations

Cross tabulation for Requesting Appropriate Recommendations		Post				Total
		Not At All	Somewhat	Mostly	Completely	
Pre	Not At All	1	0	0	0	1
	Somewhat	0	1	3	2	6
	Mostly	0	0	5	5	10
	Completely	0	0	3	6	9
Total		1	1	11	13	26

Table 5. Chi-Square tests for cross tabulation in Table 4

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.485	9	.000
N of Valid Cases	26		

Table 6. Cross tabulation of pre and post1 item for preparing a winning NSF GRFP application

Cross tabulation for Preparing Winning NSF GRFP application		Post			Total
		Somewhat	Mostly	Completely	
Pre	Not At All	3	8	1	12
	Somewhat	0	5	8	13
	Mostly	0	0	1	1
Total		3	13	10	26

Table 7. Chi-Square tests for cross tabulation in Table 6

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.629	4	.031
N of Valid Cases	26		

Post2-survey results and discussion

The previous sections focused on post1-survey responses from respondents who may or may not have attended the extended portion of the workshop. The goals for the extended workshop were to introduce participants to the NSF GRFP application requirements (e.g. the three essays required), Broader Impacts, and Intellectual Merit review criteria. Therefore, in the following results we will also discuss the results from the post2-survey, on which we expected attendees of the workshop to potentially report changes above and beyond what they learned in the first part of the workshop, which were reflected in the post1-survey results.

Considering the pre-survey results, Figures 8 and 9 show that the majority of the workshop's participants, more than eighty and seventy percent did not understand Intellectual Merit or Broader Impacts, respectively. Comparing the pre-survey to both the post1- and post2-survey results for Intellectual Merit in Figure 8, we see that the majority of respondents report "Mostly" or "Completely" for understanding Intellectual Merit. As anticipated, we see an increase in the percentage of students who "Mostly" understand Intellectual Merit from post1 to post2.

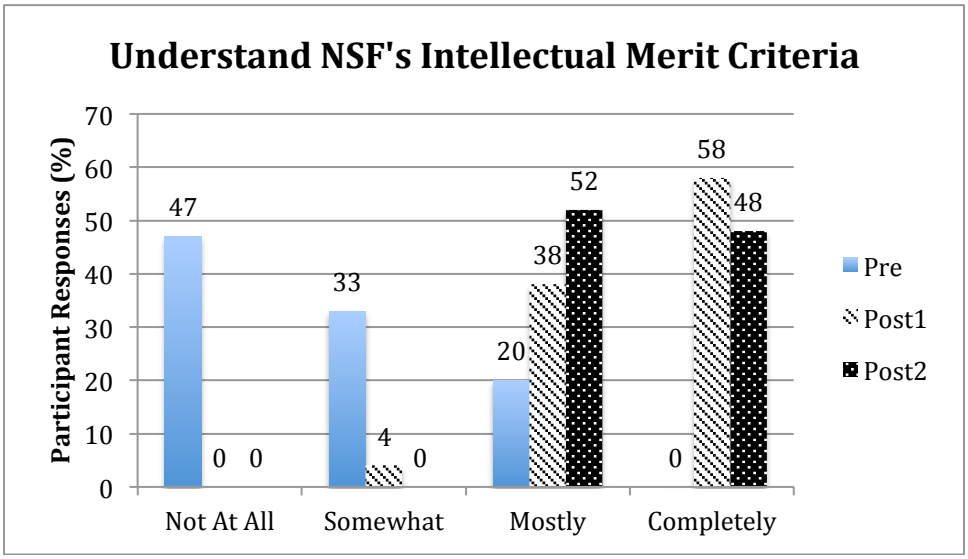

Figure 8. Respondents' understanding of NSF's Intellectual Merit Criteria

While the findings are similar for Broader Impacts, a potentially important difference is that in the post2-survey results, the majority (eighty percent) of the respondents reported "Completely" understanding Broader Impacts (Figure 9). One could hypothesize that this group of majority underrepresented graduate students identifies well with the Broader Impacts review criteria (which includes aspects such as increasing diversity) and, therefore, reported larger improvements in understanding this area as compared to improvements reported for Intellectual Merit (which include demonstrating requisites for scholarly scientific study). However, the difference in improved participant understanding between Broader Impacts and Intellectual Merit may also suggest a need for the workshop facilitators to provide improved explanations for Intellectual Merit in

subsequent workshops. As shown in Table 8, t-test results suggest that substantial changes in workshop participants' understanding of Intellectual Merit and Broader Impacts from Pre to Post1, pre to Post2 but not from Post 1 to Post 2. Chi-square tests conducted did not suggest any substantial changes, and therefore are not presented.

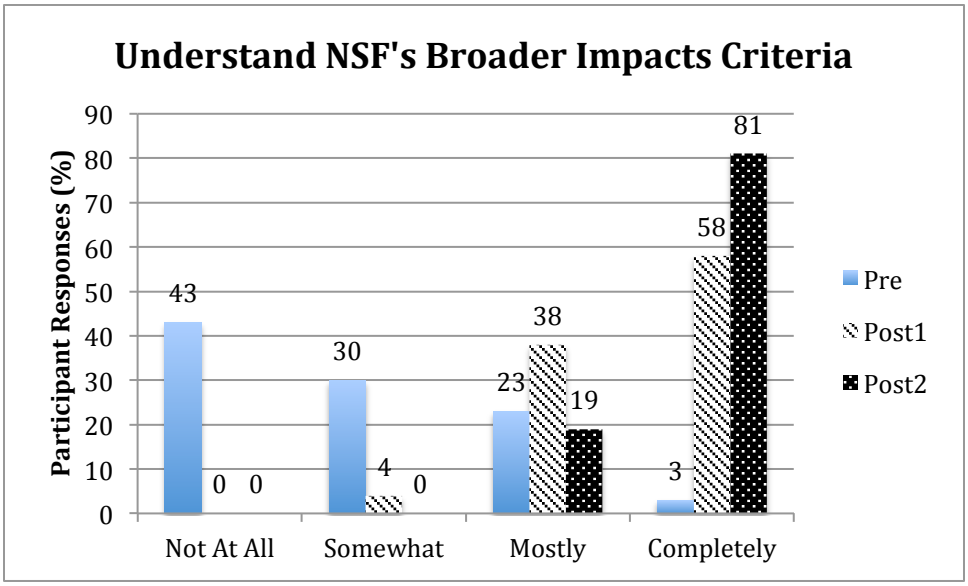

Figure 9. Respondents' understanding of NSF's Broader Impacts Criteria

Table 8. Comparison of pre to post1 and post2: Paired sample t-tests

	Paired Differences					Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	t	df	
Understand Intellectual Merit (Post1- Pre)	1.731	.962	.189	9.178	25	.000
Understand Broader Impacts (Post1- Pre)	1.615	.941	.185	8.750	25	.000
Understand Intellectual Merit (Post2- Pre)	1.762	.944	.206	8.556	20	.000
Understand Intellectual Merit (Post2-Post1)	.111	.323	.076	1.458	17	.163
Understand Broader Impacts (Post2- Pre)	1.857	1.014	.221	8.391	20	.000
Understand Broader Impacts (Post2-Post1)	.167	.514	.121	1.374	17	.187

As previously discussed, additional qualitative data collected since 2007, the beginning of the workshop, further illuminate the increased understanding students received about NSF's review criteria and the breath and depth needed to apply for graduate and subsequent research funding. The following statements by previous workshop participants support our quantitative findings about the 2012 workshop:

> A 2010 NSF GRFP Fellow, African-American female, recent recipient of a masters in Mechanical Engineering, explains "*One factor in particular that proved helpful was the strong message of incorporating Broader Impacts statements in the essays. NSF values a great researcher however places high importance on how your research will affect overall society. Their presentation helped me focus on these aspects throughout my application. The reviewers of my application also commented heavily on my ability to see the broader impacts of my research*."
>
> Another participant from the 2010 workshop, an African-American, female PhD student in Biochemistry and Molecular Biology, received an Honorable Mention initially, but was later awarded a full fellowship. She comments on the organization and deep reflection needed to successfully apply *"Applying for the fellowship became another class for me because I worked on it almost every day and made a binder exclusively for fellowships, with separators for each fellowship. Literally and figuratively, I 'dug from the crates.' I thought about everything that I was involved in and considered how I could represent that experience in a way that was unique and showed the broader impact."*
>
> A 2011 NSF GRFP recipient and computer science PhD student with severe physical disabilities who attended the 2009 workshop with the aid of her mother and her laptop later commented, "*From the workshop, I learned how to properly organize my thoughts in my mind and translate it effectively into written form. For example, the research proposal should be seen as a feasible goal that can be achievable within the time of getting your degree and therefore, can be broken down into phases the can be numbered as phase 1 and phase 2. In the end, I couldn't believe opening the email to receive the fellowship. It felt like a miracle!*" She also won a Ford Foundation Fellowship.

In addition to highlighting the knowledge that workshop participants obtained as a result of the workshop, the following student's testimonial provided support for gaining empowerment to apply for graduate funding, which supports previously discussed benefits of hierarchical and group mentoring relationships:

> Another fellowship workshop participant who was not from an underrepresented group used his 2007 NSF GRFP fellowship application to win subsequent funding. This recent gerontology PhD recipient wrote, *"Applying for a NSF GRFP is a challenging yet rewarding experience and one that could be extremely daunting without the necessary support and guidance. The workshop provided me with the opportunity to have invaluable one-to-one advising. The support during these*

advising sessions gave me the confidence in myself and my project to not give up after an unfortunate 'mix-up' during my first submission and this persistence ultimately lead to an Honorable Mention. I would strongly encourage all people applying to utilize the workshop sessions and other university resources to better your application. In doing so, know that this will be a long and arduous process (made easier by the workshop) but that in the end, regardless if you get the fellowship, it will all be worth it."

Conclusions and Recommendations

While several workshop participants have received NSF GRFPs and other awards, our empirical analysis provides further evidence of the importance of this unique type of intervention. The quantitative data provide insights into specific areas of improvements gained by attendees of the 2012 UMBC workshop. In particular, our analyses provide consistent evidence for increased preparation of workshop participants in terms of requesting recommendations as well as completing fellowship applications, both key areas of evaluation by review panels. The qualitative data further illustrate the peer mentoring and attention to detail given in the workshop that instruct and empower participants to apply for and win graduate funding.

In summary, this study assesses an emerging example of how to increase success amongst STEM graduate students and broaden participation of all students, with particular attention to underrepresented minorities, through sustained peer mentoring and training. Not only does the study address increasing graduate student academic success, but also, through our example, we demonstrate the capacity of interventions of this type to enable peer mentors to begin their legacy of success in mentoring and training early in their careers. By conducting these peer mentoring workshops, the leading authors have become better speakers and organizers of other academic and skill-building workshops, which has translated to skills that they are incorporating into their professional careers. The authors now give regular invited presentations on graduate school funding. Skills gleaned from developing the workshop have allowed the first author to become a postdoctoral associate for education and evaluation research at a leading science and technical institution. The second author is now an Assistant Professor who is demonstrating ways that she was mentored by empowering students at her current university in this peer mentoring tradition.

Previous research shows that there is a need for more educated workers in the United States and the potential impact of diversifying this workforce to fill this void.[12] The results of our survey demonstrate that a seminar such as the one described here can contribute to several factors for student success such as a) funding for their graduate education, b) connecting them to a community that is pursuing the same goal, and c) increasing their belief that they can succeed in funding their graduate education. Further, since this workshop promotes hierarchical and group peer mentoring which opens lines of communication among participants and can facilitate success in other areas. We highly recommend that universities invest in creating such a seminar. The investment will far outweigh the costs.

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