

**AC 2009-2466: USING SOCIAL NETWORKING WEB SITES TO INCREASE
SUCCESS OF UNDERREPRESENTED MINORITIES IN SCIENCE AND
ENGINEERING PROGRAMS**

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Social Networking Websites for Increased Success of Underrepresented Minorities in Science and Engineering Programs

Abstract

Social networking websites provide an environment for underrepresented populations to discuss participation in science and engineering (S&E) education. These demographics are often hesitant to pursue advanced degrees due to limited awareness of the graduate process and a lack of mentors, among other factors. In this work, Facebook (www.facebook.com), the second largest social network on the web, is used as a platform for increased support and guidance in minority participation programs. The National Science Foundation (NSF) Bridge to the Doctorate Fellowship (BTD) within the Philadelphia region is used as a test case. This social network provides a non-threatening, peer-developed setting where students can openly discuss topics ranging from everyday issues such as study techniques and skills to topics that often have a limited voice, including cultural differences and their impact on graduate life. Through open format discussion boards, academic advice on fellowship opportunities, publishing papers, networking and stress-relief activities is easily exchanged. With the increased popularity of social networking websites the information presented can serve the retention and awareness efforts of the BTD program and address the uneven participation of underrepresented groups in S&E fields in general.

Introduction

Students of Latino, African-American and Native American descent are not entering school and obtaining degrees within science, technology, engineering and mathematics (STEM) fields in proportion to other demographics^{1,2}. There are many reasons why these students are not choosing to study STEM fields, including inadequate access to a quality K-12 education, negative stereotypes, lack of role models and mentors, limited knowledge about these fields, lack of confidence in abilities, and the digital divide among others.^{1,2,3,4,5} Another area in which minorities suffer within graduate school is with cultural capital and congruity. The literature reports that an education system develops a culture similar to its society's dominant culture. In order to successfully navigate the education system a level of familiarity with that culture is necessary³. For minority students, especially Latinos, such unfamiliarity can cause many issues, create discomfort and discourage students from participation.

These disparities in participation manifest themselves through all levels of education, starting within pre-collegiate institutions and transgressing through academia and industry. In K-12 education, significant gaps exist in mathematics between white students and minority students. The National Science Board Science and Engineering Indicators 2008 states the average mathematics scores of black fifth graders are equivalent to the average third grade score of white students². In degrees of higher education, minority students make up approximately 15% of all S&E bachelors and masters degrees although they make up a much larger percentage of the total degree population². African Americans account for 5.3% of STEM field doctoral degrees while

making up nearly 13% of the population⁴. Of the 9,065 Ph.D.s awarded in engineering in 2007, 123 went to African Americans⁴. In academia, the engineering faculty with Ph.D.s at four-year institutions is 4% African American, with a large percentage of this population coming from historically black colleges and universities (HBCU's)⁴.

These issues are all interrelated, and there is strong motivation for a sufficient remedy. The benefits of diversity and expansion of the skilled workforce have been well documented⁵. The United States, as well as most of the countries around the world, view engineering as an area of national need. The aging engineering workforce could potentially have devastating impacts on individual economies as well as the global economy. The NSF estimates the US will need 20% more engineers by 2010. If things remain as they are the workforce will be in short supply as the pool of qualified graduates is expanding at two percent. Minorities will continue to make up a larger and larger percentage of the student population growing from 30% currently to 50% by 2050⁴.

Many programs have been developed to alleviate these imbalances, including summer bridge programs, tutoring services, academic enrichment activities, counseling and/or mentoring, and cooperative education and internship experiences both on and off campus^{7,8}. The importance that guidance by undergraduate school supervisors, family and friends have on a student's decision to enter graduate studies also has a measurable impact. Programs focused on inclusion have made a large impact on the number of underrepresented students obtaining education and degrees at every level. HBCU's have strong support networks and retention initiatives which has contributed to their success^{4,8}. This model has been translated to many other programs, including this work.

As a supplement to students participating in the various programs aimed at increasing minority participation in STEM, this paper discusses the use of online social networking to promote more widespread success of these efforts. Specifically, this work deals with students of the NSF Bridge to the Doctorate Fellowship within the Philadelphia region. Through a virtual, student-only network many of the issues hindering increased participation of minorities in graduate STEM fields are discussed.

NSF Bridge to the Doctorate:

The Bridge to the Doctorate Fellowship Program (BTD) is an NSF initiative within the Louis Stokes Alliance for Minority Participation (LSAMP). It provides students from underrepresented populations with fellowships for graduate studies with the goal of increasing the number of minority students obtaining Ph.D.s in STEM fields⁹. The BTD fellowship has proven successful in its efforts to increase the number of minority Ph.D.s within STEM fields. The support structure and available resources prove critical in student retention beyond the mandatory Master's and into a Ph.D. An annual retreat helps students mentally prepare, provides structure and lends a hand of support for impending and current graduate research and studies. As students come together, the shared difficulties, problems and frustrations expressed to sympathetic ears provides a feeling of strength and comfort very different from the isolation of graduate studies as a minority.

A few main factors are said to inhibit minority participation in graduate STEM. Some of them include a lack of information about graduate school and admission process to the graduate programs, the perceived value of graduate education, cultural and capital congruity, and student's perceived educational preparedness. The BTD administrative programs address all of these areas; however, if they can receive added attention beyond the administrative support of the BTD program, more minority students will pursue Ph.D.s. This is the intention of this work.

Facebook Groups Function:

The Facebook groups function has many features which allow it to be used as an educational resource. Generally an individual or group of people is given management rights to maintain the group; in this case the author of this work serves as the manager. Just about all aspects can be tuned to suit the group's specific needs, such as access, group type, and information provided, among others. Access can be given to all Facebook users, a chosen community, or a certain group of individuals. In this work, the members of the Philadelphia BTD program are individually given access, and no one else can visit the group. There are many preset options for the category and type of group that provide background information but have no other bearing on how the group is managed. This group's category is "Student" and the type is "Community". The manager can choose what type of information can be posted and in what format. A discussion board, a wall for posting short messages, a photo album, a video library, a section for posting links and for related groups on Facebook are the rest of the available features. All of the features are used in this work.

Providing for Further Success in the BTD Program:

This online network, established as a supplement to the BTD administrative support, provides for increased student communication and extends the feeling of community. This virtual network was created by registering the group on the facebook website and giving it the title, "Philadelphia Bridge to the Doctorate Student Network". Once the group is created a description is written as an introduction to the group and to describe what its main purpose is.

"Based on the BTD students' own experiences the group is used and developed as a valuable resource to support each other so that future students entering the program can have many of their questions answered ahead of time rather than entering with reservations as many of us did. The network is used to maximize the member's potential as graduate students and serve as our virtual voice to provide student feedback so that we and the program itself succeed. If any larger issues arise, our voice can be used to bring about the change we feel is necessary."

This group is committed to provide a setting in which anything can be discussed to ensure the success of all of the past, present and future BTD candidates and:

- *Be a supportive environment for current, past and potential BTD students*
- *Provide information on graduate life and succeeding as a Masters/Ph.D. student*
- *Discuss the cultural difficulties of graduate life*

- *Discuss the benefits of obtaining a Ph.D.*
- *To empower BTM students to maximize available resources*
- *Provide for potential inter-institutional collaboration and liaisons for Ph.D. granting programs*
- *Assist in retention and recruitment of current/future BTM students*
- *Provide a calendar for social events which other BTM students are planning or attending*

With the group established, members are invited, in this case consisting of the Drexel University, Delaware State, Temple University, and University of Delaware BTM cohorts. The members are encouraged to develop discussion boards for relevant issues involving their graduate education and the pursuit of a Ph.D. Made up of only students, the network is effective in allowing for all topics to be discussed, including those that are difficult to broach with administration. The fact that it is strictly a peer group is reinforced to provide for added comfort when discussing sensitive topics. Once discussion boards are created all the other members have access and can contribute their thoughts as they see fit. Other functions within Facebook are useful as well, such as posting links to useful sites for publishing papers, finding grants, calls for proposals and conferences. These additional features provide substantial additional benefit beyond providing comfort during the graduate transition into succeeding as a graduate student.

Benefits

The annual BTM retreats help all of the students tremendously. The idea behind this work is to provide that feeling and support throughout the year in a virtual manner. If the BTM cohorts want to express and cope with cultural isolation, frustrations with colleagues or anything else this work provides a virtual support system that can provide comfort. It also provides for the exchange of survival skills, study habits and how to deal with politics and policies of academia. Social networking can help alleviate any of the areas shown to be difficult for minorities in graduate school.

In a formal evaluation of the benefit of this work with the BTM students, those questioned all felt that the concept of localizing and simplifying the search for this type of information was extremely valuable, and this resource is important to many areas within academia. They expressed that they would have benefited greatly from having this network available in their earlier graduate school years and appreciated being able to help their younger peers. Similarly, as each student takes their own path to obtaining a Ph.D. the parallel insights and different viewpoints prove invaluable. They appreciated the informality of the group and being able to address any issue without fear of judgment or being intimidated into silence. Students new to the BTM community were comforted by the available support network and felt a sounding board for their questions would prove invaluable as they progressed through the program.

Most of the students questioned felt that the discussion boards were most valuable and were the resource that they returned to check for updates and to provide feedback. The various discussion boards created thus far discuss the following areas: the benefits of obtaining a Ph.D., cultural impacts of graduate school, industry versus academia career opportunities, becoming a professor at a predominantly white university vs. HBCU, graduate survival skills and overall concerns and

fears of pursuing graduate degrees. They mirror what the literature has said are some of the main concerns and hesitations about graduate school, and open discussion with peers can be effective in easing concerns, more specifically in the following areas:

- **Cultural Capital/Congruity:** Being surrounded by peers and people that make you feel comfortable is valuable in any environment. The pursuit of a Ph.D. can be overwhelming on its own, but tie in cultural isolation and the difficulty escalates. Through virtual networking social capital is increased minimizing feelings of isolation and providing a place to express personal thoughts and cultural issues. One surveyed student claimed “hearing a peer go through the same thing I am going through makes [the process] easier”. Additionally, this network can “provide counter spaces that provide a sense of belonging and safe places to learn. Counter spaces counteract or neutralize their negative encounters with peers or faculty in the department.”¹⁰ This counter space can help exchange information on how to deal with cultural differences when they become difficult, as many of the students in this group have experienced.
- **Lack of Information about Graduate School:** Many of the cohorts in this study entered graduate school with little knowledge of how the system works. The later cohort, brought into the group early in their BTM tenures, was able to access the discussion boards and obtain information which helped make the undergraduate/graduate transition easier. Discussion on performing research, dealing with professors and time management all helped to ease the BTM students’ initial difficulties of graduate education and research. “Learning I could shop around for the right advisor really made a huge difference in my happiness,” claimed one new BTM student using this resource.
- **Perceived value of graduate education:** Minority students commonly misunderstand the benefits of obtaining a Ph.D. or rarely give much thought to pursuing one. Through discussing the benefits of obtaining a Ph.D. many interesting ideas were put forth and new ones generated in response. There are a wide variety of postings ranging from the creation of knowledge and personal growth to freedom and control over your career. The responses have been positive, where all students are encouraging obtaining a Ph.D. Career choices, such as academia versus industry and other options important to this decision, have been discussed as well.
- **Perceived educational preparedness:** Many students doubt their own abilities when entering a graduate program, whether it is math skills or bad study habits. Through this space the personal shortcomings and the adjustments made to succeed have been discussed and resonated with the members: “Hearing other students doubts and knowing that they persevered was really empowering.” Most students agree that it is just personal doubt and fear which create these perceptions, and with dedication and hard work these BTM cohort students can handle any assignment or task.

Additionally, this virtual network can help with potential applicants. All applicants can be given access to the group allowing them to understand the program before entering it. This can

provide for a more focused cohort in which the students know what kind of program they are entering.

Drawbacks

Social networking has become a very popular way to exchange information and communicate with peers. Unfortunately, it is more often used for chatting with friends and as a quick distraction as opposed to an educational tool. The benefit of this work has been limited by the lack of desire for the student participants to use Facebook as an educational tool. It has been argued that Facebook blurs the line between friendship and professionalism; both professors and students are known to use the site.¹¹ Impinging on personal space with professional ideas can make some people uncomfortable. The progress in developing the group thus far has been obtained by active encouragement to contribute to the group. Without any direct incentives it has proven difficult to get the students to contribute. As an academic tool, it would prove beneficial if students/administrators develop incentives or requirements to increase contributions.

In questioning the same set of students, a few more issues were made evident. Although the space is private and only accessible by the members of the BTD Philadelphia Cohorts, Facebook is understood to be a public space in which information can be viewed by all. This lack of perceived privacy and with the ease of the spread of information in the digital age, many students were hesitant to contribute personal thoughts. Time constraints also played a large factor in students not contributing more thoughts. With the heavy load of graduate studies and the focus required to perform Ph.D. research even taking a few minutes to contribute to this virtual space can be difficult. With such intense focus, the value of different viewpoints can sometimes be underestimated.

Establishing Similar Online Networks

In this work the NSF Bridge to the Doctorate Philadelphia region serves as a test case for the feasibility of this concept. The implementation of this idea for other groups and programs requires minimal resources. The popularity and established tools within the existing online networking websites provides a solid platform. A dedicated website could be established for this purpose as well. The only requirement in the social network is the ability for members to post messages, discussions or ideas that other members can read and to which they can respond.

In the case of using an established site, a group created for this particular purpose provides the platform for discussions and information as well as provides options for privacy and membership. Generally a manager is needed to establish the goals, create an introduction, maintain the group site and see that it maintains its purpose. An advisor or professor can play the role; however, that can sometimes limit the discussions students are willing to have. An experienced graduate student or alumni within the particular program can avoid this issue and provide insight into the graduate process and success within the respective program. Once the platform is developed the manager can open the lines for communication with a few topics or ideas to make the members comfortable with the concept. Once members understand the purpose and how the group will function, they are free to develop discussions and use the network as intended.

Conclusion

Effective means for combating the issues facing minority students entering graduate STEM education are addressed through online social networking. The established means of increasing participation have done much to increase parity; however, achieving balance is extremely difficult, and with the added pressure due to the lack of engineers in the workforce, this issue is one of national merit. The success from the recent past is beginning to trickle down through the system, providing more mentors and role models and increasing awareness; yet, the work is far from complete. With increased help from within these programs in a peer-to-peer structure, increased success can be obtained and help develop students into mentors who will want to help the next generation maneuver their way more easily through their own educations.

The structure of this virtual network can be translated to fit many types of programs promoting increased participation of underrepresented minorities in STEM fields. Since many of the current issues and hindrances to participation involve cultural isolation and limited knowledge of the process, online networking can be used as an effective tool. The benefits of increased communication through a virtual network have been felt within the Philadelphia BTD student community. Expanding this type of student network to a broader audience (city, state, national and international) could largely impact the success of many programs aimed at increasing participation throughout the country and globe.

Bibliography

1. National Science Foundation, Division of Science Resources Statistics “Women, Minorities, and Persons with Disabilities in Science and Engineering”, NSF 07-315 (Arlington, VA; February 2007).
2. National Science Board. 2008. *Science and Engineering Indicators 2008*. Two Volumes. Arlington, VA: National Science Foundation (Volume 1, NSF 08-01; volume 2, NSB 08-01A).
3. Cole, Darnell and Espinoza, Araceli, “Examining the Academic Success of Latino Students in Science Technology Engineering and Mathematics (STEM) Majors”, *Journal of College Student Development*, Vol. 49 No. 4, July/August 2008.
4. Loftus, Margaret, “Untapped Potential”, *ASEE Prism*, October 2008.
5. Centre for Strategy and Evaluation Service, European Commission, “The Cost and Benefit of Diversity: Executive Summary”, October 2003.
6. Maheshwari, Sharad K. and Price, Anne L. “Understanding the Lack of Minority Representation in Graduate Programs in Computer Science and Information Technology: A Focus Group Study of Student Perceptions”, *Proceedings of the Allied Academics*, Volume 15, Number 2, Reno 2008.
7. “Preparing Minority Scientists and Engineers”, Michael F. Summers, Freeman A. Hrabowski III, *Science*, 31 March 2006 Vol. 311.
8. NSF Bridge to the Doctorate, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5477
9. “A Threat in the Air: How Stereotypes Shape Intellectual Identity and Performance”, Claude M. Steele, *American Psychologist*, June 1997 Vol. 52., No. 6, 613-629.
10. “Ong, Maria, “Effects of Informal and Formal Support Groups on Retaining Women and Minorities in U.S. Physics”, *The project SEED initiative*, The Civil Rights Project at Harvard University & TERC.
11. Golub, Alex, “The Flaws of Facebook”, *Inside Higher Ed*, www.insidehighered.com/views/2009/02/03/golub.