

The Development of Social Capital in Engineering Education to Improve Student Retention

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Abstract – The purpose of this paper is to present a framework for understanding how social capital generated through involvement in student-run engineering organizations can help to improve retention rates of African American students in engineering and positively affect their overall success. The individualistic and weed out culture of engineering, ethnic isolation, and lack of interaction with faculty and broader university community can leave these students feeling isolated. Consequently, students may become at risk for leaving the field, or not excelling in it, thereby making the goal of retaining a diverse cohort difficult to achieve. Through interview data that reflect the experiences of students involved in the National Society of Black Engineers, it can be shown that student-run organizations can help develop social capital for positive outcomes.

Keywords: social capital, minority student retention, student-run organizations

INTRODUCTION

Over the last decade, national demographics in the United States have changed. The non-Hispanic majority in this country grew only 3.4%, as compared to a Hispanic, Asian American, and African American population that increased 58%, 50%, and 16% respectively. These facts are especially interesting in light of the aging engineering workforce, traditionally composed of 82% whites and 75% males, since there will no longer be a similarly homogeneous group to replace them [Jackson, 5]. Dr. Shirley Ann Jackson, President of Rensselaer Polytechnic Institute states that our national economy and preeminence are “powered by the technological and scientific discoveries and innovations made by scientists and engineers”. This statement points to the importance of continuing to develop the newest cohorts of scientists and engineers. Consequently, in order for this nation to maintain a leadership role in developing cutting-edge research and technology, a diverse population of engineers is a necessity.

This paper focuses on African American students; however, the findings will have implications for all ethnic minorities. The challenge of retaining African American college students in engineering fields is evident from the collegiate enrollment numbers. In 2001, African Americans represented 4.8% of the engineering degrees awarded in the US, and only 41.8% of African Americans entering engineering actually graduated [Brown, Morning, Watkins, 1]. Explanations for the lack of Blacks in these fields include a lack of role models, a weed out and individualistic culture, a dearth of exposure to engineering, and a lack of support structures. Whatever the cause, the result is a lack of representation of Blacks in industry and academic positions in the field of engineering. We must explore ways, therefore, to ensure the retention of Black students. Many researchers have shown how social capital can lead to academic success; hence, the purpose of this paper is to explore how student-run organizations such as the National Society of Black Engineers can be used to generate the social capital necessary to retain minorities in the field.

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A SOCIAL CAPITAL FRAMEWORK

In this section, a discussion is offered on how a social capital framework can be utilized to analyze how the National Society of Black Engineers (and possibly other student-run organizations) can benefit its members (see Table 1 for summary). The authors first utilize Richard Stanton-Salazar's definition of social capital as, "a set of properties existing within socially patterned associations among people that, when activated, enable them to accomplish their goals or to empower themselves in some meaningful way." [Stanton-Salazar, 10], and then further distinguish between bonding social capital – bond of connectedness amongst homogeneous groups, and bridging social capital – ties formed across diverse social groups [Putnam, 9]. The "goal," here is for African American students to remain in engineering disciplines. One major challenge to this goal is the culture of individualism and competition associated with these fields; a culture that is at odds with that of African Americans [Chang as cited in Brown, 2]. Students who participate in collaborative learning and educational activities outside the classroom and who interact more with faculty members get better grades, are more satisfied with their education, and are more likely to remain in college [Wasley, 12]. Additionally, data from the National Student Survey of Engagement [NSSE, 8] suggests that getting students involved in educationally purposeful activities increases the probability of them staying in school.

James Coleman's framework of social closure gives insight as to why this increase in retention rates through active involvement may be true. He distinguishes amongst several forms of social capital – levels of trust within a social structure, obligations and expectations, information flow, and norms and sanctions. He states, "Like other forms of capital, social capital is productive, making possible the achievement of certain ends that in its absence would not be possible (pg. S98)." He goes on to suggest that social capital emphasizes network closure – a connectedness between a child, their family, friends, community, and school – which could translate into higher academic achievement [Coleman, 3]. Although student-run organizations are not necessarily made up of people who share kinship (or who are raising children for that matter), its members share connectedness of school, community (i.e. same university where much of their time is spent), and often friends. This tight network of relationships should foster the same sort of closure Coleman found in his studies. Additionally, this bonding form of social capital should positively influence students' academic achievement and, as a result, their retention.

Another barrier to the goal of retaining African American students is due to ethnic isolation [May & Chubin, 7]. As a result, many students do not have the opportunity to interact with their peers or other members of the academic community. Student run organizations may enable students to escape this isolation in two ways. The first is providing the confidence to bridge to other ethnicities. The second is structured opportunities to interact with members of the institution. How can involvement in a predominantly minority organization actually lead to less ethnic isolation? Zhou and Bankston's [13] work on how the culture of a Vietnamese community in New Orleans influences students' orientation toward schoolwork and academic achievement may provide insight. They suggest that certain adaptive advantages are created when groups adjust cultural orientations to fit into American society and maintain original cultural patterns. Thus, ethnicity becomes a distinct form of social capital for these groups that supports them in navigating the broader world. Although these authors study immigrant communities, their framework may be extended to other groups who have shared a set of beliefs, values, and behaviors (i.e. culture). The mission of a student-run organization can be a starting point for establishing such a culture for that organization. Much like the immigrant cultures, then, there is an explicit influence on member value orientation as it relates to school.

Mere interaction, however, is not enough. To further extinguish the effects of ethnic isolation, African American students must have the opportunity to encounter people (minority and non-minority), who can provide them with resources that can help them achieve. Stanton-Salazar and Dornbusch [10,11] offer a framework to depict the importance of social capital and institutional support in the educational achievement of minority students. They state that the success of minority youth "depend[s] upon regular and unobstructed opportunities for constructing instrumental relationships with institutional agents across key social spheres and institutional domains." (pg. 6) Although this work focuses on the experiences of Mexican-American students in secondary schools, their model can, and should be extended to other minorities in post-secondary institutions. Student-run organizations can offer structured opportunities to interact (or bridge) with "institutional agents" -- people who control valued institutional resources. Opportunities to see, meet, and most importantly interact with Black students and faculty at every stage of the pipeline can help foster a tiered system of social networks to help students succeed.

Table 1. Social capital framework applied to student-run organizations

Construct	Barrier Addressed	Kind of Capital	Application to Student-Run Organizations
Interconnectedness and social closure [3]	Individualistic and weed out culture of engineering	Bonding	Similar closeness and familial structure – establish norms and obligations
Ethnic Social Capital [13]	Ethnic isolation [7]	Bonding & Bridging	Strong culture grounded in mission statement and enforced by familial structure helps students develop positive achievement orientation and navigate outside world
Institutional Agent [10,11]	Lack of interaction with faculty and broader university community	Bridging	Guidance in the development of relationships with these agents and access to invaluable information

OVERVIEW OF NATIONAL SOCIETY OF BLACK ENGINEERS

With more than 19,000 pre-college, collegiate, and alumni members, NSBE, is the largest student-managed organization in the world. Upon its founding in 1975 by six African-American students at Purdue University, its mission was and continues to be “to increase the number of culturally responsible Black engineers who excel academically, succeed professionally and positively impact the community.” More than thirty years later, NSBE has an international headquarters located in Alexandria, Virginia and is comprised of more than 270 chapters on college and university campuses, 75 Alumni Extension chapters, and 75 Pre-College chapters worldwide. Although the headquarters is not comprised of students, its role is to support, rather than dictate, the daily functions of the organization.

Its mission in action takes the form of tutorial programs, group study sessions, community outreach programs, regional and national conferences, technical seminars and workshops, career fairs, mentoring activities, and many other programs. These activities have been developed so that NSBE can stimulate as well as develop interest in engineering, encourage members to seek advanced degrees and professional registrations, establish mentoring relationships for blacks in engineering, and function as a representative body on issues that affect black engineers [LMU, 6].

SOCIAL CAPITAL IN THE NATIONAL SOCIETY OF BLACK ENGINEERS

The authors believe that involvement with the National Society of Black Engineers contributes to both the retention and success of its members through the development of social capital via its programs and conferences. More specifically, it is expected that certain programs will serve as a basis for establishing an interconnected social network of students who develop a culture – based upon the mission statement – that is beneficial for academic achievement and therefore retention. Simultaneously, conferences may provide access to institutional agents that enable the bridging necessary for both academic achievement and future success. To further investigate these beliefs, students were interviewed who had successfully matriculated through a four-year university and now either hold a job in an engineering related field or are in graduate school pursuing further engineering degrees. Below, some of the themes that emerged as a result of these interviews are detailed⁴.

⁴ Semi-structured interviews consisting of Likert-scale and open-ended questions were conducted in person at the National conference in Pittsburg, PA. All four interview participants, contacted by personal email prior to the conference, were members of the Florida Agricultural & Mechanical University – Florida State University Chapter of NSBE,

Establishing a Foundation – NSBE’s Mission and “Luv”

The importance of not only knowing the mission of NSBE, but also “living” it was apparent as Carl Mack, who serves as the Executive Director at the NSBE headquarters, addressed the media in Pittsburgh, PA in March of 2006. He was not alone in his passion for the mission. Almost every speaker who addressed the general body at the national convention, including two NSBE founders and a former national chairperson recited the mission and reminded members of its importance. The claim here is not that the mission directly fosters the development of social capital; rather it institutes an ethos within the organization. This is important because the programs, which do support the development of social capital in the organization, are developed with a specific focus on putting the mission statement into action. Working in conjunction with the mission to create a culture within NSBE is the idea of “NSBE Luv” [sic].

“NSBE Luv is the reason that members of this organization defended me when I told Donald Trump that the show was called *The Apprentice*, not *The Apprenti*” – Dr. Randall Pinkett

This was the sentiment expressed by Dr. Randall Pinkett, the Fall 2004 winner of the NBC Show *The Apprentice*, during his address to the general body meeting at the national convention⁵. NSBE Luv is the idea that all members of the organization are experiencing similar trials that place them in similar positions and therefore they develop similar perspectives about the world. This notion serves as a basis for members to move beyond collegial interactions into more familial type relationships, often cited in the interviews and observed during the conference, and helps bonding social capital to form on the chapter level. All interviewees stated that the most important aspect of their involvement with NSBE was the family-like relationships they formed as a result. One participant stated, “NSBE Luv creates a family atmosphere.” This was also evidenced in participants’ tendencies to greet each other as “family.”

NSBE strives to further develop this “luv” on a chapter level by involving members in more than just organizational business-related events. Movie nights, bowling outings, poetry sessions, and other socially based events serve to establish the sort of bonding ties necessary to develop social capital. Additionally, because the relationships are viewed as “family-like,” trust and reciprocity develop as norms, at least on the chapter level. All interviewees indicated spending the majority of their time, both day and night, with NSBE members and ranked their level of trust at the chapter level as 8 (scale; 1:I don’t trust them at all, 10:I trust them completely). This time included attending classes, studying for tests, completing homework, and attending social events (both NSBE and non-NSBE sponsored events). One participant followed her rating of level of trust with the statement, “NSBE is a sort of buffer to having to feel people out... You know you already have stuff in common with them so you skip the uncomfortable stage and get right to building friendships.”

So how does NSBE “Luv” manifest beyond the chapter level? Regional, National, and Leadership conferences serve as opportunities for many chapters from the six regions of the organization to come together and develop bonding capital. Participants’ rankings of regional and national trust levels decreased to averages of 5.125 and 3.75 respectively. One participant described regional and national level interactions as “depersonalized and detached” since it is more difficult to see the impact of working together. Additionally, since there is a lot of organizational business handled at regional and national conferences, it seemed more difficult to develop the same level of relationships found on the chapter level.

Although, the rankings are low, participants’ responses and observations do indicate that chanting, social events, and leadership development activities allow students to form some level of relationship with other members of the organization with whom they would not normally have the opportunity to interact. At regional meetings, different chapters work together to create regional level chants – something one participant described as “big kids having fun.” For instance, the Region Three chant consisted of one student yelling “Whoooooose house?” and members of the region responding “Threeeeeee’s house” (observation notes). This seemed to foster pride, unity and a level of bonding amongst chapters in the same region. Also contributing to non-business interactions were parties, game nights, poetry competitions, and a closing banquet with a concert.

⁵. Upon announcing Pinkett winning the competition, Trump asked him if he would be willing to let the runner-up share his title of “The Apprentice”.

At the National Leadership Institute, students must share a room assignment with someone who he/she may not know, but who shares the same leadership position in a different region. One participant mentioned that this type of forced interaction was uncomfortable at first, but in the end leaders usually became friends.

Again, this time and relationship building at all three levels of the organization facilitate the formation of norms of behavior. One example of these norms showed up when one participant who was asked why she joined NSBE stated:

“I was on a sort of a downward spiral... a lot of my friends had started leaving school and I wasn't enthused about what I was doing. I happened to be doing part time work at the engineering building and the NSBE Vice President would often give me a ride back home (the engineering campus is separate from the main campus). On a few of the rides home I told her some of what I was going through and she encouraged me to get involved with NSBE and hang out. I began attending some of the events and even before I joined, she and others would hold me accountable for doing my work. So I decided to join.”

Joining because of peripheral involvement was not always the case. One participant stated that he joined the organization because he saw it as an opportunity to network. However, he also felt that while he had received this benefit from joining he also indicated that “family, friends, role models, mentors, and people to study with” also developed as a result of his involvement.

With this evidence that bonding social capital is formed as a result of the family-like structure of NSBE and associated “luv”, it can be seen that Coleman's idea of social closure does, indeed, apply to this organization. Beyond a closed network, participants mentioned explicitly that involvement with NSBE influenced their decision not to leave engineering. When asked, “What influenced your decision not to leave engineering,” one participant stated:

“The people I met through NSBE... Misery loves company [chuckle] I figured that I could either switch majors and possibly end up fighting the same battle over again, except by myself this time or I could stay in engineering and at least fight with a team. I knew that I had people supporting me in NSBE that would help me get through it.”

Echoing this feeling about NSBE, another participant stated, “[I decided not to leave engineering after I] went to my first [national] conference and came to the conclusion that there is no other major that is as important as engineering.” These statements, along with others that relate to NSBE's norms suggest that participation in NSBE directly influences member's orientation toward academic achievement as well as their decisions not to switch majors.

Beyond Familiarity

As stated earlier, one concern with an all-minority organization is that students may not have the opportunity to bridge with other ethnic groups. Because engineering, in both academic and research settings, is not made up of predominantly minority groups, the ability to work in these contexts becomes very important if minority engineers are going to be successful once they graduate. NSBE circumvents this possible impediment in two ways – creating opportunities for interactions with persons in other ethnic groups and fostering leadership development within the organization.

Over one hundred universities and companies come to the national conferences for career fairs. However, rather than just one impersonal chance to receive a resume from a prospective applicant, these organizations host a variety of career networking hospitality suites in adjacent hotels with food, music, and raffles for students to meet and network with both executives and human resources personnel. Sometimes recruiters are alumnae of NSBE; however, many other non-minority recruiters join these events. For example, Cummins Engine Company brought 30 employees representing human resources, hiring managers, vice presidents, and executive directors, 18 of which were not minorities. These functions seem to support the development of the “weak ties” Granovetter [as cited in Putnam 2000,] cites as valuable for finding employment opportunities as well as gaining experience with interacting with non-minorities from industry and academia. Beyond the conference, many chapters bring companies to their university to conduct workshops on various topics. An implication of this is reflected in one participant's statement, “There are so many opportunities to deal with companies on a corporate level... Hospitality suites at conferences or company visits on a chapter level allow you to interact and learn more. Without NSBE I might not have a job now.”

Does the fact that NSBE members are given opportunities to interact with members of non-minority groups translate into an ability to truly operate in these settings on a full-time basis? As previously stated, NSBE is the largest student-run organization in the world. This necessitates leadership development to ensure its maintenance and continuous growth. When asked to rate on a scale of one to ten how much NSBE influenced their leadership capacity, all participants gave an eight as their answer. One participant who held four chapter-level positions and one national-level position further expounded, “NSBE teaches you to be a leader and then lets you lead.” Echoing these sentiments, a participant who held three chapter-level positions, one regional-level position, and one national-level position stated, “If you can survive NSBE leadership you can lead a war. Look at past chairs [National Chairs of the organization] and see what they do. You have to be innovative, work with different people, and learn how to mobilize their talents.”

As a result of learning and having the opportunity to implement these leadership skills, NSBE members seem to have a conviction that these competencies can translate into any situation. For example, during the interview, participants were asked how they felt NSBE, as a minority organization, affected their interactions in industry and academia once they graduated. One participant stated, “NSBE gives you a certain type of confidence... There’s a bunch of people like you that you can relate to. This makes you more comfortable with being a leader and helps you to learn how to build relationships... NSBE gave me the confidence to work with other ethnic groups – If I can be a leader in this organization then I can interact with non-minorities as well.”

This influence, combined with the familial structure of the organization discussed earlier, resembles the constant push toward pro-educational attitudes found in immigrant groups. Further, by maintaining cultural patterns drawn from NSBE and adjusting to mainstream society, students gain adaptive advantages, and the social capital necessary to navigate the outside worlds of industry and academia. Subsequently, as stated by the participants, they have the confidence that they will be able to survive in any organization regardless of its ethnic makeup.

Conclusions & Future Work

It is concluded that NSBE provides the collaboration, trust, and sharing of power characterized by genuineness mutual respect and informality that serves as a building block for generating social capital [Gutierrez, 4]. It serves as a basis for establishing an interconnected social network of students who develop a culture – based upon the mission statement – that is beneficial for academic achievement and therefore retention. Conferences would provide access to institutional agents that enable the bridging necessary for both academic achievement and future success. The preliminary data seem to support this hypothesis as well as provide additional information into the bridging social capital utilized by members of the organization.

The culture established through NSBE’s mission as well as the interconnectedness created through its social events, study groups, and associated NSBE “Luv” lay the foundation for the bonding necessary for its members to achieve academically and subsequently remain in engineering. This seems to support Coleman’s findings that network closure – a connectedness between a child, their family, friends, community, and school – translates into higher academic achievement. Similarly, the adaptive advantages found in groups of immigrants who adapted to American society while maintaining their culture were also found in NSBE. A consistent focus on leadership development in NSBE creates a comparable environment that allows its members to develop a positive orientation toward achievement and to navigate the world outside of NSBE. The result is that members are able to create the bonding and bridging capital necessary for both retention and future success in the field of engineering. This bridging social capital is in addition to the access to resources that NSBE exposes its member to, provided by industry and university partners. This finding supports Stanton-Salazar’s findings of high school students who do not drop out.

In future work, the authors plan to expand interviews to students involved in mentorship programs created in NSBE as well as concentrate on survey data indicating other benefits of being involved in student-run organizations. It is hoped that a case can be made for universities to be more supportive, financially and morally, of these organically formed organizations.

There is an urgent need for a diverse cohort to enter the field of engineering if this country is going to continue to lead the world in innovative technological discoveries. In many studies, social capital has been shown to be a valuable tool for academic achievement and economic mobility. Therefore, it is essential to discover ways that social capital can begin to address problems of diversity. This research indicates that student-run organizations like NSBE are in a unique position to help students to develop the social capital necessary to impact the retention and

future success of minority engineers; therefore, more research should be done at the university level to find mechanisms to support them.

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