Social and Academic Investment: Exploring a Formal Peer Mentoring Program for First-Year Engineering Students

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Peer mentoring serves as a strategy for engaging students both academically and socially in higher education. A qualitative case study was conducted to examine the experiences of three first-year engineering student mentees of color who participated in a formal peer mentoring program. The study also explored the participants' perceptions of the roles of race, ethnicity, and social capital in their peer relationships. During one-on-one interviews, student mentees emphasized increases of social capital, such as more access and awareness of resources and added active roles in student organizations on campus, through their relationships with assigned mentors. Additionally, mentee participants mentioned having stronger connections to their peer mentors because of similarities in age and experiences in the classroom. As participants described benefits of the peer mentoring relationship leading to higher academic performance, enhanced skills were a major highlight. These skills included effective note taking, better study habits, and more positive interactions with faculty. Although student mentees did not perceive that race and ethnicity played a major role in their peer mentoring relationships, the female participant acknowledged gender as a major factor of the educational experience in engineering. Overall, the study highlighted that formal peer mentoring programs are highly beneficial in the orientation and transition of first-year engineering students as they navigate higher education institutions.

Introduction

As first-year students enter higher education institutions, it is important to provide education and resources to assist in their transition and adaptation to a new setting (Budny, Paul, & Bon, 2006). One way that higher education institutions typically provide these services is through precollege orientation and first-year programming that allows for formal mentoring and coaching. Peer mentoring, derived from traditional mentoring, has become an efficient tool that educators employ to help students navigate and adapt to their college

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environments. This method of mentoring explores the relationship between two people who are similar in age and personal or educational experiences (Angelique, Kyle, & Taylor, 2002; Kram, 1983) and uniquely challenges the traditional notion that mentoring requires an established relationship between an older, wiser person with several years of experience and a mentee or protégé (Townsend, Delves, Kidd, & Figg, 2011). Effective use of peer mentors eliminates the disparities in factors such as age, experience, and life background (Driscoll, Parkes, Tilley-Lubbs, Brill, & Pitts Bannister, 2009) and positively affects various aspects of the college, including increased emotional and psychosocial support to students; positive social support in students' transition to college, higher student retention and lower attrition, higher academic performance, and increased self-confidence and intellectual self-concept through peer interaction (e.g., Angelique, Kyle, & Taylor, 2002; Brawer, 1996; Clark & Crome, 2004; Colvin & Ashman, 2010; Glaser, Hall, & Halperin, 2006; Good, Halpin, & Halpin, 2000; Pascarella & Terenzini, 2005).

Although peer mentoring has proven to be an effective strategy for helping first-year students transition and adapt while in college, it has also been beneficial in aiding underrepresented students of color (e.g., Black, Latino, and Native American), namely in STEM (Science, Technology, Engineering, and Mathematics) disciplines, such as engineering (Gattis, Hill, & Lachowsky, 2007). Research shows that underrepresented students of color in STEM disciplines typically deal with several academic challenges (e.g., less interactions with faculty and peers, lower GPAs, fewer research opportunities, and lack of preparation for classes in math and science; Anderson & Kim, 2006; Cole & Espinoza, 2008; McGee & Martin, 2011) and encounter several social issues, such as differences in ethnic, racial, or cultural environment or "culture shock," ethnic isolation and alienation, and racism and ethnic stereotypes (Lett & Wright, 2003; Lundberg & Schreiner, 2004; McGee & Martin, 2011; Seymour & Hewitt, 1997). However, peer support and interactions, including peer mentoring, have become very popular over the past two decades and been widely used by higher education institutions to address the needs of students of color (Dennis, Phinney, & Chuateco, 2005; Hendrickson, 1995), particularly those in engineering majors (Brawer, 1996; Gattis, Hill, & Lachowsky, 2007; Good, Halpin, & Halpin, 2000). Although there are several benefits of peer mentoring for students of color, a primary concern is that those students may not understand or perceive the social benefits and access to resources that occur in peer mentoring (Budny, Paul, & Bon, 2006). There is limited research available that addresses students' perceptions of what it means to have social access and the benefits of social capital in peer mentoring relationships, as well as the dynamics of peer mentoring relationships in engineering and STEM education. Therefore, the purposes of this study were to explore first-year students of colors' perceptions of the impact of being in a formal peer mentoring relationship while pursuing an engineering degree and determine the perceived roles that both social capital and race and ethnicity play in the perceived impact of formal peer mentoring relationships. The following three research questions guided the study:

1) What is the nature of student mentees' perceptions of formal peer mentoring relationships?

2) What role does social capital play in peer mentoring relationships for the student mentee?
3) What role does race and ethnicity play in peer mentoring relationships as perceived by the student mentee?

Conceptual Framework

Social factors are important in aiding students in adjusting to a campus climate and can negatively affect a student's commitment to their institution (Tinto, 1975). According to Martinez (2007), developing support systems is critical for students of color, especially in the STEM disciplines, since those systems are empowering and allow students to overcome challenges, such as being less represented in higher education. Based on the need to explore the benefits and challenges of social access supported by previous research showing that social factors, such as students having role models within their support system, can increase their social capital (Martin, Simmons, & Yu, 2013; Trenor, Yu, Waight,, Zerda, & Sha, 2008), social capital theory was selected as the most appropriate conceptual framework for this study.

Throughout the years, the concept of social capital has been shaped by several researchers, such as Bourdieu (1983, 1985, 1986), Coleman (1988), Lin (1982, 1999, 2000), Portes (1998), and Stanton-Salazar (1997, 2001). According to Bourdieu (1983), social capital theory refers to the knowledge, language, values, experiences, and ways of doing things that belong to the dominant social group that can be attained through college access and interaction with others, such as peers and faculty. One of the issues with this definition of social capital, as well as other social capital literature, is that it does not acknowledge that there is differential access to resources and social networks (Dika & Singh, 2002); therefore, this study specifically employed Yosso's (2005) definition of social capital, which applies a Critical Race Theory (CRT) lens and critiques how Bourdieu's work has been used to understand social and racial inequity.

Yosso (2005) defines social capital as the social networks and community resources that students utilize to navigate through colleges and universities that provide instrumental and emotional support (Stanton-Salazar, 2001). Yosso's (2005) definition of social capital is an important theoretical framework for this study because it does not emphasize acquiring networks and resources from a dominant culture, but rather highlights the need for a sense of cultural community and emotional support in acquiring new resources or connections so that particularly Communities of Color (COC) do not feel abandoned while in the process of gaining social capital. While several studies take into account the benefits and challenges of peer mentoring and how it is positively correlated to academic performance, retention, and social support, few studies explore how social capital is utilized by first-year students of color in STEM disciplines in formal peer mentoring relationships. This study seeks to understand student mentees' perceptions of the role that social access and capital and race or ethnicity play in their formal relationships with peer mentors.

Methodology

Participant Setting

This exploratory case study was conducted at Southern Urban Research University (SURU; pseudonym) located in the southeastern part of the United States. This particular predominantly White institution (PWI) was selected because of its ethnically diverse urban location, student body make-up, and continuing efforts to improve persistence and retention of students of color. Currently, there are more than 26,000 students at this institution (approximately 32% are Black, Latino, Asian American, American Indian, and Multi-Racial), and this institution provides students with opportunities to join over 100 student organizations that address the multicultural needs of students. There are nearly 2,700 students in this specific College of Engineering, of which 9% are women, while 21% are students of color (Black, Latino, Asian American, American Indian, and multiple races; based on College of Engineering data at the institution). This particular College of Engineering is unique because it offers engineering technology disciplines as well as engineering majors.

The formal Engineering Peer Mentoring Program (EPMP; pseudonym) was created at SURU to help first-year and transfer students acquire the skills, knowledge, and relationships needed to excel in the College of Engineering (COE). Students were recruited through an introductory engineering course, and once accepted into the program, 10-12 first-year student mentees were assigned a mentor (an undergraduate student in his or her second year or beyond). Mentors and coaches, used synonymously in the EPMP program, were generally trained and hired each semester and mentored up to 10 hours per week in both a group and an individual setting. At the time of the study, approximately 90% of mentors were White male students, primarily sophomores and juniors, while only two mentors were women, and none of the mentors were African American/Black students. Mentoring teams participated in a total of nine hourly sessions per academic semester and interacted both face-to-face as well as online (e.g., responding within 24-36 hours through email or phone) through an online course management system. The goal of mentors/coaches in the program is to help first-year and transfer student mentees focus on areas such as study skills; time management; connections to resources in the COE as well as the university; and relationships with faculty members, advisors, and other campus administrators.

Sample

For the 2012-2013 academic year, there were 160 engineering student mentees in the formal peer mentoring program. Of these, 21 student mentees (13%) were women, and approximately 25% or 40 were student mentees of color (i.e. Black, Latino, American Indian, Asian or Pacific Islander, or Multi-Racial). There was an even smaller number of student mentees who were women of color. Engineering

programs at higher education institutions continue to have lower percentages of underrepresented groups (e.g., Black, Latino, American Indian, and women; Anderson & Kim, 2006; Gattis, Hill, & Lachowsky, 2007). Additionally, research shows that Asian engineering students from specific geographic locations (e.g., Southeast Asians, including Cambodians and Filipinos) should be explored in relation to underrepresented groups in STEM (Byars-Winston, Estrada, & Howard, 2008). Therefore, three students (two men and one woman) were purposefully selected to participate in this study based on the criteria of being full-time, first-year engineering students of color (ages 18-24) who were formally involved in a peer mentoring program. All participants were students of color and were engaged in a peer mentoring relationship with a White male engineering peer.

Below is a brief description of each participant. The researchers assigned all students engaged in the study a pseudonym to maintain the confidentiality and integrity of the research. The participants included the following students:

Nancy. Nancy is a Filipino female first-year student, majoring in civil engineering. She describes herself as hardworking, optimistic, and motivated. Her motivation to pursue engineering comes from following in the footsteps of her father, who is also an engineer. She wants to be successful in her college education and sees herself working in civil engineering and possibly pursuing a graduate degree at a local institution in five years.

Bryson. Bryson is a Black male second-generation first-year student, majoring in mechanical engineering. He describes himself as crazy, fun, and loud, thus alluding to the fact that one won't find him in one spot or with idle hands. He was motivated to pursue engineering because of his past educational experiences and the fact that he enjoys engineering. His 5-year plan includes a part-time job or internship at NASA while he pursues a graduate degree.

Roy. Roy is an Asian American male first-generation first-year student whose family roots are in Cambodia, majoring in civil engineering. He describes himself as loyal, honest, and positive and was motivated to pursue engineering based on his family and their influence of caring for the world. His 5-year plan includes cleaning and protecting the environment using technology.

Data Collection and Analysis

Students were invited to participate in the study through an email invitation drafted by the researcher that was sent by the director of the EPMP program to all potential participants. Participants contacted the researcher and scheduled individual in-depth, semi-structured interviews that lasted 30 to 45 minutes. The researcher conducted these interviews on SURU's campus. The interview protocol included questions related to how student mentees (1) benefitted from and addressed challenges in their peer mentoring relationships, (2) utilized the mentoring relationship to navigate through the institution (e.g., adjusting in- and out-of the-classroom, participating in extracurricular activities, and interacting with peers, faculty, and other campus administrators), and (3) perceived race and ethnicity in the peer mentoring relationship. Member checking was utilized

throughout the interview process, in which the researcher summarized and restated participants' responses for accuracy, both during and after the interviews. Specifically, the researcher followed up with the participants and had them clarify responses to certain questions asked during the initial interview as well as answer additional questions. Furthermore, document and conversational analyses were utilized to provide the context of the formal peer mentoring program as verbalized by the EPMP program director.

The audio-recorded interviews were transcribed and reviewed several times to thoroughly analyze the data. Data analysis focused on identifying common themes and key points related to students' perceptions of formal peer mentoring relationships and access to social capital (social contacts and networks) while majoring in engineering. Utilizing the six steps of thematic analysis, the researcher allowed themes to emerge from the data and become categories of analysis (Fereday & Muir-Cochrane, 2008). The first step of analysis included reading the transcripts several times to get familiarized with the data and developing an understanding of each participant's perceptions of peer mentoring programs, access to social networks and resources, and their racial experiences. Second, the most relevant words and statements related to participants' perceptions of their experiences were coded, and third, the themes were developed based on those codes. The remaining steps included reviewing the themes again and utilizing the analysis to provide both overall and subthemes for the section on findings.

Study Limitations

There were a few limitations associated with this qualitative study. First, the sample for this study was relatively small because the criteria for participants included being a first-year student of color in a particular formal mentoring program. Additionally, there were time restrictions on the study because participants were recruited and interviewed within a short timeframe; however, qualitative methods are less concerned with sample size for generalizability purposes and are more concerned about transferability. Transferability is defined as the extent to which findings are useful or meaningful to theory, practice, and future research (Lincoln & Guba, 1985) and allows readers of the study to make assumptions based on their various perspectives. While the study highlights student mentees' perceptions of the formal peer mentoring process and the role of social capital, the interview discussions did not bring forth great depth about student perceptions of the role of race and ethnicity in formal peer mentoring relationships. Notwithstanding these limitations, the present study makes an important contribution to research by understanding formal peer mentoring relationships from the perspective of the peer mentee and highlighting mentee's awareness of their access to resources or lack thereof. By conducting a qualitative, exploratory case study on formal peer mentoring programs and their impact on student mentees' perceptions of their experiences, the findings further explore how peer mentoring can be observed from a social capital lens and identify navigation tools for students of color in STEM disciplines.

Findings

This qualitative exploratory case study sought to investigate how student mentees perceived the impact of a formal peer mentoring program as well as the role that race, ethnicity, and social capital played in those peer mentoring relationships. Overall themes and subthemes based on participants' responses to interview questions regarding perceptions of their experiences are presented. The overall themes identified include characteristics of the mentor, role of the mentee, benefits and challenges of a peer mentoring relationship, influence on classroom experience, and leadership outside the classroom. The following sections describe each theme and subtheme.

Characteristics of the Student Mentor

Mentors serve multiple roles in mentoring relationships, including counselor, tutor, coach, friend, and advisor, whether related to personal or professional factors (Miller, 2002). However, when asked about what role student mentees' perceived that their mentors played, three major subthemes emerged: (1) mentor as a relatable person and friend, (2) mentor as a conduit of balance for social and academic needs, and (3) mentor as a problem solver and resource.

Mentor as a relatable person and friend. According to Welsh (2004), peer mentors are colleagues who can have the same problems as the mentee and share other factors, such as strategies, professional or personal information, and friendship or support. First-year engineering mentees in this study talked about their mentors being colleagues, peers, and friends. Specifically, participants responded by saying,

> He was more like a colleague. I felt like he was more like an older brother that watches over you, and that's the kind of relationship I felt. (Nancy)

> I thought I would be lectured to more, but it turned out to be different, though. I felt like my mentor was a friend, and it was just a very close relationship…he had…two classes with me, so we were able to talk about that. (Roy)

> It was more of a student-to-student relationship, where I know that he's been through what I've been through, so I had that respect for him, and I knew that I could ask anything because he went through it. (Bryson)

These responses demonstrated how important the peer connection was to the student mentees. Peer connections are usually meaningful in mentoring relationships because these interactions allow the mentor and mentee to personally relate to each other's experience, which provides a feeling of ease when communicating with each other (Newton & Ender, 2010). All participants felt as though the peer mentor was a friend or colleague because they had similar experiences, and because of this, the mentees were able to relate and establish an immediate connection to the mentor.

Mentor as a conduit of balance for social and academic needs. Engineering is a program of study that consists of rigorous courses and proves to be a challenge for many students (Chang, Sharkness, Newman, & Hurtado, 2010; Foxx, 2015). All of the participants felt that engineering coursework was time-consuming and had to focus in order to make good grades. Roy stated, "You have to sacrifice some family time for it…build relationships with a lot of professors and students in order to maintain the mentality of working hard in the engineering field." Concerning the courses taken in engineering, Bryson added:

> I've taken some classes already…you know it will be a little bit of this, little bit of that, then I actually get to the classes, and they're going fifty more times in depth than I'm thinking, especially the sciences. The sciences were rough so far, but I made it through, thankfully.

Although all of the student mentees identified majoring in engineering as intensive academic work, one of the subthemes that emerged was the mentor's ability to promote balance between both social and academic needs.

According to Martinez (2007), mentors must realize that their role is to be a conduit for students to develop both academically and socially. Peer mentors tend to be beneficial because they are more empathetic and can offer not only academic support, but also emotional support due to their similar educational and personal experiences (Angelique, Kyle, & Taylor, 2002). During the interviews, all three student mentees highlighted that they felt the peer mentor could relate to where they were, and Nancy went even further to say, "he taught us to not just focus on engineering work at all times and to make time for other stuff like personal time, working out, eating healthy, and not just focus on school work." Often times, student mentees are able to learn from the mentor's past actions, whether achievements or failures, and can use moments with their mentors to observe how they handle conflicts or balance personal or professional demands (Schockett & Haring-Hidore, 1985). Nancy's mentor emphasizes that she should focus on being a well-rounded person. Nancy stated that the mentor explained to her that "It's not all about the academic life and that you need to go out and have fun with your friends and don't stress out too much…[the mentor] told us that it's good to take a break and do some physical activity and get back to studying. It'll help [us] focus more." Sanft Jensen and McMurray (2008) emphasize that peer mentors can serve as connecting links by getting other students involved in the classroom and linking them to resources outside the classroom as well. Based on the student mentees' perceptions, the peer mentors definitely were "connecting links" and provided balance both in and out of the classroom because they attended to both personal and academic matters.

Mentor as a problem solver and resource. In Ishiyama's (2007) study on the perceptions of the role of the mentor among students of color, particularly African American students, career support was highlighted, which involved helping students find opportunities. Additionally, Good et al. (2000) found that mentors found that their problem-solving abilities improved as a result of serving as peer mentors. A mentor's ability to help mentees pursue their goals and find resources

and opportunities is vital to the mentoring process. When participants were asked how they were connected to opportunities outside of the classroom and what they learned from their peer mentor, all stated that they were exposed to either new resources or resources on campus that they were unaware of before the mentoring relationship. In particular, Nancy talked about the opportunities she had been afforded and how her mentor played a role in those opportunities. Specifically, she said, "he made us aware of a lot of resources like the university career center and building a resume and having mock interviews there and also the pilot leadership program. He told us to join that when we have time." Bryson, when discussing exposure to resources, added,

> Yeah, that was probably one of my favorite parts because…I couldn't pay for the rest of the semester. I was panicking. So, I asked the [mentor] about it, and he sent me to the…financial aid office. I had no idea that was even a thing on campus, and they sent me there, told me exactly what to ask for, and I got there…filled it out and left. They saved my semester, honestly.

In Bryson's situation, the mentor was able to serve as both a resource and problem solver. Bryson concluded this part of the interview by saying,

> Yeah if he [mentor] wouldn't have told me where the financial aid office was…I probably would have been gone because I had no idea. I had basically accepted it, talked to my parents and was like… "I'm not going to be able to pay for the rest of the semester."

Bryson had financial issues, and his mentor was able to connect him to the right resource to handle the conflict and help him fix the problem so he could stay in school.

Role of the Student Mentee

Mentoring is not just about mentors building their leadership or helping mentees live out their goals by advising them or providing resources. It is equally important that student mentees carry out the mentor's suggestions, as appropriate, and utilize resources to ensure their academic and personal success. One of the major subthemes that emerged when students discussed their role as mentees was the sense of urgency to take initiative and be more proactive in their responsibilities in both their personal and academic endeavors.

When the interviewees were asked to perceive their role as mentees, their responses indicated that they felt their roles were to listen, take initiative, and be more proactive. Bryson described his role as a mentee as one where he had someone to check on him and ensure he was getting his homework done and studying to successfully pass his tests. Then, Bryson added,

> [Peer mentors] are just basically setting you up to be able to do it all on your own…they're building us up as adults and giving us strategies we need to be able to get through these four years of college.

He recognized that peer mentoring served a greater purpose, which was to build students so that they not only graduate from college, but become responsible citizens in their communities.

Although taking initiative and being proactive in tasks can be empowering and produce several rewards for the student mentee, one participant thought that the process of having access to resources and social networks can be overwhelming. Specifically, Nancy highlighted,

> The mentor wants us to do a lot of things, and I feel like it's hard to keep up and try to do all those things while trying to do academic work as well. So, it's kind of hard to just be proactive and take initiative in doing those things, but at the same time, I know that I should try, as a person, to do those things.

This is one of the challenges that student mentees in peer mentoring relationships often deal with and must address, which will be discussed in the next section that evaluates the perceived challenges of a formal peer mentoring relationships by the student mentee.

Dynamics in Peer Mentoring Relationships

Benefits. Peer mentoring relationships provide several benefits for first-year students, especially first-generation college students, such as being exposed to campus resources, having a better sense of belonging, increasing social connections, properly transitioning into the college environment, and developing academic success strategies to persist and graduate (Clark & Crome, 2004; Colvin & Ashman, 2010; Glaser, Hall, & Halperin, 2006; Rodger & Tremblay, 2003). All participants indicated that their mentoring relationships with their peers positively benefitted them. As highlighted, most of the benefits for the student mentees included mentors being a resource, investing in the personal development of students by taking time to advise them in certain areas (i.e., time management and active involvement on campus) and preparing them for future career goals. In particular, Nancy saw the mentor as her push to connect with campus resources and explained, "[the mentor] taught us that we should be more active on campus and participate in extracurricular activities and to not just focus on engineering work." Bryson had a similar response, talking about his mentor being resourceful and providing direction when he had questions. He elaborated by saying,

> But, even if they couldn't answer it, they knew who to point me to to get an answer, like, with all the different policies the university has…I had questions with [policies], and they pointed me in the right direction…giving me an email [address] or a room number. They were like, "okay you can go to this person, and they'll answer every single question you have about that topic."

Roy also saw the benefits of improving in certain areas and found having a mentor to be a great resource. He said,

> Some benefits? Just knowing how to improve yourself for the future when you take other classes and just, in general, be ready for the future in college. I definitely saw how better I could prioritize my time. I definitely saw how I could use resources that are available around me more and just have more time to spend with my family.

The peer mentoring experience in this study was very beneficial to students, and they felt that their mentors made them more aware of their surroundings and the

resources that were available to them. Students were also able to use their time more wisely with the mentor's guidance.

Challenges. Although the goal of mentorship is to ensure that both parties are benefitting from the process and partaking in a meaningful experience, there are challenges that occur as well. Some challenges for mentees in peer mentoring relationships include excessive dependence on the mentor, a greater time commitment, scheduling issues, mismatch with mentors, and hesitance in opening up to mentors (Colvin & Ashman, 2010; Glaser, Hall, & Halperin, 2006). Although there are numerous challenges, participants in this study did not experience many of these factors. Namely, three major challenges that student mentees faced in their relationships with mentors were scheduling sessions, balancing opportunities and resources, and perceiving the time commitment to be burdensome for mentors.

Specifically, Nancy mentioned that she and her mentor would intentionally avoid any conflicts; however, she also stated, "he was mostly tired when we conducted sessions, too, because he's doing all the engineering work and doing the formal mentoring program for us." This highlights how mentoring can be strenuous at times and create negative perceptions for a mentee of their interactions with their peer mentor. Along the lines of technical issues with sessions, Bryson felt that the sessions could have been better communicated at times because he missed a few of them based on sudden schedule changes. Specifically, he mentioned,

> I'd say with the scheduling, if there was a change, I would say to email the day that it's changed to because I don't know if I just didn't get the email or if I just missed it. I had no idea the day had changed, but other than that, everything was great.

Because the mentoring program requires coordinating the schedules of different people, schedule challenges are bound to happen in mentoring relationships. Most formal mentoring programs will face scheduling and programmatic issues and must continue to reinforce constant communication in mentoring relationships as well as keep relevant information updated in a common space, physically or electronically, for all participants.

Roy also added that, while new opportunities are usually favorable, the minimal time to join and participate in those benefits was overwhelming. Specifically, he said,

> …when it came down to…join that program or that one, if I have time to do this and that, thinking about it sometimes was just overwhelming. But, yeah, those are the challenges of being in this program.

As stated in Colvin and Ashman (2010), student mentees are sometimes challenged with their level of time commitment to the peer mentoring relationship. Roy's account of feeling overwhelmed by the resources serves as an example of this challenge. He was worried about not having enough time to balance all opportunities, which made it harder to prioritize them when presented.

Influence on Classroom Behaviors and Experiences

Taking notes and increasing study habits. Most of the participants mentioned that one of the outcomes of being in a formal peer mentoring relationship was that they felt better prepared for classes because they had enhanced their note taking and study skills. When asked how the formal peer mentoring relationship had affected classroom participation, Bryson mentioned,

> I take notes now. [My mentor] talked me into that because he asked me how I sat through lectures because I was asking him about my liberal studies class and how to prepare for those exams because they just stand up there and lecture and give us no materials at all, and he was telling me the best thing to do was just listen for the most important things and jot those down as bullet points. So, I started taking notes in the classroom, and it helped a lot 'cause my first liberal studies test grade I got a 70…I started taking notes after that test, and then, on the next test, I got an 89. So, that was a big jump, and I was like, "okay this [taking] notes thing does work out."

Roy mentioned "academic improvement" when asked how his mentoring relationship affected his abilities in the classroom. He further explained what improved and said, "like, for example, taking better notes or constantly taking notes to keep me busy." The interviewees felt that their peer mentors really pushed them to prepare for the rigorous engineering coursework, as well as other course subjects, such as liberal studies, as mentioned by Bryson. Proper classroom preparation, such as taking effective notes for classes or studying for tests, is essential to academic success in college. According to Credé and Kuncel (2008), study habits and skills predict academic performance, especially with grade point average and individual grades in classes. With rigorous engineering courses, effective study skills and test-taking strategies are imperative for students to keep up with their coursework and remain in the discipline.

Scheduling classes. One commonality in the peer mentoring relationships was the similar engineering coursework taken by both the student mentee and mentor. Mentors were able to share their experiences with mentees on courses that are taken during engineering students' first year, which informed the student mentee's decisions in terms of which courses to register for each semester. Additionally, these peer mentoring relationships were unique because both the student mentees and mentors took some courses together. In particular, two of the three student mentees had at least one class with their mentor for the semester. At times, Nancy was able to help the mentor with coursework. The mentor was also able to help Nancy, who declared engineering as a major during her second semester of the first year, plan her class schedule so that she would graduate on time (within 4-6 years). Nancy said,

> He told me that, in order to catch up and graduate on time, I needed to take summer classes in order to be with the freshman of engineering. He also advised me that I shouldn't be afraid to take three engineering core classes with calculus and physics and just to take them and do the best that I can.

Roy, another student mentee who had classes with his mentor, also expressed that

the mentor was vital in helping him decide his class schedule. Through mutual initiation of communication, Roy talked about how he would email the mentor, and the mentor would ask general details, such as what classes Roy needed to take for the fall or what they had to do for homework. Roy and Nancy were able to take the advice of their peer mentors concerning their class schedules because of the mentors' experiences of taking various engineering courses and their knowledge of the order in which courses should be taken.

Leadership Outside of the Classroom

Starting or joining organizations. According to Sanft, Jensen, & McMurray (2008), student mentees often get student mentors who get them involved with social resources and networks both inside and outside of the classroom. When all three of the participants were asked how their peer mentoring relationships affected their activities outside of the classroom, all stated that they either had joined or were starting an organization on campus. Coincidentally, Roy and Nancy were both planning to volunteer for the same start-up organization as suggested by their mentors when expressing their interests. Some of the responses of the interviewees were as follows:

> I was also inspired by [the mentor] to start up a club to do volunteer work… he heard my idea…during our talk sessions…and he informed me that there used to be a club…for the engineering department to do volunteering work, and he said he'd like to help me out to start it back up. We are actually going to volunteer at an animal shelter…a museum…and a soup kitchen in one day. Yeah, it's a one-day project to see how it goes, and I hope it will be a monthly thing, but it depends on all the work schedules of all the individuals that will be joining us. (Nancy)
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> I joined the Residential Hall Council because one of the other students that was in my formal peer mentoring session told me that they were in their hall council…and they're were actually getting things done. We got new couches, new seats, new TV. It was cool to suggest something, be able to type up a two-page proposal, give it to the RC (residential counselor), and actually see it happen. (Bryson)

One of the main benefits of peer mentoring is increased social resources and connections. These accounts of the student mentees' experiences as a result of a formal peer mentoring relationship highlight how interactions with student peers can lead to more involvement in clubs and organizations on campus, thus increasing students' social capital and exposure to more resources and networks.

Faculty-student relationships. Participants also discussed further developing relationships that they formed with professors as a result of being mentored by an engineering peer. Specifically, Nancy recalls a conversation with her mentor and says,

> Like, relationships with professors or faculty members, he told us to engage in that and build our relationships more to get to know our professors because they can create great recommendations. So, I take the time to take initiative

and talk to my professors if I'm struggling and just stand out.

Roy also mentioned that his peer mentoring relationship boosted his confidence to interact with his professors. He stated, "yeah, I talk to more engineering professors outside of the classroom at their office," and when asked what those conversations are typically about, he said, "it's just getting advice about a course and getting advice about a major." Research shows that students who interact or engage in relationships with faculty members and professors are more likely to have higher academic performance, self-efficacy, and confidence (Amelink & Meszaros, 2011; Carini, Kuh, & Klein, 2006; Cole, 2008; Vogt, 2008). The encouragement by peer mentors for study participants to confidently engage more with faculty members and increase their chances of academic success through the additional assistance (e.g., helping with engineering coursework problems) is vital.

Discussion

This study sought to explain students' perceptions of the impact of a formal peer mentoring relationship while pursuing an engineering degree, analyze the role that race and ethnicity as another means of social access may have played in the peer mentoring relationships, and explore student mentees' understanding of social capital in the peer mentoring relationship. Findings indicated that, overall, student mentees were highly satisfied with their peer mentoring relationships and increased their social capital as a result of participating in a formal peer mentoring program. An increase in social capital is particularly important for students of color in engineering (especially African American, Latino, and American Indian students) because there is a lack of those students in both the field and in STEM higher education. Social capital allows students of color to connect to new resources that will be vital to their successful completion of a bachelor's degree in engineering. Findings also showed that student mentees' felt that race and ethnicity did not play a major role in their relationships; however, gender played a role and made the female participant (Nancy) feel as though she was a minority in the engineering program.

Student Mentees' Perceived Role of Peer Mentoring Relationships

Peer mentoring relationships have significantly contributed to higher education and provided many benefits for first-year student mentees, such as improving academically, accessing resources and social networks on campus, and providing a sense of belonging by connecting with other student peers who can relate to their experiences (Clark & Crome, 2004; Colvin & Ashman, 2010; Glaser, Hall, & Halperin, 2006; Rodger & Tremblay, 2003). The findings of this study indicated that student mentees benefitted from peer mentoring in the classroom by being more prepared (e.g., taking notes, increasing study habits, and interacting more with their engineering professors). Student mentees also acknowledged that

their leadership outside of the classroom, including joining or creating student organizations, would enhance their college experience as well as improve the community where the institution is located.

Although there were several benefits as a result of student mentees participating in a formal peer mentoring program, there were also a few challenges, such as being overwhelmed by access to social resources and networks, student mentees being concerned about their mentors' needs, and conflicts with scheduling for mentor sessions. In order to address these concerns of student mentees, formal peer mentoring programs should consider providing more training to mentors to address how they can balance mentoring with other obligations, as well as ways that mentors can guide student mentees without them feeling overwhelmed by the resources. This may include providing general information concerning resources in an online space or through documents (e.g., manuals or fact sheets), but suggesting specific resources based on the goals that are set in the mentoring relationship. In terms of scheduling issues, mentors should reinforce communicating clearly with student mentees, and the program can encourage student mentees and mentors to post scheduling sessions in their online space to ensure consistency of the sessions.

Influence of Social Factors on Peer Mentoring Relationships

Race and ethnicity. Social inequities, such as prejudice against class, race, and gender, continue to exist within higher education. According to Martinez (2007), the elimination of racial, cultural, and socioeconomic factors in the conversations concerning social access and capital create an incomplete image of social capital. Therefore, race and ethnicity must be considered, as well as the role of social capital. Participants were asked questions based on their experiences related to racial identity while attending Southern Urban Research University (SURU), as well as whether they felt race played a role in their formal peer mentoring relationships. All of the participants stated that their race and ethnicity did not play a role in how they interacted with their peer mentors or the particular institution. Participants hesitantly provided brief responses in relation to race and ethnicity, such as,

> Honestly, race and ethnicity doesn't play a factor. It depends on your experience in general; that's all that matters. (Roy)
>
> I don't think it was a role at all. It was just more that both of us were engineering students, and that's what led the whole thing. (Bryson)

According to Tatum (1992), students' resistance to talking about race stems from several factors, such as seeing race as a taboo topic, being fearful to mention it, or viewing the United States as a meritocracy, where individuals receive praise based on their individual efforts. Younger generations might not see race and ethnicity as significant because modern society is always changing and growing in terms of racial and ethnic diversity.

However, Nancy made comments that conveyed that conversations about race and ethnicity should be further developed. Nancy, when asked about how she perceived race and ethnicity in terms of her educational experiences, said, "My race and ethnicity influenced my educational experience by becoming an outlier

and trying to stand apart from the crowd." Nancy viewed herself as an outsider who had to be set apart from others. This can be interpreted from Nancy's stance to defy the odds and graduate from college, despite any challenges or the low numbers of women and persons of color graduating with STEM degrees. Nancy's perceived need to be visible highlights a challenge that students of color often face in predominantly White environments called "invisibility." Although this term was originally developed to understand the psychological nature of Black males (Franklin, 1999), it has been developed to apply to other Communities of Color, as well as women. The notion of invisibility is that students of color are often neglected and silenced, due to demands to blend in and adapt to the structures set in place in a predominately White school environment. Therefore, students of color often react to this notion by continuously working to prove that they belong and standing out by working harder and ensuring that their voices are heard (Franklin, 1999; Sesko & Biernat, 2010). Yosso's (2005) social capital theory, as part of a larger framework called "community cultural wealth", highlights this need to promote the cultural diversity and value of all races in order to eliminate major distinctions that are often viewed as deficiencies in Communities of Color. As the national agenda to retain and graduate students of color in STEM disciplines continues to be executed, it will be important to explore race and ethnicity to better understand how students of color see themselves in relation to others in the engineering environment. This study highlights the need to closely examine students of colors' interactions with peers, faculty members, and campus administrators and how racial and cultural differences affect their navigation in an environment where they are often underrepresented.

Unsurprisingly, the issue of gender was also mentioned as Nancy shared her personal experiences in the classroom as an engineering major. Women of color often face issues related to being both a particular gender and being part of a specific racial group in STEM fields, which is referred to as the "double bind" (Ong, Wright, Espinosa, & Orfield, 2011; Scott & Martin, 2014). Nancy specifically stated, "I feel like a minority since the majority of engineering majors are predominantly male, and I am a female of color; therefore, I have to prove myself as a competitor." Nancy also mentioned an example in which, while working on a class project, her project group members intimidated and alienated her because she was the only female in the group and explained how her mentor encouraged her to take leadership in her project group. Specifically, she said,

> Like, for my engineering class, I was struggling with my group, and because I was the only girl, I felt like I had no control over what the group wanted to do. So, [the mentor] helped me by saying that I could overcome that obstacle by taking initiative and getting involved with the group more. [The mentoring relationship] helped me overcome that obstacle. I talked to my group members, got them together, took leadership in getting the project done, and stayed on top of things with them. The group members accepted me well…I arranged all the meetings and got my team members to stay on top of the work and would track each one down and see how they would do things and tied it all together.

Nancy did not perceive that gender played a role in how she interacted with her male peer mentor; however, it played a major part in her interactions with males in the classroom. The mentor helped Nancy in becoming empowered to take the initiative in the group project and assert herself to overcome any gender concerns. Although there was only one woman participant in the study, Nancy's experiences highlight a national concern with women of color in STEM concerning visibility in the STEM fields (Hill, Corbett, & St. Rose, 2010; Landivar, 2013). Women of color tend to experience more challenges and barriers than their male counterparts. In a study by Scott and Martin (2014), male students of color perceived significantly fewer barriers and challenges to studying STEM in higher education than their female counterparts, which highlights the challenge of the "double bind" that women of color in STEM often face. Therefore, the complicated and intersectional roles of gender, race, and ethnicity and how formal peer mentoring programs train mentor participants should be carefully considered. Diversity training that looks at gender and racial differences as well as the intersectionality of multiple social identities should be explored to understand how students relate to their peers or even faculty members or advisors in their specific engineering colleges.

Role of Social Capital on Peer Mentoring Relationships

According to Stanton-Salazar and Spina (2003), in order to sustain effective social capital in a mentoring relationship, there must be resourceful relationships and activities that are organized within a network of peers and institutional agents. In other words, social capital, which is defined as the connection to community resources and networks that provide emotional and instrumental support as a student navigates through an institution, should be made accessible through opportunities, such as formal peer mentoring programs. All the participants experienced increased access to social capital through their formal peer mentoring relationships. Social capital can be important in eliminating the social inequities across all categories such as class, gender, race, and ethnicity. Access to more social capital (e.g., tutoring, social support from peer mentor, and involvement in engineering and non-engineering student organizations) through a formal peer mentoring program positions students of color in engineering to utilize resources that would eliminate barriers (e.g., rigorous coursework and lack of academic and social support) that may cause them to leave engineering. By sharing resources and providing opportunities to all groups, students see the need for resiliency, especially students of color, and can address issues related to race and class.

Because of access to relationships with knowledgeable peers and faculty through the formal peer mentoring program, the engineering students of color who participated in this study have taken several positive, proactive steps in the process of obtaining a college degree in engineering. Specifically, they have joined other student organizations on campus and have taken initiative in their local communities through their volunteer efforts. Additionally, student mentees have become more aware of all the campus resources available to them and have developed meaningful relationships with their peers, faculty members, advisors,

and other campus administrators to be more successful in the classroom, as well as their engineering program. While this concept is not necessarily specific for minorities majoring in engineering, it does provide these students with the knowledge and resources that they may not otherwise have access to, nor find the time to seek out for themselves. The mentors and mentees both alluded to time constraints and the complexity of subject matter as areas that otherwise would limit engineering students from navigating these spaces on their own.

Future Research & Implications

Higher education institutions are held accountable for providing students who are underrepresented with an environment that integrates both the academic and social aspects of the college or university (Tinto, 1993). First-year students experience many changes when transitioning from high school to college. These transitions include psychological and emotional changes due to adapting to a new environment, shifts in family dynamics because they leave and separate from their home communities, and even the changes in coursework and the higher levels of critical thinking required to be academically successful at the college or university level. Formal peer mentoring programs can aid in the smooth transition of first-year students of color by providing more access to social networks, organizations, and people within organizations, thus helping these students to orient to a college or university more rapidly. While this study highlights social benefits (e.g., peer support and early exposure to institutional resources) and academic benefits (e.g., better study habits, time management, and grade performance), there are some other factors that professionals and staff members in the Orientation, Transition, and Retention (OTR) fields should consider.

Connecting Families to the First-Year Peer Mentoring Formal Programs

An often meaningful aspect of transition for first-year students is the adjustment to being away from their family members and home communities. This study suggests a high level of importance for students' families to become acquainted with the collegiate environment so that they may determine which resources will be useful in helping with institutional navigation. This exchange, once a student leaves home to attend college, is vital to their proper adjustment to a higher education institution (Budny, Paul, & Bon, 2006). One of the participants of the study, Bryson, mentioned not knowing the location of the financial aid office or from whom he may receive help with his financial situation. Bryson sought assistance from his parents, but they also did not know of the available campus resources. Given this fact, it is recommended that OTR professionals create, or expand, ways to include students' families in the process and exchange occurring in formal peer mentoring programs. Connecting peer mentoring programs with families may include actions such as sending informational newsletters about peer

mentoring activities directly to family member, creating an information database listing commonly used resources, working with campus partners to engage families with planned programs or events that bring more awareness to the formal peer mentoring programs, and providing general updates about the progress participants are making in their transition into higher education.

Mandating Formal Peer Mentoring Programs for First-Year Engineering Students

Typically, college students are advised to become involved with various programming at their institutions. Specifically, first-year students are highly recommended, or even required by some institutions, to participate in seminars or courses exclusively catering to their specific population. The findings of this study suggest that first-year engineering students, especially underrepresented students, should be mandated to participate in a formal peer mentoring program. As found in this study, as well as other studies, peer mentoring programs for students of color help to address issues, such as lack of social support or rigorous coursework. This recommendation would help OTR professionals to attend to any unique challenges faced by underrepresented groups in STEM (e.g., women and certain Communities of Color) and may even increase retention rates because the issues are being addressed earlier in first-year students' academic programs.

Involving Engineering Faculty in Formal Peer Mentoring Programs

While the study highlighted that student mentees interacted more with engineering faculty members, there was not much mention of how involved faculty members were with the formal peer mentoring program. For OTR professionals, this presents an opportunity to better incorporate faculty members in the process of formal peer mentoring programs and courses designed for first-year engineering students. There should be mandatory training for faculty and staff members in colleges of engineering to aid in the process of exposing students to campus and institutional resources and ensuring that student participants of the peer mentoring program are meeting the academic and personal goals they established. The involvement of faculty guarantees triangulation in terms of first-year students being exposed to the accurate resources from OTR staff, peer mentors, and faculty and staff members in their academic colleges. In this training, faculty and staff members of academic colleges would be able to better understand the sensitivity and pressures associated with the role of being a first-year student or even a first-year student of color in engineering.

This study suggests a need for colleges and universities to emphasize the use of formal peer mentoring programs as a strategy for the retention of engineering students of color earlier within their undergraduate careers. Engineering proves to be a tough discipline; however, formal peer mentoring relationships have helped first-year engineering students of color get the aid needed to be

successful with their academic work as well as their social interactions with others, such as peer groups and faculty members. By utilizing formal peer mentoring programs to promote racial and gender diversity, influence students of color in STEM disciplines, and establish clear accountability measures for all stakeholders, including first-year engineering student mentees and peer mentors, OTR professionals, and faculty and staff members in academic colleges, higher education institutions may benefit from higher retention and graduation rates of underrepresented students of color in STEM fields.

This study also contributes to the literature on peer mentoring relationships by highlighting how social capital can be utilized within these relationships. Although this study demonstrates that peer mentoring is associated with access to social capital, future research will further explore how race and ethnicity impacts engineering students of colors' relationships with peers and faculty members and impacts the accumulation of student mentees' social capital. Studies should also focus on the connection between familial support and capital and formal peer mentoring programs. Students' families were not mentioned as much in terms of the participants' awareness of college or university resources, so the connection of familial support with formal programs on campus, such as peer mentoring, if any, should be explored. Additionally, research should investigate how mentors define social capital and feel they contribute to the formal peer mentoring process, as well as how gender issues impact female mentees or even female mentors in formal peer mentoring programs at higher education institutions. In this study, the student mentees mentioned that mentors have a lot of duties outside of mentoring, yet those mentors were still able to connect student mentees to the right resources and help them pursue their goals. The work-life balance of peer mentors should be explored in future studies.

Conclusion

This study highlights the importance of access to social connections and resources in a peer mentoring relationship and provides higher education institutions with information that supports that formal peer mentoring programs in engineering can improve first-year students' transitions to higher education institutions and engage them both academically and socially while pursuing their degrees. Formal peer mentoring programs can improve social interactions for first-year students, especially students in Communities of Color, and provide awareness to academic matters, such as grades, classroom preparation strategies, and relationships with peers, faculty members, advisors, and other campus administrators. This study emphasizes the need to consider social differences, such as race, ethnicity, and gender, when understanding how students of color utilize social capital, as described by Yosso (2005), in their peer mentoring relationships. While race and ethnicity did not play a major role in how first-year engineering student mentees interacted with their peer mentors, gender was part of the conversation, especially for the female participant. Gender did not specifically affect how the female participant interacted with her male peer mentor; however, the mentoring

relationship with her mentor was vital in increasing her confidence when interacting with male peers in and out of the classroom. Studies should further explore race, ethnicity, and gender as distinct social differences, but should also seek to understand the complex role of intersectionality of these social factors for women of color.

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