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OUTREACH AND IDENTITY DEVELOPMENT: NEW PERSPECTIVES ON COLLEGE STUDENT PERSISTENCE

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ABSTRACT

College student persistence continues to pose challenges for higher education institutions, despite over 40 years of research. Although persistence is studied from many different angles, the majority of studies examining the causes of and cures for students' departure from college reflect the importance of engagement in the higher education environment. An innovative type of engagement is involving college students in high school outreach. This article reports on a study involving 19 college students who participated in a National Science Foundation (NSF)-funded project intended to increase the enrollment and persistence of engineering students, specifically examining how engaging in outreach activities developed participants' views of themselves as engineers. We found that outreach activities incorporated several types of engagement and that participants engaged in outreach began to develop a professional engineering identity, both of which are linked to college student persistence. The study's implications for research and practice are discussed.

College student retention continues to pose challenges for higher education institutions, despite over 40 years of research (Reason, 2009). Studies have shown that

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student characteristics (Dennis, Calvino, & Gonzalez, 2008; Reason, 2003), family background (Johnson, Soldner, Leonard, Alvarez, Inkelas, Rowan-Kenyon, et al., 2007; Martinez, Sher, Krull, & Wood, 2009; Ostrove & Long, 2007), and institutional characteristics such as instruction (Pascarella, Seifert, & Whitt, 2008) and climate (Museus, Nichols & Lambert, 2008; Rendon, Jalomo, & Nora, 2001) factor into college students' persistence. While this research examines college student retention from different angles, the vast majority of studies exploring the causes of and cures for students' departure from college reflect the important role of students' engagement in the higher education environment in their persistence and degree completion.

One type of engagement many institutions are developing is including college students in high school outreach. For example, the University of California San Diego (UCSD) employs undergraduate students as mentors and tutors for its Early Academic Outreach Program, which targets "first generation, economically disadvantaged, and English language learners" (UCSD, 2011). The Colleges of Medicine at Florida Atlantic University (FAU) and California State University at Davis (CSU Davis) both utilize medical students in high school outreach programs intended to encourage a diverse student population to consider careers in health sciences (CSU Davis, 2011; FAU, 2011). This article reports on a study involving 19 college students who participated in a National Science Foundation (NSF)-funded project intended to increase the enrollment and persistence of engineering students. One of the tools employed for meeting the grant's goals was an outreach program staffed by undergraduate students who developed demonstration projects that were presented to high school students. This study focuses on the impact of participation in outreach activities on undergraduate students' commitment to their major and degree completion, specifically examining how engaging in outreach activities contributed to participants seeing themselves as engineers.

Understanding factors that contribute to student persistence in science, technology, engineering, and math (STEM) majors, and particularly in engineering, is crucial. Nationally, a focus on developing more STEM graduates is seen as vital to the United States' economy and position as a global leader (Shaw & Barbuti, 2010). However, despite local and national calls for increasing the enrollment in, and completion of, STEM majors, higher education institutions struggle to retain students in these programs. Chen's (2009) study found that 55% of students who enter STEM majors as college freshmen either change majors or depart from college without earning any degree. Within engineering specifically, the National Center for Educational Statistics (Aud, Fox, & KewalRamani, 2010) reports that only 5.3% of college degrees awarded in 2007-2008 were in engineering and engineering technology. With its focus on engineering students, the purpose of this study was to increase our understanding of ways institutions can encourage students to complete engineering degrees.

RELEVANT LITERATURE

College Student Engagement

Since the publication of Astin's (1984) work related to his theory of student involvement, research into the experiences of college students has echoed his finding that active involvement in the college environment leads to college degree completion. Tinto's (1993) work also emphasized engagement and focused on the importance of both academic and social involvement on campus as keys to increasing student persistence. More recently, Bean (2005) identified academic and social factors as two of nine themes across student retention research. These ideas have shaped much of the programming on college campuses, as well as research that continues to examine the impact of different types of engagement on students' persistence.

Student engagement is operationalized in many different ways as researchers attempt to grasp a better understanding of its role in college student persistence. Current research continues to juggle definitions and measure the differential influence of types of engagement. For example, Kuh, Cruce, Shoup, Kinzie, and Gonyea (2008) found that "educationally purposeful engagement" had a statistically significant impact on persistence in first-year students, even after they controlled for several background characteristics such as race, social class, and academic preparation (p. 151). In this study, engagement was defined as "time spent studying, time spent in co-curricular activities, and a global measure of engagement in effective educational practices" (p. 544) including such items as "asked questions in class or contributed to class discussion," "participated in a community-based project as part of a regular course," and "discussed ideas from your readings or classes with others outside of class (students, family members, coworkers, etc.)" (p. 558), indicating a definition of engagement that is more academically focused than others.

Bean (2005) identified social factors as one theme that cuts across college student retention literature, noting that social "resources" on campus include "faculty, staff, and particularly other students" (p. 228). Social engagement can take the form of conversations with others, interacting within campus residence halls, engaging in athletic activities, or participation in a variety of campus activities, all of which increase students' "satisfaction, self-confidence, loyalty, fitting in, and remaining enrolled" (Bean, 2005, p. 229). However, with the many competing responsibilities of today's college student, many students focus their engagement on academics and work. Tinto (1998) reiterated the importance of emphasizing academic engagement because, while the effect is different at different types of institutions, academic engagement appears to have a greater impact on persistence than social engagement. Living-learning communities are one way to marry students' academic and social engagement by providing focused residential experiences that emphasize common academic

interests. Living-learning communities developed around STEM academic interests have been shown to have some positive impact on STEM majors' persistence (Soldner, Rowan-Kenyon, & Inkelas, 2008). More research is needed to determine whether living-learning communities enhance persistence, particularly for students who have limited time to be involved in what they may perceive as the extra burden of social engagement.

First-generation college students are one group of students who tend to be less socially engaged on campus (Martinez et al., 2009). Martinez et al. cautioned that many interventions intended to increase students' social engagement on campus conflict with these students' need to work. This was true for Anna, a first-generation college student highlighted in Bergerson's (2007) case study. Anna frequently mentioned that she did not have time to participate in activities on campus because she had to work 20 hours a week off campus to pay tuition. Because many students, but particularly those who are first-generation and come from lower social-class backgrounds, must work off-campus, Martinez et al. suggested that efforts to engage these students should focus on alleviating their "financial, academic and job-related concerns" (p. 100) as opposed to emphasizing involvement in extra-curricular activities.

Exploring the persistence of students from lower social class backgrounds led Ostrove and Long (2007) to note that institutions can do a better job of helping students with limited financial means to feel like they "belong" on campus (p. 384). These authors noted that institutions that do a better job of retaining students from lower social class backgrounds employ peer counselors to assist these students in navigating college life. Dennis, Calvino, and Gonzalez (2008) also suggested the use of peer counseling as a way to engage transfer students with other students and increase their sense of belonging on campus.

Peer counseling offers a form of engagement both for students who are counseled by their peers, as well as the peer counselors. Not only do these students engage with each other in peer-to-peer relationships, but for peer counselors there is a degree of engagement with the institution as they develop the skills and resources necessary for assisting newer students. Bergerson and Petersen (2009) found that college students participating in a mentoring program for middle school students experienced a growth in self-confidence and commitment to completing college that positively impacted their persistence decisions. James, Jurich, and Estes (2001) found similar increases in self-image and civic responsibility that they argued contributed positively to the overall college experiences of their participants, who were involved in a high school outreach program intended to increase the college participation of underrepresented students.

Research has demonstrated that campus engagement, both social and academic, has a positive impact on college student persistence (Astin, 1984; Bean, 2005; Kuh et al., 2008). It is also clear that engagement is defined in many ways. The outreach program described in this study serves not only as a recruitment tool, but as a form of campus engagement for outreach team members who

interact with faculty and peers utilizing skills learned in the classroom to develop demonstration projects which they present to high school students. Their role as representatives of the university as well as their work with each other on the teams mirrors that of a peer counseling or mentoring model. The studies on the positive impact of peer mentoring (Bergerson & Petersen, 2009; James et al., 2001) show some evidence that the involvement of our study participants in an outreach program might have positive ramifications for their persistence in college; however, these studies did not explain the process by which these positive experiences might be translated into persistence. The following conceptual framework can help illuminate this connection.

Conceptual Framework

The work of Weidman (1989) provided a theoretical frame for understanding how positive experiences in outreach programs might translate to persistence. Weidman argued that a significant element of college student socialization is socialization into their career field. When students develop a sense of commitment to a particular field, Weidman noted, their commitment to completing the degree required to work in that field increases. Weidman's model accounts for the values and expectations that students bring with them to college, including family and peer relationships. While in college, Weidman argued, students weigh the expectations of their chosen career with these pre-college relationships and values and choose whether to maintain previously held norms or to incorporate new approaches into their lives. Similar to the process of organizational socialization (VanMaanen & Schein, 1979), as students grow more familiar with the norms of their chosen career field and begin to incorporate those norms into their lives, their success, or persistence in this field increases. Bean (2005) also touched on the importance of commitment; however, in Bean's delineation of the nine themes of retention, commitment is conceptualized as loyalty to the institution. Despite the difference between institutional commitment and commitment to a major, Bean's admonition to institutional agents to consider the impact of their retention-related interventions on student attitudes that are linked to loyalty cuts across both types of commitment.

Several disciplines regularly employ pre-service socialization tactics to begin the process of inducting undergraduate students into their chosen career fields. Pre-service teaching, for example, contributes to the development of professional identity (Cattley, 2007). Nursing is another field in which undergraduates gain experience in the job setting as part of degree programs. McKenna, McCall, and Wray (2010) found that practicums in specialized areas of nursing not only helped reaffirm their participants' career choice, but positively influenced participants' process of determining which nursing specialization to pursue. In the field of medicine, Bourdreau, Cruess, and Cruess (2011) explored how a curriculum based on "physicianship," which focused on "the physician as healer

and professional" (p. 89), and incorporated "early clinical exposure and small-group instruction" (p. 93) encouraged the development of a professional identity early in students' medical school program. Other studies highlighted the nuances of the development of a professional identity in graduate students exploring faculty positions (Baker & Lattuca, 2010; Bieber & Worley, 2006; Gopaul, 2011). Generally, these studies found that providing students with exposure to the work of their chosen career, and the environments in which that work takes place, assists them in developing a professional role identity as part of their graduate education and increases their understanding of and commitment to their career fields. Utilizing concepts of student socialization and the development of professional identity, our study explored whether participation in the NSF outreach teams contributed to the development of study participants' professional role identities and influenced their commitment to their major.

Research Questions

The purpose of the study was to increase our understanding of the influence of participating in the NSF outreach program on participants' commitment to their major and subsequent persistence decisions. The following research questions guided the study's data collection and analysis:

1. What aspects of involvement in the outreach teams reflect elements of campus engagement known to relate to college student persistence?
2. How do participants describe the influence of participating in the outreach program on their connection to the college of engineering and their commitment to an engineering major?
3. How does participating in the outreach program play into participants' professional role identity development?

METHODS

Qualitative methods were selected for this study because of the nature of the research questions. The descriptive study employed interpretive methods (Erickson, 1986). Data were collected and analyzed for individual students and then analyzed across participants to find common themes. The 5 female and 14 male participants ranged from first-year to senior students, and included two community college students planning to transfer to the University. All participants were full-time students in engineering programs at Western State University (WSU) or Mountain City Community College (MCCC) and were employed as outreach team members by the WSU College of Engineering through the support of the NSF grant. We contacted students who were outreach team members via e-mail and asked for their voluntary participation in an interview or to provide feedback via e-mail. Approximately one-third of the outreach team members agreed to be interviewed, and five others provided information via e-mail.

Data Collection

Data collection took place over the course of 3 years, the duration of the NSF grant, and included individual interviews, data from student timecards, and observations. Participant interviews were the primary source of data collection. Fourteen students were interviewed by the researchers. These semi-structured interviews lasted about 25-40 minutes and were audio-taped and then transcribed verbatim by the researchers. As part of their outreach team responsibilities, all outreach team members were asked to identify challenges and successes related to their outreach activities, as well as explain what they had learned during each pay period on their timecards. Five students made this information available to the research team, and their responses to these questions were included in the data corpus. Students were also observed in their outreach roles at high schools and on-campus engineering sessions, such as "Meet an Engineer" night, a week-long summer camp, and the College of Engineering open house. All three sources of data were used to develop research findings.

Data Analysis

Data analysis was a continual process, with initial analysis as data were collected and transcribed. Using analytic induction (Erickson, 1986), each researcher individually examined the data for common themes. Each researcher developed a list of emergent themes and noted the relationships between them. Then, as a team, we tested and retested these themes against the data to ensure that sufficient evidence was present for each theme. Erickson (p. 148) defined this process as making "the largest possible number of connections to items of data in the corpus." The final step in the analysis was to compare disconfirming and confirming data to seek errors in the original themes, which enhanced the confidence with which we are able to present evidence for the following emergent themes.

FINDINGS AND DISCUSSION

Study Context

The outreach teams in which our participants were involved were one component of a recruitment and retention effort at WSU which was funded by a National Science Foundation grant. The goal of the program was to increase the enrollment in and degree completion rates for engineering programs at WSU, in response to a state-wide effort to increase the numbers of engineers in the state. The outreach program was developed as a recruitment and retention tool.

Study participants were students hired by six WSU engineering departments (electrical and computer engineering, bioengineering, chemical engineering, materials science engineering, civil and environmental engineering, and mechanical engineering) to participate in College of Engineering outreach efforts.

Students served on outreach teams in their individual department, and, working closely with a departmental faculty member who was also a co-principal investigator on the grant, they created a demonstration project which they presented to high school students. Each outreach team visited high school science and math classes during the academic year, participated in engineering fairs and events at high schools and on the university campus, and introduced high school students to engineering at an annual summer camp on the university campus. Participants were paid a stipend from NSF grant funds and were expected to work 10-15 hours per week. Students reported their hours on time cards which were processed by the College of Engineering every 2 weeks. Several participants continued their involvement with the program for 3 years, while others were more transitional in their involvement.

Four themes emerged from the data:

1. connections to faculty;
2. connecting concepts to the real world;
3. connecting with peers; and
4. seeing myself as an engineer.

Each of these themes is described below.

Connections with Faculty

One element of Kuh et al.'s (2008) concept of educationally purposeful engagement is interactions with faculty, both in and outside of the classroom. Involvement in the outreach teams clearly facilitated this type of engagement. Nearly every participant talked about the increased involvement with faculty that resulted from their participation in the outreach teams. Dave, a first-year civil engineering student stated:

> It's been nice to be able to go to a teacher and not just have them getting you out of their office so they can do the next thing on their chore list. So it's nice seeing that Peter [civil engineering faculty] and all these other NSF advisors, they are really, yeah, gung-ho for their teams.

Connecting to faculty also allowed students to gain a better understanding of engineering as a major and career field, as illustrated by Carol's comments about her electrical engineering advisor:

> [Dr. Fields] sent me an email about a guy who was . . . who had a masters of mechanical engineering and later on he went into med school and became a doctor. And he was telling us how his engineering degree actually helped him to get into the school of medicine. And, I was like . . . that's really cool what you can do with an engineering degree. It really opens many doors for someone, and that just made me even more excited about my career.

Additionally, participants saw NSF outreach team supervisors as valued sources of support who were invested in students' growth as engineers. Mike spoke to this perspective:

> They like to help. And that's been nice to realize. . . . They're still people and they want to help and they want us to learn and that's why they're here. 'Cause they could be somewhere else. They like to see students grow and learn and do new things.

For one female participant from electrical and computer engineering, experiencing a distinct connection with her female NSF faculty supervisor was beneficial in a specific manner. Sharon recalled being reminded of the significance of being a woman engineer:

> I don't really like to think of myself as necessarily a role model because I'm a person that doesn't necessarily like to stand in the spotlight, but I know particularly [Dr. Fields] wanted me to narrate all of the videos because she wanted a female to do it. She likes the fact that I'm a young female engineer that's going out there and helping. I know she kind of sees me in that role to some extent.

Across all the interviews, participants saw building a connection with faculty as important in terms of experiencing not only supportive words of encouragement, but mentoring, which furthered their interest in becoming an engineer. For example, Jason shared:

> There's been some mentoring from some professors that has been really important, that inspired me personally. I feel like they care about us learning, they don't just blow you off and don't spend enough time with you to learn things. I mean, they do as much as they can to help you succeed. I even thought about becoming a professor, because you really feel how it changes lives, and it's you know, really, really cool.

Finally, participants considered the connections between themselves and their professors related to their work with high school students. Luke noted:

> when you're working with the NSF program and you're going to faculty members to see what they've done, or what presentations they give to high school kids, you find out that a lot of these professors care a lot about the students. Not only the college students, but also the high school students, trying to communicate with them, to connect with them, that engineering is a possibility, and um, that we need you.

The opportunity to make connections and develop ideas and projects with their NSF faculty supervisors was noted by nearly all of our study participants. Several linked these connections with their greater understanding of and commitment to engineering. These interactions with outreach team faculty supervisors also provided opportunities for participants to connect abstract ideas to the real world.

Connecting Concepts to the Real World

Several participants talked about how creating their outreach teams' demonstration projects and introducing high school students to the concepts incorporated

into these projects allowed them to connect classroom theories to real-world application. The ability to make these connections enhances student learning and can lead to increased academic engagement (Tinto, 1998). Randy, a third-year materials science engineering student, described how his ideas about engineering changed as he participated in the grant project:

> It's [engineering] not all math and science. It's a lot of applications of how to figure out what we need and how to make it into different sorts of applications. And, I used to think that it was just sitting in a lab all day, and doing research, and that was the extent of it. Now I know there's also sales and there's marketing, and there's the business side and all the law involved.

Stacy, a second-year mechanical engineering student added: "It's fun to work on stuff. And it reconnects me to the basics of engineering—why I love it and what keeps me motivated and stuff." And, Anna, a first-year pre-engineering student working with the electrical outreach team, noted on her time card, "I've gotten more excited about classes after seeing some of the demos firsthand last week." Zlotkowski (2005) echoed the importance of knowledge application in educational and professional skill development for both new and continuing students. This aspect of the NSF project provides opportunities for active and experiential learning.

Participating in outreach teams provided opportunities for participants to work in multi-year teams on projects that connected them with the community and allowed them to grow comfortable with the practical application of their classroom knowledge. Additionally, participants saw utilizing their engineering knowledge as a tool to encourage high school students to pursue the field. Candice elaborated:

> I see it as a way of being able to help people and being able to combine my engineering interest with that kind of reaching out, helping others. I think it is satisfying to help somebody. You can convince them that they are good at math. I think just kind of helping kids have a little more confidence in themselves and to think about a different possibility for their lives is rewarding.

Opportunities to interact with high school students also provided study participants with the chance to connect to the broader community, which can serve students' social and academic needs. Candice talked about her desire to work with the community in her civil engineering career, which her NSF involvement facilitated:

> I like the fact that civil engineering allows you to be more involved with the community itself. From my understanding, in most aspects of civil engineering you're dealing with city councils, making decisions with community involvement. I really like that aspect so I really wanted to do something where I could do the work and work with the community. Plus, I want to pursue a career where I could work directly with the environment so that was the biggest difference for me unlike the other engineering fields.

Outreach team members began to make significant connections to the broader community through their high school visits and other outreach activities. The program also provided vital connections to members of the WSU engineering community. The importance of these connections is described next.

Connecting with Peers

Connecting with peers and feeling like they were part of a learning community was another theme across study participants. Tinto (1998) argued that this was essential for encouraging the type of academic involvement that leads to higher persistence rates. Sharon, noted:

> Being able to have a friend who shared my interest and passion in engineering and feeling like there was someone who really just explained the concepts better when the teacher and TA were helping, being able to have a collaboration with someone who was willing to get through it made a difference to me.

Tinto's (1998) research on learning communities found that students in environments that encouraged collaborative learning developed "higher levels of cognitive complexity" (p. 171) than they could through taking unrelated courses with a constantly changing group of peers. The outreach teams created a relatively stable learning environment for students at different points in their engineering programs. Mike, an MCCC student, spoke about the benefits of having access to knowledgeable peers,

> Um, being able to work with other members who are already here, ask them questions, and use the knowledge that I've had, that I've built over the last two years, to build something [important]. It's just all kind of come together, which is nice.

Luke furthers this perspective by speaking to the motivation experienced when interacting with engineering peers, stating:

> This program gets you in touch with some of the juniors, some of the students who are in the program. You get to know their stories and you get that personal interaction. Everyone's willing to talk so you get to see that there's a lot of people that are really enthused about coming through the engineering program, and they have an attachment to being an engineer. And they really want to apply themselves to benefit society.

We found that participants in our study commented on the importance of these connections with the WSU engineering community both for individual support as well as gains in understanding specific concepts and the broader field of engineering, which allowed them to begin seeing themselves as engineers. This process is described in the following section.

Seeing Myself as an Engineer

Most study participants commented on how participating in the outreach teams allowed them to see themselves as engineers, and increased their commitment to their major and career field. The opportunity to take on a professional role identity was illustrated in Rory's comments:

> I think if you have a good experience with something you do it's always good to talk to someone and explain, "I'm an engineer. I do this and you might want to try it too." I don't really know how to explain this, but I'm trying to get someone in the same field.

Stacy emphasized how teaching concepts to high school students reinforced her commitment to engineering:

> It always reinforces my desire, because when I teach about it and I talk about it, and I teach the kids about practices—sometimes it can be daunting. . . . But then, you know, when we present it to them, it's like you're not expected to do, you know, multiplication before you learn addition and subtraction. And when I teach them that, it always reminds me of that. . . . And it keeps me motivated in a way.

Jim wrote about explaining the importance of math in engineering, which reveals the confidence developed through these presentations:

> The students' and teachers' curiosity naturally lead into a discussion about the importance of math. I'm pretty sure we nailed a good explanation of the importance of it, and then gave a number of simple examples as the opportunities popped up. In short, we said that learning math is synonymous to needing to know the Chinese language if you expect to be successful shopping in an inner city Chinese market. More specifically, engineering is written and understood in the language of mathematics; to understand the concepts, you have to speak the language. I mentioned the fact that there's a small but steep hill of difficulty to climb in math, and once you're over things start to come together in a magical and amazing way.

In addition to seeing themselves as engineers through their outreach work and developing confidence in their engineering skills, participants talked about gaining a clearer understanding of why they were interested in engineering as a major and career. Some participants focused on the availability of jobs. As an example, Felix offered this perspective:

> I like this field [power engineering] because first of all, the planet is in a huge energy crisis, gas prices are going down, but in the future we will need alternate sources of energy, something you can use at a lower price. So, for a long-term basis, I feel if I can get into some renewable sources of energy that would give me a very good job. Plus, the economy is really bad, so it's not good for electrical engineers, but power engineering offers a lot of jobs.

Most participants spoke about the financial benefits of engineering careers, but they also described a sense of fulfillment from knowing their real world work could make a difference in society. Dave P. explained:

> Being able to say, look at a building and say I helped design that building. That's something that I've always wanted to do. My dad says, I helped design the space shuttle, and I'm like well, that's just awesome. And I look around at buildings, like the copper top downtown, and being able to say I helped design that and I helped build that would be something—that would be nice to have on my resume with the money, but it's, that's your pride. To be able to say I helped design something that people use every day to get worth out of.

Jason also experienced a desire to be an expert in his field, but ultimately wanted to make a difference in the world as an engineer who made meaningful decisions. He noted,

> I guess what keeps me going is it's for me it's mostly when I graduate, I will be someone that their opinion will be respected, someone that people will look up to as a scientist, and also hopefully one day people will consult me or ask my opinion. I think that's very important—the sense of contribution to society and you know, that you're important, you're not just some Joe Blow.

Part of professional identity development is learning more about the field the student is interested in. Our participants often had opportunities to interact with local engineering community that were not available to all students. For example, Larry worked at a professional engineering conference with his outreach team members, and the experience was exceptionally meaningful for him. He described this on his timecard, when he reported working 12 hours at the conference:

> I learned more this past weekend about companies and how they work more than I ever have. The experience I had at AMTA was one of a kind and was the most informative opportunity in the field of Electromagnetics and Antenna Transmission I have ever had. I thoroughly enjoyed the presentation for the students in the conference room itself and the ideas were mind blowing. I would do it again if I had the chance.

Related to beginning to understand why they wanted to be engineers, and learning more about the field of engineering, participants' work on the outreach team helped them see the potential in the high school students they visited. Sharon described her role as an engineer sharing engineering concepts with high school students:

> As an engineer, I want to be involved in shaping students' futures. I want to let them know all what engineering is about. Hopefully, making a difference will allow students to have that much more of a head start.

Sharon's words speak to a sense of fulfillment developed while helping high school students, which went beyond the application of knowledge described by participants earlier. Jason also experienced this sense of fulfillment:

> Just seeing how much potential there is in other kids, you know, as engineering students, and me outreaching to them, and then they thought almost as engineers, you know. And that, was a good feeling, that was pretty inspiring, how they actually looked up to us, you know. So you know, I think you plant a seed in someone's life, and just to know that you've done that, it's pretty, it makes you feel good about it.

Finally, participants talked about the skills they gained through the projects and presentations. These comments were most notably found on the time cards of the five students who made that data available. For example, Josh noted,

> I am getting good at talking in front of classes for the most part, but even though I may know something like the back of my hand when it comes to doing homework, talking about it can be more difficult than it seems.

Neil added:

> I've learned more about presenting and it seems like in order to really speak to the students, you have to get down to their level. How are engineers making their lives better, specifically? They probably don't care about things like power lines, but certainly they love videogames, music, movies, and especially lasers. So we'll just want to keep that in mind when we do these demos. I remember that when I was presenting, there were some students who just weren't into it and then I brought in the fact that their favorite music artists auto-tune their voices to get that perfect sinusoid when they're singing a long tone and they got more interested. The "so-this-is how-they-do-it" factor really helps.

Our findings illustrate how the outreach teams associated with the NSF grant in the WSU college of engineering connect to concepts related to engagement. They also demonstrate how such an experience can contribute to the development of professional identity as engineers. While we do not have the longitudinal data required to know whether all of these students persisted in their pursuit of an engineering degree, we do know that both career socialization and engagement are tied to increased persistence, which leads us to believe that programs such as this can contribute to the persistence of engineering students.

DISCUSSION AND IMPLICATIONS

The purpose of this qualitative research study was to contribute to an understanding of how institutions can positively influence engineering students' persistence to degree attainment. Specifically, the study sought to understand whether a high school outreach program that involved current engineering undergraduate

students could serve as a form of campus engagement, and to explore the influence of participation in this program on the development of college students' identity as engineers. Student engagement literature, and a conceptual framework of career socialization provided a foundation for the study, which found that the outreach program did serve as a form of campus engagement, and that students began to see themselves as engineers as a result of their participation in the program.

College student persistence literature has shown the importance of both social and academic engagement in college life (Astin, 1984; Bean, 2005; Tinto, 1993, 1998). Tinto's (1998) work argued for the integration of both social and academic involvement through learning communities, interactive and experiential classroom environments, and collaboration. Tying social connections to academics, Tinto argued, would better serve students, whose demographics have changed significantly over the past four decades. The integration of social and academic involvement better meets the needs of adult students, working class students, and first-generation students, who tend to have more off-campus work and family responsibilities, and who shy away from traditional forms of engagement such as campus activities, on-campus housing, and other voluntary means of involvement (Bergerson, 2007; Johnson et al., 2007; Martinez et al., 2009; Ostrove & Long, 2007).

Our study shows that an outreach program that employs current college students to recruit high school students into engineering programs can serve as a form of campus engagement. Students involved in our program developed stronger connections to the faculty with whom they worked, which Kuh et al. (2008) described as a form of educationally purposeful engagement. Additionally, students developed the social ties described by Bean (2005) as essential to persistence when they had the opportunity to work in small groups with peers at different levels of degree completion.

Another aspect of the program that ties to the engagement research is students' development of demonstration projects to present to high school students. Creating working demonstrations of course-based ideas such as math, physics, and specific engineering concepts allowed students to apply complex theoretical ideas to practice, similar to the work that they will do as professional engineers. The collaboration involved in these projects was valuable for students, particularly those who were newer to engineering, who valued the expertise and knowledge of their more advanced peers. Additionally, students who were early in their engineering programs enjoyed the opportunity to apply concepts to real-life work, due to the fact that most of the introductory engineering, math, and physics courses required for enrollment in advanced engineering courses and labs do not have an application element to them. Bringing these concepts to life in the demonstration projects was exciting for the newer engineering students, several of whom talked about how this made them more enthusiastic about their current courses as well as more committed to staying in engineering so they could enroll in lab courses later in the program.

Our study findings indicate that outreach programs that include collaborative small groups closely supervised by faculty, as well as applications of concepts to hands-on work, have many links with both social and academic engagement. The peer-to-peer and faculty-to-student relationships reflect important social connections, while the opportunity to interact with faculty and peers outside of the classroom in experiential learning projects is a clear form of academic engagement. While these findings are interesting, we believe the larger significance of our study relates to the conceptual framework of career socialization and the role of the outreach teams in developing a professional identity as an engineer in students' commitment to their majors.

Weidman (1989) argued that college student persistence is tied to professional socialization. In Weidman's model, professional student socialization occurs as students weigh their pre-college values and norms against those to which they are exposed while in college. Interactions with campus agents are key to the socialization process, and the more frequent and consistent these interactions, the stronger the socialization towards a particular career is. Other research identified professional identity development opportunities as essential to career socialization in college (Baker & Lattuca, 2010; Bieber & Worley, 2006; Cattley, 2007; Gopaul, 2011; McKenna et al., 2010). By providing outreach team members with opportunities to act as engineering "experts" with high school students, outreach teams allow them to try on engineering as a professional identity. Across both interviews and written feedback our participants noted these opportunities as significant in their development as engineering majors.

Our findings show that beyond engaging students in both academic and social ways, the NSF outreach teams created a sense of "being" engineers. Participants talked about the growth that was part of answering difficult questions from high school students and teachers, developing and demonstrating projects that encompassed complex theoretical knowledge, explaining complicated concepts to students, and encouraging high school students to enroll in engineering. Several students referred to themselves as engineers when they shared these comments, leading us to believe that they actually saw themselves in this professional role when they interacted with high school students. The quality and consistency of their interactions with faculty supervisors contributed to this growth as well.

In addition to allowing students to see themselves as engineers, the outreach team experience offered participants opportunities to learn more about their chosen field of engineering. These students were invited to work at professional association meetings, present to and meet members of the grant advisory board, and learn more about the professional expectations for their work within the demonstration projects. All of these experiences contributed to an increased awareness of the options available to them within the field of engineering once they complete their degrees, which is one purpose of the pre-service experience within a number of majors (Baker & Lattuca, 2010; Bieber & Worley, 2006; Cattley, 2007; Gopaul, 2011; McKenna et al., 2010).

While we do not have clear evidence that engagement in the NSF outreach teams directly impacted our participants' persistence to degree completion, our findings suggest that they engaged more fully in their engineering programs as a result of this program, and that their involvement in the teams contributed to a sense of professional identity which positively influenced their commitment to the engineering major. These findings have implications for both research and practice.

Implications for Research

Both campus engagement and career socialization are thought to contribute to college students' persistence to degree attainment (Astin, 1984; Tinto, 1993; Weidman, 1989). While our study illustrates connections between the outreach program and the concept of engagement, as well as clear linkages between the outreach experience and career socialization, it does not make clear a relationship between these connections and the retention of engineering students. Longitudinal and comparative research is necessary to more clearly illustrate such connections. Researchers could compare students who experience an intervention like this outreach program to those who do not have such opportunities to differences in their experiences.

Additionally, research involving a broader range of students across engineering would enable us to see whether involving different types of engineering and students from different backgrounds result in variations in the influence of such programs. Related to this is exploring whether outreach that is not tied to a specific major is effective in providing both engagement and career socialization opportunities. Many higher education institutions have "ambassador" programs where current students work with institutional recruitment programs to increase enrollment. These programs may provide connections to campus similar to those of the NSF program, but they may not allow students the sense of professional identity developed by our participants. Research should explore whether there is a value-added component to a major-based program such as ours, relative to more general outreach programs.

Finally, researchers should address whether involving students in these types of programs earlier or later in their academic careers makes a difference in the experience. Many pre-service program elements occur late in the students' academic program, while one of the intents of our outreach program was to improve the persistence of early-engineering students.

Implications for Practice

Our findings suggest that practitioners involved in increasing college student retention might incorporate high school outreach into their campus-based efforts. Particularly in colleges with applied majors, outreach programs may increase the professional socialization of undergraduates. We encourage individuals in

these types of programs to consider incorporating outreach into their programs, and to do so early in students' academic programs. Additionally, our findings show that the involvement of faculty with participants was essential to the success of the program. We suggest that those developing outreach programs involve faculty from the outset, and consider ways to reward faculty for the time and effort required to make consistent quality connections with students that contribute to their career socialization. Finally, our findings may have implications for enrollment management professionals who desire to utilize college students in the recruitment of prospective students. While the career socialization element of the program might be missing from such an arrangement, we did find clear connections between participation in outreach and several concepts related to engagement that point to the benefit of students' involvement in such programs.

LIMITATIONS

All research studies have limitations that impact their applicability to a variety of settings, and ours is no exception. Below, we describe and address these limitations. However, although limitations do exist, the study is nonetheless significant in its contribution to the extension of the college student socialization literature as well as to meaningful recommendations for practice and research.

The first limitation of our study was the sample size. Although we had a robust sample of students from the NSF outreach program, we were not able to interview students from all of the engineering departments who participated in the program. This was due to the decentralized coordination of the grant in general, which led to varying degrees of commitment among the engineering faculty PIs for this aspect of the program. The lack of commitment in some departments was illustrated by their neglect to inform students of our intent to interview them, as well as not providing us with accurate information for contacting the students. So, while we can speak strongly for the success of the program in electrical and computer, civil and environmental, materials science, and mechanical engineering, we have less evidence of its impact on bioengineering and chemical engineering students. However, we do know that faculty supervisors' level of commitment to the program in general across departments was high, and that students from all departments participated regularly in the outreach, so we may assume that with similar opportunities for presenting and faculty support, bioengineering and chemical engineering students felt the same benefits from this program as students in other departments.

Second, we acknowledge that we do not have the ability to predict whether involvement in the engineering program does, in fact, increase persistence to degree attainment. Comparative, longitudinal research could demonstrate the impact of the program on retention and compare NSF outreach teams' persistence with that of similarly situated engineering students. However, it is important to note that the purpose of our study was not to prove that the program impacted

retention; rather, the study's purpose was to explore the program's relationship to ideas of campus engagement and to unpack the notion of career socialization as an aspect of persistence. The study achieved these purposes and certainly paves the way for future research as well as innovations in practice related to increasing the persistence of engineering majors.

Finally, as is the nature of any qualitative research, the results of this study must be considered within the context of the specific program and institution within which it was implemented. Those engaged in the practice of college student engagement and retention will want to consider what elements of this program might be useful in their specific institutional and departmental settings. Additionally, the concept of career socialization as a retention tool is certainly more applicable for applied majors such as engineering, business, nursing and other applied health sciences, and education, than it might be for more theoretically-based majors such as English, philosophy, or sociology. However, although the program described in this study may not be completely applicable in other institutional and departmental settings, we believe the study's findings contribute to the conversation around college student engagement and persistence and that both researchers and practitioners interested in these issues will find value in these findings.

CONCLUSION

Weidman's (1989) work on college student retention proposed the notion of career socialization as an element of students' persistence. Building on this idea, this study examined how participation in an engineering outreach program provided opportunities for students to engage with their institution and develop a professional identity. By linking participants to faculty and peers, as well as creating opportunities to connect theory to real world applications, this program feeds students' ability to "see" themselves as engineers. Presenting this nascent professional identity to high school students then increased participants' commitment to their major and career field. While one limitation of our study is the lack of longitudinal data about the persistence of study participants, we do know that educational goal commitment is an element of persistence (Tinto, 1993). Our study provides support for including professional identity development in campus practices that center on increasing retention.

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