AC 2012-4740: GENDERED SOCIALIZATION DURING THE FIRST SEMESTER: CONTRASTING EXPERIENCES OF MALE AND FEMALE TRANSFER/NON-TRADITIONAL ENGINEERING STUDENTS

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Gendered Socialization During the First Semester: Contrasting Experiences of Male and Female Transfer/Non-Traditional Engineering Students

Abstract

As part of a larger, multi-year, mixed-method research study that examined the attitudes, perceptions, and experiences of engineering students, this paper presents an in-depth qualitative analysis of 15 transfer and/or non-traditional engineering students attending a large urban public university located in the Southeast. Transfer students at this institution have shown a higher level of persistence and higher graduation rate in comparison to traditional engineering students (students who are 18-20 years old and recently graduated from high school). The qualitative analysis showed that the females’ choice of major was largely influenced and supported by either their family, or caring faculty members who voluntarily served as their mentors. In contrast, male students appeared to have more diverse reasons for their transfer decisions. The social and cultural transition experience of male and female students also exhibited a sharp contrast. Male transfer/non-traditional students found themselves receiving respect from younger students, while female students faced multiple challenges including lack of peer support, financial hardship, and family-related responsibilities. In particular, their team work experiences illuminated an interesting facet of social dynamics that they encountered in relation to younger male and female students. Findings derived from the larger survey data and thematic analysis of the interview data collected from 77 traditional engineering students were partially used to contextualize the unique aspects of the transition experiences and perspectives of transfer/non-traditional students.

Introduction

During the last two decades, there has been a growing public consensus that it is vital to prepare a qualified engineering workforce that will generate a profound impact on the nation’s economy and prosperity. Based on the most recent U.S. Bureau of Labor Statistics projections, the demand for qualified engineering graduates nation-wide will grow 11% between 2008 and 2018, but the actual number of students graduating with engineering degrees remained relatively unchanged between 2005 and 2009 with a slight improvement made in 2010. Contradictory to the long-held belief that the engineering fields suffer from low retention rates, recent studies show that the retention rate of engineering students is relatively higher than other majors. Researchers suggest that the stationary number of qualified engineering graduates is primarily based on the extremely low rate of inward migration from other majors. Very few students who matriculated in other majors transfer to the engineering fields.

While many studies have investigated the first-year college experience of traditional engineering students, few research studies have explored the first year transition experience of transfer/non-traditional engineering students. As a result, the existing literature addressing this important group of students who could play a critical role in meeting society’s demand for competent and qualified engineering graduates is lacking. As part of a larger, multi-year, mixed-method research project that examines the attitudes, perceptions, and experiences of engineering
students, this paper presents an in-depth, qualitative analysis of 15 transfer and/or non-traditional engineering students including five female students and 10 male students.

Literature Review: Significance of Transfer/Non-traditional College Students

During the last four decades, the college student population has become increasingly diverse in terms of age, race/ethnicity, and socioeconomic backgrounds. The traditional image of a college student (an 18 year old high school graduate who remains in the institution for four to six years) has eroded significantly. First, the role and significance of community college in higher education has increased over the past forty years. Of the 15.6 million undergraduate students nationwide in 2007, 6.6 million were enrolled in community colleges, occupying 42.3% of the entire college student population.\(^5\) According to a report from the National Science Foundation (NSF)\(^6\), 44% of college graduates in engineering and sciences have attended a community college at some point during their undergraduate education. Researchers claim that transfer students from community colleges have contributed to the diversity of STEM fields because the proportion of women and minority students attending community colleges is significantly higher than those found in four year institutions.\(^7\) Second, the number of college graduates who attended more than one institution during the course of their undergraduate program increased from 49% in 1970 to 54% in 1990.\(^8\) According to the National Center for Education Statistics (NCES)\(^9\), almost half (47.3%) of the students who earned their first-time bachelor’s degree during the 2000 academic year attended more than one institution.

Hardships Faced by Transfer/Non-traditional Students

Researchers have long demonstrated that transfer/non-traditional students have a higher risk of dropping out or leaving the program without obtaining a college degree. Saupe and Long\(^10\) compared the one-year persistence and six-year graduation rates between traditional college students (referred to as “native students”) and transfer students at the University of Missouri-Columbia. They found that transfer students consistently showed a lower rate of persistence and graduation than traditional students. Eimers and Mullen\(^11\) did a replication study with the same institutional data from the University of Missouri-Columbia. Dougherty\(^12\) conducted a similar study at the University of Maryland. Both subsequent investigations by these independent researchers yielded similar results. Furthermore, the Eimers and Mullen study\(^11\) revealed that minority transfer students were less likely to complete their bachelor’s degree compared to white or Asian-American students even when their course credit hours and GPAs were controlled. Using multi-institutional data from the National Education Longitudinal Study of 1988 (NELS: 88/00), Rab\(^13\) examined the trajectory of degree completion for transfer students attending multiple institutions. She found that low income students were more likely to exhibit multi-institutional enrollment patterns, which are considered a less efficient route for completing a degree. She interpreted that this type of inefficient and unproductive pattern of swirling taken by many low-income students exacerbates “the continuing reproduction of class inequalities and helps create new forms of stratification within higher education” (p. 8).

Even though the number of studies that examine the retention/graduation statistics or overall college experience of transfer or non-traditional students in engineering are limited, a few existing studies suggest that transfer/non-traditional students in engineering (or STEM fields as a
whole) face greater challenges in their academic and professional pursuits. Micceri\textsuperscript{14} found that it takes longer for transfer students to complete a degree from their college entry in comparison to ‘traditional’ engineering students. Reyes’s qualitative study\textsuperscript{15} showed that women of color who transferred from a community college to a STEM program within a four year college experienced a negative institutional atmosphere that did not facilitate their sense of belonging. More specifically, the female transfer students were subject to an implicit message that they did not belong to the new institution due to their age, ethnicity, gender, and the presumption that few transfer students are adequately prepared for rigorous academic work. Contradictory to the findings of the above two studies, Crisp and her colleagues\textsuperscript{16} found that the transfer status of students does not impact their graduation trajectory. Since their study was conducted in a Hispanic serving institution (HSI), Crisp et al.\textsuperscript{16} interpreted that HSIs may function as a vital point of access for diverse students, and may generate opportunity to bring more Hispanic students into STEM disciplines.

Gender, Race/Ethnicity, and Social Engagement among Engineering Students

Previous studies suggest that social engagement activities can be critical to the academic success and retention of engineering students, especially female and underrepresented ethnic minority students. For example, female engineering students deciding what to major in were more motivated by encouragement provided by their mentors, while male engineering students typically associate their decision with the behavioral aspects of engineering (e.g., the ability to build stuff and figure out how things work).\textsuperscript{17, 18} According to Chachra et al.\textsuperscript{19}, female engineering students more often participated in both engineering and non-engineering extracurricular activities compared to their male counterparts. Furthermore, female students also attached more value to the non-engineering activities at a statistically significant level (p < 0.05). Based on this result, these researchers concluded that activities that occurred outside of their engineering classroom might play a more vital role for a female engineering student compared to their male peers.

The literature provides ample evidence regarding the importance of interpersonal relationships and social engagement for the success of a female student in a traditionally male dominated field (e.g. mathematics or engineering). The seminal work of Belenky et al.\textsuperscript{20} offers valuable insight into the nature of challenges faced by female students in engineering education. Belenky and her colleagues\textsuperscript{20} explain that women are connected knowers and, therefore, tend to rely on interpersonal relationships and commonality of experience when they approach a new idea or knowledge. Not surprisingly, scholars in STEM education have also reported that a relationship-rich learning context (e.g., group work) positively influences female student learning experiences,\textsuperscript{21, 22} and actual learning outcomes\textsuperscript{23, 24} in comparison to a separated and individuated learning context. Researchers\textsuperscript{25, 26, 27, 28} also reported that a high quality and supportive relationship with instructional authority is critical to the intellectual pursuit and perseverance of a female student in a male dominated domain.

It should be noted that several studies\textsuperscript{28, 29, 30} reporting a positive correlation between social engagement and student retention or academic success variables were conducted with students identified as underrepresented minorities in engineering (e.g., females, racial minority students). Trenor and her associates\textsuperscript{29} revealed significant associations between the intentions of female
students to persist in engineering, and their perceived social support as well as their sense of belonging, which are two engineering-specific social engagement variables. Amelink and Creamer’s multi-institutional research with female engineering students also demonstrated that two survey items associated with peer-oriented social engagement (“getting along with other students in the engineering major” and “feeling as though they are treated with respect by male students” in their program) were significantly correlated with their intent to pursue an engineering-related career. Espinosa’s study reported that some categories of social engagement are positively related to the persistence of female students as a whole while others only have a meaningful association with women of color. Brown et al.’s study conducted with African-American engineering students at Historically Black Colleges and Universities (HBCU) revealed a statistically significant relationship between general, non-engineering-specific, peer-oriented social engagement and student persistence. When these results are viewed together, social engagement and sense of belonging seem to be an important factor for marginalized groups of students (e.g., females, underrepresented racial minorities) aspiring to succeed in engineering.

Institutional Contexts

This study is part of a comprehensive, long-term effort to improve recruitment and retention strategies for freshman engineering students at a large urban public university located in the Southeast. The data presented in this paper involved engineering students that were enrolled in their first introductory engineering course during the fall semesters of 2009 (n = 444) and 2010 (n = 495). The course introduces them to the engineering profession and the various engineering disciplines, basic engineering theory and mathematics, the engineering design process, project planning, cost estimating, teamwork, and oral and written technical communications. Calculus I is a co-requisite and the course is restricted to College of Engineering students during the fall semester. Enrollment in each section is limited to approximately 30 students to facilitate positive student-student and student-faculty interactions. A teaching assistant (TA) is assigned to each section to serve as a mentor and grader. Students work in small teams to complete three hands-on projects that require them to design, build, and test their solutions.

Select sections of the introductory engineering course are reserved for students who participate in the residential Freshman Learning Community (FLC), which is a successful support program run by the College of Engineering to provide on-site academic and professional development programs that include peer mentoring, tutoring, supplemental instruction, chemistry study nights, guest speakers, and site visits to local engineering companies. About 220 students, representing approximately half of each new freshman engineering cohort, live in the FLC.

Retention and Graduation Statistics of Transfer Students

The University and the College of Engineering have experienced rapid growth during the last ten years. The total enrollment of the university increased from 17,000 in 2000 to 25,063 in 2010. The number of freshmen admitted to engineering programs was 231 in 2000. This number increased to 459 in 2009. The number of transfer students in the College of Engineering also steadily increased during this time period. In 2000, 180 transfer students were admitted to the college compared to the 251 new transfer students enrolled in 2009.
Contradictory to the common expectation and statistics observed in other studies and other institutions, transfer students at this institution have shown a slightly higher level of retention and a more significant level of graduation rate in comparison to traditional engineering students (students who are 18-20 years old, recently graduated from high school). Table 1 summarizes this data and Figure 1 visually displays the same data. The most recent first year retention rate of new transfer students in the College of Engineering is 75.2% (for the cohort of 2008 transfer students). In comparison, the one-year retention rate for the entire population of new freshman students in the college is 71.1%. Likewise, the six year graduation rate for engineering transfer students is significantly higher (60.5%) than the graduation rate of the entire engineering student population (40.9%) for the 2003 cohort. This pattern is explicit in the institutional data accumulated during the past 15 years.

Table 1: Retention and Graduation Rates for the College of Engineering Versus Transfer Engineering Students Only

<table>
<thead>
<tr>
<th></th>
<th>1 Year Retention Rate (%)</th>
<th>Graduation Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>College</td>
<td>Transfer students only</td>
</tr>
<tr>
<td>2000</td>
<td>63.6</td>
<td>65.0</td>
</tr>
<tr>
<td>2001</td>
<td>66.7</td>
<td>73.1</td>
</tr>
<tr>
<td>2002</td>
<td>60.0</td>
<td>73.1</td>
</tr>
<tr>
<td>2003</td>
<td>67.2</td>
<td>74.5</td>
</tr>
<tr>
<td>2004</td>
<td>67.8</td>
<td>76.9</td>
</tr>
<tr>
<td>2005</td>
<td>67.3</td>
<td>76.0</td>
</tr>
<tr>
<td>2006</td>
<td>65.9</td>
<td>74.9</td>
</tr>
<tr>
<td>2007</td>
<td>72.8</td>
<td>72.0</td>
</tr>
<tr>
<td>2008</td>
<td>71.1</td>
<td>75.2</td>
</tr>
</tbody>
</table>

Figure 1: Retention and Graduation Rates for the College of Engineering versus and Transfer Engineering Students Only
Research Design, Participants, and Data Collection

The larger, mixed method study contains the analyses of multiple quantitative and qualitative data sets including the Pittsburgh Freshman Engineering Attitude Survey (PFAS)\textsuperscript{33}, institutional retention statistics, interviews with students and faculty, and class observations of introductory engineering classes. Ninety-two engineering students (73 males and 19 females) that were enrolled in the introductory engineering class were interviewed during the fall 2009 and 2010 semesters. This qualitative interview sample included 68 Caucasians, 11 Asians (including four Middle Eastern students), six African-Americans, five Hispanics, one Native-American, and one student who did not specify their ethnicity. While seven interviews were conducted with 2-3 students, 78 interviews were conducted individually. Both types of interviews took about 25 to 90 minutes, and were based on a semi-structured interview protocol listing several key questions about their major/transfer decisions and transition experiences. All 15 transfer/non-traditional student participants completed an individual interview; two students participated in two rounds of the interview process during the semester. All interviews were audio-recorded, and subsequently transcribed verbatim. After the initial thematic analysis\textsuperscript{34} of all 92 students was completed, the research team conducted a more focused analysis with the 15 transfer/non-traditional students. The thematic analysis was conducted to identify major commonalities and differences in the transfer decisions and transition experiences of two groups of students. Individual case analysis was followed to explain some unique aspects of selected participants. Findings from the 15 transfer/non-traditional students are contextualized in a larger qualitative study that included a total of 92 freshman engineering student interviews.

Major Findings from the Larger Mixed-Methods Study

Quantitative survey data analysis generated significant results in two topic areas; a. student perceptions about the required amount of work/effort to succeed in the engineer program and expected benefits of earning an engineering degree, and b. gendered patterns in male and female student social relationships during the first semester.

- By the end of the semester, an increased number of students indicated that they did not desire to pursue engineering as a career. On average, fewer students believed that the future benefits of studying engineering were worth the effort. They expressed a less favorable view about the professionalism expected of engineers at the end of the semester. However, effect sizes for most of these relationships were small ranging from \( d = 0.20 \) to \( d = 0.33 \).

- In order to identify factors that may have influenced the students’ attitude about engineering as a career choice, correlation coefficients (\( r \)) between the statement of “I don’t care for this career” and the other post-survey items were examined. Sixteen items were found to be significantly and moderately associated with this opinion \( (0.35 \leq r \leq 0.65) \). The top five items that exhibited strongest correlations reflect students’ evaluation of the cost and benefit of pursuing an engineering degree. Results of the quantitative analyses suggest that students’ persistence in the major may be related to their perceptions of the cost and benefit of the engineering degree. (Table 2)
Table 2: Post-Survey Items Moderately Related to: I Don’t Care for This Career

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>r*</th>
</tr>
</thead>
<tbody>
<tr>
<td>The rewards of getting an engineering degree are not worth the effort.</td>
<td>0.61</td>
</tr>
<tr>
<td>I expect that engineering will be a rewarding career.</td>
<td>-0.59</td>
</tr>
<tr>
<td>The future benefits of studying engineering are worth the effort.</td>
<td>-0.56</td>
</tr>
<tr>
<td>The advantages of studying engineering outweigh the disadvantages.</td>
<td>-0.54</td>
</tr>
<tr>
<td>I expect that studying engineering will be rewarding.</td>
<td>-0.51</td>
</tr>
</tbody>
</table>

• By the end of the semester, male students showed a significant and positive change in their peer relationships while female students exhibited little improvement in this category.

• Qualitative data yielded similar findings. When asked to identify a few major challenges that they faced during the first semester on campus, students most commonly listed *heavy school workload and time management* as two major challenges. This finding suggests that students realized that the expected/required workload in engineering was more than what they had initially anticipated.

• A comparative analysis of male and female peer relationships and support systems indicated that male students develop positive peer relationships more quickly, and list a variety of support networks including family, the College of Engineering FLC, and friends. In contrast, female students tended to remain close to their families or develop a social network based on the FLC program.

Qualitative Findings

Findings presented in this section were derived from a qualitative analysis of 15 transfer/non-traditional students (10 males and five females). All participants were Caucasian except for one African-American female student. Two students were pursuing a second bachelor’s degree after they had obtained the first degree in another field and worked for two to four years, one student came from another program outside of the College of Engineering, three students transferred from a different four-year institution, one student was a veteran with some college course credits, and the remaining eight students recently transferred from a variety of community colleges in and out of state.

Table 3: Profiles of 15 Transfer/Non-Traditional Student Participants

<table>
<thead>
<tr>
<th>#</th>
<th>Name (Pseudonym)</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Transferred from</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chris D</td>
<td>Male</td>
<td>White</td>
<td>Second degree student</td>
</tr>
<tr>
<td>2</td>
<td>Eric R</td>
<td>Male</td>
<td>White</td>
<td>Transferred from a 4 year college</td>
</tr>
<tr>
<td>3</td>
<td>Travis H</td>
<td>Male</td>
<td>White</td>
<td>Transferred from a local community college</td>
</tr>
<tr>
<td>4</td>
<td>Henry G</td>
<td>Male</td>
<td>White</td>
<td>Transferred from a community college</td>
</tr>
<tr>
<td>5</td>
<td>Tommy B</td>
<td>Male</td>
<td>White</td>
<td>Second degree student</td>
</tr>
<tr>
<td>6</td>
<td>Michael B</td>
<td>Male</td>
<td>White</td>
<td>Military veteran with some college course credits</td>
</tr>
<tr>
<td>7</td>
<td>Joseph D</td>
<td>Male</td>
<td>White</td>
<td>Transfer student from a community college</td>
</tr>
<tr>
<td>8</td>
<td>Matt G</td>
<td>Male</td>
<td>White</td>
<td>Transferred from a community college</td>
</tr>
</tbody>
</table>
Gender Difference in Transfer Decision

The two major reasons that prompted the transfer/non-traditional student to pursue an engineering degree were their own interest in a specific aspect of engineering (e.g., designing a new product) and/or family support. Six of the 10 male students (60%) and four of the five female students (80%) interviewed explained that they love the creative aspects of engineering (e.g., “building things”, “problem solving”, “figuring things out”), and that their decision was based on their own “research into the people who are doing today what I would like to do after graduation.” They concluded that the type of work they want to do led them to choose an engineering major. Three males (30%) and three females (60%) mentioned their families’ favorable view of the engineering profession and/or support for their major decision. The primary factor that contributed to their transfer decision varied between male and female students. While only one male student (10%) referred to his previous advisor/faculty member as an important figure who influenced his transfer decision, two female transfer students (40%) who did not have any personal/family-based connection to engineering made their transfer/major decision following a faculty member’s recommendation. For example, Marie was working as a mechanic for several years and did not envision herself pursuing a four year degree until her community college professor told her that he saw engineering management potential in her, and encouraged her not to settle for a technician position.

Marie: Daniel Kleins (pseudonym) who is the physics professor at Morrow Community College. He was an adjunct here (her current university) but, I don’t know how far back that was. I don’t know. (Omitted some sentences here). I talked to David and we discussed this whole long thing. And, he stared at me and he said, “You know what I see when I look at you?” and he goes, “I see engineering management.” And he’s like, “Don’t you dare be a technician!”And, he said, “You need to run the company”. So, [I was] sitting with him and talking to him for the longest time. I don’t know what was said, but I found out later that he was in constant communication with my instructors.

As a whole, the major selected by female students was largely influenced and supported by either their family and/or caring faculty members who voluntarily served as their mentors. In contrast, the transfer decisions made by male students reflected more diverse reasons beyond the two major factors explained above, and included their prior work experience, a perception of engineering as a promising field for career advancement, and/or close friends who study engineering.

Gender Difference in Social Relationships on Campus
There is a sharp contrast in the social and cultural transition experiences of male versus female students. Male transfer and non-traditional students found themselves receiving respect from younger students, while still being able to connect with “like-minded” individuals with whom they could establish “study relationships.” In contrast, female transfer and non-traditional students felt they were “so out of the loop” and that “there was something missing” in their program experience. They found it hard to build a new support network on campus. The two quotes listed below from Travis (a male transfer student from a local community college) and Melissa (a female transfer student from another university) show such a contrast.

Interviewer: Tell me about a little bit about your social relationship with other students. 
Travis: I’ve gotten along well with most everybody. A lot of the younger students, I know, have noticed, I guess, because of being older, and as hard as I work, they kind of respect that..... Some of the younger ones, though... [I] kind of noticed that they were more mature and responsible and acted older than their age. It made me feel more comfortable because, I’m used to people who are acting on a higher maturity level and stuff. So just like at work, you tend to make better relationships with people who are a little bit more like-minded with you and people you don’t think are too irresponsible.

Melissa: The engineering program itself, it doesn’t really… If you just go to class, you’re not going to really meet people that… (Paused). You- you’re not guaranteed to meet people that you’ll want to hang out with. (Interviewer: Right.) I went to the Theta Tau [engineering service fraternity] Formal with one of my friend who’s in the fraternity and that was kind of cool. But, I still- I mean… you know, it’s an engineering fraternity. (Interviewer: Yeah.) So I met a couple of people. But, it was still like… you know, it was like there was something missing to it.

While only one of 10 male transfer students indicated that it was a major challenge to establish peer relationships or gain peer support, all five female transfer students reported that peer relationship building was very challenging, and they provided lengthy, vivid descriptions about the topic. Four females (Rena, Sarah, Marie, and Melissa) described their troubled experiences with other male students either on their project team or in class and Abby experienced a negative relationship with another female on her team. Only one male reported a problem working with his team members, but he was still able to find another collegial team member to work with him and successfully completed the team project. In contrast, the four female students struggled throughout their group work process, and listed it as a negative component of the class experience. This finding contradicts the overall qualitative finding that group work is one of the most enjoyable and valuable experiences in class, which was reported by the majority of male and female freshman engineering students.

As a whole, the transfer students had a more mature attitude toward education and stronger self-discipline based on their prior work experience and/or their need to juggle multiple responsibilities at home and school. They characterized themselves as “a lot more serious about” their education than other “seventeen/eighteen year old freshmen,” and expressed a strong desire for success. Rena’s interview reflected her sense of direction and strong commitment: “Being an older student, I’ve learned a lot of this stuff. Just kind of being out there and understanding what I need to do to change my behaviors and my habits not to wash dishes for the rest of my life.”
With a clear sense of direction in their education and desire for success, the transfer students were motivated to excel in their classes. In general, the transfer students clearly understood that most young freshman students would not or cannot share their time-trained perspectives. Rena explained why it was hard for her to accept their reckless behaviors during the group work process.

The freshmen. They’re not serious. They’re going to play Call of Duty all weekend instead of doing their part of the [group] assignment to get to you because, I’m the team leader of my group. I’ll tell them to have it to me by 3 o’clock on this day because I have class until whenever. And, I need to proofread this before I submit it because I don’t trust them to do their work well enough. And, it just always comes down to the same thing--dragging the kids who don’t really care. I mean, I can understand developing teamwork. But if this is supposed to be a weed-out class, I guess, to get people to understand whether or not they want to do it, if they decide they don’t want to then, that affects me.

While male transfer students easily earned respect from other younger male students, female transfer students did not get the same respect. They had to fight to lead their team when the group was on the verge of collapsing and risking their grade. Marie became the leader of her project group, but was still forced to argue with a male student who constantly insisted that they stick to “his way.”

Steve is very much [out of control]. I have to figure him out sometimes and he kind of snaps at you every now and then. He apologizes afterwards but it’s very much has to be his way. And, finally you just got to keep your mouth shut and just “Go right ahead, dude.” And, for our presentation--which I couldn’t believe how bad that presentation was, but he was like, “Don’t worry about it. Don’t worry about a thing because I’ve got it.” It’s just the way--[he does].

Abby’s experience was unique since the person who made her uncomfortable was another female student on her team. Abby explained her insecure feeling working with her:

But, I think some of the students are… can be a little bit more competitive. Especially the ones that’s like engineering. And just with the beam thing (a project) it’s like everyone in the group has to come up with a beam design. But, the best one is the one that your team is going to like to build and use. So, I know the one girl in my group. She's like, “Oh, I've done this before.” And it was kind of like a little discouraging because you know [that] she might help you as far as… like a little bit. But, ultimately she's probably going to want hers to be… (selected as the choice of the group).

The only African American female student in our study (Sarah) added another interesting facet. She experienced multiple challenges including financial hardship and family responsibilities with her young daughter. While struggling, Sarah did not feel as if there was adequate support available from her program or engineering peers. Responding to the interviewer’s question about on-campus support and peer support, Sarah replied:
Honestly, in my situation, I don’t have much support. Just ‘cause I’m not a typical freshman student. So, I don’t get to really develop those relationships as I would want to. Especially, considering that the majority of my teammates are male and my classmates are male. We really don’t have… [common] things, or, they’re not African American. So, it’s like we have less things to relate to. So, it’s like just mainly work.

However, Sarah was the only participant who expressed a sense of pride and joy responding to the concept of societal contribution made by engineers in class. While the rest of the transfer students tended to view the goodness of the engineering field from the perspective of their career and job, Sarah took the idea of societal contribution to heart and listed it as the best part of the introductory engineering class:

Interviewer: What do you think is the best part of the class? Or the most beneficial part of the class?
Sarah: I think that for me personally; it really (opened my eyes). At first, I thought Engineers were just people that would just sit on a computer doing calculations all day. This class really opened my eyes to what Engineering is and how it affects the world. I didn’t know that! I just thought it was kind of like a scientist; but not really--I knew they invented things. But, I didn’t understand how influential Engineers are. And this class really helped me understand it and it just made me want to be one even more.

Financial Hardship

In this study, a higher proportion of female students reported a financial hardship during their interviews. Among 10 male students, only three (30%) reported financial hardship as a concern, and three females out of five (60%) explained their struggle with financial means. Having an off-campus, part-time job to support their own education posed a problem in their academic work. The college provides a variety of support programs for engineering freshman students who need additional instructional support. However, Rena could not utilize the resources because she had to work during the time her TA was available. She asked for:

More SI (supplemental instruction) sessions because apparently our TA was there one day a week or something like that, but I had work. So, I couldn’t come. I don’t know. Just maybe having more availability of either like XXX (name of another support program) tutors, or someone’s who’s been in (the engineering class) to go in and kind of bounce ideas off or to get help with especially with the calculation and stuff. Being able to sit down and not wait for (Mr.) Brown’s office hours or wait until you get into class to ask questions.

Despite all of the challenges described in this section, the majority of transfer/non-traditional students hoped to remain in the program and successfully complete their engineering degree. In particular, the five female students showed great self-determination and goal orientation despite the heightened level of challenges that they had with other engineering peers. The majority of the female students found their niche by joining a professional organization, becoming “a big sister” for other younger women, or forming a supportive relationship with faculty members.
Discussions and Conclusions

This qualitative study provides valuable insight into the transition experiences of transfer and non-traditional engineering students. In particular, the paper highlights unique challenges faced by female transfer and non-traditional students during their transition period, while revealing their resilience and persistence.

The first-year experience of female transfer students presented multiple challenges including lack of peer support, financial hardship, and family-related responsibilities. In particular, their teamwork experiences revealed an interesting facet of social dynamics that they went through in relation to younger male and female students. Based on their higher maturity level and prior life/work-related experience, these female transfer students had better organization and communication skills than most of the young engineering freshman students. This made them naturally emerge as a leader during their collaborative team projects. While the same phenomenon also occurred with male transfer students, female transfer students were less likely to receive respect from other male students on their team. As a result, the female transfer students aspiring to excel in their coursework while facing resistance and/or lack of cooperation from young male students found the group work process challenging and less enjoyable.

Abby’s experience with another female student illuminates another interesting facet of relational dynamics in a male-dominated social environment. Scholars explained that this kind of implicit tension can be found among the members of a stigmatized group, such as females or under-represented racial minorities in engineering.\(^{35}\) When female students are viewed as less suitable or capable than other males in the environment, females are more likely to distance themselves from other females, and even become more competitive with one another in order to “stand out as … better”\(^{15}\) (p. 252). Huetado and his colleagues\(^{35}\) reported a similar phenomenon in science disciplines. Students of color were eager to validate their academic competency as they felt the pressure of social stigma attached to their race/ethnicity. The competitive learning environment often found in engineering classes may facilitate these types of peer-relationships, which are not conducive to student learning or retention.\(^{35}\)

Well-aligned to the major findings of several previous qualitative studies on transfer/non-traditional students in STEM fields, this study also suggests that there could be some unique challenges faced by minority students who are under-represented in engineering.\(^{15,37}\) Sarah, the only African-American participant in our study, presented a mixture of multiple challenges, including a sense of isolation, lack of academic support, difficult family obligations, and financial constraint. Researchers have long explained that women of color in engineering face unique challenges due to their race/ethnicity. It is not surprising that she did not develop any social relationships with peers in engineering; instead, she depended on her social relationships through her local church. However, it should also be noted that she is the only one who was deeply inspired by the idea of the engineering profession making a contribution to larger society. This finding needs further investigation.

Like other previous studies, this research has several limitations including a small sample size, a unique institutional context, and varied individual and family backgrounds of the 15 participants. Findings from this study are exploratory in nature, and should be read as an in-depth description
and comparative analysis of the 15 male and female engineering transfer/non-traditional students in order to generate critical insights for further, more systematic investigation. This study depicts only a few aspects of transfer/non-traditional engineering students’ transition experiences, and excludes many other important aspects. Therefore, this study is the beginning of a series of research findings that investigate the unique challenges faced by a smaller subset of engineering students (e.g., female transfer students, minority students, students from economically disadvantaged backgrounds) in an effort to better understand the complex relationships across gender, race/ethnicity, and socioeconomic status in engineering education.

Bibliographical Information