WOMEN'S EXPERIENCES IN THE STEM COMMUNITY COLLEGE TRANSFER PATHWAY

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The experiences of women using the community college transfer pathway to earn four-year degrees in science, technology, engineering, and math (STEM) fields have not been studied extensively. This study examined the experiences of thirty women (67% first-generation college students, 23% ethnic minority students) pursuing STEM degrees; they were interviewed once while finishing at community college and again one semester later. The results illustrate facilitators at the community college, including inspirational professors, effective transfer advising, academic resources, and flexible work schedules, and barriers resulting from ineffective initial advising. After transferring to a four-year institution, the majority of women persisted in STEM majors despite many barriers, such as negative course experiences, poor advising, and limited finances. Finding a helpful professor or advisor and co-transfer support boosted belongingness and contributed to persistence. Two students switched to non-STEM fields, while two students withdrew from the four-year school completely; these students faced significant financial barriers and did not find a helpful professor or advisor in a STEM field. Finally, four students delayed their transfer, primarily due to financial reasons and family responsibilities. Implications for future research and practice are discussed.

KEY WORDS: *persistence, first-generation college students, financial barriers, community college transfer, advising*

1. INTRODUCTION

This paper focuses on women's experiences in the community college transfer pathway as they strive to pursue baccalaureate degrees in science, technology, engineering, and math (STEM) fields. As noted by Starobin and Lanaan (2010), community colleges play a vital role in STEM education today, with more than 50% of students using community colleges as their entry point to higher education. In fact, women earn the majority of associate's degrees within community colleges; however, only 5% of the 500,000 associate's degrees earned by women each year are in STEM fields (National Science Foundation, 2006). In addition, male students outnumber their female peers in STEM majors in community colleges at a ratio of three to one (Hardy and Katsinas, 2010). Although baccalaureate trends indicate gains by women across subfields, most poignantly in biology, women are still underrepresented in many STEM fields including computer science and engineering (National Science Foundation, 2006).

Earning a four-year degree in a STEM field makes a difference for future earnings and job prospects. For example, most STEM occupations require a bachelor's degree, and individuals who earn a bachelor's degree are expected to accrue one million dollars more over their lifetime than those who do not (Carnevale *et al.*, 2010). While the transfer function of community colleges has great promise to increase the numbers of women earning STEM baccalaureate degrees, additional examination and support is needed. Only a fraction of the students planning to transfer from community colleges to four-year schools actually do; notably, less than 10% of students from the lowest income quartiles, the majority of whom choose community colleges to begin their college educations, earn a four-year degree within six years (Tinto, 2004).

While prior research has provided an important foundation for understanding challenges facing women pursuing STEM majors in college (e.g., Seymour and Hewitt, 1997), one cannot assume that women pursuing community college pathways en route to four-year STEM degrees share the same experiences as women who pursue degrees at four-year institutions from the start. Similarly, this study is informed by studies of community college transfer (e.g., Hagedorn and Lester, 2006) while recognizing that women pursuing STEM community college transfer pathways may encounter some challenges particular to the pursuit of STEM disciplines. In this study, we followed women pursuing STEM fields from the community college as they strived to transfer into four-year college and university settings to earn bachelor's degrees. We asked:

1. Among women who persisted in STEM upon transfer to a four-year institution, which elements of their experiences, positive and negative, were salient?

2. Among women who delayed transfer or did not persist in a STEM major upon transfer to a four-year institution, which barriers were salient?

2. COMMUNITY COLLEGE STUDENTS AND STEM TRANSFER

Students from lower income, first-generation college backgrounds, a majority of whom are ethnic minorities and women, use community colleges as their entry point to a four-year degree; however, only a small percentage will actually transfer to a four-year college (Bailey *et al.*, 2005; Tinto, 2004). Clark (1960) described the "cooling out" function of community colleges as the tendency for community college students to enter with the intention of transferring to a four-year school but then scale back their aspirations in order to pursue a shorter term vocational trade or terminal degree. Many scholars have since critiqued this perspective that community colleges deter or dampen students' aspirations; in fact, recent work has argued that community colleges actually "warm up" the transfer intentions of many students (Alexander *et al.*, 2008; Bahr, 2008).

Dowd (2007) noted that community colleges have served many different functions, including job training and adult basic education, but the pressure on community colleges to provide an effective and efficient mechanism for transfer has intensified in recent years. In addition to broad economic pressures, more jobs now require a four-year degree (Carnevale *et al.*, 2010). Community colleges are grappling with resource and financial constraints as they aim to serve the largest and most diverse population of students in the country. Most community colleges are not currently positioned to efficiently support larger numbers of students to transfer, while simultaneously providing open access to all students.

Contributing to this challenge is that many students today are entering community college without an adequate foundation to enroll in transfer-based coursework. For example,

Hagedorn and Lester (2006), in a study of 5000 Latino community college students in Los Angeles, found that after the equivalent of three years in community college, less than 9% of students were in a position to transfer to a four-year school. Hagedorn and DuBray (2010) found that while thousands of students each year take developmental math, few continue on to the transfer-based math courses; at the same time, the majority of students who do transfer to four-year schools in STEM do not require any developmental courses. Needing developmental coursework adds substantial time to transfer and degree completion, and thus, some students may assess that a terminal degree may be more feasible to obtain.

On the other hand, not all students require or are inhibited by the need for developmental coursework. Institutional barriers also create challenges on the pathway to transfer. Hagedorn *et al.* (2008), in a study of 400 students from nine community colleges in Los Angeles, found that ineffective advising, influenced by extremely high student-to-counselor ratios, led to a lack of student information about transfer requirements. Several other studies have also cited transfer delays as resulting from limited advising resources (Handel, 2007; Hoffman and Wallach, 2005; Ornelas and Solorzano, 2004). In addition, energy has been invested in improving articulation agreements between community colleges and four-year institutions. Statewide initiatives in California aim to provide an exemplary model in this domain, as they strive to clearly outline the learning modules, or course-to-course equivalencies, needed at community college prior to transfer so that students can access this information early on (Handel, 2007).

After transferring to a four-year college or university, students must sustain their progress toward completing the bachelor's degree and manage to keep their STEM major intact. Orientation, advising, and mentoring programs have been found to assist in the successful transition of students (Townsend and Wilson, 2006), but little is known about discipline-based efforts. Now that half of the nation's college students pursuing STEM fields begin at community colleges, the potential for growing STEM talent via community colleges is larger than ever (Starobin and Lanaan, 2005; Tsapogas, 2004). Yet, research focused on STEM persistence in the community college transfer pathway is limited, and clearly very needed (National Science Board, 2003; Starobin and Lanaan, 2010).

3. PERSISTENCE OF WOMEN IN STEM

Even if women persist in transferring, their STEM major can become vulnerable upon transfer. Prior research has helped to identify factors that contribute to the loss of women from the STEM pipeline at four-year institutions. For example, Seymour and Hewitt's (1997) foundational study of seven four-year college campuses helped to illuminate the factors that negatively influenced both women who left STEM fields, and those who persisted, with an emphasis on poor teaching and classroom culture. Valian's (1998) powerful synthesis of literature concerning women across fields identified that a range of gendered personal expectations, societal values, and structural factors contribute to the slowing of women's advancement. As noted in her book, women can still more easily say "forget medical school, I'll [get married, become a nurse, become a social worker]" (p. 159). Additionally, recent research found that women tend to opt out of science if they see their long-term life goals as incongruent with a career in science (Diekman *et al.*, 2010).

Although community colleges are known for their reputation of providing access to higher education for students from all walks of life (Dowd, 2007; Starobin and Lanaan, 2010), research suggests that women in community colleges could face negative experiences in their pursuit of nontraditional fields. For example, Lester's (2010) research focused on women pursuing male-

dominated career and technical education programs within community colleges, found that the women reported experiences of gender bias, lack of emotional support, and lack of institutional support. In our research focused on community college students in Massachusetts, we found that women students were more likely to report a combination of personal (e.g., taking care of family members) and institutional (e.g., ineffective advising) delays than men were, and that additional delays led students to question the feasibility of persisting in STEM majors (Packard, *et al.*, in press). For women, each loss to the STEM field is significant, because so few women pursue STEM degrees in community colleges (Hardy and Kitsanas, 2010).

4. THEORETICAL FRAMEWORK

We were guided by Savickas' (2005) career construction theory and Bourdieu's (1986) theory of cultural capital in this research. According to Savickas' (2005) career construction theory, "careers do not unfold; they are constructed as individuals make choices that express their self-concepts and substantiate their goals in the social reality of work roles" (p. 43). Of importance is how people create meaning out of the decisions they make, amidst the complex situations they face, in the development of their own stories. In addition, progress toward career goals can be difficult to make or even to assess because "some people encounter barriers that force them to regress, drift, founder, stagnate, or stop" (p. 50). As a result, the feasibility of future goals is continually reassessed within a broader ecological context of opportunities and demands (Patton and McMahon, 2006). Indeed, many community college students face economic constraints, so they often feel pressured to compromise their educational goals (Packard and Babineau, 2009) and to work many hours while going to school (Harrell and Forney, 2003). This framework was appropriate to guide our inquiry because of our interests in how women describe their experiences within these complex pathways.

Bourdieu (1986) originally conceptualized cultural capital as the relevant knowledge, information, skills, and resources that individuals can gain that are as valuable as monetary resources. Various forms of capital, including cultural capital and social capital, contribute to one's power and progress. In education, for example, individuals can increase their social capital through their social relationships and exchanges with their teachers, as evidenced by enhanced insider's knowledge and navigation of the educational system. Individuals within a social network, such as professors or advisors, therefore act as "information channels" to students; a more comprehensive network, or set of information channels, is likely to be more fruitful in gaining access to social capital than is relying on any one information channel alone (Stanton-Salazar, 1997). Extending this literature to the present study, a more comprehensive network of knowledgeable advisors is likely to improve women's navigation of the STEM community college pathway. In order to form an understanding of the women's career narratives, we paid attention to the various supports that women had access to both at the community college and upon transfer to the four-year school.

5. METHOD

5.1 Participants

A purposive sample of thirty female students participated in this study. The women ranged in age from eighteen to forty-three, and 23% were ethnic minority students (five black, one

Asian, one Latina). Six had children, and four were married. Most were first-generation college students (67%). Typical father occupations included truck drivers, landscapers, and machine operators, whereas mothers were most frequently reported to be homemakers, clerks, or nurse's aides. At the start of the study, the participants were pursuing a range of STEM fields including biology, chemistry, engineering, environmental science, and math. They were recruited from five community colleges in Massachusetts (four urban and one rural). Ultimately, twenty-six transferred (eight to private colleges and eighteen to public colleges or universities) and four delayed transfer to a public university.

5.2 Data Sources

Students were recruited to participate if they (1) had an interest in pursuing a STEM field, as indicated by their current major or career plans, (2) were finishing their time at the community college, and (3) were planning to transfer from their current community college to a four-year school to earn their first bachelor's degree. Students who fit these criteria were recruited by flyers at each school, with assistance from the transfer offices and faculty teaching STEM courses. In addition, we recruited students who were part of a longitudinal survey study of community college students who had indicated that they were within a semester of completing their time at the community college. Recruitment proved to be challenging. Although many women were enrolled in STEM coursework, few were enrolled in STEM majors or planning to transfer. Nearly all of the women we encountered, who were enrolled in STEM coursework, were not intending to pursue STEM transfer programs and instead were enrolled in terminal associate's programs, such as dental hygiene, respiratory therapy, or sonography. This is consistent with Hardy and Katsinas' (2010) analysis of enrollment trends which indicated that while few women were enrolled in STEM programs in community colleges, many women enrolled in medical associate's programs.

Participants were interviewed at two points in time. Baseline interviews occurred during or immediately following their last semester at community college. Follow-up interviews were conducted approximately six to nine months later, at the conclusion of completing their first semester at the four-year school. Narrative methods have been advocated for understanding the experience of economically diverse participants (e.g., Patton and McMahon, 2006). Consistent with career construction theory (Savickas, 2005) and Moustakas' (1994) phenomenological interview method, our interviews were semistructured, encouraging women to describe their experiences and career stories from their own perspectives (Gilgun, 2005). The baseline interviews included these prompts: (1) How did you get to this point in your educational pathway? (2) What have been the most important factors or experiences shaping your path? (3) Describe any factors that negatively influenced your progress, (4) Describe the people and resources that positively influenced your progress, and (5) Tell us more about which four-year school you are positioned to transfer, and your plans for after transfer. In the post-interviews, a similar format was used but with a focus on the experiences in the four-year school. Interviews were conducted over the telephone, ranging from forty-five to ninety minutes. These conversations were recorded and later transcribed.

To increase the trustworthiness of the results, participant feedback was encouraged during the interview process, and we also used the strategy of member checking as suggested by Lincoln and Guba (1985). Specifically, after each interview the storyline of the interview was documented and discussed with another member of the research team. Any outstanding questions were identified, and the participant was contacted to clarify and revise the interpretation.

5.3 Data Analysis

Following Moustakas' (1994) method for analyzing phenomenological interviews, we first temporarily suspended prior knowledge of the topic by bracketing presuppositions (see also Morrow, 2005). It is believed that by suspending prior knowledge, researchers can create a catalyst for their curiosity, and in turn, a new perception of the phenomenon may occur (LeVasseur, 2003). Hermeneutical phenomenology recognizes that researchers still have a role in interpreting the experience of others. Thus, it is important that researchers additionally disclose prior experience so that readers may understand how prior assumptions may influence the approach and presentation of the study (Creswell, 2007). Within our team of researchers we experienced a mixture of socioeconomic backgrounds (working class and middle class), ethnic backgrounds (European American, Native American, Asian American, and African American), and educational opportunities (community college and four-year college, public and private colleges). We read literature focused on women in STEM fields and conducted prior research focused on lower income students in STEM fields and on working students. We anticipated that the students would face barriers, such as being deterred by lifestyles and careers modeled in the field, but we also expected to learn about their resourcefulness. We strived to initially bracket this prior knowledge and experience in order to learn about the women's experiences from their points of view rather than as we anticipated hearing their stories.

We immersed ourselves in the data by reading interview transcripts from baseline and follow-up interviews in order to gain a deeper understanding of the content of the data (Morrow, 2005). After reading the interviews, we identified themes that were essential to the participants' experiences, with a focus on their experiences of faciliators and barriers. Experiences similar in meaning were clustered together. For example, segments that were initially characterized as poor teaching, unapproachable professor, or larger class sizes were collectively organized under the broader theme of negative course experiences at the four-year school.

Next, we revisited the storylines that emerged from the baseline and follow-up interview, with an emphasis on whether the participant had persisted in STEM or not, and the essential meanings she made of her experience. We compared women who had persisted and did not persist for salient themes across each group. Furthermore, as a form of researcher triangulation, researchers who were not involved with the interviews or initial analyses were enlisted to cross-check the themes generated.

6 RESULTS

6.1 Persistence in STEM: Experiences Before Transfer

Overall, twenty-two of thirty women persisted with their STEM majors intact after completing a semester at the four-year institution. In their baseline interviews, women expressed primarily positive sentiments about their community college experiences, focusing on five facilitators while also describing two barriers. The salient elements of those who persisted in their STEM major were: (1) inspiring professors who encouraged STEM pursuit, (2) gratefulness for peer academic support, (3) appreciation for helpful transfer advising, (4) value of family support, (5) flexibility in work schedules which facilitated college-going, (6) delays from ineffective initial advising, and (7) limited finances as stressors, barriers, and influencers.

6.1.1 Inspiring Professors Encouraged STEM Pursuit

Most of the participants felt inspired by their professors (*n*=18). The students described the professors as experienced, knowledgeable, patient, encouraging, and caring. Lori, who was studying media technology, described the faculty as providing a "family environment." She added, "I felt they were very experienced, they were great professors and I had a great time. I learned a lot and I think it was worth the money." Similarly, Bethany, who was studying environmental science, described an "amazing" chemistry professor who helped her to realize she liked science and a professor in her major who encouraged students in the profession while recognizing their financial limitations. She said that this professor "offered to pay for anyone who couldn't afford a membership with the American Wildlife Society." Joanna, a chemistry major, echoed this sentiment when talking about her first chemistry professor at the community college. She recalled, "In high school I never thought I was good at science, but this professor encouraged me and now I know I am." Yet another student, Jamie, shared that her advisor helped her to get a job in the environmental field, "which is kind of like the work I want to be doing in the future so he was really helpful."

6.1.2 Grateful for Peer Academic Support

In addition, they appreciated access to college resources, including college-organized study groups and tutoring support (*n*=10). Erin, who planned to study engineering, greatly appreciated the math resource center at her college. She said, "For a while I was just jumping around taking classes so I didn't really have a set group until I fell into the math thing, and then I definitely had peers to talk to." Pam, a premed student, also described this element when she said, "I have a couple of study groups in every class I have. They want to succeed just as much as I do."

6.1.3 Appreciation for Helpful Transfer Advising

Many students (*n*=17) emphasized the importance of the assistance they had from advisors in the transfer process. One college from which we recruited students had access to a special advisor who assisted with transfer to selective private colleges. One participant, Molly, was studying biology and was awarded a full scholarship to a selective private college. Speaking of the special advisor, she gushed:

> I told her what I wanted to do with my life and where I wanted to go. She just really grabbed the bull by the horns and she stayed on top of me and made sure I had everything done that needed to be done, making sure that I was keeping up with my grades and everything. She is wonderful and I wish everyone had her.

Another student, Chen, a student studying applied math, talked about the help the transfer office provided when she ran into a problem with financial aid. She said, "The advisor contacted [the four-year university] and told me what to do."

6.1.4 Value of Family Support

The participants valued the support they had from their families (*n*=16). This support was demonstrated in various ways, from encouragement to talking about their field of study to facilitating their access to study time. Joanna, pursuing chemistry, described how her mother, who worked at the same job, covered shifts at work when needed, and that her sister "gets excited when [she does] well." Emily, who was studying forensic science, shared, "[My husband] will take the kids when I need to study and he also studies with me."

6.1.5 Flexibility in Work Schedules Facilitated College-Going

Working was central in their experiences, and as a result, participants emphasized the importance of having flexibility to organize their work schedules around school (n=14). Sarah, a math major, had a strategy for organizing her work time. She explained:

> I have most of my hours scheduled on the weekends and I work only one shift during the school week. I make a schedule for myself and make sure all my school work is done before I have to go in.

Another student, Carmen, wanted to find a job in the medical field but stayed employed at the grocery store because of the flexible hours provided.

6.1.6 Delays from Ineffective Initial Advising

Many students did not know that they were going to transfer to a four-year institution when they first started to take classes at the community college. This was problematic because students needed to learn, early on, which courses transferred to which four-year schools. Overall, seven students described frustration with ineffective initial advising. For example, Riana, a premed student, worked with an initial advisor who was not knowledgeable about the requirements of her major. By the time she reached the transfer office, she realized that she had taken several incorrect classes. She said:

> Never just go to your counselor and hope and pray that they're telling you the right thing, because there were classes that I took that I didn't need to take…You have to [do your research] because it's your money.

As discussed in the next section, the students could not afford to have unnecessary delays in their education as they already had a challenging time financing their time in school.

6.1.7 Limited Finances as Stressors, Barriers, and Influencers

Money was a major theme across all participants, whether talking generally about their lack of money and how that influenced their decision to pursue community college in the first place, or more specifically, conflicts when combining work and school (n=11), pressures from family responsibilities (n=5), or how their limited spare time deterred participation in volunteer or intern experiences (n=8). For example, Carmen, a biology student, shared, "My parents did not go to school, we didn't have any money…well I am lucky to even get here." Diane, when describing the factors that influenced her decision to attend community college, explained, "it was also cheaper than any other school…so [it was] because of the money." Gretchen echoed this sentiment, "My aunt had said that I would save a lot of money if I went to community college and got my general education stuff out of the way and then transfer." Riana, who worked three jobs while going to school in order to support herself and her daughter, said, "I would like to work less but can't."

6.2 Persistence in STEM: Experiences After Transfer

For the twenty-two women who persisted in STEM after transfer, different issues were salient upon arriving at the four-year institution and the overall tone of their transfer experiences was noticeably negative. Collectively, they emphasized four barriers and three strategies that helped to facilitate their persistence. The elements that were salient in their post-transfer experience were: (1) negative course experiences, (2) poor experiences with four-year advisors, (3) campus as unwelcoming, (4) financial pressures and work challenges, (5) shifting

fields encouraged persistence, (6) finding a helpful professor or advisor influenced persistence, and (7) access to cotransfer support boosted belongingness.

6.2.1 Negative Course Experiences

All of the students mentioned a negative aspect of their four-year course experiences in STEM. Most of the students (*n*=19) complained of the change in the pace and rigor of the courses because the courses went much faster and without as much support. Others described negative experiences with the course structure and professors (*n*=12) because most of the class was conducted online, with the help of teaching assistants, or in such a large setting that any connection to the professor or opportunity for remediation was limited. For example, Alexis explained, "I feel more comfortable asking questions in a smaller setting and when there are 200 other students around me, I do not really feel so comfortable." Sarah experienced a lack of connection to her math professors, regardless of class size. She said:

> At [the community college], all my teachers knew me in classes and when I saw them in the hallways. At [university] none of my teachers knew who I was. Even if I had a class of thirty people, I feel like the teacher still didn't know who I was.

Joanna also found a lack of connection to her professors. She said, "My professor was unhelpful with e-mail replies and office hours, and I ended up dropping the course." Taisha thought the professors did not want to be helpful. She said, "They do not sit down and give you ideas about what to do…it's like they threw you in a lake and you have to swim in it yourself."

For others, the negative experience had to do with the content of the course. For example, Molly struggled in her chemistry class at the four-year selective private college. She said:

> I just feel like everything was at a different level. The classes were really difficult and I had already taken the first half of organic chemistry [at the community college] and I needed to take the second half. So I signed up for the second half and nothing matched up. I felt really behind and I ended up withdrawing from that class. Now I am going to start organic chemistry this semester from the very beginning.

Thus, even though Molly's credits transferred, the class still had to be retaken. Sarah reported a similar experience with a math course. She found the course different from and more difficult than at community college, mostly because homework and quizzing was completed online and without much feedback; ultimately, she dropped this core course.

6.2.2 Poor Experiences with Four-Year Advisors

Overall, twelve students saw their experiences of initial advising as poor, such that whomever they were assigned did not assist them or was simply not available to even meet with them. Helen, who transferred to a selective private college, explained that she met with an advisor who did not provide detailed information about what to do if premed was a goal for her, saying, "I wish I could have met with [the premed advisor] first, because I would have taken different classes." Taisha, who transferred to a four-year university, said, "I believe everyone has an advisor, I just do not know mine. I have never met my advisor. I signed up for classes myself on the internet." Similarly, Diane had yet to meet her advisor and had to pick her classes on her own. Another student,

Sarah, felt her advising was not individualized enough. She explained: "It would have been helpful to have one-on-one time with the advisor so I could speak with him more about my interests…there were 3-4 people being advised." Finally, many students added that the orientation they experienced was not specific enough to transfers or to their major to be helpful.

6.2.3 Campus As Unwelcoming

Although not an issue for all students, a thread across the women's experiences was feeling the campus was unwelcoming. Two primary issues contributed to this feeling. First, students found it difficult to make friends on campus since students already knew each other. About her classmates, Iris said, "They are not approachable." Traci used the language of "competitive" and "vicious" to describe her peers. She said, "It's difficult to be friendly with people who are that extreme." For others, it was the way that transfer students were marginalized, such as by their late registration time. Molly explained: "I wasn't allowed to register until the freshmen registration period. So the junior classes I needed had already been filled up by other juniors and seniors." Diane added, "There was not much choice because most of the classes were full. I just signed up for what they had left." Again, the students did not have the time to afford missing out on the key classes they needed to complete their majors.

6.2.4 Financial Pressures and Work Challenges

Just as when they were attending community college, they faced financial barriers and the need to work. They found it challenging to manage the work hours they needed to financially make ends meet and the hours required to succeed in the four-year school. Annie noted the difference of transferring to the four-year university because of all of the required computer-based homework. She said, "It was hard because I could no longer do my homework at work. At [the community college], I brought my homework with me to the job."

Another student, Taisha, found the transition very stressful because the overall climate was not supportive of working students. She explained:

> I commute and I also have a job to maintain my own household. It is a lot of work and there is not enough time…Five classes were very stressful for me and I had a hard time dealing with them. I cannot be there till 10 pm at night. It gets rough to balance sometimes. The teachers do not understand that.

Iris also expressed that the climate was less supportive of working students. She said:

> I feel the teachers are a lot harder on you in terms of the work load. Basically, we get more work. For example, at [the community college], they understood that you could not do something because you had a job, but at [the four-year college], half of my teachers could not believe I had a job.

Helen also started the four-year college working forty hours per week as a bartender, her job from when she was in community college, and later quit because her job would not allow her to change her schedule. She explained, "The only reason I got to quit was because I am taking maximum amount of loans…It's hard." Molly had received excellent financial aid but still lacked money for living expenses. She said: It's really hard to get by…I could use more financial support, help with food." She added, "I wanted to take an internship so I could start building up my resume, but I can't really do much of anything right now."

6.2.5 Shifting Fields Encouraged Persistence

Overall, eight students shifted fields of STEM study in their first semester of transfer. For Susan, this was because she ended up changing her intended four-year institution and they did not offer atmospheric science, and so she had to change to environmental science. Erin had intended to study engineering or physics but declared math after being discouraged by her initial interactions with the physics department, where she felt no one appeared to advocate for her transfer of credits or appeared interested in advising her. Another student, Sarah, commented on feeling intimidated in her math major. She shared:

> Some of [my peers] were intimidating because they were mostly male, especially in my computer science and calculus class. Even if they were on the same level as me, like they got the same grades on quizzes, they acted like they knew more. At [the community college], it was easier to act like I didn't know and learn. At [the university], I felt like there was a lot of pressure to act like I knew everything… for example, everyone in my computer science class already knew a lot about programming and computer science and that made it more intimidating, whereas at [the community college] everyone felt like they were on the same level and were there to learn.

Ultimately, Sarah decided to change to animal science where she felt more comfortable with the peers, faculty, and classes.

6.2.6 Finding a Helpful Professor or Advisor Influenced Persistence

With so much discouragement in their first semester, many students contemplated changing their major or the four-year school they had chosen. One of the primary reasons students gave for persisting with their major at the four-year school was finding a helpful professor or advisor (n=15). Iris shared:

> I have a really good advisor now. I walked into the office, and he offered to be my advisor. He was better than my other advisor because he is more supportive and my other advisor was not supportive at all.

A similar experience was reported by Alexis, who felt lost and went into a faculty member's office whose reputation was for helping students. She said:

> We figured out that I did not have an advisor. I approached her late fall, when I was registering for spring classes. It was already too late to add on any of the classes I needed. [But] my experience with her was great.

Jamie thought about leaving her field, yet found support from many faculty members and her advisor. She described what happened in her first semester at the four-year college:

> I wondered if I would get a job in this degree or in this field, and I thought I wanted to switch back to health sciences. I was going towards occupational therapy. When I went to my advisor and even my professors, they talked me out of it. They reminded me that I wanted to do forensic science and they were right, I want to work in a lab and do science. They were very helpful.

Others found that a faculty member took the extra time to reach out and support them. Erin shared that a professor had recommended her to a teaching assistant position. Initially, she was feeling concerned about her fit with the college, but her experience with the professor helped her to "feel good about the college."

6.2.7 Access to Cotransfer Support Boosted Belongingness

The other important element that buffered women in their initial transition to the four-year institution was the presence of cotransfer support (*n*=20), such as within study groups or orientation programs that provided access to other transfer students. Lori, for example, enjoyed meeting recent transfers during orientation. She said, "They showed us around the school and helped us take care of everything we needed to take care of. It was helpful because experienced students answered questions and told you where to go if you were lost." Lois added:

> All the [nontraditional-aged transfers] are friendly…It is nice. We always stop and say hi. It seems like we have the same experience as they all seem to be coming from community college too.

In addition, Iris had access to a more formalized relationship. She said, "They signed me up to a specific person, who was my transfer mentor. She showed me around and connected with me. We sometimes grab lunch together now."

6.3 Switching Out of STEM

Only two women switched out of STEM within the first semester of arriving at the four-year college. Collectively, their stories read very similarly to the women who persisted in terms of experiencing courses negatively and appreciating cotransfer support. To summarize the elements in their experiences that were salient for why they switched majors, they expressed financial and time pressures, ineffective advising leading to delays, and concerns about math preparation. For example, Farah intended to study a math-related field or psychological science. She struggled with her self-efficacy in math. Upon transferring, the advisor at the four-year public university told her "she might have trouble." Farah reported that she "made a mistake by listening to her" and immediately reacted by switching her major to sociology. She shared that she will have to stick with this plan because she cannot afford to stay in school any longer. Similarly, Tina switched from a study of human biology to human services upon arrival at the four-year public university. She described her concern about finances. At the community college, she said, "I didn't have a real advisor for the first several years of school, so I took a lot of unneeded classes and wasted a few years and thousands of dollars." After she transferred, she realized that she could complete a degree in human services much more quickly than anything else, including biology. When asked if she was still interested in a science-related field, she replied, "But [biology] is not possible for me anymore; it would take me way too long to finish."

6.4 Withdrawing from the Four-Year Institution

Two women described their decision to withdraw from the four-year school within their first semester of transfer. Both had transferred to different selective private four-year colleges and decided to withdraw completely from college by the end of the first semester. Ultimately, these students were worried about money, decided to go to a selective private college where they received strong financial aid, but then second-guessed their choice upon arriving and encountering negative experiences. In contrast to students who persisted, they never found a counternarrative for the messages they received in the environment that said they did not belong or their fear that the expensive education was a waste of money. As a result, they just wanted to leave, and ultimately that is what they did. To summarize, the elements of their

experiences that were salient for why they decided to withdraw, they expressed financial pressures, poor advising, and a lack of belongingness.

To illustrate, Serena said, "The reason is that I'm not really a 100% sure what I want to do. So rather than waste time and money, because [the selective private college] is pricey, I thought I should figure out what I want to do first." Looking back at the community college baseline interview, she had entered the four-year selective private college with little support and information. She explained, "My academic advisor – he didn't help me at all. I did a lot of it on my own. Most of it was online through the website." She added, "They could've been a little more helpful with the transfer process…like talking to me about how credits transfer and stuff. I wasn't really clear."

Gabrielle, who transferred to a different selective private college, arrived on campus and immediately had a negative experience with her advisor. She described:

> He looked me in the face and was like, "You're from a community college, what are you doing here?" He basically said that none of the classes that I had taken at the community college were any good, they weren't going to count for anything, and I had to start over. He asked, "Can you even do this major in the time that you are here, are you sure you want to do this major?"

From there the experience continued to decline, as she expressed a sense that she did not belong at this college. She said,

> [The students] don't go off campus; they don't have people they know around here… I have a job, I have family here, I have friends here, and it was just very different than what everybody else was doing. It was like odd man out…I was just really unhappy.

Reviewing her baseline interview, she expressed trepidation and ambivalence. She had decided to go to the college because they offered her the best financial aid package, and she did not want to regret overlooking the opportunity. That financial package, however, did not retain her.

6.5 Delaying Transfer

Overall, four students delayed their transfer. Again, we focused more on the elements of their experiences that were salient for why they decided to delay their transfer. They expressed financial and family responsibilities as well as a lack of advising and mentoring when at the community college.

Annie said, "[The community colleges] need better staff to help incoming students. They pick random people for you who do not know the major and you don't know the major. I had to look in the book and do personal research." Then, when it came time to transfer, she said:

> I had to defer this semester because I just can't afford to go right now. I have been working, saving up money to afford to go to this school. I could have used a hand in figuring out how to get financial aid, as far as going from a community college to a four-year college is concerned, because that's what I am hung up on right now.

Hannah, another student, described never intending on transferring until a professor took a special interest in her. She then got her on the transfer pathway, but she felt uninformed:

> I haven't really learned about the process yet. [The professor] just pulled me aside and asked me what I was going to do later on. Like four other professors have done the same thing, which makes me wonder if all these professors are wondering what I'm going to do next…maybe I should do something.

Later, she said she continued to feel the transfer process was daunting and intimidating. She said, "There were a lot of pieces and I got scared. I did not know how to do everything myself. I work full-time."

The third participant to delay transfer, Diamond, described how her husband had been the only one working while she was in community college for four years, making the finances in her household "very tight." As a result, the four-year college had to wait: "I cannot do everything at one time because I also have kids. I am concerned moneywise; I don't know how I'm going to pay for it." The fourth participant, Wendy, said she had to pursue work instead of going to school and was not sure how to finance the four-year degree. Thus, these participants described some initial encouragement to consider the transfer pathway, whether by professors or family members, and financial support while in community college that made it feasible to go. However, when taking the next step to transfer, they did not have the financial resources or the information to take that next step, and were thus delayed in their transfer goals.

7. DISCUSSION

In this study we followed the progress of women using the community college transfer pathway to pursue four-year STEM degrees. Women who persisted in STEM majors described positive, inspirational experiences with community college faculty, helpful transfer advising, and access to academic resources, which served to position them toward transfer. They managed to overcome delays resulting from ineffective initial advising experiences by moving forward with help from transfer advisors, academic resources, and inspirational professors. Having support from the home as well as flexibility from employers made college-going possible despite their many financial and family responsibilities. After transfer, women described a difficult transition. Courses at the four-year colleges and universities were faster, more challenging, larger, or did not align with their previous coursework. They described difficulty connecting to faculty and finding an advisor in the first transfer semester—factors that nearly derailed their efforts. Consistent with literature on cultural and social capital (Bourdieu, 1986; Stanton-Salazar, 1997), we found that key individuals, including helpful faculty members, advisors, and cotransfer peers, provided invaluable information and resources which boosted women's sense of belonging and facilitated their persistence in STEM majors.

Although only a small number of women switched from a STEM field to a non-STEM field, delayed their transfer to the four-year school, or withdrew from the four-year institution during the first semester, their experiences are noteworthy. Echoing themes from Seymour and Hewitt (1997), many common barriers were shared by women who persisted and did not persist in STEM majors. In this study, the two transfer students who switched from STEM to another field of study reported financial and time pressures leading them to look for a major that could be completed in a more efficient amount of time, a finding consistent with our previous work focused on community college students (Packard and Babineau, 2009). In addition to recognizing financial barriers, described most emphatically by those who delayed and withdrew, it is important to again acknowledge that the lack of social and informational resources played a role (Smith, 2007; Stanton-Salazar, 1997). A lack of timely advising contributed to delays, while a lack of advocacy from advisors or professors contributed to students' decisions to leave the four-year school.

Career construction theory emphasizes how individuals make meaning of their experiences, including the barriers they encounter, and does not portray a career as a process that

passively unfolds (Savickas, 2005). We recognize that this study is about women's experiences in STEM, and yet with rare exceptions, the women in this study did not talk explicitly about factors salient in research focused on the underrepresentation of women in a STEM field, such as about how women's desires to be mothers or the importance of relationships in their lives conflicted with their long-range goals (e.g., Diekman *et al.*, 2010). Instead, time and money were important features of the women's experiences. Women emphasized their need to finish school efficiently, their struggles with finances, the challenge of combining work and school, and disappointment with wasting time and money due to ineffective advising. By focusing on how women described their experiences, this study sheds light on why and how women see socioeconomic barriers as contributing to constrained choices when they encounter detours within a community college transfer pathway.

Different from Lester's (2010) study where community college women faced gender bias in their career and technical education classrooms, the women in this study described positive, inspirational faculty in their community college STEM courses who invested in them and launched them into the field. However, the differences in their sense of belongingness upon the transition to the four-year school, selective private colleges, and large public universities alike were stark. Carlone and Johnson's (2007) research found that women of color in STEM fields described needing more than competency and achievement to persist in STEM; additionally, they emphasized the importance of recognition, of oneself and by others in the field, as contributing to a sense of belonging in the field. In this project the women also emphasized the importance of classroom and campus community. Our results are consistent with Amelink and Creamer's (2010) work that suggested that undergraduate women in engineering used the classroom as a glimpse into their future profession; if they could not see colleagueship and respect modeled, they were less likely to anticipate working in the field. Unfortunately, transfer students have less time to establish this sense of belongingness and community in the four-year school, creating an additional vulnerability in their persistence in STEM.

Only a very small number of community college students transfer to selective private colleges each year (Dowd *et al.*, 2008). In Massachusetts there is such close proximity to a wide range of selective private colleges that many students at least consider the option of a selective private college. In our study one community college had a grant-funded special advisor who pro-actively recruited students to consider selective private colleges and facilitated students' transfer progress to selective private schools. Thus in our study the number of women attending a private selective college was unusual compared to national trends. Here, cultural and social capital (Bourdieu, 1986; Stanton-Salazar, 1997) likely played a role such that having access to a special program advisor skilled in the navigation to a selective private college served to create a pathway for the women.

8. FUTURE RESEARCH AND PRACTICE

Although this study had the strength of interviewing women at two points in time and included the experiences of women who persisted as well as women who did not persist in their STEM transfer plans, the scope of this study was distinctly limited. This study included a relatively small sample of students within one state who were primarily white and from first-generation college backgrounds. In addition, only one woman was considering engineering and none were considering computer science. Future research, on the national level, can aim to examine the different experiences of women, such as women who are from first-

generation college and not first-generation college backgrounds, a more ethnically diverse sample, and a larger number of women in computer science or engineering fields. Prior research has already suggested that computer science and engineering face particular challenges in the recruitment and retention of women students (e.g., Margolis and Fisher, 2002).

Future research can strive to examine the intersection of class, gender, and racial-ethnic background among STEM transfer students. In this study, the women of color did not notably describe different barriers than their white female counterparts, and their numbers (particularly for Latinas and Asian women) were so small that we were not able to look meaningfully at any demographic group. In the future, intersectionality is a fruitful lens that can be used to understand the experiences of first-generation college women of color pursuing STEM fields (Collins, 2000). The added layers of nontraditional-aged student, working student, and transfer student may provide additional complexity, such that it is at the intersections of these identities that we come to understand the barriers and facilitators of progress for women using community college transfer pathways for STEM degrees. In addition, the selectivity of the four-year institution requires additional investigation (Moodie, 2007). Within our sample, the two women who completely withdrew from the four-year institution had transferred to a selective private college, although others had also transferred to similar schools with positive outcomes. Future research can explore whether persistence in STEM fields at the four-year institutions is influenced by the changes in demographics of their peers and faculty, particularly when students transfer to predominantly white and highly selective institutions.

This study points to important practical implications. Beyond establishing a transfer-going culture at the community college (Dowd, 2007), four-year institutions clearly need to consider their transfer-receiving culture (Moodie, 2007). Mattis and Sislin (2005) discussed the importance of going beyond articulation agreements in engineering fields, such that four-year faculty reach out to community colleges to build partnerships and ensure a seamless transition for transfer students upon arrival. In addition, transfer students in STEM fields would benefit from more intentional and comprehensive orientation and mentoring programs to include advisors (Townsend and Wilson, 2006) and peer mentoring programs (Peters *et al.*, 2006), both demonstrated to be effective mechanisms for boosting persistence. Specifically, having transfer mentors within STEM disciplines, as well as organized study groups within courses, can help.

At the institutional level, advising models and resources need to be examined (e.g., Hagedorn *et al.*, 2006; Ornelas and Solorzano, 2004). Professional development and training for faculty advisors who work with transfer students is critical, as advisors can spark intention to transfer and support transfer goals (Bahr, 2008). In one institution, a change toward proactive, deliberate advising where advisors act as advocates for students was linked to improved student persistence and satisfaction (Smith, 2007). Faculty experience many constraints on their time; institutional efforts need to be realistic and mindful of supporting both faculty and students. One promising approach is to have faculty embed advising messages into their courses so that they reach a larger number of students with improved efficiency (Tatum *et al.*, 2006).

Beyond the advisor and peer resource level, Stanton-Salazar (2010) advised administrators to consider their institutional policies that govern financial aid, credit transfer, and access to campus resources in order to promote the success of transfer students. While this type of self-assessment of institutional practices is likely to promote cultural and social capital of all transfer students, it is important to bring a disciplinary lens to discussions of fostering a transfer-going or transfer-friendly culture. For example, transfer students also tend to be

working students, or students with family responsibilities, and may be less likely to access the experiences in STEM that promote a sense of commitment and leadership to the field, such as serving in a research lab, as a teaching assistant, or collaborating in community outreach. Since transfer students do not have the same time to ramp up and access these opportunities, institutions need to consider ways to improve the application process such as providing mentoring assistance. Unfortunately, the nation may lose out on female transfer students' potential talent and contribution in the long-run if they face challenges when transitioning into the workplace or graduate school due to a lack of relevant experience en route to the bachelor's degree.

The community college transfer pathway is only growing in its importance within the landscape of higher education. The power of the transfer pathway for STEM, and for facilitating the progress of women from diverse ethnic and socioeconomic backgrounds, is also tremendous. Yet, more work is needed. Through institutional efforts and collaborative partnerships among high schools, colleges, and workplaces we may be able to harness the potential of this pathway and transform the STEM workforce.

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