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Living Learning Communities: An Intervention in Keeping Women Strong in Science, Technology, Engineering, and Mathematics

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LOYOLA MARYMOUNT UNIVERISTY

Living Learning Communities: An Intervention in Keeping Women Strong in Science, Technology, Engineering, and Mathematics

by

Jennifer Belichesky

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Living Learning Communities: An Intervention in Keeping Women Strong in Science, Technology, Engineering, and Mathematics

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To my husband, Seth, who has continued to amaze, inspire, and humble me by how much he loves me, supports me, and believes in me. I truly know that without his sarcastic wit, calm demeanor, big shoulder to cry on, willingness to be Mr. Mom, ability to make me laugh at myself, and you can do it attitude this work could not have happened. I love you.

To my sons, I dedicate this work to the two of you in the hope of inspiring in you the greatness you have inspired in me. You have been the driving force to get my derrière in a chair and finish this dissertation. I love you both.

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ABSTRACT

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The purpose of this study was to expand on the current research pertaining to women in science, technology, engineering, and mathematics (STEM) majors, better understand the experiences of undergraduate women in the sciences, identify barriers to female persistence in their intended STEM majors, and understand the impact of the STEM co-educational Living Learning Community (LLC) model on female persistence. This study employed a mixed-methods approach that was grounded in standpoint methodology. The qualitative data were collected through focus groups and one-on-one interviews with the female participants and was analyzed through a critical feminist lens utilizing standpoint methodology and coded utilizing inductive analysis. The quantitative data were collected and analyzed utilizing a simple statistical analysis of key academic variables indicative of student success: cumulative high school GPAs, SAT scores, first year cumulative GPAs, freshman persistence patterns in the intended major, and freshman retention patterns at the university. The findings of this study illustrated that the co-educational LLC model created an inclusive academic and social environment that positively impacted the female participants' experiences and persistence in STEM. The findings also found the inclusion of men in the community aided in the demystification of male superiority in the

sciences for the female participants. This study also highlighted the significance of social identity in the decision making process to join a science LLC.

CHAPTER 1

BACKGROUND OF THE STUDY

Introduction

In recent years there has been a shift in higher education towards more women than men attending and graduating from colleges and universities. This shift has created a sensibility that women have finally made it, and college men are now demanding our attention because they are on the brink of extinction (Gurian, 2005). However, the reality is that while more women than men may be attending college, they are not equally represented across all fields of study, specifically in science, technology, engineering, and mathematics (STEM) disciplines. Even with the increases in women earning STEM degrees over the last 30 years, they still only represent 38% of those graduating with a bachelor's in these fields (Hill, Corbett, & St. Rose, 2010; Sax, 2001). As degree levels increase, the representation of women in STEM declines, resulting in fewer women earning graduate and doctoral degrees, entering into academia, and taking jobs in the STEM workforce (National Science Foundation Division of Science Resources Statistics, 2009; Sax, 2001; Szelenyi & Inkelas, 2011).

The underrepresentation of women in the STEM workforce is a significant issue. When women are not involved in product design and research, their needs, preferences, and lived experiences may be overlooked or misunderstood. Margolis and Fisher (2002, as cited in Hill et al., 2010) found that in early stages of voice-recognition software development, the software was often calibrated utilizing a male voice, resulting in the literal absence of the female voice. They also found that during the early stages of developing the automotive airbag, an all-male engineering team tailored the airbags to accommodate male bodies, resulting in several airbag

induced deaths for women and children (Hill et al., 2010). Furthermore, recent comments by Harvard University President, Lawrence H. Summers, suggested the underrepresentation of women in STEM is due to their upbringing, genetics, and time spent on child-rearing, indicating that our true understanding of the lived experiences of women in STEM is limited and still dominated by male perceptions.

Women in STEM

At the high school level, research has shown promise in the ability of women to persist in STEM courses and their level of preparedness for college. Recent studies have indicated "about as many girls as boys leave high school prepared to pursue science and engineering majors in college" (Hill et al., 2010, p. xiv). High school women are earning math and science credits at the same rate as their male counterparts (Shettle et al., 2007), exhibiting confidence in their math and science abilities (Vogt, Hocevar, & Hagedorn, 2007) and increasing their representation among those who earn high scores on math placement tests (Brody & Mills, 2005). These findings are significant because they counter one of the most cited reasons that women do not enter and persist in STEM: a lack of academic preparedness (Seymour & Hewitt, 1997).

Even though women entering into STEM majors are graduating from high school with the skills necessary to succeed in these majors, a majority of them will not persist in STEM after their first few years in college, with most women changing their major during their freshman year of college (Hill et al., 2010). For freshman students, their first year serves as the greatest predictor in their persistence to graduation. According to Upcraft and Gardner (1989), the first six weeks of the fall semester are the most critical for first-year students. Of the freshman students who will not persist into their sophomore year, half of them will drop out in during the

critical first six weeks. During this time students are transitioning through feelings of homesickness, concerns about fitting in, isolation, doubts about choice of school, anxiety about their intellectual competency, and their first round of midterm exams (Chickering & Reisser, 1993). For many students, particularly STEM students, the first round of midterm exams also signals doubt in academic self-confidence, resulting in many considering a change of major.

In their second systematic review of the literature on college impact from 1995 to 2005, Pascarella and Terenzini (2005) found student self-confidence in their academic abilities to be one of the most significant predictors for persistence in college. In regard to students in STEM, academic self-concept is often cited as a major predictor to persistence in the major (Hill et al., 2010; Pascarella & Terenzini, 2005; Sax, 1994). Among first-year women, negative academic self-concept, defined as lack of confidence in their math and science abilities, has often been cited as a reason why women do not persist in STEM (Brainard & Carlin, 1997; Seymour & Hewitt, 1997). Even when women majoring in STEM enter college with high academic self-confidence, their self-confidence in their math and science abilities tends to decline dramatically by the end of their freshman year (Brainard & Carlin, 1997; Hill et al., 2010).

In the winter of 2010, the American Association of University Women (AAUW) released a report providing a comprehensive review of the current state of women in STEM. Authors of the report, Hill et al. (2010), found that student self-perception of academic ability to succeed in STEM majors was a primary motivator and barrier in the desire to persist. In their research, they identified "stereotype threat," defined as the "threat of being viewed through the lens of a negative stereotype or the fear of doing something that would confirm that stereotype" (Hill et al., 2010, p. 39), as a leading cause of negative self-concept about STEM academic abilities. In

the case of women, studies have found that they tend to avoid majoring in the sciences because they fear fulfilling the negative stereotypes that women do not have the necessary skills to succeed in these areas, and science is better suited for men (Spencer, Steele, & Quinn, 1999). Even when women do have a strong self-concept about their math and science abilities, they are still susceptible to the effects of stereotype threat.

In addition, studies have found that stereotypes about perceived gendered abilities can create a sensibility that women are incapable of developing the necessary skills to succeed in STEM fields (Sadker, Sadker, & Zittleman, 2009). Hence, if women do major in STEM as undergraduates, these stereotypes would be reinforced by a lack of women faculty and female mentors. Other factors often cited as contributing to the decline of female persistence in STEM are limited access to same-sex role models (Sax, 2001), feelings of isolation (Brainard & Carlin, 1997), competitive grading practices (Colbeck, Cabrera, & Terenzini, 2001), and chilly classroom environments utilizing pedagogical practices that serve to alienate and silence women (Fassinger, 1995; Hall & Sandler, 1982).

Interventions

In addition to synthesizing what we currently know about female persistence in STEM, the AAUW report also provided a comprehensive review of recommendations for interventions, defined as ways to eliminate barriers to female persistence. At the collegiate level, most recommendations focused on creating environments that engage and support women inside and outside of the classroom. Key interventions listed were actively recruiting women into STEM majors, promoting social interactions between faculty and students, creating more physical space for students in STEM departments (such as a student lounge), exposing students to the

achievements of women in STEM, hiring more women faculty, creating STEM peer mentor and women-only groups, and adopting classroom pedagogies that engage female students. While each of these interventions proposes ways to create welcoming and supportive learning environments for women in STEM, they still fall short of successfully merging research and theory into viable impactful interventions. Many of the recommendations rely on changes at the individual level rather than at the institutional level. If left to individual faculty and staff to implement these interventions, the result would be uneven and ineffective. To positively impact the experiences of women majoring in STEM, universities need to create collaborative learning environments that unify these interventions into one experience or program.

Living Learning Communities as Models for Intervention

Living Learning Communities (LLCs) provide an effective model for intervention because they have been shown to increase student retention, especially from the freshman into the sophomore year (Stassen, 2003). LLC models are not new to higher education. In 1920, the University of Wisconsin was the first to systematically integrate student curricular and co-curricular learning (Smith, MacGregor, Matthews, & Gabelnick, 2004). In the last few decades, LLCs have seen resurgence as a model to address quality issues in the American undergraduate experience (Inkelas & Associates, 2008; Inkelas & Weisman, 2003). The reemergence of integrated learning was also supported by research indicating that, "student engagement in educationally purposeful activities inside and outside of the classroom is a precursor to higher levels of student learning and personal development as well as an indicator of educational effectiveness" (Zhao & Kuh, 2004, p. 115). In addition, these communities have also shown significant gains in freshman retention and persistence (Stassen, 2003).

In its current manifestation, the LLC model is grounded in Tinto's (1993) theory of student departure that suggested students are more likely to remain at an institution if they have opportunities to become engaged in the life of the institution through their social and academic experiences. To engage students in purposeful activities that integrate their curricular and co-curricular experiences, LLC models incorporate both an academic and residential component. While many variations exist, the basic LLC model consists of students living together in the same residence hall, students engaging in curricular and co-curricular programming designed especially for the participants of the community, enrollment in a freshman seminar course, and a faculty in residence who engages the students in the residence hall (Inkelas & Weisman, 2003; Smith et al., 2004; Zhao & Kuh, 2004). Enrollment in communities varies across institutions, with some universities requiring every freshman student to enroll, while other universities provide students with an option to self-select into a community of their interests (Smith et al., 2004).

In regards to the impact of LLCs on student outcomes, Pascarella and Terenzini (2005) found in the review of the literature that LLCs have statistically significant positive effects on freshman persistence into sophomore year by fostering supportive peer groups, enhancing greater student participation in the classroom, encouraging greater student engagement in co-curricular activities, and establishing a higher self-perception of academic ability. Most notable about the outcomes listed above, specifically the impact of LLCs on student persistence, classroom participation, peer group support, and self-perception of academic ability, is that they represent the desired outcomes articulated by the AAUW report as necessary for women to persist in STEM majors.

Statement of the Problem

Despite gains at the high school level, women are still not entering into and persisting in STEM majors at equal rates as their male counterparts. Even with the dramatic increase in the women earning STEM degrees over the last 30 years (Sax, 2001), these increases fail to account for the fact that women are still earning less than 40% of STEM degrees. In 2007, the Higher Education Research Institute released their survey of the American freshman, revealing that only 15% of freshman women intended to major in STEM fields compared to 30% of freshman men (Pryor, Hurtado, Sharkness, & Korn, 2007)

Of the small portion of women who decide to major in these fields, many will not persist in their intended STEM majors after their first two years of college (Hill et al., 2010), with the most noticeable decline occurring after freshman year (Brainard & Carlin, 1997). The disparity between high school gains and lack of participation in STEM at the collegiate level indicates a need to understand what is preventing women from capitalizing on their abilities. For those women who do major in STEM only to change majors at the end of their freshman year, a greater understanding of the freshman STEM experience needs to be incorporated into the research.

Purpose of the Study

The purpose of this study was tri-fold. The first purpose was to expand on the current research pertaining to women in STEM fields by conducting a mixed-methods study of a co-educational science LLC in order to better understand the experiences of undergraduate women in STEM. The second purpose was to identify barriers to female persistence, defined as persisting in their intended STEM major from their freshman year through graduation, from the

perspective of the students. The third purpose of this study was to understand the impact of the LLC model as a viable intervention to positively impact female persistence in STEM disciplines.

Significance of the Study

The experience of undergraduate women in STEM is an important area of research, particularly in understanding how their experiences factor into their decisions to persist. As a model for intervention, LLCs are a unique opportunity to synthesize the recommendations for encouraging female persistence in STEM disciplines into a systematic approach that can be incorporated at the start of their undergraduate experience. While previous research has highlighted several positive outcomes associated with LLC participation (Pascarella & Terenzini, 2005; Stassen; 2003; Zhao & Kuh, 2004), few studies have explored the impact of the LLC model on female persistence in STEM disciplines.

The current research on the impact of the LLC model on female persistence has provided a small but growing body of literature, and the majority of this research has focused on the examination of the women-only STEM LLC model. For example, Szelenyi and Inkelas (2011) examined the impact of a women-only science LLC on aspirations to attend graduate school in STEM. Ghandi (1999) and Hathaway, Sharp and Davis (2001) examined the relationship between women in a women-only STEM LLC and persistence in their intended major, finding that LLC participation was beneficial in retaining women within their intended STEM major. Hughes (2010) examined how participation in a women-only science LLC impacted women's persistence and career aspirations in STEM. Johnson, Soldner and Inkelas' (2006) research is one of the only studies that have looked at the ways in which a women-only versus a co-educational STEM LLC impacts the female experience in STEM. In addition, this small body of

research has primarily relied upon quantitative methods, with the exception of Kahveci, Southerland and Gilmer (2007) who employed a mixed-methods approach and Hughes (2010) who utilized qualitative methods in order to determine how a women-only science LLC program impacted female persistence within STEM.

The paucity of research on the effects of STEM LLCs on female persistence highlights a need for more research to fully understand the experience of female participants (Ghandi, 1999; Hathaway et al., 2001; Kahveci et al., 2007; Szelenyi & Inkelas, 2011). Current understandings of women's experiences continue to remain limited as we attempt to examine this issue through a quantitative lens. While quantitative research has provided a plethora of variables indicating predictors to persistence, very little is known about what women are subjectively experiencing and what can be done to promote their long-term commitment to STEM disciplines. In order to truly begin to understand the experiences of women in STEM, more "theory-driven qualitative studies" are required to "mak[e] these interventions and their significance more visible to science and the science education committees" (Kahveci et al., 2007, p. 60). Therefore, the purpose of this study was to expand on the current research pertaining to women in STEM by conducting a mixed-methods study based in standpoint theory of a co-educational science LLC to understand the impact of the LLC model on female persistence in the STEM.

Feminist Analysis of a STEM LLC

This study centralized the role of gender in examining the impact of the LLC model on the persistence of women in STEM fields. This study employed Weiler's (1988) critical feminist theory to establish the ways in which society, specifically through educational practices, has served to oppress women and how feminist counter-hegemonic thinking works to create a new

understanding of women's oppression and transform society. This study then built upon Weiler's feminist counter-hegemonic theory by exploring three different feminist approaches to increasing women's engagement in science education and the classroom. This study also utilized Harding's (1998, 2004) feminist standpoint methodology to privilege women and their ways of knowing in the research in order to inform societal productions of knowledge.

Critical feminist theory has looked at forms of resistance that enable women to create collective oppositional movements and empower them to create change within the oppressive nature of the educational system (Weiler, 1988). Creating impactful change requires a definition of resistance that not only includes forms of opposition, but also includes "more critical and politicized work in the form of organized and conscious collective oppositional actions" (Weiler, 1988, p. 53). Weiler defined this critical, organized, and collective opposition as counter-hegemony. Weiler explained that counter-hegemony is the "creation of a self-conscious analysis of a situation and the development of a collective practices and organization that can oppose the hegemony of the existing order and begin to build the base for a new understanding and transformation of society" (p. 53).

In science education, feminist educators create counter-hegemonic initiatives that seek to empower female students to define themselves in a society and intellectual tradition that denies the existence of their experiences and ability to produce knowledge. The initiatives they create are based in their understanding of the way in which gender impacts student learning. Sinnes (2006) defined three different approaches utilized by feminist educators to increase female engagement in the sciences, including gender neutral, female friendly, and gender sensitive approaches. The gender-neutral approach is based in the understanding that women and men

engage in science education in the exact same manner. The female-friendly approach believes that men and women engage in science education in distinctly different ways. Finally, the gender-sensitive approach to science education is based in the understanding that each individual engages in science learning in their own unique way, regardless of their gender.

Building upon Weiler's theoretical concept and Sinnes (2006) feminist approaches to science education, Harding's (2004) standpoint theory introduced a feminist methodology that privileged the voice of the women in the research. Traditionally, white males have been the constructors of neutral sciences and its ideologies. Their privileged position within the sciences has resulted in the marginalization of women into positions of subordination (Harding, 2004; Rose, 2004). This has also resulted in a male Eurocentric "implied speaker" of scientific inquiry, effectively excluding women and their abilities to make meaning from the knowledge production process (Harding, 2004, p. 4)

Harding (2004) contended that starting research from a feminist standpoint challenges the relationship between power and the production of knowledge by addressing the inadequacies of the dominant conceptual framework in guiding and informing mainstream epistemologies and methodologies. She argued that beginning from the standpoint of "the other," often seen as women, provides an opportunity to start thinking differently about cultural differences and power relations by highlighting how each of these differences contributes to expanding our knowledge base (Harding, 1998).

These models provided a theoretical foundation to frame the research questions guiding this study. By starting research from the position of the female STEM students, instead of the generally accepted quantifiable Eurocentric masculine methodologies that dominate scientific

thought and inquiry, this study privileged the voice of the female participants in the research in order to better understand their lived experiences. By understanding the unique perspectives of the women in STEM, this study informs the knowledge of production and uncovers the ways in which women can understand and combat the institutionalized oppression of their educational experiences.

Research Question

To better understand the experience of women in STEM and the impact of the co-educational LLC model as an intervention to positively impact female persistence in the sciences, the following research question guided this study:

> What are the gendered experiences of women participating in a co-educational STEM LLC and how do these experiences affect their academic performance and persistence in STEM fields?

This study examined how the environment created by a co-educational LLC model served to create spaces for women to feel included within the scientific culture of the STEM discipline. This study found that the residential and academic components of the co-educational STEM LLC provided an inclusive environment that engaged its female participants in a manner that positively impacted their persistence within their intended STEM major.

Research Design and Method

This was a mixed-methods study, grounded in standpoint methodology, which examined the impact of a co-educational STEM LLC on female persistence in the sciences. The setting of this study was a mid-sized religiously affiliated liberal arts university in a large urban area that created the Science Early Awareness Program (SEAP) for 19-24 of its incoming Natural Science

and Biology majors. I conducted this study through a series of qualitative and quantitative methodologies that provided an in-depth examination of female experiences in STEM by privileging the voice of the students in the research. I conducted focus groups and interviews with the female SEAP participants who participated in the program during their freshman year and who were majoring in or recently graduated with a degree in STEM at the time of the study. I utilized simple statistical analysis to analyze first year retention rates, persistence rates in intended STEM majors, academic major migration patterns, and academic performance, defined as grade point averages (GPAs). Also, I reviewed various documents, such as SEAP founding documents, program brochures, website, and annual reports, in order to provide the historical and contextual impact of the SEAP LLC on female persistence in STEM.

Limitations

The major limitation in this study was my dual role as researcher and university administrator. As the Director of the Office of First Year Experience, I was charged with creating intervention models to ensure 90% retention of freshman students into their sophomore year. From this perspective, I viewed the LLC as a promising model to effect real change across the freshman class by positively impacting student persistence within majors specifically and at the university in general. My positionality within this research meant that I had to be diligent in creating my own interventions of reflection and outside perspectives to ensure that my bias did not negatively distort my findings.

Delimitations

I chose to limit this study to a very small population of women participating in a co-educational science LLC at one institution of higher education; therefore, the findings might not

be generalizable to other women in other STEM programs at other universities. Overall, it was the purpose of this study to focus on the experiences of women in STEM and provide an opportunity for their voices to be heard in the research.

Outline and Organization of Dissertation

In summary, the purpose of this study was to understand the experiences of women majoring in STEM and the impact of the LLC model on their persistence in the sciences. Chapter 1 identifies the problem to be studied and the significance of this study to the research on women in STEM. Chapter 2 provides a review of pertinent literature regarding women in STEM, barriers to their persistence, interventions, LLC models, and feminist theory. Chapter 3 provides a detailed overview of the research methodology and design. Chapter 4 presents the research findings and the analysis of the findings. Chapter 5 includes a restatement of the purpose of the study, the significance of the findings, recommendations for K-12 and higher education practitioners, and suggestions for future research.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

The purpose of this study was to understand the gendered experiences of undergraduate women in STEM by privileging their voices in the research in order to understand the factors that impact their persistence in their intended majors. This review of the literature provides context for why the study of female persistence in STEM is significant and a conceptual framework through which this study was situated. The first half of this chapter includes an overview of the issues pertaining to women in STEM, specifically examining the issues of undergraduate women in STEM. This focus includes the achievements of women in the sciences at the high school level, the current state of undergraduate women in STEM, the barriers to persistence within STEM majors, models for intervention to positively impact female persistence in STEM, and the role of LLCs in the STEM female undergraduate experience. The second half of this review presents the theoretical framework that informs this study: feminist theory and standpoint theory.

Women in STEM

In January of 2005 at the Diversifying the Sciences and Engineering Workforce: Women, Underrepresented Minorities, and Their S&E Careers Conference, Lawrence H. Summers, president of Harvard University, addressed the underrepresentation of women in the sciences. During his speech, he attributed the shortage of women to the innate differences between men and women, indicating that women's underrepresentation was due to their genetics, upbringing, and time spent on child-rearing. He also questioned the extent to which discrimination has negatively impacted women's representation in the sciences. While his disparaging remarks

ignited a flurry of responses and a call for his resignation, they also highlighted a need to better understand the experiences of women in STEM because the current understanding of their lived experiences has been dominated and limited by masculine perceptions.

In regards to women at the undergraduate level, this masculine understanding has also created a sensibility that women have finally made it and men should be demanding our attention (Gurian, 2005). While women have begun to outnumber men in total number attending institutions of higher education, they have still not achieved equality in all areas of study and have continuously been significantly underrepresented in STEM disciplines. Even with the increases in women earning STEM degrees over the last 30 years, they still only represent 38% of those graduating with a bachelor's in these fields (Hill et al., 2010). As degree levels increase, the representation of women in STEM declines, resulting in fewer women earning doctoral degrees or entering into academia and the STEM workforce (Hill et al., 2010; Sax, 2001; Szelenyi & Inkelas, 2011).

The underrepresentation of women in the STEM workforce is a significant issue. Diversifying the STEM workforce is critical for creative innovation and technology. Greater diversity helps to create an extensive workforce with multiple perspectives and provides a richer base of experience to approach problem solving, research, and product design (Cox, 2001). When women are absent from the research and development process, so are their perspectives. Therefore, male values become and remain dominant (Mills, 1988; Ramsay & Letherby, 2006). This dominance often results in female needs and preferences being overlooked, further reinforcing their societal marginalization (Ramsay & Letherby, 2006).

Margolis and Fisher (2002) found that in early stages voice-recognition software development, the software was often calibrated utilizing a male voice, resulting in the women's voice being "literally unheard" (as cited in Hill et. al., 2010, pg. 3). They also found that a "predominately male group of engineers tailored the first generation of automotive airbags to adult male bodies," resulting in several airbag induced deaths for women and children (as cited in Hill et. al., 2010, pg. 3). While airbag induced deaths is an extreme example, it does underscore how women's basic needs are not addressed in a male-dominated STEM workforce. It also highlights the necessity to fully understand why women are not persisting in STEM fields of study and how research can impact change.

High school women and STEM. At the high school level, research has shown promise in the ability of women to persist in STEM courses and their level of preparedness for college. Recent studies have indicated "about as many girls as boys leave high school prepared to pursue science and engineering majors in college" (Hill et al., 2010, p. xiv). High school women are earning math and science credits at the same rate as their male counterparts (Shettle et al., 2007), exhibiting confidence in their math and science abilities (Vogt et al., 2007), and increasing their representation among those who earn high scores on math placement tests (Brody & Mills, 2005). These findings are significant because they counter one of the most cited reasons that women do not enter and persist in STEM: a lack of academic preparedness (Seymour & Hewitt, 1997). They also highlight the ability of research to inform educational practices that can adequately prepare girls at the high school level to pursue studies in the sciences.

Despite these gains at the high school level, women are still not entering into STEM majors at equal rates. Even with the dramatic increase in women earning STEM degrees over

the last 30 years (Sax, 2001), these increases fail to account for the fact that women are still earning less than 40% of STEM degrees. In 2007, the Higher Education Research Institute released their survey of the American freshman, revealing that only 15% of freshman women intended to major in STEM fields compared to 30% of freshman men (Pryor, Hurtado, Sharkness, & Korn, 2007). Of the small portion of women who do decide to major in these fields, many will not persist in these majors after their first two years of college, (Hill et al., 2010) with the most noticeable decline occurring after their freshman year (Brainard & Carlin, 1997).

The disparity between their high school gains and their lack of participation in STEM at the collegiate level indicates a need to understand what is preventing women from capitalizing on their abilities. For those women who do major in the sciences, only to change majors at the end of their freshman year, a greater understanding of the freshman STEM experience needs to be incorporated into the research. Therefore, this study focused on the experiences of freshman women in STEM in order to discover the barriers to persistence from the perspective of the students.

Undergraduate women in STEM fields. For freshman students, their first year serves as the greatest predictor in their persistence to graduation. Upcraft and Gardner (1989) found that the first six weeks of the fall semester are the most critical for first-year students. Of the freshman students who will not persist into their sophomore year, half of them will drop out in during these critical first six weeks. During this time, students typically transition through feelings of homesickness, concerns about fitting in, a sense of isolation, doubts about school choice, anxiety about their intellectual competency, and their first round of midterm exams

(Chickering & Reisser, 1993). For many students, particularly STEM students, the first round of midterm exams also signals doubt in academic self-confidence resulting in many considering a change of major.

Academic self-concept. In their second systematic review of the literature on college impact from 1995 to 2005, Pascarella and Terenzini (2005) found student self-confidence in their academic abilities to be one of the most significant predictors for persistence in college. In regard to students in STEM disciplines, academic self-concept has often been cited as a major predictor to persistence in the major (Hill et al., 2010; Pascarella & Terenzini, 2005; Sax, 1994). Among first-year women, negative academic self-concept, defined as lack of confidence in their math and science abilities, has often been cited as a reason why women do not persist in STEM (Brainard & Carlin, 1998; Sadker et al., 2009; Seymour & Hewitt, 1997). Even when women majoring in STEM enter college with high academic self-confidence, their self-confidence in their math and science abilities tends to decline dramatically by the end of their freshman year (Brainard & Carlin, 1997; Hill et al., 2010).

As discussed in Chapter 1, the AAUW released a report in the winter of 2010 called *Why So Few: Women in Science, Technology, Engineering, and Mathematics.* This report provided a comprehensive review of the current state of women in STEM. Authors Hill et al. (2010) found that student self-perception of academic ability to succeed in STEM majors was a primary motivator and barrier in the desire to persist. In their research, Hill et al. identified "stereotype threat, " defined as the "threat of being viewed through the lens of a negative stereotype or the fear of doing something that would confirm that stereotype" (p. 39), as a leading cause of negative self-concept about STEM academic abilities. In the case of women, they will tend to

avoid majoring in the sciences because they fear they will fulfill the negative stereotype that women do not have the necessary skills to succeed in these areas and science is better suited for men (Alvesson & Billing, 1992; Sadker et al., 2009; Tyler & Cohen, 2010). Even when women do have a strong self-concept about their math and science abilities, they are still susceptible to the effects of stereotype threat. Many women tend to hold themselves to a higher standard than their male counterparts in trying to overcompensate for their gender in male-dominated fields of academic study (Van den Brink, Benschop, & Jansen, 2010).

Faculty mentors. Studies have found that stereotypes about perceived gendered abilities can create a sensibility that women are incapable of developing the necessary skills to succeed in STEM fields. If women do major in STEM as undergraduates, these stereotypes will likely be reinforced by a lack of women faculty and female mentors. While women make-up 40% of full-time faculty at American degree-granting colleges and universities, this number varies across academic discipline (Hill et al., 2010; Sadker et al., 2009). In 2008, women comprised only 34% of the tenured track faculty in STEM and less than 25% of tenured faculty, with most women in the sciences occupying lower paying non-tenured track teaching positions (Hill et al., 2010).

The clustering of women into non-tenure track STEM positions is the result of a male dominated field that works to perpetuate masculine ideologies of what and who tenure-track faculty should be (Alvesson & Billing, 1992; Sadker et al., 2009; Snizek & Neil, 1992). Within academia and specifically within STEM disciplines, the overtly masculine nature of the field has resulted in reinforcing the invisibility of women by underscoring their contributions to theoretical and methodological thought (Harding, 2004; Mills, 1988; Ramsay & Letherby, 2006). In addition to viewing their work as insignificant, many have seen and continue to see women as

only suited for lower level teaching positions because the demands of family and childrearing are detrimental to a successful tenure-track process (Acker, 1992). This stereotype was reinforced by Lawrence H. Summers comments, stated earlier, attributing the disparity between women and men in tenure-track STEM positions to child-rearing and the innate differences between women and men. Summer's comments also highlighted the perceptions of ability that reinforce the stereotype that women are better suited for different fields of study, often referred to as "soft" disciplines, and men are better suited for "hard" disciplines, such as the sciences (Acker, 1992; Sadker et al., 2009; Snizek & Neil, 1992; Tyler & Cohen, 2010).

For female students in STEM, the underrepresentation of women faculty has also translated to limited access to same-sex roles models and mentors, which has been cited as necessary for women to persist in STEM (Sadker et al., 2009; Sax, 2001). Other factors that have been cited as contributing to the decline of female persistence in STEM are feelings of isolation (Brainard & Carlin, 1997), competitive grading practices (Colbeck et al., 2001), and classroom pedagogical practices and environments that serve to alienate and silence women (Fassinger, 1995; Hall & Sandler, 1982).

Chilly classroom climate. When considering the female educational experience, the classroom serves as a critical environment in developing student self-confidence and ability to actively participate in learning. Research has found that active student participation, defined as verbal interactions with the instructor and other students in the form of raising questions and offering comments, facilitates learning (Howard & Baird, 2000), cultivates critical thinking skills (Smith, 1977), and results in a more positive perception of the learning experience (Sadker & Sadker, 1994). Furthermore, while student participation can lead to increased learning, studies

have found it also proves to better prepare students for their careers (Howard & Baird, 2000). Considering the impact of classroom participation on student learning, coupled with women in STEM feeling alienated by classroom practices, it behooves us to examine how the collegiate classroom can serve to undermine the persistence of women in STEM.

In Hall and Sandler's (1982) seminal work, *The Classroom Climate: A Chilly One for Women*, they found the higher education classroom to be an inhospitable learning environment for women. Hall and Sandler contributed this chilly classroom environment to the role of faculty and their interactions with students. They suggested that some faculty act towards women in a manner that reduces women's self-confidence, lowering their participation in class and their academic performance and serving to reduce their academic and career aspirations. Examples of this negative behavior towards female students include instructors ignoring or interrupting female students more than male students, giving male students more eye contact during class discussion, and calling upon male students by name.

While Hall and Sandler focused on the role of the instructor in creating an inhospitable environment for women, their findings also suggest that fellow students might play a significant role in perpetuating a hostile classroom environment for women. Fassinger (1995) found that student gender is a significant component to class participation, but faculty gender is not. She argued that the professors' gender and interpersonal style of teaching might not have played a key role in women's classroom participation and interaction. Rather, her findings suggested that class traits, defined as interactions between peers and the emotional climate of the classroom, and student traits, defined as student classroom confidence, preparedness, and comprehension of

the subject matter, were better predictors of student participation and involvement in the classroom.

Canada and Pringle (1995) also suggested that students play a key role in creating the classroom climate. Their findings stated that the addition of male students in the collegiate classroom could contribute to an inhospitable environment for female students. They collected data over a five-year transition period of a single-sex female university into a co-ed university in order to observe patterns of female interactions in different classroom settings. Their findings also highlight the role of students in contributing to classroom dynamics. They found that when females were in a single sex classroom their participation levels were high and were found to be equivalent to the levels of male participation in mixed-sexed classrooms. This indicated that the female students did have high levels of participation when placed within a certain setting, but as the number of male students increased within the classroom, women's participation levels tended to decrease.

Interventions

The examination of the literature indicates that women have made gains in their persistence in STEM courses at the K-12 level, but these gains are not being translated to their experiences at the collegiate level. Upon entering into the undergraduate STEM classroom, women are faced with a series of barriers that prevent them from persisting in these majors. Furthermore, while quantitative research has provided a plethora of variables indicating predictors to persistence, very little is known about what these women are experiencing and what can be done to promote their long-term commitment to STEM.

In addition to synthesizing what we currently know about women in STEM, the AAUW report also provided a comprehensive review of recommendations for interventions, defined as ways to eliminate barriers to female persistence. At the collegiate level, most recommendations focused on creating environments that engage and support women inside and outside of the classroom. Key interventions listed were: actively recruiting women into STEM majors, promoting social interactions between faculty and students, creating more physical space for students in STEM departments such as a student lounge, exposing students to the achievements of women in STEM, hiring more women faculty, creating STEM peer mentor and all women groups, and adopting classroom pedagogies that engage female students.

In regards to chilly classroom environments, Auster and MacRone (1994) found specific faculty behaviors helped to circumvent the chilly classroom climates, especially the negative presence of male students in the classroom. They found female student participation levels increased if faculty members called on students often and used students' names, provided positive encouragement, asked students analytical not factual questions, and sought students' opinions even if their hands were not raised. They also suggested that faculty utilize collaborative learning groups to encourage active engagement. Hence, if faculty members take more conscious and consistent steps to ensure that students feel their ideas, questions, and knowledge are being considered and seen as important, female student participation will increase.

While each of the interventions listed above proposes ways to create welcoming and supportive learning environments for women in STEM, they still fall short of successfully merging research and theory into viable impactful interventions. Many of the recommendations

rely on changes at the individual level rather than at the institutional level. If left to individual faculty members and staff to implement these interventions, the result will be uneven and ineffective. To positively impact the experiences of women majoring in STEM, universities need to create collaborative learning environments that unify these interventions into one experience or program. Therefore, this study also examined the effects of LLCs as models for intervention in the persistence of freshman women majoring in STEM disciplines.

LLCs as a Model for Intervention

LLCs provide an effective model for intervention because they have been shown to increase student retention, especially from the freshman into the sophomore year (Stassen, 2003). LLC models are not new to higher education. The first version of a LLC was instituted at the University of Wisconsin from 1927-1932. Called the Experimental College, it was designed to transform the traditional undergraduate experience by incorporating a common curriculum, community building pedagogical approaches, active learning, a residential social experience, and solidarity between the faculty and students (Smith et al., 2004). To better support students in their academic work, faculty members served as mentors and were referred to as "advisors" rather than "professors" (Smith et al., 2004). In their advisor role, they were strongly encouraged to socially interact with students outside of the traditional classroom environment through weekly one-on-one meetings and office hours in the residence halls. Even though the Experimental College was short-lived, it was still the first documented attempt to systematically integrate student curricular and co-curricular learning.

In the 1980s there was resurgence in the desire for integrated learning to address a series of reports criticizing the quality of the American undergraduate experience (Inkelas &

Associates, 2008; Inkelas & Weisman, 2003). The reemergence of integrated learning was also supported by research indicating "student engagement in educationally purposeful activities inside and outside of the classroom is a precursor to higher levels of student learning and personal development as well as an indicator of educational effectiveness" (Zhao & Kuh, 2004, p. 115). In addition, these communities were also showing significant gains in freshman retention and persistence (Stassen, 2003).

In its current manifestation, the LLC model is grounded in Tinto's (1993) theory of student departure which suggested students are more likely to remain at an institution if they have opportunities to become engaged in the life of the institution through their social and academic experiences. To engage students in purposeful activities that integrate their curricular and co-curricular experiences, LLC models incorporate both an academic and residential component. While there are many variations, the basic LLC model consists of students enrolling in linked academic courses with coordinated curriculum, living together in the same residence hall where they are provided with academic and social programming, enrolling in a freshman seminar course, and engaging with faculty in the residence hall (Inkelas & Associates, 2008; Smith et al., 2004; Zhao & Kuh, 2004). LLCs are usually themed by student interest, such as a healthy lifestyle community, or by academic interest or major, such as students majoring in psychology. Enrollment in communities varies across institutions, with some universities requiring every freshman student to enroll, and other universities providing students with an option to self-select into a community of their interests (Smith et al., 2004).

In regards to the impact of LLCs on student outcomes, Pascarella and Terenzini (2005) found in the review of the literature that LLCs have statistically significant positive effects on

freshman persistence into their sophomore year by fostering supportive peer groups. Students who participate in LLCs have demonstrated greater participation in the classroom, increased student engagement in co-curricular activities, and stronger self-perception of their academic abilities compared to their non-LLC counterparts. What is notable about the student outcomes listed above, specifically the impact of LLCs on student persistence, classroom participation, peer group support, and self-perception of academic ability, is that they represent the desired outcomes articulated by the AAUW report as necessary for women to persist in STEM majors.

The current body of research examining the impact of STEM LLCs on female persistence is small and primarily focused on examining the impact of women-only science LLC programs. Szelenyi and Inkelas (2011) examined the impact of a women-only science LLC on aspirations to attend graduate school in STEM. They found a positive causal effect between socially supportive resident hall LLC programs and women's academic performance in sciences and STEM focused graduate school plans. Ghandi (1999) and Hathaway et al. (2001) both examined the relationship between women in a women's only STEM LLC and persistence in their intended majors, finding that LLC participation was beneficial in retaining women within their intended STEM major. Kahveci et al. (2007) examined the impact of a women-only science LLC on participants' experiences in STEM. They also found positive correlations with participation and persistence within the intended STEM major of study, highlighting increased participation in STEM based upon their experiences within the LLC. Hughes' (2010) study focused on examining how participation in a single-sex science LLC at a large research-focused university impacted participants' STEM career decision-making process. Hughes also found that female participation in a single-sex science LLC positively impacted female persistence in STEM.

In spite of these findings, few studies have explored the impact of the co-educational LLC model on female persistence in science disciplines. Johnson et al. (2006) is one of the few studies to examine a co-educational science LLC in order to determine the ways in which women's only versus co-educational STEM LLCs can impact the female experience. Ultimately, they found no difference between the impact of women-only and co-educational programs on women's participation and persistence within their intended STEM majors.

In addition, this small body of research primarily relied upon quantitative methods, with the exception of Kahveci et al. (2007) and Hughes (2010). Kahveci et al. (2007) employed a mixed-methods approach and Hughes (2010) utilized qualitative methods to research the impact of the single-sex STEM LLC model on the female experience in the sciences. While quantitative research has provided great insight into predictive persistence variables, it has also highlighted a need for qualitative research to fully understand the experiences of women in STEM (Ghandi, 1999; Hathaway et al., 2001; Kahveci et al., 2007; Szelenyi & Inkelas, 2011). In regards to recommendations for future research, Kahveci et al. (2007) found a need for more "theory-driven qualitative studies" in order to create more visibility to the "science and the science education committees" about the significance of LLC interventions in positively impacting women's persistence in STEM (p. 60). Therefore, the purpose of this study was to also expand on the current research pertaining to women in STEM by conducting a mixed-methods study based in feminist and standpoint theories of a co-educational science LLC in order to understand the impact of the LLC model on female persistence in STEM.

Feminist Analysis of a STEM LLC

This study embraced a feminist framework that centralized the role of gender in examining the factors that contribute to the persistence of women in STEM fields, specifically examining the impact of the LLC model as a positive intervention for women. This study employed Weiler's (1988) critical feminist theory to establish the ways in which society, specifically through educational practices, serves to oppress women and how feminist counter-hegemonic thinking can work to transform women's educational experiences in STEM. This study then built upon Weiler's critical feminist theory by highlighting three feminist approaches to science education that each focus on a different way of engaging women in STEM. Finally, this study explored how feminist pedagogies can transform the way women participate in their STEM learning experiences.

Gender Equity in Education

In regards to education, Weiler (1988) insisted that educational practices have worked to produce and reproduce gender under a system of oppression. This system has been based in patriarchal ideologies that serve to subordinate women by funneling them into "female friendly" disciplines and keeping them out of "male friendly" disciplines, such as STEM (Alvesson & Billing; 1992; Sadker et al., 2009; Weiler, 1988). Within feminist theoretical frameworks, reproduction theory has served as a foundation to understand the ways in which schools function to reproduce gender divisions and oppression. At the school site, feminist theorists have worked to uncover the role of schools in perpetuating the oppression of women in society (Weiler, 2001). In this regard, schools become highly politicized sites that work to enforce the hegemonic ideological views that privilege Eurocentric masculine ways of knowing and devalue the roles of

women in knowledge production (Harding, 2004; Ramsay & Letherby, 2006; Rose, 2004; Weiler, 1988).

In order to combat the oppressive nature of the educational system, critical feminist theory has looked at forms of resistance that serve to create collective oppositional movements to empower women and create change (Weiler, 1988). In this way, it differs from feminist reproduction theory, outlined above, by considering "human beings as agents who are able to contest and redefine the ideological messages they receive in schools" (Weiler, 1988, p. 40). When working within the reproductive nature of the patriarchal school system, Weiler (1988) argued that critical feminist theory must work to create opportunities for individual consciousness and resistance if the oppression of women is to change. Resistance is a key concept when examining the lives of women because it highlights their abilities as human agents to create their own meaning, but can also serve to further their oppression. Therefore, Weiler (1988) highlighted three themes important to examine when attempting to combat reproduction of gender oppression with resistance: each person has the ability to make meaning of their lives and to resist oppression, the capacity to understand and resist oppression is limited and influenced by gender, race, and class, and some forms of resistance utilized by individuals can lead to a deeper form of domination and even the oppression of others.

Due to the possibilities of resistance to further reinforce oppression, Weiler (1988) questioned the ability of resistance to really create change and called for a different way to view resistance. In order for critical feminist theory to create impactful change for women, it must redefine resistance to include not just forms of opposition but "more critical and politicized work in the form of organized and conscious collective oppositional actions" (Weiler, 1988, p. 53).

Weiler defined this critical, organized, and collective opposition as counter-hegemony. Weiler (1988) defined counter-hegemony as the "creation of a self-conscious analysis of a situation and the development of a collective practices and organization that can oppose the hegemony of the existing order and begin to build the base for a new understanding and transformation of society" (p. 53).

Creating and sustaining a feminist counter-hegemonic movement means that women need to begin by defining themselves in a society and intellectual tradition that has denied the existence of their experiences and ability to produce knowledge. In regards to education, the hegemony of the existing order is one based in male ideologies and productions of knowledge. The constructors of neutral sciences and its ideologies have historically been white males who have occupied privileged positions of power while women have been marginalized into positions of subordination (Harding, 2004; Harstock, 1998; Ramsay & Letherby, 2006; Rose, 2004; Weiler, 1988).

Feminist Theory in Science Education

As a form of knowledge production, science is not value neutral but historically situated within the cultural experiences of those who produce it (Barton & Brickhouse, 2006; Harding, 2004; Weiler, 1988). This knowledge is then transmitted through educational practices that reinforce the experience and understandings of the dominant group. Traditionally in STEM disciplines, the dominant hegemony is based in a male understanding of the world where the "implied speaker" has always been male and Eurocentric (Harding, 2004, p. 4). The overtly masculine nature of the STEM disciplines has not only resulted in women being shut out of the knowledge production process, but also in them being undervalued in and marginalized by their

STEM educational experiences (Harding, 2004; Harstock, 1998; Weiler, 1988). In order to transform the educational experiences of women in STEM, curricular and pedagogical interventions must be implemented to create sustained engagement of women in the sciences.

For feminist educators, the educational experience of women in STEM is more than a learning process focused on cognitive development, skill building, and knowledge production, it is also learning about how to engage in the science community (Barton & Brickhouse, 2006; Sinnes, 2006; Weiner, 2006). Incorporating engagement into the learning process means that learning is seen as an "embodied activity" that not only focuses on what skills and knowledge women are acquiring but also the "identities that girls generate or accept within science and science-related communities" (Barton & Brickhouse, 2006, p. 224). The development of a science identity is critical to a woman's continued engagement in the sciences because it determines if she decides to persist at the STEM undergraduate, graduate, and professional levels.

When developing educational initiatives to enhance the engagement of women in STEM, Sinnes (2006) found that feminist educators implemented initiatives that reflected a specific understanding of how a student's gender impacts how he or she learns and engages in science education. Depending upon how educators understand the impact of gender on learning determines the approach they will utilize to counter gender inequality. By applying feminist theories and critiques of science education, Sinnes (2006) discovered three feminist approaches most commonly used by science educators to increase student engagement: gender neutral, female friendly, and gender sensitive. Each approach represented a distinctly different

understanding of how gender impacts student learning and what types of initiatives are needed to increase women's engagement in STEM.

Gender-neutral science education. Sinnes (2006) described gender-neutral science education as an "equality feminist" approach based in an understanding that no difference exists in how men and women engage in the sciences (p. 74). Equality feminists believe that women have been "kept away from science because of political and social forces external to science" and, if given the opportunities to engage in the sciences, will "produce exactly the same scientific knowledge as males" (Sinnes, 2006, p. 74). For equality feminists, science is objective and value free. They have argued that the gender of the researcher does not impact the researcher's ability to produce scientific knowledge, but that the gender of the researcher does impact research priorities (Sinnes, 2006). If women are given equal opportunities to engage in STEM, equality feminists have contended that society would greatly benefit from the contributions of female scientists because the experiences of women would be given priority in the research.

In regards to science education initiatives, equality feminists have created gender-neutral educational environments that provide the same opportunities and challenges for women and men. They have implemented gender-neutral initiatives that are "equally relevant to both boys and girls" in order to actively engaged all students (Sinnes, 2006, p. 80). Educational materials utilized in the science classroom have portrayed women and men in untraditional gender roles that equally highlight the science accomplishments of both genders. Students have also been exposed to an equal number of female and male teachers who have employed gender-neutral teaching practices. These practices have included giving male and female students equal

attention, utilizing non-discriminatory language, and insuring that women have equal opportunities in science labs (Sinnes, 2006).

Female-friendly science education. In contrast to equality feminists, female-friendly science education is based in an understanding that distinct differences exist between how men and women engage in science. Sinnes (2006) referred to female-friendly science education as a "difference feminist" approach to understanding how gender impacts student engagement (p. 76). Difference feminists have insisted that by "valuing characteristics associated with masculinity higher than feminine or female characteristics," equality feminist reinforce and reproduce male ideologies as the norm (p. 76). For difference feminists, society is not gender neutral. Rather, they have found that men and women develop differently, learn differently, and have different attitudes and identities that impact how they engage in the sciences. Due to this, difference feminists have worked to acknowledge and value the differences between the genders in order to create inclusive educational environments for women.

The beliefs of difference feminists have included that women contribute to science knowledge production in different and better ways than men. Due to their underprivileged position in society, difference feminists have emphasized that women are able to be more objective in their observations, and their objectivity provides them with an advantage over their male counterparts to better see and understand the complexities of the individual in their research (Sinnes, 2006). Another way women have been seen as contributing differently to the production of scientific knowledge is their socially responsible approach to scientific inquiry. Difference feminists have contributed this to women having an "ethic of caring" and men having

an "ethic of right" when it comes to their research priorities, which has resulted in a more democratic and environmentally responsible scientific inquiry process (Sinnes, 2006, p. 76).

As a science education initiative, difference feminists have focused on creating curriculums that are inclusive of women by integrating the contributions of women in the sciences into the classroom and adding to the research on how women engage in the sciences. In addition, teaching materials have focused on reflecting women's experiences, highlighting the ways in which scientific knowledge is influenced by those who have created it, and functioning as intentionally "political in terms of visualizing the oppression of females" in the sciences (Sinnes, 2006, p. 80). Difference feminist teachers have utilized various feminist pedagogical models that are sensitive to engaging women in the classroom and, at times, have employed separatist initiatives where men and women are separated by gender in the classroom or at the school site.

Gender-sensitive science education. The last approach that Sinnes (2006) explored was gender-sensitive science education, which she referred to as "postmodern feminism" because it was based in postmodern ideologies (p. 78). Postmodern feminists have challenged difference feminists because they have felt the term "woman" is socially constructed and is too narrowly defined as one group with only one set of cultural experiences. Rather, postmodern feminists have focused on seeing women as multidimensional with multiple groups and multiple experiences defining their lived experiences. Postmodern feminists have sought to acknowledge the difference between all individuals, regardless of their gender, by valuing each individual's experiences and working to make those experiences relevant to the learning of science.

In the scientific knowledge production process, postmodern feminists have focused on valuing the contributions of both women and men. Unlike difference feminist, they have not espoused the belief that women produce better knowledge than men, but they have felt that increasing women's involvement in scientific inquiry is necessary to provide greater opportunities for women to have "the possibility of telling their scientific story" (p. 79). By continuing to exclude women from scientific inquiry, postmodern feminists have contended that all knowledge production continues to be male dominated and reserved for the experiences of only one segment of society, when it should be expanded to include and value the experiences of all segments.

Gender-sensitive science education initiatives utilize curriculums and educational materials that include "science developed by minorities and other cultures" and "visualize the differences between different types of scientific inquiry," highlighting the "social and political factors" that impact science (Sinnes, 2006, p. 81). In the classroom, postmodern feminists have focused on determining student interests by engaging all students on an individual level, not by their gender. This focus has allowed teachers to see each student as an individual and to create classroom activities that are responsive to the varying perspectives of each student. In doing so, teachers have worked to acknowledge the cultural experiences of all individuals and to create inclusive educational practices that value everyone's scientific contribution.

Feminist Pedagogies in the Science Classroom

Feminist pedagogical practices are crucial in engaging women in science education because the marginalization of women in the knowledge production process begins in the classroom (Sadker et al., 2009). While each feminist approach to science education is based in a

different understanding about how gender impacts student learning, they are all united in their desire for inclusive classroom pedagogies that engage women in STEM. For feminist educators, this means employing feminist pedagogies that are grounded in a "concept of experience" (Weiner, 2006, p. 88). Within this concept, the classroom is viewed in terms of "extending inclusiveness, democracy, [and] participation in the pedagogic process, [while] utilizing the authenticity of personal experience as a counter to impersonal, academic forms of knowledge" (Weiner, 2006, p. 88). This focus has allowed feminist educators to create relationships that challenge the traditional patriarchal authority structures by equalizing the classroom power structure (Barton & Brickhouse, 2006; Weiner, 2006).

In *Teaching to Transgress: Education as the Practice of Freedom*, bell hooks (1994) found that students contributed to classroom dialogue through "authority of experience," a concept based upon the collective understanding that each person brings experiential knowledge into the classroom and this knowledge serves to enhance the learning experience for all students. In the classroom environment, "many white males have brought to the classroom an insistence on the authority of experience that enables them to feel that anything they have to say is worth hearing" and that their "ideas and experiences should be the central focus of the classroom discussion" causing women to feel that they "will be judged as intellectually inadequate" (hooks, 1994, p. 81). This thought process highlights the reproduction of societal domination, where male and female students bring into the classroom certain behaviors that mirror their roles within a white patriarchal society (hooks, 1994). In this society, men have traditionally been valued as being the voice of authority and knowledge. Therefore, when male students enter into a

classroom that empowers them with the opportunity to participate, they tend to dominate the classroom environment and knowledge production process.

To counter this domination, hooks (1994) advocated for an engaged pedagogy, grounded in a critical thinking approach to learning, which required students to be critically engaged as active participants and not as silent or passive consumers in their education. Engaged pedagogy is achieved when the classroom environment is able to successfully function as a learning community that is concerned with acknowledging each person's presence, not just that of the professor or the male students. In order to be successful, it must maintain an ongoing recognition that each person influences and contributes to the non-hierarchical classroom dynamics in order to create an open learning community.

Creating an open learning community requires teachers and students to learn how to respect and value each person's experience by not organizing "authority of experience" into a hierarchical system. hooks (1994) acknowledged that it is not easy to establish an open learning community because students have not previously been trained to recognize their roles and the roles of other students in influencing classroom dynamics. Even though students are speaking in class, "they don't really know how to listen to other students" (p. 150). Getting students to listen to each other, and not just the male students or the professor, means that instructors must teach by example and be aware that they will have to work to "alter the existing pedagogical structure to teach students how to listen, how to hear one another" (p. 150). If this is accomplished, students and teachers will be able to create learning spaces where all voices are valued and heard, all students feel comfortable speaking and engaging in the learning process, and most

important for women in STEM, students will no longer fear that they will be judged as intellectually inadequate.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Introduction

As a model for intervention, LLCs are a unique opportunity to synthesize the recommendations for encouraging female persistence in STEM disciplines into a systematic approach that can be incorporated at the start of their undergraduate experience. Previous LLC research has found several increased benefits for student participants: first year retention, grade point average, critical thinking, civic engagement, co-curricular engagement, and academic transitions to college (Pascarella & Terenzini, 2005; Stassen; 2003; Zhao & Kuh, 2004). However, few studies have explored the impact of the co-educational LLC model on female persistence in STEM disciplines. The current research remains limited to the following: experiences of women in highly competitive women-only STEM LLCs and impacts on student retention within intended majors (Ghandi, 1999; Hathaway et al., 2001; Kahveci et al., 2007); women in women-only STEM LLC's and the causal effect on their graduate school aspirations (Szelenyi & Inkelas, 2011); the impact of the experiences of women in women-only science LLC's on their career decisions (Hughes, 2010); and the impacts of co-educational versus single-sex STEM LLCs on students' experiences (Johnson et al., 2006).

In addition, this small body of research has primarily relied upon quantitative methods, with the exceptions of Hughes (2010) and Kahveci et al. (2007). Hughes (2010) conducted a qualitative study with seven women in order to understand the effect of a single-sex STEM LLCs on their decisions to persist in the sciences and their career decision-making process. Kahveci et al. (2007) employed a mixed-methods approach in determining the impact of women's LLC

programs on female persistence within STEM. They distributed a survey to 36 participants and conducted participant observations and in-depth interviews with three of the participants. In their concluding paragraph for future research implications they noted:

> Additional theory-driven qualitative studies like ours that explore national and international interventions directed toward increasing the representation of women in [STEM], and making these interventions and their significance more visible to science and the science education committee are needed. (Kahveci et al., 2007, p. 60)

Therefore, the purpose of this study was to expand on the current research pertaining to women in STEM by conducting a mixed-methods study, based in standpoint theory, of a co-educational science LLC in order to understand the impact of the LLC model on female persistence in STEM majors.

Research Design

To understand the lived experiences of women in STEM, it was essential that the voices of the women in this study were given the opportunity to be heard and for their unique perspectives to inform the research. Historically, the voices of women have been excluded and marginalized by the patriarchal hegemonic conceptual frameworks that have served to guide scientific inquiry (Harding, 2004; Harstock, 1998; Weiler, 1988). The overtly masculine nature of the sciences has served to reinforce the invisibility of the female experience by underscoring its value in contributing to theoretical and methodological thought (Harding, 2004; Harstock, 1998; Rose, 2004). It is due to these factors that I utilized standpoint theory as the methodology to guide the research and data collection.

Methodology

Standpoint Theory

Standpoint theory first emerged in the 1970s and 1980s as a critical feminist response to the Eurocentric male ideologies that have dominated power and societal knowledge making (Harding, 2004). The constructors of neutral sciences and its ideologies have historically been white males who have occupied positions of power and, therefore, marginalized women into positions of subordination (Rose, 2004). In regards to scientific inquiry, these factors have resulted in the "implied speaker" always being male and Eurocentric (Harding, 2004, p. 4). The patriarchal domination of scientific inquiry has resulted in women and their abilities to make meaning being shut out of knowledge production. Therefore, in order to truly begin to understand the experiences of undergraduate women in the sciences and uncover the way in which the masculine nature of STEM works to marginalize them, a theoretical methodology that placed women and their experiences at the center of the research was necessary (Harding, 1998; Harding, 2004; Harstock, 1998; Rose, 2004).

Scientific knowledge has been dominated by male ideologies that have served to subordinate women and their ways of knowing, often resulting in women's research being devalued and ignored. Within knowledge production, meaning has primarily only attributed to those thoughts deemed rational and objective by a masculine understanding. This understanding has created a preference for male styles of reasoning or objectivity and, in turn, has devalued women's reasoning styles as less than ideal (Harding, 1998; Harstock, 1998). Within this subordinate position, women's issues have been pigeon holed as only being relevant to women, and their research has been deemed as "folk knowledge," incapable of informing

methodological, theoretical, and political thought (Harding, 2004, p. 3; Rose, 2004). By devaluing women's research, masculine ways of knowing have become privileged as ideologically sound and value neutral. Harding (2004) posited that value-neutral research is another way in which dominant groups work to advance their hegemonic interests and, in doing so, fail to detect the realities of social relations that account for the experiences of the "other," those marginalized by the dominant group's interests and ideologies.

Standpoint theory is about power and the ability to construct knowledge from more than one perspective. Knowledge is socially situated and constructed; therefore, the situations of oppressed groups will always be different from those experiences of the dominant group (Harding, 2004; Harstock, 1998). But the power dynamic between the dominant and marginalized groups enables the dominant group to produce distinctive types of knowledge that subordinate, marginalize, and silence the experiences of the marginalized groups (Rose, 2004). While this domination enables the production of distinctive types of knowledge, this knowledge is based upon the limited experiences of the privileged groups. In order to create knowledge that is inclusive of all groups, research should seek to uncover experiences that provide "different perceptions of ourselves and our environments" (Harding, 2004, p. 7). Therefore, feminist standpoint theories start from the belief that power and knowledge are connected, but not all power and knowledge belong to those in the dominant group.

Starting research from a feminist standpoint challenges the relationship between the production of knowledge and power by empowering the oppressed groups, who have been disadvantaged by the dominant conceptual framework, and valuing their experiences in the research (Harding 1998, 2004; Harstock, 1998). To remedy the inadequacies of the dominant

conceptual framework in guiding and informing mainstream epistemologies and methodologies, standpoint theory emphasizes that research must start from the perspective of women's lived experiences. Beginning from the standpoint of "the other" provides an opportunity to start thinking differently about cultural differences and power relations by highlighting how each of these differences can contribute to enlarging our knowledge base (Harding, 1998; Harstock, 1998).

In the case of women, standpoint theory offers an opportunity for women's voices and experiences to be privileged in the research because it values their distinctive and different understandings of social relations and how gender provides differing ways of knowing (Harding, 1998; Harstock, 1998). By starting from the experiences of women, standpoint research enables women to develop a group consciousness that seeks to design, value, and engage in the kinds of research that can "transform their consciousness to begin to see the possibilities of ending their oppression" (Harding, 2004, p. 5).

As a methodology, standpoint theory provides a "conceptual framework for analyzing the resources that women's distinctive standpoints on nature can provide for science and technology policy for the social studies of science and technology" (Harding, 1998, p. 90). Privileging the voices of women in the research can increase our understanding of human knowledge and the ways in which gender impacts that knowledge. Feminist standpoint theory accomplishes this by bringing subjective and objectives ways of knowing together, starting with and continually returning to the subjective shared experience of women's oppression (Harding, 2004; Harstock, 1998; Rose, 2004). It works to explain inaccessible accounts of nature and social relations that provide valuable resources to social justice movements by enabling researchers to create

oppositional and shared consciousness in oppressed groups (Harding, 2004; Harstock, 1998). Standpoint theory flips the relationship between researcher and research subject by providing women, as the oppressed group, the opportunity to become "collective subjects" of research rather than only as "objects of other's observations, naming, and management" (Harding, 2004, p. 3). In this way, the experiences of women, "the living participating I," provide women and researchers with an opportunity to redefine what is and what is not objective knowledge (Rose, 2004, p. 76).

Redefining what constitutes valuable philosophies, methodologies, and theories is a crucial task in elevating the importance of the female experience in the production of knowledge and power. Beginning research projects from the standpoint of women's lives can highlight the ways in which dominant institutions and their conceptual frameworks serve as oppressive forms of power (Harding, 2004; Harstock, 1998). Within higher education, it is necessary to personify the main objective of standpoint theory to uncover the institutionalized practices that work to rationalize and funnel women into 'female-friendly disciplines' while maintaining the marginalizing masculine nature of the sciences (Harding, 2004, 1998; Harstock, 1998; Rose; 2004). Employing a feminist standpoint approach to research calls for uncovering and utilizing the unique resources of women's particular social locations in order to identify and provide an "objective understanding of the sexist androcentric presuppositions shaping dominant institutions, their conceptual frameworks, cultures, and practices" (Harding, 1998).

By beginning research from the position of the female STEM students, instead of the generally accepted quantifiable Eurocentric masculine methodologies that dominant scientific thought and inquiry, this study privileged the voice of the female participants in order to better

understand their lived experiences. This ways of knowing, of creating knowledge from the standpoints of women, best explains their oppressive positionality within the STEM discipline because it possesses "strong objectivity" developed through the rigorous practice of understanding and presenting their particular standpoints (Harding, 2004, p. 131). In this regard, Harding (2004) argued that standpoint theory, versus other mainstream methodologies, is scientifically better suited for knowledge projects that seek to best understand the unique perspectives of oppressed people. The reliability and validity of standpoint research comes from the rigorous task of collecting narratives to uncover a standpoint through an intimate process that produces findings more closely connected to the realities of the participants (Harding, 2004). Through focus groups and interviews, this study proposed that the standpoint of undergraduate women in STEM possess a unique perspective in understanding the ways in which institutionalized oppression continually operates to marginalize women in the sciences.

Research Question and Hypothesis

To better understand the impact of a co-educational STEM LLC on the persistence of women in their intended majors, the following primary research question guided this study:

> What are the gendered experiences of freshman women participating in a co-educational STEM LLC? How do these experiences affect their academic performance, co-curricular engagement, and persistence in STEM fields?

This study examined how the environment created by the SEAP co-educational LLC model served to create spaces for women to feel included within the scientific culture of the STEM discipline and, therefore, positively impacted their persistence in the sciences.

Research Site

I conducted this study at a mid-sized religiously affiliated liberal arts college in an urban area that employed a co-educational STEM LLC for its freshmen Biology and Natural Science majors. The Associate Dean of the College of Science created SEAP and launched it in the fall of 2007. The implementation of the program came about in the hopes of establishing a learning environment conducive to increasing student engagement in their science disciplines, their academic performance, their interactions with students and faculty, and their freshman retention for mid-level performing students.

A program mailer sent to their homes first introduced potential participants to SEAP before they attended freshman orientation. During freshman orientation, academic advisors and the Associate Dean of the College of Science approached potential SEAP participants to further discuss the merits of the program. Recruitment and selection was based upon high school academic performance, defined as high school cumulative GPA and SAT scores, and performance on the university math placement exam. Based upon their math placement scores, science students placed into three levels of math courses: high performing students into calculus, mid-performing student into pre-calculus, and low-performing students into algebra. The students who placed into pre-calculus were those recruited at freshman orientation to participate in the SEAP community.

Based upon historical student performance and retention trends, the College of Science has found that those students who place into pre-calculus are less likely to persist in their intended STEM majors. Hence, the College of Science created SEAP as a yearlong freshman-only program to ensure that students felt supported in their academics from the start.

Participation in the program has required that students live on the same floor of a freshman residence hall, enroll in SEAP only academic courses, and engage in SEAP specific co-curricular opportunities and activities that complemented their academic curriculum. In any given year, the SEAP community has been made up of 19-24 Natural Science and Biology majors with at least 60% of the participants being female, an impressive population considering the College of Science did not create the program to be a single-sex LLC geared towards women-only issues and the average gender make-up of the College of Science has been 48% women.

At the time of this study, SEAP was recruiting its sixth cohort, yet very little was known about its impact on students, especially on its female participants. Assessment of the community had only focused on academic outcomes regarding cumulative GPA and student persistence at the university, although this small body of data did look promising. According to the Associate Dean of the College of Science, students who participated in SEAP on average earned higher GPAs compared to non-SEAP Natural Science and Biology majors, retained at the institution at a higher rate than their non-SEAP counterparts, and were more engaged in co-curricular activities. Missing from the assessment was how these findings could be distributed across gender, the rates of SEAP persistence in their intended majors, and the impact of SEAP on the academic experiences of its participants.

Entry

The development of relationships between faculty, participants, and me facilitated my entry to this site. For this study, the Dean and Associate Dean of the College of Science and the participating female students granted me access to all SEAP activities and programs, to the

residence hall where the SEAP students resided, and to the faculty who created and coordinated the SEAP program at the time of this study.

Participants

I selected the female students invited to participate in this study based upon the following criteria:

1. They participated in the SEAP LLC during their freshman year.
2. At the time of the study, their academic majors reflected their intended STEM major and their academic standings, verified by units earned, placed them in their senior year or having recently graduated from the university.
3. They had to be able to be physically present for the focus group and in-depth interviews. Therefore, I did not invite those women who had recently graduated and moved out of the area to participate.

By focusing on those female students who have remained in their intended major after their SEAP experience, this study was able to highlight the impact of the LLC on their academic experiences. The selection of participants who have achieved senior or graduate academic standing served two purposes. First, based upon the STEM curriculum for the College of Science, these students would have been immersed in or completed their upper division science-only curriculum at the time of the study. Second, by selecting senior standing and recent graduates, the probability that they would change their major was minimal. The rigor of the last two years of the STEM curriculum coupled with the persistence of these women in their intended major created an opportunity for these women to inform the research by providing a unique perspective of their experiences. I invited approximately 18 women who fulfilled the criteria

listed above to participate in the study. Nine of the 18 women responded to the focus group invitation and participated in the focus groups. Of the nine women who participated in the focus groups, I invited seven of them to participate in the in-depth one-on-one interviews and all seven of them partook in the interview portion of this study.

Methods

This was a mixed-methods study examining the impact of the SEAP LLC model on female persistence in STEM fields, particularly in Biology and Natural Science. I conducted this study through a series of qualitative and quantitative methods to provide an in-depth examination of the female experience in STEM by focusing on the perceptions of the students.

Focus Groups

Focus groups served as one of the primary data sources because of their ability to examine group interactions to produce data and insights that would be less accessible in one-on-one interviews (Hatch, 2002). In addition, focus groups also work best when trying to explore the perspectives of particular groups on specific topics (Hatch, 2002). For the purposes of this study, the focus groups were a significant component to understanding the dynamics between the SEAP participants and how the LLC model created support networks that served as valuable interventions.

In an effort to determine if the LLC model fostered female relationships that served as a support mechanism and an intervention model for female persistence, I conducted the focus groups during the Fall 2011 semester and focused on the women's SEAP experiences in retrospect, their academic plans for the next year or plans after graduation, and the reasons they persisted in their majors.

To insure accuracy, I addressed threats to validity, articulated as inaccuracy and incompleteness of participants' responses, through audio-recorded focus group sessions, moderator notes, verbatim transcription, and member checks (Marshall & Rossman, 2006; Maxwell, 1996). I addressed threats to validity, seen as vulnerability due to self-report bias, by triangulating these findings with methods that did not have the same biases or source of invalidity, such as interviews, unobtrusive data, and artifact analysis (Marshall & Rossman, 2006; Maxwell, 1996).

Interviews

The second data collection method I used was in-depth and semi-structured interviews that employed guiding questions, allowing for open-ended responses that "encourage[d] informants to explain their unique perspectives on the issues at hand" (Hatch, 2002, p. 23). I conducted the first set of interviews in conjunction with the focus groups and after the focus groups concluded. According to Hatch (2002), this method provides an opportunity to "explore more deeply participant's perspectives on actions observed by the researcher" (p. 91).

Set 1 consisted of one-on-one interviews with the SEAP female participants after their focus groups. While this study hoped to create a safe environment in the focus group setting, I still understood that some women might not be as open to sharing their perspective when surrounded by others. Therefore, I followed the focus groups with one-on-one interviews with the participants to create an environment that would eliminate any fears about their perceptions being devalued by the group and to further explore the meaning of their responses. I structured these interviews like conversations that served to uncover the participant's "perspective on the phenomenon of interest" as the participant, not me as the researcher, viewed it (Marshall &

Rossman, 2006). In addition, the conversation structure was also a key to conveying to the female participants that their views on and experiences in STEM were "valuable and useful" (Marshall & Rossman, 2006). Initial questions for these interviews, which were employed to begin the conversation, were generated based upon their focus group responses.

Set 2 was a one-on-one interview with the key administrator charged with creating the SEAP LLC program. The purpose of interviewing the Associate Dean of the College of Science was to provide the perspective of the administrators in regards to the issues and to have a greater understanding of the program and policies (Foley, 1990; MacLeod, 2009; Marshall & Rossman, 2006; Valenzuela, 1999). I incorporated this interview into the research in order to provide historical context for the creation of this program, understand the college's perceptions of female persistence in STEM majors, and discover the long-term goals of the SEAP model.

Similar to focus groups, I addressed the threats to validity, articulated as inaccuracy and incompleteness of participants' responses, by audio-recorded interviews, interviewer notes, verbatim transcription, and member checks to insure accuracy (Marshall & Rossman, 2006; Maxwell, 1996). I addressed threats to validity, seen as vulnerability due to self-report bias, by triangulating these findings with methods that did not have the same biases or source of invalidity (Marshall & Rossman, 2006; Maxwell, 1996). For Set 1, I triangulated interview data with focus group responses, administrator interview responses, and unobtrusive data analysis. I triangulated the Set 2 interview with the Associate Dean with findings from the focus groups, student interviews, and unobtrusive data analysis.

Unobtrusive Data

I triangulated the focus group and one-on-one data with a simple statistical analysis of academic performance variables. The variables identified for this study were: high school cumulative GPA, SAT scores, freshman year cumulative GPA, freshman year university retention, and freshman year in-college retention. I collected these data for the Fall 2007-2011 SEAP and College of Science freshman cohorts. I selected these cohort years based upon the fact that they represented all SEAP cohorts who have completed their freshman year. I then disaggregated the data into four groups: SEAP cohort, SEAP female cohort, College of Science freshman cohort, and the College of Science freshman female cohort. All data collected only pertained to the freshman year because this is when the students participated in SEAP.

The purpose of utilizing unobtrusive data was the alternative perspective it could provide in researching the impact of SEAP on its female participants. Unobtrusive data can tell their own story about the phenomenon being studied, which is crucial when triangulating findings from other data sources because unobtrusive data are independent of the perceptions and self-report biases of participants being interviewed and observed (Hatch, 2002; Marshall & Rossman, 2006). In addition, unobtrusive data could aid in establishing "history and context in which to ground the findings generated from other data" (Hatch, 2002, p. 120) and provide insight into the "values and beliefs of participants in the setting" (Marshall & Rossman, 2006, p. 107). Therefore, this information provided a historical examination of SEAP persistence patterns in intended STEM majors and retention patterns at the university, and it also helped to understand the values and beliefs of the SEAP environment and the College of Science towards female persistence.

Data and Coding

I collected the data for this study using the following qualitative and quantitative methods: focus groups, interviews, and unobtrusive data analysis. I analyzed qualitative data through a feminist critical lens employing standpoint methodology that privileged the voice and experiences of the SEAP female participants in the research. Chapter 4 presents the findings in the form of narrative excerpts from the focus groups and interviews. I coded all qualitative data from the study utilizing inductive analysis to discover patterns and themes in the data rather than stipulating the analytic categories before the coding process (Marshall & Rossman, 2006). I then separated the coded data by themes supporting the premise of this study. I triangulated emerging themes through discussion with the participants, literature that substantiated the findings, and unobtrusive data analysis supporting findings from the focus groups and interviews. I analyzed the quantitative data collected for this study through simple statistical data analyses to determine patterns in the SEAP students' major migrations, first year persistence rates, academic major persistence rates, and academic performance. I also triangulated these data with findings from the focus groups and interviews.

Safety of Evidence

I audio recorded all focus groups and interviews and a third party transcribed them. To ensure anonymity of the participants, the university, the college, and the LLC, each received a fictitious name. I kept audio recordings in a secure lock box labeled by fictitious names and secured all other data on one computer with coded access.

Limitations

This study had two major limitations: the first limitation was my dual role as researcher and university administrator, and the second limitation was my reliance on interviews as a primary data source. As the Director of the Office of First Year Experience, I was charged with the freshman retention effort and working to create intervention models that ensured a 90% retention of freshman students into their sophomore year. From this perspective, I saw the LLCs as a promising model to effect real change across the freshman class by positively impacting student persistence within majors and at the university. My positionality within this research meant I had to be diligent in creating my own interventions of reflection and outside perspectives to ensure that my bias did not negatively distort my findings.

The second limitation was my reliance on interview responses, in both the focus group and one-on-one interviews, as the primary data source for this study. Both focus groups and interviews required the participants to be willing and comfortable sharing their experiences in the areas I hoped to explore, specifically their experiences in STEM (Marshall & Rossman, 2006). Even if they were comfortable sharing their experiences, they may not have been aware of the "recurring patterns" in their lived experience and may have had trouble articulating these patterns in the interview (Marshall & Rossman, 2006, p. 101). To address this limitation, I worked to hone my listening skills and ability to inspire confidence and trust with my participants, and I also developed gentle probing techniques to facilitate response elaboration (Marshall & Rossman, 2006).

CHAPTER 4

RESEARCH EVIDENCE AND ANALYSIS

Introduction

The purpose of this study was to expand on the current research pertaining to women in STEM fields by conducting a mixed-methods study of a co-educational science LLC to better understand the gendered experiences of undergraduate women in STEM. In addition, this study sought to identify barriers to female persistence, defined as persisting in their intended STEM majors from their freshman year through graduation, from the perspective of the students. This study also sought to understand the impact of the LLC model as a viable intervention to positively impact female persistence in STEM.

This chapter presents the data that I collected through SEAP female participant focus groups, in-depth SEAP female participant one-on-one interviews, and the collection of unobtrusive data. The unobtrusive data collected for this study and presented in this chapter focused primarily on the academic records of the 2007-2012 SEAP and College of Science freshman cohorts. I collected these data with the intention of answering the research question guiding this study:

> What are the gendered experiences of freshman women participating in a co-educational STEM LLC? How do these experiences affect their co-curricular engagement, academic performance, and persistence in STEM fields?

I analyzed the qualitative data collected for this study through a critical feminist lens utilizing standpoint methodology and coded utilizing inductive analysis. Through an ongoing process, the inductive analysis provided me with an opportunity to discover emerging patterns.

As the result, I identified the following four themes: (a) the significance of social identity in a STEM LLC; (b) heteronormative assumptions and feminism in a science LLC; (c) the role of community in creating an inclusive environment; and (d) the role of community in creating an inclusive academic space promoting female success in STEM. I collected the quantitative data and analyzed it utilizing a simple statistical analysis of key academic variables indicative of student success, including cumulative high school GPAs, SAT scores, first year cumulative GPAs, freshman persistence patterns in their intended major, and freshman retention patterns at the university.

The findings from this study are reported here and are organized by the four themes outlined above.

Theme One: Significance of Social Identity in a STEM LLC

In the next sections, I use the participants' pseudonyms and share direct quotes using the initials S.P. to denote Study Participants. During the focus group, one participant highlighted an emerging theme among all the female participants in the study regarding concerns about joining an LLC focused on their academic major and their inherent desires to belong to a community, have friends, and create a college experience distinctly different from their high school experience. She stated, "I was kind of unsure about it. I just imagined it was going to be a bunch of nerdy science kids . . . but I knew it would help me make friends really easily" (Chloe, S.P.).

This section is divided into two sub-patterns. Sub-pattern one focuses on the participants' negative perceptions of what participants in a science LLC would be and the impact of those perceptions on their college experience. Sub-pattern two highlights the female

participants' concerns about making new friends in college and their desires for a built-in social community.

Negative Perceptions of a Science LLC

Before they attended the freshman orientation, the women received a mailer at their homes introducing the SEAP program through a brochure and a letter from the Dean of the College of Science. For most of the women, this first introduction was also when many of them initially decided not to participate, a decision that stemmed from a concern that the other participants would be a bunch of "science geeks." One participant felt that "they're all going to be dorks and super book worms and oh, heck no, I am not going to be in this little group and not explore college" (Janis, S.P.). Another echoed this concern because she believed that SEAP would consist of a "bunch of science geeks that are kind of weird" (Catherine, S.P.).

Once the women attended freshman orientation, they had an opportunity to meet other science majors and potential SEAP participants. While freshman orientation helped to alleviate some of the women's concerns about joining SEAP, for one this experience only served to reinforce her science geek concerns about SEAP:

> Yeah, [Peter] was in my group, and he's, he's almost a nerd. He likes to study but he's really socially awkward. So, I was kind of nervous about that. (Linda, S.P.)
>
> Question: You talked about how you were a little bit nervous about [Peter] because he was socially awkward, why did that make you nervous?
>
> That the rest of the group would be. (Linda, S.P.)
>
> Question: And if they were all socially awkward, what would that mean?
>
> I'm not sure, I guess I was just hoping that SEAP would be like, the big community, and it was . . . but before I knew about that and so, I was worried that if everybody was socially awkward that it would be harder to find good friends within the group. (Linda, S.P.)

Impact on their college experiences. When deciding to join SEAP, one participant's fear that SEAP would consist of a "bunch of science geeks that are kind of weird" was more aligned with her desire to have a college experience different from her high school experience. She viewed college as an opportunity to be less shy than she was in high school and to "branch out more" (Catherine, S.P.). She was concerned that spending time with the "science nerds" would thwart this desire because "they aren't really the most outgoing people," and, if she was going to be surrounded by them, she felt she would be "taking a step backwards" (Catherine, S.P.). Being defined by the other SEAP participants was also a concern for others. One was concerned about how her membership in SEAP would alter her non-SEAP peers' perceptions of her and how that might negatively impact her college experience:

> I just felt like if I was going to be surrounded by them. I was afraid that people were going to assume that I was like them. That association, you know, so I was like, oh, I don't want to be. You know, I'm going to this new school, like I want to, you know, have this, you know, new persona about myself. I want to start fresh, why would I be you know, affiliated with the stereotypical geeks. (Janis, S.P.)

Another was concerned about how the group would impact her ability to meet others, and, if the group was comprised of nerds, how would she be able to fit in:

> That was more, if I'm surrounded by people that were all nerds, would I make other friends? Or would I not fit in, cause I don't like, I don't consider myself a nerd, I don't study as much as other people. (Linda, S.P.)
>
> Question: Okay, so nerd equals studying a lot?
>
> Yeah. And just, like not wanting to go out and have fun, and all they do is studying basically. Um and also I think nerds don't have a ton of social skills. So I was worried about that. (Linda, S.P.)

In her one-on-one interview, I asked one participant to expand on the term "science geek/nerd" and why this perception was so troubling for her. She indicated:

> Maybe it's just not having, like, great social skills. Only studying, um not interacting well with other people, and just like, not being fun. Because I was going to college, I didn't want to like, sit and study in my room all the time, I wanted to like, meet new people and like, have new experiences. So like, I just saw that and I was like, oh, like, I don't want to live with a bunch of kids that are just going to sit and study all the time. Um, and like, take school, way too seriously. (Chloe, S.P.)

The characterization of a science geek or nerd expressed by these women suggested an individual who spends most of their time studying, does not socialize frequently with others, and is socially awkward.

Only one SEAP participant in the study was not concerned about the possible science nerd association because she actually perceived herself to already be "that kid:"

> Right, exactly, so it was just, that like, I'm, I'm a huge nerd. There's no getting past it. And so, being "that kid" was just like, I, I guess I've always just known what I wanted to do and I've gone for it. And a lot of the times, I know people can do things for the wrong reasons, oh, well everybody else is doing it or oh, I just want this part of it, so I guess I'll sacrifice doing this to get what I want. Where I just like, I, I knew it was something I wanted to do, it sounded awesome, it sounded like a great opportunity to be more involved in the sciences. More of the classes are based around science, which I enjoy, then I'll enjoy my classes. (Mary, S.P.)

As a self-proclaimed science nerd, she was exactly what the other women had been concerned about when joining SEAP. During her one-on-one interview, I asked her about the initial concern that many of the women expressed about SEAP being a bunch of science geeks and nerds and if this was a concern for her:

> I don't know if I am going to say anything remotely close to what they have said. But I would say I'm a science nerd not a science geek, because being a nerd is kind of like, I think of being a nerd as the person who loves to go to school. The person that loves what they do and they love academia, versus a science geek. I feel like they're just good at it. Cause I have a friend that I consider a geek who is, he doesn't have to study, he just knows all the stuff, can regurgitate it onto his text and explain it to you, just as poorly as the teacher did because it is so complex. He gets it. And then they lack the social side. It's almost like they're so smart they don't know what to do with themselves. (Mary, S.P.)

Even though Mary self-identified as a nerd, she also created a clear distinction between herself and the science geek persona that was causing concern for the other women. For her, nerd was equivalent to having passion for their subject, but geek suggested someone who lacks social skills and a passion for their academic pursuits.

Desire for a Built-In Social Community

While there was a concern about the type of students who may join SEAP, a strong desire to have friends overshadowed this concern:

> The living situation, how they take classes together, and lived together. I thought that would be really nice because socially I knew it would help me make friends really easily, and the people in my classes I could get help with. (Chloe, S.P.)

Linda and Chloe also saw this opportunity to make "instant friends" (Chloe, S.P.). For all the women, the fear of not having friends was a major concern in their transition to college. The desire to make friends for one participant stemmed from a fear of not having any:

> I knew going into college, everyone has to try to make friends and this would be a way that I could have friends without having to try too hard. So that was important because I didn't want to have no friends in college. (Linda, S.P.)

While she was concerned with not having to try too hard to make friends, another was concerned with her ability to be outgoing enough to make friends, and she viewed SEAP as helping her overcome this:

> So I think it was more like, the uncertainty of being able to make friends, but then I'd be like oh, but I have this group of friends that I could just hang out with until I like, maybe find other friends. I don't know, I like, I'm like outgoing, but I'm not, I'm not necessarily good at like, going up to people and being like, oh yeah, like, let's hang out, or like starting a conversation with some random person. So I just thought it'd be like, kind of already like, um, automatic friends, almost. (Chloe, S.P.)

For another participant, it seemed to not necessarily matter if they all became friends but she did insist:

> I did like the fact that we'd be living together. And in my head thought we would be close and whether I like the other people or not, that's another story, but at least we would have a bond. (Karen, S.P.)

In addition to the residential aspect of the community, the students were also expected to arrive to campus a week before classes began so they could participate in the SEAP Adventure, a three-day pre-class excursion for building community. Many of the women indicated that this trip was one of the reasons they decided to join SEAP because they felt that it would provide a chance to meet people before the rest of campus moved in and this would allow for more opportunities to make friends. For one, the trip was the deciding factor in her decision to join SEAP:

> Having to come before school started, so we came three or four days early, so we were able to bond over, over just hanging out and not having to worry about classes. And then I also knew that within, like, having to come early would make us all be friends cause we would have no one else on campus to hang out with. (Linda, S.P.)

Similar to Linda, another indicated that the pre-excursion trip and the community residential arrangement were the reasons why she decided to join SEAP. She was worried that she would never make new friends and that it might be difficult for her to transition to her new college environment. She felt that the built-in community would help lessen her concerns because:

> I think the fact that we lived together, was one really big thing. Also, the [SEAP Adventure], which is when we move in a week early. You don't have to worry about the crowds and you get to know anyone else. I was, I think, one of two students from my high school who came to [the University], so I knew no one. I was so nervous, which is probably one of the reasons why I just nodded yes to SEAP. So I figured when [the Associate Dean] said, 'you get to live with them, you get to move in early, and meet them early, and you have a group before you actually start school' was kind of a really big thing for me. In my head, I was thinking I'm never going to have friends and it's going to be so hard and I was so scared and nervous. And I think that was one thing that really made me think. Okay, I'll have people that I will be in classes with, and I'll live with them, and we will do things together. So if anything, I'll always have this SEAP group. (Pam, S.P.)

While all of the women participating in the study viewed SEAP as an opportunity to make friends, two were also concerned about their abilities to focus on their academics and felt that SEAP would also provide additional academic support. One excelled in her science courses in high school, but was concerned about her ability to perform at the collegiate level:

> I mean like, I wouldn't mind taking [science] courses, like I enjoyed them, but I was, like, yeah, I would get As. They weren't hard. They weren't like, overly, like challenging where I couldn't take the course at all. So I think that yeah, I can handle it at high school level, but I can't imagine myself handling it at a college level. (Janis, S.P.)

Her concern about her ability to perform at the collegiate level was intensified when she attended freshman orientation. It was at orientation, when she was registering for her fall classes, that she learned that her Occupational Therapy major was in the College of Science. Prior to this, she stated:

> I never really saw myself as a science major, and I think that my impression of science majors was, you were a science major because you wanted to be a doctor or a scientist [not an occupational therapist]. (Janis, S.P.)

Yet, upon realizing she was going to be in the sciences, she was more inclined to join SEAP:

> I thought, it wasn't necessarily the faculty or the resources that SEAP provided, I just thought that if other students who are science majors that actually want to be science majors and are actually passionate about the subject, if I was going to be surrounded by people who are so passionate about science, I thought well, this is like a shoe-in for study groups and people to help me. So I didn't really think I was going to contribute at all, I thought they were going to just be helping me. Cause I was so unwilling to be a science major. (Janis, S.P.)

The other was the only participant in the study who was also an athlete and had to juggle the demands of her athletic training schedule with the demands of her academic major. Morgan felt that SEAP would provide her with the opportunity to focus on academics:

> I really did not think I was going to give academics the time of day if I didn't join SEAP. (Morgan. S.P.)

She also felt that the smaller SEAP classes would allow her more access to her faculty:

> I think that I was worried that I wasn't going to do so well, I was worried that I was going to have a lot on my plate. So I wanted to have a good relationship with my teachers, in a small, and I know I said I don't like it when my teachers know me, but I like it that they're there, that the option is there. That it's a small enough class size that, you know, I can go get help if I want it and I won't be overrun by these huge classrooms. So I think that the community wasn't super important with me, in terms of my peers, and also probably because I knew that I was going to be on water polo, and I was like oh I'll already have a community, I don't really care. (Morgan, S.P.)

She was also the only SEAP participant in this study who did not join SEAP for the community aspect. However, as previously stated, community was important for her; she just considered her community to be her water polo team. While she may have initially viewed her water polo team as providing her with a social community, she definitely viewed SEAP as providing her with an academic community:

> I think it would have been difficult for me if I had not been in SEAP cause I would have been the only one, I would not have been able to talk to anyone on my team about science and how hard it is, because nobody would have been able to relate. (Morgan, S.P.)

Analysis

The dichotomous relationship between science nerd and the desire to belong derives from the female participants' fears about transitioning to their new collegiate environment. The transition from high school to college creates a plethora of anxieties about navigating a new social climate, concerns about fitting in, and anxiety about meeting new peers and establishing new friendships (Chickering & Reisser, 1993). These anxieties can then result in a heightened sensitivity to peer perception and acceptance as evident in the women's concerns about joining the SEAP community and how their membership might impact their perceived ability to make new friends.

The fears about joining SEAP expressed by the women during the focus groups and one-on-one interviews can be viewed and best understood in relation to social identity theory. As indicated above, the transition to college requires these women to create new social communities and social identities (Chickering & Reisser, 1993). When creating a social identity, Taifel (1982) suggested that individuals are more likely to join groups they feel will have a positive impact on their identity and their ability to feel that they have successfully transitioned into their new social environment. Furthermore, Taifel (1981) indicated that an individual's self-concept derives from knowing he or she belongs to a social group and the emotional value he or she has placed on that membership. When joining a group, individuals will place value on the ability of the group to positively impact their identity. This value is determined by creating an in-group and out-of-group social dynamic that positively characterizes the in-group and negatively stereotypes the out-of-group (Taifel, 1982). By belonging to the perceived in-group, an individual's fear of uncertainty about his or her social identity can diminish and his or her self-esteem can increase (Taifel, 1982).

The women's concerns expressed during their interviews about joining SEAP demonstrated their desire to create a new social identity that would positively impact their college experiences. Their initial fears that the SEAP participants would be a bunch of science geeks or nerds indicated that they did not view themselves or their social identities as being part of this group. Prior to joining SEAP, the women viewed themselves as part of a larger societal in-group comprised of non-science geeks or nerds, therefore placing science geeks and nerds into an out-of-group category they negatively stereotyped as socially undesirable. When deciding to join SEAP, the women were concerned that their affiliation with SEAP would result in them

becoming part of the out-of-group and being negatively stereotyped by their non-SEAP peers. The fear of joining a group and becoming the negative stereotype associated with that group has been referred to as social identity threat. Social identity threat is the fear of becoming the negative stereotype and, as a result, experiencing social devaluation due to an incorrect categorization and lack of acceptance by one's peers (Branscombe, Ellemers, Spears, & Doozje, 1999). For these women, their concern of being "affiliated with the stereotypical geeks" (Janis, S.P.) created a larger concern about how their freshman peers would perceive them and how their membership in SEAP could result in social isolation.

Even though the women expressed negative pre-conceived notions about SEAP, once they attended the freshman orientation and were provided with additional information about the community's residential structure and pre-class excursion, their desire to belong to a social group outweighed their fears. As stated earlier, the months leading up to the start of college and the first few months in college are often characterized by concerns about making new friends, finding a social community, and feeling accepted (Chickering & Reisser, 1993). SEAP presented an opportunity for these women that would alleviate these concerns because it provided "instant friends" (Chloe, S.P.), a social community, and a sense of belonging. According to social identity theory, an individual's social identity and self-concept is enhanced by knowing that he or she belongs to a community and by the emotional value he or she instills in their membership to that community (Taifel, 1982). Compared to their non-SEAP freshman peers, the study participants transitioned into their freshman year with a built-in social community comprised of 24 of their new friends. The ability to feel like they belonged to a group displaced their concerns of being stereotyped as science geeks or nerds isolated from their

non-SEAP peers because it alleviated their transition anxieties about not finding friends. In the end, the emotional value that SEAP provided these women outweighed their pre-conceived and unfounded notions of their SEAP peers.

Theme Two: Heteronormative Assumptions and Feminism in a Science LLC

I asked each study participant, "Would you have joined SEAP if it were an all-female community?" Their responses reflected the second theme to emerge in the research, namely a heteronormative assumption about the science environment and a negative perception of feminism:

> God, no. No, I can't stand it. It would come off as a feminist vibe. (Catherine, S.P.)
>
> Just a bunch of lesbians studying science. (Morgan, S.P.)

This section is divided into three sub-patterns: (a) the negative connotation of a women-only science LLC; (b) the students' definitions of feminism; and (c) the students' understandings of themselves as feminists. Within the first sub-pattern, I identified three elements relating to why the women would not have joined a women-only science LLC, including fear of being labeled a feminist lesbian, fear of other women, and a desire to interact with men. In the second sub-pattern, two elements emerged, including a negative perception of feminism and a desire to see feminists place less value on gender. Lastly, for the third sub-pattern, three different types of feminist personas emerged, namely the proud feminist, the passive feminist, and the reluctant feminist.

Negative Connotation of a Women-Only Science LLC

During the focus groups, I asked the women if they would have joined SEAP if it had been a women-only science LLC. I asked the women this question in response to the research

discussed in Chapter 2 highlighting the positive outcomes associated with participating in a women-only STEM LLC (Ghandi, 1999; Hathaway et al., 2001; Hughes; 2010; Kahveci et al., 2007; Johnson et al., 2006; Rosenthal, London, Levy, & Lobel, 2011; Szelenyi & Inkelas, 2011). All nine women indicated that they would not have joined such a LLC, and Catherine's response of "God, no. No, I can't stand it. It would come off as a feminist vibe" best represented their reasoning. During their one-on-one interviews, I asked each female to further explain why she would have not joined a women-only science LLC and their responses fell into three distinctive categories: a fear of being labeled a feminist, fear of other women, and a desire to interact with men.

Fear of being labeled a feminist lesbian. When asked why they would have abstained from joining an all-women's science LLC, many of the women feared being labeled as a feminist. One indicated that as a freshman she would have "automatically assumed that they were the stereotypical like, you know, like man-hater like, like women's rights, blah, blah, blah" and she was concerned that she would "be considered like, a lesbian or something, who didn't shave her legs" by her peers because "there is another stereotype that all these women are in a group because they must, they don't like to socialize with boys" (Janis, S.P.).

The idea of being stereotyped as a lesbian for joining an all-women's science community also came up during another one-on-one interview:

> Question: Some say they wouldn't have joined because if it was all female, it would have had too much of a feminist vibe. What do you think that means feminist vibe?
>
> Um, I, you know, go women. I don't know. Probably just a bunch of lesbians studying science, a bunch of hippies, and girls that don't care about dressing, you know, just stuff like that. Yeah, that's probably what I think about it. The reason that I think about that though, is because you know, society and whatever they've instilled in us. Cause that's

> what I think the university would have looked at, you know the other students. If it was only female, they probably would have been like, oh it's just a bunch of lesbian chicks, learning about science, or something like that. (Morgan, S.P.)

When asked why her peers at the university might have thought this about a women-only science LLC, she explained:

> Probably because they're fearful. I would think, that they're probably just, people always make fun and poke when they're scared or when they're, you know, instigated, or they're you know, intimidated or something. I think that people make fun when they're, you know, uncomfortable, so um, yeah, I think they would have done that cause they, you know, probably wouldn't have understood it, or, you know, the women were too smart, and it's a bunch of women studying science. And you know, the women in science are going down, but oh no, there's a SEAP, you know, that's all women, and they're all studying science. I think they all would have been intimidated, and the only way they know how to act is to you know, to lash out. (Morgan, S.P.)

Even though Morgan was able to provide a rationale for the feminist lesbian stereotype that the women attributed to a women-only science community, their negative perceptions suggested a women-only academic group equated to feminism and, in turn, equated to lesbianism. They also made the link between feminist and lesbian when discussing the definition of a feminist, which I explore further in sub-patterns two and three.

Fear of other women. Even though many of the women were concerned about being labeled as a feminist or being perceived as a man-hater from the outside, they also indicated a concern with being surrounded by all women in the group itself. One indicated that she "would not have felt safe being with all girls," a concern that stemmed from her high school experiences where she "never got along well with girls" (Mary, S.P.). She felt that she "would have felt like more an outcast" because "I feel like [girls] don't like me all the time" (Mary, S.P.).

Another participant also indicated that she would have struggled in a women-only LLC:

> I went to a public high school, mostly I had guy friends, so I liked having, talking with guys, having guy friends. If it was all girls, I would feel intimidated; I don't

> communicate that well with girls [and] probably wouldn't have been definitely not as much fun. (Amy, S.P.)

Amy and Mary were not the only SEAP females who were challenged by relationships with women. Another participant also struggled with her female relationships. Considering that she was also a student-athlete and was participating in an all-female water polo team, she explained the thought of living in a women-only LLC would have been cause for concern:

> I can only imagine, the women that I, that were in SEAP my year and having it just be them and then having another 12 girls on top of that, I would probably kill myself. I, but then again, I don't really get along with women, as much as I do with men. (Morgan, S.P.)

Another participant also indicated that she "wouldn't have done SEAP if it was all girls" (Linda, S.P.) because she had attended an all-girls high school for four years, the only participant in the study to do so, and was ready for a different experience. When asked what the difference would be, she indicated:

> At least at my high school it was, everybody knew everyone else's business. In an obnoxious way, but I guess sometimes it was nice to have that, but not, I've had enough over the four years. So just, just an experience I guess that, I don't know, just too many, like little drama stuff that I was over. (Linda, S.P.)

When asked to explain this fear of other women, their responses indicated that this stemmed from a "mean girls" stereotype (Janis, S.P.). Another participant explained:

> Any girl, doesn't matter if they're like 'nerdy' or not, they can be like, really like, vicious, and like gossipy. (Chloe, S.P.)

Desire to interact with men. Similar to their desires to have friends and a sense of community, they also expressed a desire for the community to include men. The women felt that the male presence would provide a greater sense of community that they felt would not have been possible in a women-only LLC. One participant explained she felt that "it's probably

important to have the male perspective; I think it keeps it grounded" (Morgan, S.P.). Another felt that men would provide a richer social experience and an escape from the women:

> I think more, it would be more of a social thing, like, okay, I want to be able to talk with guys too. I don't want to be like, with the same girls. And also like, I just um, any girl doesn't matter if they're like "nerdy" or not, they can be like, really like, vicious, and like gossipy, and guys aren't. So I just said it'd be a breath of fresh air to just be like, just like, get away from that. (Chloe, S.P.)

Unlike her peers, Catherine was less concerned with the negative perception of belonging to an women-only LLC or a fear of the other women being mean, rather she viewed the male presence as an opportunity to create a college experience different from her high school experience:

> With SEAP I think going to college I just wanted to, um, I don't know, I've always been kind of romantic. I was like, I just want to get a boyfriend now, so I wanted to be able to meet guys, start fresh, start new. Cause in high school, like I was shy, I didn't have many guy friends, so coming to college I was like no, this is going to be different. I'm gonna be myself, I'm gonna have a wide variety of friends, um, and so the fact that SEAP was co-ed I was like, well we'll be living together, we'll have classes together, it'll be a smaller group, the atmosphere, if we all enjoy science, I thought it would help in that sense. (Catherine, S.P.)

She believed that if SEAP had been a women-only LLC it would have negatively impacted her ability to readily meet her male peers:

> But if SEAP was all girls, um, I mean . . . it would just be, we'd all be living together, and then um, like not really have like, as easily a way to meet guys. It would be kind of more like, on your own terms, like on your own, perchance, meeting someone and talking to him. Or um, like no one really to interact with . . . So, if it was um, yeah, if it was all girls, I guess I would have felt like it was like an all-girls school where I'd have to put in the extra effort to go outside and meet guys. Rather than have then kind of there, integrated with what I was part of. (Catherine, S.P.)

The Students' Definition of Feminism

The negative reaction of the women during the focus group about the idea of joining a women-only science LLC suggested that their perception of feminism was associated with lesbians and carried a negative connotation. In an attempt to further explore the participants'

ideas about feminism, I asked each participant to define the term. Their definitions carried several commonalities with the most prevalent being a negative perception of feminism and a desire to see feminists place less value on gender.

Of the seven women who participated in the one-on-one interviews, only two had a positive view of feminism and what a feminist represents. One defined a feminist as a "strong woman who is doing what she wants to do" (Amy, S.P.). Another, who also saw feminists as strong women, further elaborated by stating that a feminist "knows what she wants and I think that she is not scared of the stigmas that society puts on women and the things that women are supposed to do" (Morgan, S.P.).

For the remaining five women, their individual approaches to feminism varied slightly, but they all shared a common belief that feminists place too much importance on the negative societal perceptions of the female gender. One participant conceded in her interview that being a feminist "doesn't necessarily mean that you're a lesbian or that you hate men or that you don't shave your legs" (Janis, S.P.). She also indicated that her views on feminism had transformed over her tenure at the university. As a freshman, she felt that society viewed feminists as "radical activists" who were not advocating for an equal playing field "but actually advocating for women to be above men in any economic hierarchy or job status" (Janis, S.P.). One of her reasons for society's view of feminists as radical is that she often found them portrayed as very argumentative and unbending in their opinions. Four years later, her perceptions of feminists and feminism had changed:

> Question: What is your definition of feminism now?
>
> Equal playing field, or sort of like, however you like to express it. If a male feels like, he is equal to a female, but he doesn't have to like, have a sandwich board on him and

> advocate or saying that he's a feminist. I don't have to like, like go on top of a table and yell at people for whatever, you know, x, y, and z. Like, it doesn't have to be, like an extremely vocal expression, it can just be very simple, like, oh yeah I'm a feminist, I believe like, a guy can do this and a girl can do this. Like me personally, I'm not like, like a huge advocate where I'm like, yelling at people for doing stereotypical gender things, I guess you could say. (Janis, S.P.)

One participant had an overall positive view of feminism, but began to articulate a spectrum of feminism where she saw two different types of feminism: normal and extreme. She stated that feminism "on a normal basis" was "not being like submissive, or not being like, oh I can't do it because I'm a girl" (Chloe, S.P.). She also saw feminist in the workplace and in the school setting as not willing to back down just because they were women. She felt that "just because I'm a woman, doesn't mean I'm not as smart, or as creative, or as driven or hardworking as my male counterparts" (Chloe, S.P.). But she also saw an extreme side to feminism that she felt helped to promote a victim mentality:

> How it was men telling us we had to do this. And it's just like, no I can make my own decisions so it's like, I feel like, I was like, are you kidding me? It's almost kind of like, they're just kind of making excuses and that bothers me, but I feel like that's just the really extreme feminism that you read about in textbooks, whereas, everyday like, it's just like, not being intimidated by men, cause they're supposedly supposed to be smarter than us. (Chloe, S.P.)

In response to the extreme feminism she articulated above, she felt that instead of "making all these excuses about what like, the men are doing and what society is doing to you" that feminist should "just like, who cares? Just ignore it like, and do like, do what you can do" (Chloe, S.P.).

The idea of feminism promoting a victim mentality was also at the center of another participant's definition of feminism. Unlike Chloe, she did not see feminism on a continuum of extreme and normal; she only saw feminism as promoting victimization:

> The whole thing of feminist being like, woe is me, the world's out to get me, like guys are still oppressing me, even today. It just drives me nuts; it's like, okay maybe in your

> mind, but really? No, I mean, come on, I mean yes, there's inequality everywhere but you can't just sit back and complain, do your part, work and like, prove yourself and people will treat you as equals. Just don't sit there and kind of like, complain all the time like, men are just out to get us. Like you know, yeah they say, they're making these laws and making these changes, but really they're not. It's just like, I mean, that just bugs me, it's like no, I mean, come on, interact with people and make a change. Don't just sit back. So, that's where my frustration with feminist kind of come out. (Catherine, S.P.)

Similar to Chloe, Catherine also felt that women should not allow their gender to determine their success. Rather, she felt that feminists should advocate for women to prove themselves and in doing so, they would be able to achieve equality.

Another participant defined feminism as promoting female power and seeking to make sure that women and men are equal. In her responses she indicated that while she believes in "men and women being equal" she does not believe that women need to "compensate for everything" (Linda, S.P.). When discussing female oppression, she felt that current feminists feel the need to make sure their voices are heard because "they used to be oppressed, even though it wasn't necessarily them, they need to like, make sure that their voice is heard more so now" (Linda, S.P.). Linda's reference to women being oppressed in the past suggests that she does not necessarily believe that women are currently being oppressed. Rather Linda felt, similarly to Chloe and Catherine, that everyone had the opportunity to "work their way to the top if they want to" (Linda, S.P.), and that they should not let their gender be the determining factor in their success or lack of success.

One participant had the most complex view of feminism. In regards to society, she felt that "the way that feminism is presented it just has a bad, it has like a negative connotation" (Mary, S.P.). She attributed part of this negative connotation to her perception that feminists have a sense of entitlement that blinds them to truly understanding the limitations of gender:

> For me, like I know what feminism is and it's not like, all women all the time. But I feel like, with the, as a woman, I am all for the betterment of women in society. However, when I've met and interacted with other women who are feminist or identify with feminist, they're like well we need to do this because that's misogynistic and we need to get rid of that. And then, some things, when I look at it, I like to think that I look at it from both sides as like, that's great, but there's some things that women can't do, they're not meant to do, therefore shouldn't do it. Where feminists are like, why not? We're entitled to. (Mary, S.P.)

When asked to further elaborate on this idea of what women cannot or were not meant to do, Mary's answers further highlighted a societal understanding of gender influenced by a male perspective. When it came to what women were not meant to do, she focused on sports:

> Sports in general, women have broken in and like, it's, we can play sports, we can be athletic, we can be competitive. But there's something that's like, unattractive to me, for a women to be like, you know, one of the guys, like trying to be a man. Like, why would you want to be, you know, a man, why would you want to play football and tackle people and not like, it's not even like, why would you want to get hit and get dirty. Like, it's not like that, you know, it's not, I don't know, I guess I feel like women are so nurturing and men are aggressive and the protector and all of that, like, it's weird for a woman to step into that position voluntarily. Really like, play football or do something like, I guess the word is like, like, beastly almost. (Mary, S.P.)

She also supplied a "reverse example" of what men were not meant to do in our society:

> I know that um feminist would say a women's place isn't only in the home. And that's great, but I don't know very many women who would want their husband to come home and decorate their entire house, the way that they wanted it to be decorated and like, take control and you know, cook all the food and do everything. (Mary, S.P.)

In both of these examples, Mary's reasoning for why men are more suited to sports and women are more suited to being in the home was based on an understanding that these strengths are inherently built into each gender and not learned behaviors dictated by a patriarchal society. She would advocate that feminists acknowledge and respect gender differences and see each gender

for their strengths. She feels that men and women should work together and "It should be done as a team" because:

> I'm better at some things that my friends aren't good at, and my friends are good at some things that I'm not good at. That doesn't mean that I should try to be 100% the most perfect well rounded person, and the same thing in society, women don't have to do everything that men can do and vice versa […]. Like, why on earth would you want [men] to take the place in the home? I'm not saying that the women's place is in the home, but it's like, we're good at it. (Mary, S.P.)

As indicated above, Mary's desire to recognize gender difference is based in a patriarchal understanding of where each gender excels. While Mary's preference would be for feminist to recognize and advocate for the differences between the sexes, this was not her belief when it came to her career. She felt that "in terms of success" that if she was "going to be a doctor it's because it's what I'm good at regardless of being a female compared to a male" (Mary, S.P.).

The Students' Understandings of Themselves as Feminists

During the one-on-one interviews, I asked each participant to define feminism. After discussing their definition of feminism as outlined above in sub-pattern two, I asked each female participant if she was a feminist based upon the definition she gave of feminism. Of the seven women, six said they identified with being a feminist but also used this as an opportunity to further refine their definition of feminism. Through this refinement process, three types of feminist profiles began to emerge: the proud feminist, the passive feminist, and the reluctant feminist.

The proud feminist. Morgan and Chloe both acknowledged that they were feminists. When asked, Morgan emphatically said yes. Her response correlated with her definition of feminism because she saw herself as a strong woman not concerned about the stigmas that

society may place on her. Chloe also indicated that she was a feminist, but stated that she felt it was easier to be a feminist in college because:

> it's easy to say that in college, cause like college guys just can't seem to figure out how to take care of themselves, and how to be mature and how to study and prioritize. Whereas, [college women] are like, so advanced, that's what I think. So maybe later on in life, when they try and figure things out, it might be like, a little bit harder to be like, oh I'm smarter than you, I know it. Um, so like, they might be more of like a challenge later on. But I can definitely say like, I don't think I, oh I can't do that cause I'm a woman, or people telling me I can't do it cause I don't notice it really here, at least. (Chloe, S.P.)

Chloe saw herself as a strong, smart, and capable female who did not let her male counterparts determine her success, particularly because she viewed herself as much better than them. She was concerned that when her male counterparts finally matured enough to get their priorities in order, it might be more difficult for her to continue to see herself as a strong female and better than her male counterparts.

The passive feminist. Janis also immediately identified as being a feminist; however, her feminism was one that bordered on passive. She criticized what she would call a "closet feminist," defining this as someone who claims to be a feminist but does not "say anything about it" when someone does something "that's not okay" to another woman (Janis, S.P.). She questioned how such a person could say she is a feminist and not take action when a wrong is being committed. When Janis finds herself in these situations, she stated that she would address the person's actions without being willing to create a scene or become argumentative. Instead of insisting this person "take that back and apologize," she would tell him or her to "think about it and I just leave it at that" (Janis, S.P.). This response correlated with her earlier definition of feminism that viewed radical feminist as extremely argumentative. While she was willing to

make someone aware of his or her actions, she was not willing to force the issue; she was not willing to become the argumentative feminist.

Amy viewed herself as a "little bit" of a feminist. She considered herself as a feminist because she wanted "to be respected, equally, as equally as you can be" (Amy, S.P.). At the same time, she also felt that her desire for chivalry and her unwillingness to go and "fight for it" were at odds with being a full-fledged feminist. She stated that she likes "it when guys open doors for" her because she "definitely likes the polite aspect" of it and did not necessarily believe that "really heavy feminist people" would agree (Amy, S.P.). This idea of "really heavy feminist people" speaks to the "radical feminist" that both Chloe and Janis alluded to when defining their definition of feminism. Similarly to Janis, Amy also indicated that she would step in if she felt she was being unfairly treated, but that would be the extent of her actions:

> You know, and I don't know if I'm going to be one of those people who will go out and fight for it. I will definitely put my foot down in personal situation and make it clear to someone if I don't feel that I was treated right, but I don't know if I would go out and um, make a movement, you know. (Amy, S.P.)

Janis and Amy both viewed themselves as being feminists, but they also were clear to distinguish themselves from "extreme" feminism. While they were both willing to stand up for woman's rights when they witnessed it in a personal situation, neither of them were willing to be argumentative or join the feminist movement on a global scale.

The reluctant feminist. When asked if they were feminists, both Linda and Mary initially said no. However, upon further discussion, they both seemed to see themselves as feminists when viewing feminism on a continuum constructed of multiple definitions and different types. When asked if she was a feminist, the following exchange occurred:

> No. (Linda, S.P.)

> Question: Do you only see feminism in this one definition that you articulated?
>
> Uh, no, I see it all over, I guess. Like, just, I don't know, when I think of a feminist, I think of people that speak up for women's rights more than anything else. But there's also different kinds of feminists I think. (Linda, S.P.)
>
> Question: Okay, but you would not classify yourself as one?
>
> No. (Linda, S.P.)
>
> Question: And, and why is that?
>
> I guess I wouldn't classify myself in the headstrong women's power, but I guess I would then. (Linda, S.P.)

Linda's sense of different approaches to being a feminist prompted further discussion and revealed that in some ways she did identify with being a feminist:

> Question: Let's say you did classify yourself as a feminist, what does your feminism look like?
>
> I think that would be going back to just trying to get what I want and hopefully not having my gender stand in the way. (Linda, S.P.)

Towards the end of this portion of the interviewer, Linda discussed that she would be offended if she encountered a situation where her gender was used against her to prevent her from attaining something she desired. In this situation she indicated that "yeah" she was a feminist but made sure to clarify that it was not in the "verbal headstrong way" she defined earlier. This clarification aligned her with Amy and Janis' passive feminism. Like them, she viewed herself as a feminist in a personal situation where she would stand up for her rights, but was unwilling to do so in a headstrong, argumentative manner.

Mary also initially resisted defining herself as a feminist because she viewed feminism as too limiting in its scope. For Mary, she felt that "regardless of gender, race, creed, people should

be able to bring what they want to bring to the table and it should be respected" (Mary, S.P.). She saw the respect that feminists desire as something that should be extended to all individuals, not just to women because they are women, and it is because of this that she initially indicated that "I wouldn't consider myself a feminist because I feel like people all around the world should be treated" with respect (Mary, S.P.). During this portion of the interview, we discussed the three waves of feminism outlined in Sinnes (2006) article and referenced in Chapter 2. Mary resonated with postmodern feminism because of its ability to acknowledge and value the experiences and differences between all individuals, regardless of their gender. It was during this discussion that she admitted that "based on what we just discussed, I would have to say that I am" a feminist. But she also made sure to clarify:

> But, I still wouldn't go around identifying myself as a feminist. I guess, overall I would say I'm a person who advocates for equal rights of everybody. […] I have the right to be something and be treated um, as an equal with all of my like associates, because it's something that I'm capable of doing, not because I'm a woman or anything like that. (Mary, S.P.)

While Mary was willing to see herself as a feminist, she was only willing to do so within a limited scope and was still not willing to acquiesce to a feminism she sees as demanding respect simply because of her gender.

Analysis

The women's negative connotation of a women-only science LLC was indicative of a heteronormative assumption about the collegiate science environment. Heteronormativity is the process by which the dominate culture works to reproduce and reinforce the value of heterosexual beliefs, practices and policies as normal, resulting in the devaluation and marginalization of homosexual beliefs and behaviors as non-normal (Jackson, 2006; Johnson,

2006; Sartore & Cunningham, 2009). In society, heteronormativity promotes the assumptions that there are only two sexes with affixed gender meanings that reinforce heterosexual attraction and relationships as normal (Sartore & Cunningham, 2009). These assumptions have influenced the values adopted by society, organizations, and social groups (Jackson, 2006).

The women's negative characterization of a women-only science LLC as being a "bunch of lesbians" and having a "feminist vibe" illustrated a heteronormative assumption about a women-only academic group. The women did not express these same concerns when speaking about female sororities, women-only service organizations, or in Morgan's situation, her women's water polo team. The science component is one aspect that differentiates the women-only LLC from the groups listed above and has its own societal gender connotations. The sciences have historically been gendered as male and have been dominated by a patriarchal understanding of society (Alvesson & Billing, 1992; Harding, 2004; Sadker et al., 2009; Weiler, 1988). This understanding has created a commonly held societal stereotype that women entering into the sciences are butch, manly, and not viewed as feminine (Foor & Walden, 2009). These commonly held stereotypes about the sciences inform the women's characterizations of a women-only science LLC as being comprised of lesbians and feminist. In other words, by joining a co-educational community, the presence of men would create the conditions operative of heteronormative assumptions that the co-educational community prescribes to heterosexual beliefs and practices; therefore, they would not be mistakenly perceived as lesbian.

Their concerns about being perceived as lesbians by their new peers represented the same threat to their new social identity as being perceived as a science geek or nerd. As discussed earlier, the value that an individual places on group membership is based upon his or her

perceived ability of the group membership to positively impact his or her identity (Taifel, 1982). In determining that value, an individual will create two groups where he or she will positively characterize one group as the in-group and negatively stereotype the other as the out-of-group (Taifel, 1982). In this scenario, the co-educational SEAP LLC represented the in-group and the women-only science LLC represented the out-of-group. The women affixed a positive value to SEAP because they created a heterosexual assumption of the community and the relationships within the community, resulting in a positive impact of their membership on their social identities and statuses within the larger university community. They subsequently affixed a negative value to a women-only science LLC because they stereotyped it as feminist, lesbian, and lacking male interaction that would result in a negative impact on their social identity and ability to be accepted by their peers. Membership in a women-only science LLC would expose them to the same stereotype threat expressed in the first theme. In this scenario, the stereotype threat is the fear of being perceived as a feminist and as a lesbian. Within a heteronormative society, being perceived as a lesbian is a stigma aligned with experiencing separation, status loss, discrimination, and isolation from one's peers (Sartore & Cunningham, 2009).

In addition to their fears of being perceived as lesbians, the women also expressed concerns about a women-only science LLC having a feminist vibe. This resulted in further discussion about how they perceived feminists, their definitions of feminism, and if they viewed themselves as feminists. The women's responses indicated a complex and contradictory view of feminism that ranged from accepting feminist ideals to denouncing feminist ideologies and practices as outdated, aggressive, too focused on gender, and promoting a victim mentality. Their initial concerns about being perceived as feminists reinforce recent findings suggesting that

young women may reject claiming a feminist identity due to their own and others' negative perceptions associated with feminism (Houvouras & Carter, 2008).

The negative perceptions most commonly stated by young women about feminists are that they are angry, outspoken, aggressive, anti-male, radical, politically liberal, discriminatory, and more likely to be a lesbian (Houvouras & Carter, 2008; Twenge & Zucker, 1999). College-age women are also less likely to identify with being feminist or with the feminist movement even if they support equality for women (Buschman & Lenart, 1996; Houvouras & Carter, 2008; Twenge & Zucker, 1999). Houvouras and Carter (2008) found that young women perceive feminists to be advocating for women's rights at the expense of men and they attributed this to the women's belief that gender equality already exits. Buschman and Lenart (1996) attributed the women's negative responses to feminism to a lack of awareness about the women's movement and the negative portrayal of feminism in the media.

Buschman and Lenart (1996) found that women's attitudes towards feminism fell into four categories: feminist, post-feminist, precarious-feminist, and anti-feminist. Post-feminist and precarious feminist represent the two largest groups and also best describe the women in this study. Post-feminist were characterized as having a strong sense of individuality and a neutral position towards collective group action. Overall, they were reported as feeling that women's current societal status is okay and were "unaware of discrimination and are more likely to see the battle for equality as a past victory rather than an on-going struggle" (p. 67). The precarious feminist was also described as exhibiting a strong belief in individualism but also having strong group identification. While she tends to see the need for group action to better the current status of women, she also believes that she would advance based upon her own merit and individual

abilities. Unlike the post-feminist, the precarious feminist still believes that there is a need to improve the status of women but is also wary identifying as feminist because of the negative stereotyping of the women's movement in popular discourse.

With the exception of Catherine, who did not identify as a feminist, the women's definitions of feminism and subsequently their definitions of themselves as feminists mirror the characteristics of the post-modern and precarious feminist. Similar to the post-feminists, the women in this study had a neutral position towards collective group action. All of the women in the study indicated that they believed in gender equality but were critical of the feminist movement's focus on gender resulting in the promotion of a victim mentality. They constructed a feminist continuum of "normal" and "extreme feminism" (Chloe, S.P.) where they believed that extreme feminist ideologies promoted women's success at the cost of male success and, therefore, viewed feminism as not necessarily supportive of gender equality. They also expressed a belief that feminism was an outdated construct because they felt that women "used to be oppressed" (Linda, S.P.) but have achieved equality.

As a group, the women characterized "extreme feminist" as too aggressive, headstrong, and argumentative. This characterization resulted in many of the women reluctantly acknowledging they were feminists. Similar to the precarious feminist, the women were also cautious of identifying themselves as feminists, believed they would advance based upon their own abilities and merits, and sub-consciously understood that the status of women still needed to be improved. When it came to succeeding in society, the women uniformly agreed that individuals should not let their gender be the determining factor in their success and viewed their success as contingent upon their own abilities to perform. Even though they expressed a strong

belief in individualism to achieve their success, they also expressed an awareness of gender inequality. The women's awareness of gender inequality was not explicit but rather implicit in their definitions of feminism and how they viewed themselves as feminists. They were supportive of women's rights, understood that inequality still existed, and were aware of the social stigmas placed on women.

While they also identified themselves as feminists, their feminism operated on an individual level, not a group level. The women indicated they were willing to stand up for women's rights in a personal situation but were unwilling to join the global feminist movement. They were also unwilling to be seen as aggressive and argumentative and preferred a more passive approach to their feminism. The women's understanding of feminism and their definitions of feminism indicated a desire to be a feminist on their own terms: feminism that views their success based upon their own merits and abilities, feminism without aggression or group affiliation, and feminism devoid of patriarchal understanding.

Theme Three: The Role of Community in Creating an Inclusive Social Environment

One participant's statement regarding the family dynamics of SEAP during her one-on-one interview reflected a third pattern to emerge in the research, the role of community in creating an inclusive social environment. She stated, "It just felt, like family. All the guys felt like my brothers and the girls, sisters." (Linda, S.P.). This section is divided into two sub-patterns: (a) the impact of the community model in creating an inclusive environment and (b) the differing roles of women and men in the community. Within the first sub-pattern, three elements were identified: family sensibility, long-lasting friendships, and transition. For the second sub-

pattern, two elements emerged: female contributions to the social community and male contributions to the social community.

The Impact of the Community Model in Creating a Family Atmosphere

During the focus groups, several of the women indicated that the community experience was one of the greatest aspects of participating in the SEAP LLC. These comments were followed-up by more in-depth questioning during their one-on-one interviews. It became apparent during the interviews that the community impacted their overall experience in transitioning to a new environment as a college student. As explored earlier in theme one, many of these women were concerned about the transition to a new environment, finding friends, and feeling a sense of belonging to a community. SEAP's community model not only provided these women with a built-in community, it also provided them with a family atmosphere and strong friendships, resulting in a smooth transition to college.

Family sensibility. The SEAP Adventure pre-class excursion, which occurred a few days before school started and the rest of the freshman class moved-in, solidified the family sensibility of the community. During the pre-trip, one participant experienced her first birthday away from her family. She indicated that this was "really hard day for me because you know, away from my parents and everything, away from my friends" (Amy, S.P.), and she was surrounded by people she had known for only a few days. On her birthday, the SEAP students purchased a cake and threw her an impromptu birthday party. This gesture made her feel like "they were that accepting of me two days in. I was like wow, okay, this is like a family thing. This is, this is for life. Yeah, SEAP for life" (Amy, S.P.).

For another participant, the sense of feeling like she was at home occurred when the other freshman students were moving in. Since she and the rest of the SEAP community had already been moved in, she felt that she already had "a group of friends, so you just felt so much more at home already then like, when everyone was there. And it was kind of like a shock, cause already felt like so, at home, like on the first day of move-in for everyone else" (Chloe, S.P.).

Another participant felt that the "social aspect played a huge role on my SEAP experience and my freshman year" (Janis, S.P.). She too felt that the SEAP Adventure pre-trip helped to create a family sensibility:

> Having the [pre-class excursion] experience and settling in and meeting all the SEAPers prior to everyone else moving in, it definitely set a dynamic that had, like, it was truly a family. And having the SEAPers know each other before school started, kind of accelerated the relationship we had . . . Just having that, you know, all family floor definitely helped the situation. (Janis, S.P.)

While the pre-class excursion helped to create a family atmosphere, the living arrangement enabled this sensibility to build and continue because all of the SEAP students lived on the same floor, with males residing in one wing and females in another. One participant best explained how the living arrangement impacted her ability to feel like her peers were family:

> I think when you live with people in that close proximity. It's not just living with them, but being in camp with them all year. Doing every single activity. It's just a bond. It's like family. You don't love everyone the way I love family members, there are the crazy ones, but they know you better than people can know me in one class, or groups, or classes. They just know me better than most people. (Karen, S.P.)

Life-long friendships. The residential aspect of the community was integral to the family sensibility that many of the women reported and it was also crucial in helping them form some of their strongest and long lasting friendships while in college. One participant felt that she "lived with 20 of my best friends" and that because of SEAP she "met a lot of great people that

are still in my life" (Karen, S.P.). Another also suggested that the SEAP residential floor was unique to the SEAP community and not an experience shared by her non-SEAP peers:

> I know um, a lot of people that I talked to that lived on floors, I would talk to and they were like, oh yeah, no one, like no one hung out in like, in the lounge or the hallways. Like, um, I didn't know my neighbors, or like, they didn't have a very good sense of community. And like, I don't know if it was just because it was that particular floor or because they didn't have a community on their floor. I would say, yeah, I think we were much better in terms of social, being outgoing and being friendly to each other. And being able to go out and see anyone in the hall, you could go sit with and have a conversation with and be comfortable. Where I feel like a lot of people didn't really know anyone in their hall and it was really quiet, it was dead. (Chloe, S.P.)

The ability to live together was important to Chloe, because it provided a plethora of opportunities to engage with her peers in ways that her other freshman counterparts were not experiencing. She indicated that had she not been in SEAP "maybe I would have made friends with these people, just in my classes" but SEAP provided her with a "comfortable base" at the university where she felt that "it wasn't like, oh man, I have to go find friends" (Chloe, S.P.). Not only did she feel that she did not have to go and finds friends, but "a lot of my really good friends were in that program with me. Making lifelong friendships, that's cheesy, but . . . " (Chloe, S.P.).

Another also benefited from the residential aspect of SEAP. As a freshman, she considered herself a shy individual who was very concerned about making friends and feeling accepted by her peers. Catherine feared that if she had not joined SEAP then she would not have:

> given myself the chance to really go forward and be who I am and stop being shy. While I probably would have had my group of friends, I don't know if it would have really taught me how to branch out . . . I don't think to the level that I'm at now. Maybe like, I would have been comfortable, but not where it's, you know, like home. (Catherine, S.P.)

The SEAP community model aided in alleviating her fears because she:

> came to school and I immediately had friends. And so for the rest of the year there was always someone I could talk to, someone I could hang out with, people that accepted me, made me feel cool, finally, which I'd never felt before. Um, that just carried throughout the years . . . So it was just nice to be accepted in that way. And know that there were people who genuinely wanted to hang out with me, um, just made me feel cooler than I'd ever been. (Catherine, S.P.)

For Catherine, the friendships that she made in her freshman year created a feeling of acceptance that permeated throughout the rest of her college experience and allowed her the confidence to continue to branch out and make friends.

Two other participants also made long lasting friendships in the community, but they varied from what the other women expressed. For the other women, SEAP was their primary social community and the people they socialized with for all aspects of their freshman experience. This was not the case for Amy and Morgan. Amy indicated that her "social was outside of SEAP" (Amy, S.P.). She viewed these friends as "people who were really into the college experience and not into the classes" (Amy, S.P.). While she also was seeking a college experience, she also felt that she "needed my education and seeing that other people were, you know, going for it too, was reassurance for me that it's okay" (Amy, S.P.). While her SEAP peers enabled her to focus on her academics, they also provided her with friendships that extended beyond the social:

> I mean, you're comfortable with family . . . if I honestly felt that they cared about me and they were going through the exact same thing that I was going through, in different ways, but the same, same stuff and, you, you had to stick together. You know, we were the only ones in this program, sure we had friends in science outside of the program, but we were all in this together. (Amy, S.P.)

The community aspect of SEAP was challenging for Morgan because of her water polo commitments and community. Due to her participation in both communities, she was never fully

able to integrate in either: "I was unable to forge good relationships in either of them" (Morgan, S.P.). This inability to form strong bonds with the SEAP community continued to be a challenge for Morgan throughout the rest of her time at the university:

> Um, I feel bad about it because, um, they all talk still, they all just still hang out and get together and do stuff, I don't even know. But there's like little groups that still hang out, you know, like the girls all hang out. And some of the guys are all in the same frat. So they're still all of them that have those close friendships, and so I feel bad cause I'm just kind of, I don't have that relationship with them, just cause I didn't forge it my freshman year. (Morgan, S.P.)

In spite of this, when asked with whom she was closest during her freshman year, Morgan indicated that it was Janis, her SEAP roommate. Janis "was the closest person" to Morgan and the "one [she] went to for everything" (Janis, S.P.). She viewed their relationship as very "tight" and Janis was the one she "told everything to" (Janis, S.P.). While she was unable to forge relationships with the larger SEAP cohort, she was able to establish a strong friendship with Janis.

Smooth transition to college. Another element to emerge in this theme was the impact of the community model to assist with creating a smooth transition to college. As discussed in Chapter 2 of this study, the first six weeks of the freshman semester are the most critical in determining if a student will remain in college or drop out (Upcraft & Gardner, 1989). This fact is often the result of a difficult transition where students are feeling an array of emotions from homesickness, concerns about fitting into their new environment, anxiety about making new friends, and being alone (Chickering & Reisser, 1993).

Many of the women felt that by participating in SEAP, they were able to enjoy a smoother transition to college. One indicated that "the community was really important, for the same reasons, it's all about the transition I guess, for me. And just making it easier, and the

community really made me feel like, at home" (Linda, S.P.). The ability of the community to create a home like environment also resulted in several of them not feeling homesick. Another felt that the community structure was important for her transition because she "wasn't homesick at all because of SEAP" (Janis, S.P.), and another agreed with Janis' statement during the focus group and added that because of SEAP "freshman year was such a breeze" (Karen, S.P.).

For Catherine, Chloe, and Linda, the community structure and built-in friendships were key to their successful transition:

> And so, I had these friends, and it wasn't like, I had to work by myself to make friends. I met them and then we worked together to expand our friendship to people on the entire floor, so then a bunch more people were playing midnight soccer. And so, it definitely made my transition easier because like, those, I mean, the first week of school I felt comfortable with people. I didn't feel awkward or shy not knowing anybody. (Catherine, S.P.)

For Chloe, the friendships also provided an opportunity to explore her new college campus without feeling like she was alone:

> Well I think just as being a freshman, it's just nice to have um, a community so like, you feel comfortable to pursue, like, oh like you want to go this meeting? Like I wouldn't go by myself, but like, if you come with me, so like, just being comfortable to pursue things because you have people supporting you, or like people who like, are going too. So I think that helps in college and I'm more outgoing if, I have other friends like there. (Chloe, S.P.)

Linda indicated that her friendships with her fellow SEAP peers helped her through the transition. She felt that "it was good to have them around as we transitioned to college" because they were "all going through very similar things of missing home" and trying to "make it on our own" and the community provided "a shoulder to lean on" and get through the difficulties of the transition (Linda, S.P.).

The Differing Roles of Women and Men in the Community

The co-ed aspect of the SEAP community was important for all the women when deciding to join the community. As discussed in the second theme, all of the women indicated they would not have joined a women-only LLC because of the following: fear of being labeled a feminist lesbian, fear of other women, and a desire to interact with men. Throughout their freshman year together, the women felt that the male presence was needed. One participant stated, "we needed them, we needed them" (Amy, S.P.). The desire for the male presence stemmed from a belief that the men would provide a "different perspective on life" (Chloe, S.P.) and a "diverse social experience" (Catherine, S.P.). The women viewed this difference and diversity as helping to make SEAP "dynamic" (Amy, S.P.) and keeping the community "grounded" (Morgan, S.P.). Each group "had their place" (Amy, S.P.) and contributed to the community in different ways. The focus for this section will be on the contribution of each group to the social community environment. I will discuss their contributions to the academic environment at length in theme four.

Female contributions to the social community. When asked what the women provided to the community, most of the participants indicated that they "perceived the guys as a social outlet and then the girls as academic" (Janis, S.P.). As indicated above, the role of the women in the academic community will be further explored in theme four. When asked what the women provided for the social aspects of the community, two contradictory elements emerged. The female participant indicated that the other women provided great emotional support and close friendships, but they also felt the women created excessive drama in the community.

Friendships. In regards to emotional support and close friendships, the women indicated that they would turn to the other women in times of need. When going through a break-up during her freshman year, Amy relied heavily on her SEAP roommate to get through it. When she struggled with other aspects of the transition to college she indicated that she "would go to my SEAP girls for emotional support" (Amy, S.P.). Another also indicated that she "would go to them for all those things" (Linda, S.P.) relating to her transition to college, relationship issues, and issues with other friends. When asked why they found the women to be such great friends, one participant best explained the female relationship dynamic:

> It was just good to have a group of friends, female friends, that I could really go up to and ask anything. I could be myself, you know, I could be myself with the guys, but you can't always ask them anything, and so, it was just nice to have that group of girls I could really relate to. Um, and just kind of, I mean all of my friends have been a family away from home, but then I guess more sisterly kind of. (Catherine, S.P.)

Similar to Linda's earlier comment about the community as being one of brothers and sisters, Catherine also saw the women as fulfilling a sisterly role that allowed her the freedom to truly be herself and feel accepted. She also indicated that while she felt that she could vent to the male SEAP students, she was more comfortable going "into detail of [her] emotions" with the women because the men "just don't really know how to give good advice" (Catherine, S.P.).

Drama. Even though the women indicated that they sought their emotional support from their female SEAP peers, they also stated that there were excessive amounts of drama in the SEAP community and they attributed most of this to the women. In the focus group, one participant found that the women could be "really cliquey" and "very bitchy" creating a "catty environment" that was "very high school-ish, there was just a lot of unnecessary drama. Just so much drama, I don't even know where to start. It just came out of the blue" (Janis, S.P.). Her

description of the women and their behavior aligned with a "mean girls" stereotype the female participants expressed in theme two about joining a women-only LLC.

When trying to ascertain why they felt the women created so much drama, Morgan and Chloe expressed two different rationales. Morgan believed that drama is inherent in a woman's nature. She stated that, "I think that if you put a lot of women together, it's probably bound to happen. Um, I think it's in certain women's nature" and she felt that "girls we had on our floor really enjoyed that" (Morgan, S.P.). Chloe thought it was less about a woman's nature and more about how women react when they experience feelings of hurt and rejection:

> [women] get more insulted by things. Like, more personally like, their feelings get hurt. Um it's like a defense mechanism, whereas guys are like, whatever like, I don't have to talk to him anymore. I feel like if like, if someone they like, they don't, maybe they don't talk about it as much. But girls, when they get their feelings hurt they're like, more vocal about it, maybe. (Chloe, S.P.)

Regardless of women's motivation to create drama, the presence of drama in the community solidified for several of the female participants a need to have a male presence to balance out the community and to provide an escape from the drama.

Male contributions to the social community. When asked what the men added to the comprehensive community experience, including academic and social, two contributions emerged: the participants saw them as providing the fun and escape from the drama. Absent from the women's initial responses was any reference to what the men added to the academic community. Upon further questioning, the women clarified their responses regarding the men's contributions to the academic community and their responses will be explored in theme four.

Fun. One participant viewed the men as "more of like an entertainment factor than anything else" because they made everyone laugh and would play "silly games" that would

engage the community (Chloe, S.P.). Another felt that the men brought the women **"**down to reality and allowed us to have fun" because she was "pretty sure that if you stuck us all in a room, we'd all just do our homework and then like, go to bed" (Mary, S.P.). Another expressed a similar thought:

> They added fun because, and um, maybe it's true for all science, I feel like girls in the science we are very serious. You know, we are here, we have a tough job to do and we are going to do it and we are competing, you know, in many ways. Academically, you know, socially, you know, everything like, we are here for a reason . . . Um, but so they definitely made us relax and um, maybe it was the group of guys that we had that were the jokesters, or had the guitar and you know, definitely threw in, hey we are in college, we aren't just like, here, we aren't just here to learn, but we're here to experience college life. (Amy, S.P.)

For the female participants, the men added a level of fun that was not always possible with just the women. In trying to understand why they felt this way, the women indicated that the men were more "laid back with school work and just in life, generally" (Morgan, S.P.). This laid back sensibility caused all of the women to seek out their male counterparts for social and weekend activities. Linda felt that the men just:

> really made the experience a good one for me, I would say. Because they were, you know, they brought more fun into the group, which made everything better. The girls were mostly pretty serious and while that's like, why you came to college, it's not very fun all the time. So I think the guys, they calmed a lot of us down I would say, and just made us more relaxed about stuff, cause they weren't as, not high strung, but they weren't as, yeah, high strung as we were. (Linda, S.P.)

Their laid back approach to school and fun behavior created a nice atmosphere for the community because as one participant indicated, "I'd say that we helped keep the guys more serious. They added the fun, we added serious and it was good chemistry between all of us" (Linda, S.P.).

Escape. While the men provided the fun, they also provided an escape from the drama. One participant felt that "the guys kept us together, kept us sane, because without them, it would have just imploded" (Pam, S.P.). Another indicated that "if you wanted to get out of the crazy you went over to the guy's side" (Morgan, S.P.) of the residential floor. The women did acknowledge that a few men engaged in the drama just as much as the women did, but, overall, the men did not participate in the chaos of the drama created by the women. In addition to not participating in the women's drama, the men also did not create any drama amongst themselves resulting in the female participants viewing the men as providing a "nice break from the girl's hall" and creating an environment in their male hall that was "no drama" and was " just kind of like laid back, very, very casual" (Janis, S.P.).

Analysis

The role of the LLC in creating an inclusive social environment counteracted some of the predominant freshman concerns experienced by freshmen: anxiety of feeling accepted by their new peers, making new friends, and feelings of social isolation (Chickering & Reisser, 1993). For women in the sciences, these transition concerns are often exacerbated by the patriarchal nature of the STEM environment. This environment often causes women to leave the sciences because they feel isolated by their peers and believe they are the only ones struggling in their field (Brainard & Carlin, 1997; Kahveci et al., 2007; Rosenthal et al., 2011; Shapiro & Sax, 2011).

Recent studies have found that women's experiences and peer relations outside of the classroom can impact a woman's desire to persist in the sciences from her freshman year through graduation (Kahveci et al., 2007; Margolis, Fisher, & Miller, 2000; Shapiro & Sax, 2011).

Rosenthal et al. (2011) found that social support could positively impact a women's sense of belonging, support, and engagement in the sciences. The social support of women and men in their majors who are willing to share their struggles helps other women overcome feelings of isolation. Women participating in a women-only science LLC have reported that the residential community provides opportunities to engage with each other in academic and non-academic ways, resulting in feeling a strong sense of solidarity with their female peers (Hughes, 2010; Kahveci et al., 2007). These women have also indicated the residential community provided emotional support because they were able to share their experiences with their peers and realize they were not alone in their struggles (Hughes, 2010; Kahveci et al., 2007).

The SEAP women also expressed the role of the social community in positively impacting their freshman experience, specifically as it related to their transition to college. For many of them, the social aspects SEAP provided were integral to their successful transitions to their new environment because they felt they had a community that supported them. Similar to the findings reported for the women-only STEM LLCs about the positive impact of the residential community, the SEAP women also reported feeling a strong sense of solidarity with their LLC peers, where they were emotionally supported by their SEAP peers and felt they were not alone in their struggles.

Unlike the findings reported for the women-only LLC, the women in this study also reported having the support and friendship of their male science peers. Within the male-dominated field of STEM, women often feel isolated from their peers because of intimidation and hostility received from their male peers (Rosenthal et al., 2011). By engaging in a co-educational science LLC, the women in this study were able to circumvent this issue because

they were able to create support systems made up of their female and male peers. In addition to being able to identify with their female peers, they were also able to witness and identify with the struggles of their male peers, resulting in the demystification of male superiority in the sciences. The residential component provided these women with multiple opportunities to engage with their male peers in a more socially intimate manner than they would have been able to had they just had a class together. The social community offered opportunities to befriend their male peers, engage in social activities with them, and share their academic and non-academic struggles with each other.

While both the women and men provided a sense of social community, their roles within the social community differed. The participants viewed the other women as providing close friendships and drama, and they saw the men as providing the fun and relief from the drama. These findings are consistent with research that has found that male undergraduates spend more time than their female peers on activities that have been recognized as stress relievers (Lederman, 2007; Noel-Levitz, 2011; Sax, 2007). Some of these activities have been identified as playing sports, partying, watching TV, and playing video games (Sax, 2007). Conversely, undergraduate women tend to enter college with higher levels of stress and engage in activities that induce stress, such as studying, at higher levels than their male peers (Sax, 2007). Living with their male peers exposed the SEAP women to their stress relieving activities. The men provided the women with an alternative to the stresses of their schoolwork by creating a fun environment the women could participate in. As stated by the women, if they had not had a male presence in the community then all they would have done was their "homework and then like, go to bed" (Mary, S.P.).

The co-educational aspect of SEAP provided the women with the same positive social outcomes associated with women who have participated in a women-only LLC. The difference for the SEAP women was that these outcomes extended to their experiences with their male science peers, resulting in a demystification of male superiority that may still exist for the participants of a women-only LLC. This demystification was the result of the women being able to spend time with the men in classes and in the residential hall, allowing the women to see their male peers as friends and to see them struggling just like they were.

Theme Four: The Role of Community in Creating an Inclusive Academic Space Promoting Female Success in STEM

One particular statement regarding the impact of the LLC model on the academic transition to college highlighted the final theme to emerge in the research: "having the kind of living-learning community related to what you're studying or your academics, or whatever you're working on, it's just nice to know that people can be in the same situation that you are and you're not alone" (Catherine, S.P.). The fourth theme focuses on the role of the community in helping these women feel a part of a smaller SEAP science community, which resulted in them feeling part of and belonging to the larger College of Science community. This section is divided into two sub-patterns: (a) the impact of the community model in creating an inclusive academic environment and (b) academic performance. I identified four elements in the first sub-pattern: you are not alone, differing contributions to the academic community, the impact of faculty and SEAP peer mentors, and the science classroom experience. In the second sub-pattern, three elements emerged: grade point averages, first year in-college retention, and first year retention at the university.

The Impact of the Community Model in Creating an Inclusive Academic Environment

In the third theme, the role of the community model proved integral to the female participants' social and emotional wellbeing. The community model also had a strong impact on the women's academic experiences and sense of belonging in SEAP and the College of Science. The women indicated during the focus groups and their one-on-one interviews that the community model also provided an opportunity to know they were not alone in their struggles, especially regarding their academics, and that they had resources to support them through their difficult times. The women defined these resources as their SEAP peers, SEAP faculty, and mentors. This resulted in the women experiencing a classroom environment conducive to their participation without the fear of failure or judgment from their peers.

You are not alone. During their freshman year, the women not only struggled with the social and emotional transition to college, as articulated in theme three, but they also struggled with their academics. The women's academic struggles were alleviated by the closeness of the SEAP community and their ability to see their peers struggling. The SEAP residential community also provided a unique opportunity for the women to be surrounded by other science majors, resulting in a sense of comrades understanding the level and amount of studying required of science majors and promoting an atmosphere conducive to studying.

In regards to not feeling like they were the only ones struggling, the women indicated that living together and taking the same classes together "helped the fact that we were all able to kind of vent" and this "kind of drew us closer, cause it was like, oh wow, you're dealing with that too? You're stressing out too? Oh awesome, cause me too" (Janis, S.P.). By taking the same classes and living on the same floor, the women were able to better relate to their SEAP peers'

struggles because they were enrolled in the same courses and had the same experiences. In addition to providing these women with an opportunity to see their peers struggling, the residential component also provided built in academic assistance:

> I saw that other people were struggling and I saw that other people were getting it more than I was. And so, and being able to see that, because you know if you're just studying by yourself, I found out, you don't know if everyone else gets it, you don't know if everyone else is struggling with something, but living with them, you'd see okay, well, we all need to work on this or wow, yeah, I'm really not getting it so, it was great in that respect . . . And you knew when someone was free, go ask a question, instead of like, calling someone, hey can we work on this uh tomorrow or something? When are you free? Because you know when people are free 'cause you see it or you know when they have class, cause it's the same class as you. Yeah. And you would hear people you know, complaining, just eavesdropping and it made me feel comfortable knowing that you know, other people struggled. (Amy, S.P.)

The SEAP classroom was another opportunity for the students to share their struggles with each other and their faculty. All SEAP students were required to take a one unit Freshmen Seminar focused on transitioning to the university, discerning careers for the sciences, and learning about various curricular and co-curricular involvements on campus. During this class, they also discussed current issues in the SEAP community and their academic classes. Many of the women found the seminar class helpful in their transition to the university and to the College of Science. One of the participants indicated:

> I think it was important to me for the same reason that it was important to the community. Because sometimes you just don't know how other people are feeling and sometimes you just are uncomfortable maybe voicing yourself and so, with SEAP class . . . it was kind of like, well if one person said it then everybody else would go like, oh my gosh, yes. And you could almost like, feel everybody going [sigh] because we all agreed that we're not the only person in the room who feels that whatever the situation was uncomfortable, upsetting, we didn't like it and so it was just kind of like, okay now I know everybody is feeling what I'm feeling, and same thing for everybody else in the room. It's like, we all know we're on the same page and we can get past it as a group, community, instead of me being a lone person thinking I was uncomfortable with. (Mary, S.P.)

Knowing their peers were struggling provided a sense of comfort for the women because "you're there with your friends and you know someone, it makes it a little better because you're kind of struggling through it with someone. Um, so you don't feel alone" (Catherine, S.P.).

The residential component also created an atmosphere conducive to studying because they "knew everyone was studying; I knew that I needed to study" (Amy, S.P.). Several of the women indicated that had they not participated in SEAP, they might have struggled with feeling supported by their non-science residential peers. They felt rooming with non-science majors would have negatively impacted their abilities to study and feel academically supported. One participant indicated:

> Like if I was like, in [another residence hall] and my roommate was like a Communications major and my other roommate was a dance major, I would have a really hard time. I guess like, science majors it's kind of important for us to stick together because it's just like so hard, we always have to study. It would just be like really frustrating and hard to keep with it if you see that, oh my comm. major friend gets to like, go out because she has like her midterms that are always like really hard but then after that she just has to go to her classes. She doesn't have a lot going on, and that would really frustrate me. Like, if my friends had nothing to do and I was constantly busy. I think that helps to, we all had the same interests so, um, we all kind of like supported each other. (Chloe, S.P.)

As a student athlete, Morgan also expressed concern about her ability to feel academically supported. She felt it "would have been difficult for me if I had not been in SEAP 'cause I would have been the only one, I would not have been able to talk to anyone on my [water polo] team about science and how hard it is, because nobody would have been able to relate (Morgan, S.P.)"

The ability to relate to their SEAP peers and share their struggles was not limited to just the female members of the SEAP community. The women indicated that the men struggled too, but "that they would not talk about it as much as the girls would." (Catherine, S.P.). They felt

that the girls were more "vocal" with each other about their struggles and the men would "complain about classes" and their grades, but just not as much as the women did (Chloe, S.P.). When asked why they felt the women were more vocal about their struggles, one participant postulated that "guys don't really talk about their feelings or what's going on with them" and if they did talk about it "it was probably with the guys group" (Morgan, S.P.) so the women might not necessarily hear about it as much as they did with their female counterparts with whom they were sharing a room and a residential wing.

When the men did vocalize their struggles, a difference in how the men and women internalized their academic struggles emerged. The women felt that the men tended to explain their struggles in terms of it being someone else's fault that they were not doing well academically. When the men did earn a bad grade, one participant found that they were more inclined to blame it on not liking the class or the professor because they "didn't want to admit it" that it might be their fault (Chloe, S.P). In contrast, the women seemed to internalize their struggles by feeling a bad grade was the result of "not studying hard enough" (Chloe, S.P.) or not understanding the material. Regardless of how they each internalized their struggles, the women did feel "they would all work together" as a community and try "to figure it out" (Catherine, S.P.).

Differing contributions to the academic community. While the women felt that the male presence was necessary for the social community experience, they did not express the same sentiment regarding the male contribution to the SEAP academic community experience. The women felt it was important to have a male presence in their classes because "guys think differently," they tend to be "more logical," and women are "more abstract and creative," and

having “two different things working together is important in like classes” (Chloe, S.P.). Even though they stated that the male presence added a different perspective to the classroom experience, the women also indicated that the male students did not really “add anything” to the academic experience because “they were just kind of, they were just there” (Chloe, S.P.).

When describing their approaches to schoolwork, the women felt the men had “a more relaxed approach” (Amy, S.P.) and “kind of took a back seat” (Morgan, S.P.) in group projects. Whereas, the women viewed their female peers as being more “focused on their academics” (Janis, S.P.) and “more serious” (Linda, S.P.) about their schoolwork. These divergent views resulted in the women favoring the other women when it came to academics and feeling inspired and challenged by their female counterparts. One felt like she was “surrounded by smart women” who added “intelligence” (Amy, S.P.) to the community. This “reassured” her because she felt it was “okay to be completely driven and completely into studying and getting a good grades” (Amy, S.P.). She also indicated that it created a “little bit of a competition” because if “they are going to do well, I need to do well too” (Amy, S.P.). Another participant also saw the women as “providing that challenge” because she felt that not only did she want to “get just as good of a grade as they do” she wanted to do “better” (Chloe, S.P). When asked if they felt in competition with their male peers, the overall answer was “no.” While they agreed that smart men were in SEAP, many of them felt that a majority of the men did not “really add anything” (Chloe, S.P.) and often wondered “how they got into college” (Janis, S.P.).

When asked why the women felt this way about their male SEAP peers, they attributed their feelings to the men’s study habits and lack of academic performance in-group projects. Due to the fact that the SEAP students were enrolled in the same courses and were living

together, they were all aware of each other's homework load and ultimately the women felt that the males "methods of studying were just horrible" (Janis, S.P.). The men "would study hard, but they would put it off to the last minute," and this would result in them "pounding energy drinks" and "staying up all night" (Catherine, S.P.). In some situations, the women found that the men would turn to prescription drugs to get their work done:

> I would hear, oh so and so is trying to get Adderall. So it's like, okay, then I would look down on them, it's like really? You put this off far enough so you're resorting to take drugs that aren't even prescribed to you so you can get this done? Like one, that's like, you're harming yourself and you're not gonna learn anything that way. Then I would, it's like, you're being a complete idiot. No matter how smart academically you might be, that, that's just stupid. Um, and so other things where it's just like, if they would stay up all night, and if it's just like Red Bulls or whatever, it's like oh stupid boys, they just, you know, it would just kind of come down to like, I never really noticed it before but guys don't mature as fast as girls, so it's that whole immaturity thing. And like, oh you know, like how dumb they left it. But when they would go to the extremes, then I would look down on them, like you could have prevented this. (Catherine, S.P.)

One participant also expressed a belief that her male peers were immature in their approaches to their academic responsibilities:

> They just seemed really immature. Like, they wanted to play video games more. Or, they just don't know how to prioritize things, um, and so it's like, it's not like they're not smart, they're just not putting the work in. Um, so they could get better grades if they wanted to, they're just not focusing on school as much as they should, I guess. They're like focusing on stupid little things. So, but like the girls just really, like, know how to prioritize and know how to like, okay, let's be serious, let's like, let's get our work done. Um, so I just think they, they put more work into it. They take it more seriously. (Chloe, S.P.)

Their lack of focus, use of illegal substances, and irresponsible approach to schoolwork negatively influenced how the women perceived the men's academic abilities. The women felt when the males earned a bad grade and placed blame elsewhere, they were really the ones to blame because of their lack of focus. When they would complain about pulling all-nighters, the

women felt like "no you didn't, because you could have gotten your work done before" (Linda, S.P.), but you chose to procrastinate and play video games.

The women's negative perception of the men's academics was only strengthened by their performance during group projects. When it came to group work, the women felt the men "took a back seat, they participated and they did the group work, but they weren't super active" (Morgan, S.P.) unlike their female group members. When asked to define what not being super active looked like, one participant stated:

> For the group projects they would one, either leave it to the last minute and expect you to just do it. Or they would contribute but it was like, half-ass work so you would have to throw it away and start over again. And who knows if they intentionally meant to do it half-assed or that was just their hard work. Um, but in terms of, or yeah, yeah, they just wouldn't contribute at all. Like, cause they're lazy or whatever. Um, but individual projects, um, like the individual assignments they would wait till the last minute, copy someone else's work. (Janis, S.P.)

Having to pick up the men's slack in group work was really frustrating for the women because they worked ahead of time, met their deadlines, and exhibited a more serious approach to getting their work done than their male peers. They also admitted that they would pick up the slack because they would not want their grades to suffer. Some of the women also reported they would assess who was in their group and the women would "take the project over and do most of it" and delegate the "guys to do those little things" (Morgan, S.P.) because they felt the women "would just get it done faster" and if the men did not complete their sections it would not negatively impact the women's grades (Linda, S.P.).

The impact of faculty and mentors. In addition to the community, the women also reported that the faculty and peer mentors were a valuable part of the SEAP experience.

Faculty. In regards to the faculty, one participant was "more impressed by them" than her other faculty because she felt that they "wanted to make sure we succeeded, versus other teachers that just don't. Like I'm sure they care too, but not in the same way that the SEAP professors do" (Linda, S.P.). When asked to explain what a professor who cares looks like, this participant stated that her SEAP faculty "cared a lot more. They got like, learned our names and learned about our lives. Um, my econ professor freshman year, she didn't really know anybody in the class" (Linda, S.P.). She also stated she did "better in classes when the teachers, like, if they notice that I'm struggling, then they'll call me out on it versus classes where I'm anonymous" (Linda, S.P.).

The SEAP instructors also helped the women learn how to build relationships with their faculty. During the focus group, one participant stated that she "she liked how the teachers were there for us" because "it did help us, kind of teach us, how to build relationships with our teachers, which has really helped me over the years" (Catherine, S.P.). One of the ways the faculty helped the women to build relationships was aiding the women in developing a healthy approach to office hours. The SEAP faculty really promoted and pushed office hours for the students. Another participant observed that her SEAP faculty:

> would hang around class um, you know, either during break, you know, to answer questions, but also, you know to say hi, you know, be friendly. Um, and that was important, where, I kind of see, saw other um, science uh people just kind of walk in right before class, get into their thing right away and then leave. (Amy, S.P.)

The SEAP faculty's approach to the students during and after classes helped the women realize that they can talk with the faculty "outside of the classroom" because, as one participant felt, "office hours should not be intimidating" (Janis, S.P.). She continued, the "fact that they are willing to meet with you, kind of carried onto my sophomore year and realized like, oh wow, it's

not just the SEAP teachers that want to meet with you, all of the teachers are like that" (Janis, S.P.). But this is something she felt she might not have discovered had she not been made to feel comfortable utilizing office hours. Another participant also stated that they made office hours more comfortable and this impacted her desire to participate in class:

> I felt more comfortable with just going to them for office hours. So many times, students don't go to office hours just 'cause they're not comfortable talking to a teacher, they're just scared and you know, for whatever other reasons, I was comfortable enough with them, where I could talk to them like, hey I didn't do so good, could you explain this? And, and if they say, well this is why. Well, I don't understand that. You know, I think it made it more comfortable for me to, probably speak up in class, talk in class, and talk to them. (Morgan, S.P.)

The SEAP faculty also provided the students with access to resources, teaching assistant positions, research positions, advice about their academics, graduate school, and life in general:

> The relationship with the faculty is the really valuable part about SEAP because two out of my three letters of recommendation [for graduate school] were from SEAP faculty. Like, um, I ended up being a [science] TA for our sophomore year. And it was just like, you just, you have those connections and you see them on campus and it's like "oh hi, how are you?" Versus other faculty, you just sometimes you just see them and you're like, "oh, I'm going to keep going this way." (Mary, S.P.)

Another participant also felt that the relationships she fostered with her SEAP faculty created connections and provided opportunities throughout her four-year tenure at the University:

> I agree I think the connections with each other and also with other people, was really one of the best things for me. Because I think a lot of the things I did [here] I never would have gotten the opportunity to do, or it would have been a lot harder for me to get those chances, if it wasn't for who I met with SEAP or the fact that I was in SEAP. Even just TA'ing their SEAP class, or just TA'ing the biology class in general, doing orientation, getting involved with research, presenting research and doing all these other things. I think I would have had a lot harder times getting those opportunities, even now that I graduated; I'm still getting help because of the connections I made in SEAP. It's still there; it's one of the most valuable things for me. (Pam, S.P.)

Peer mentors. The women also indicated that their SEAP peer mentors were valuable to the SEAP experience because they provided support through their freshman year. There were two

groups of peer mentors assigned to the SEAP community: the Resident Advisors (RA), who lived with the SEAP students in their residence hall, and the Teaching Assistants (TA), who worked with their Freshmen Success course faculty. The RAs were comprised of one female for the women's wing and one male for the men's wing. For the first few SEAP cohorts and for the women participating in this study, the gender of the TAs was predominately female. In the later cohorts, the RAs also served as the TAs. With the exception of the first cohort, the RAs and the TAs were also former SEAP participants.

The peer mentors proved most valuable in helping the women with their transition to college, making them feel like they were not alone in their struggles, and, most importantly, creating a sense that there was hope. One participant viewed the female RA as providing comfort because "knowing that she struggled too and that she's now out of it and to see how she is now and that it is possible . . . to overcome all of this stuff" (Janis, S.P.). Her RA also "helped me so much too like, adjust to college life and like, the fact that she was a SEAPer also. She helped me kind of, transition to the college experience" (Janis, S.P.). Another participant also felt that it was helpful to talk with the mentors because it reinforced for her that "I knew that then I wasn't, or that we weren't the only ones struggling with what was going on" (Linda, S.P.). This was because the mentors "understood and they were able to help us, listen and sympathize" because they had gone through it the year before (Linda, S.P.).

It was helpful for the women to have former SEAP students in these positions because as one observed:

> Just 'cause they know what the students were going through academically and socially, they know how stressful it is to have these SEAP classes. Um, and then, even socially, they, they've been through all this tension, tense time throughout the community where they know they're like, getting sick of their neighbors, and all that stuff. Whereas a regular RA, they wouldn't know what they're going through, and like, then the residents can't turn to them for that stuff. (Janis, S.P.)

It was also important they were women. One participant felt that while she may have connected with a male, "it might have taken me longer just because, um, I think maybe because they would have been older than me" and she would have been concerned about making a "bad impression" (Catherine, S.P.). The gender of her peer mentors did not matter as much for another, but it did matter that they were upperclassmen. She believed that "having an upperclassman who you can ask about classes to take advice for like different professors and how they teach and what helps" because "when you're a freshman you don't really know anybody" (Chloe, S.P.) or anything about the campus and faculty.

The science classroom experience. One of the major academic components of the SEAP model was that all the students enrolled in the SEAP specific courses for the fall semester. These courses consisted of a pre-calculus, general chemistry, general biology, college writing, chemistry lab, biology lab, and the Freshmen Success course. As a result of this, the SEAP women indicated they felt more comfortable in these classes, which positively impacted the way they would participate in class. One participant indicated that in the SEAP classes "you just talked; you weren't scared about asking questions, you weren't scared about voicing your opinion out loud" (Mary, S.P.). But in her other classes, with people she did not know, she would "just sit there and be like, oh well I knew the answer and continued taking notes" (Mary, S.P.). Being in class with her SEAP peers made another feel more "comfortable in the classroom and like, not being afraid to ask questions and all that stuff. It led me to kind of, be more involved in class, in the classroom and want to learn more" (Janis, S.P.).

The women explained that they would feel more comfortable in these classes:

> I felt more comfortable um, 'cause I know these kids and I know that they're not going to judge me. Um, and you know, I know that because I'm living with them and everything,

> I know that they are nervous about it too. I'm not the only one who doesn't feel prepared for it. Or you know, is nervous about it. Um, so I think it was like a help in that way. (Amy, S.P.)

Another participant also felt more comfortable when she had classes with her SEAP colleagues because they were able to share in a common struggle and turn to each other to get assistance with assignment:

> I think also because they were just as confused as me. And in class like, we could all just tell, we would look at each other and we would just like, you could tell like, I don't know what the heck is going on, okay good, me neither. And so, we would, and when we would try and do these projects, we would go like, from like hallway to hallway, room to room, to try and figure out, do you guys know what you're doing? Did you figure this out? (Catherine, S.P.)

Similar to Mary, another woman also felt that community created a supportive academic environment that she did not feel when she entered into larger lecture hall style classes. When asked why she felt this, she indicated:

> because you're like more comfortable with them. And, it's kind of like, in those classes, none of us were really super nervous to give presentations 'cause we're all friends. But then like, when you went into like a bigger lecture, where you didn't know anyone, it makes you way more nervous. Um, I'm not really sure like what it is about, cause I mean your friends can, maybe they can be more forgiving if like you said something, well that's not true. I feel like your friends would be like, harsher on you if you say something stupid. I don't know, we were just a lot more comfortable with each other, like, um, maybe people asking each other for help, which was nice. It wasn't like a huge lecture hall, where you raise your hand and you're just really nervous like, really nervous about it because it's so many people with their eyes on you. So maybe it's just like the, like the community. It was smaller and we're all really comfortable so, you could raise your hand and answer a question without feeling awkward and you could ask questions too. Um, that definitely helped. (Chloe, S.P.)

Not only did the students create a classroom environment that was conducive to the women feeling comfortable to participate, but they also created an environment where they functioned as a community and helped each other. During one of the classes he was teaching for the SEAP students, the Associate Dean of the College of Science observed:

> So here we are in class, and all the students are looking around, where's Matt? And I'm just listening to the conversation, "Where's Matt? Oh I haven't seen him." They get on the phone and call Matt, "Get to class!" and then you know, ten minutes later Matt comes walking in. I mean, they were a real community, it was pretty amazing to me, I mean . . . You know you've been in school a long time, when have you ever seen that happen?

Their community bond between the SEAP students reflected a willingness to work together as a community and assist each other in academic and non-academic ways. It also infused in its members a sense of responsibility towards the success and wellbeing of their SEAP peers.

The community bond between the SEAP participants lasted after the program concluded. During their sophomore, junior, and senior years, the women reported that they would still prefer to work with their SEAP peers compared to their non-SEAP peers in their science classes:

> You know I might see someone in a, in a science class that is also in my sorority and sure yeah, I'll go over there and you know, we'll be buddies for the class or something. But I wouldn't rely on them as much as I rely and trust SEAP students. I feel like we went through a lot together . . . [because] we had to present, we had to be academic with each other, we had to comfort one another 'cause you know, we needed the support, they were there. Um, and you were able to get help from everyone um, it was just, SEAP had all of those aspects. (Amy, S.P.)

Academic Performance

I triangulated the focus group and one-on-one data with a simple statistical analysis of academic performance variables. The variables identified for this study were: high school cumulative GPA, SAT scores, freshman year cumulative GPA, freshman year university retention, and freshman year in-college retention. I collected these data for the Fall 2007-2011 SEAP and College of Science freshman cohorts. I selected these cohort years based upon the criteria that they represented all SEAP cohorts who have completed their freshman year. I then disaggregated the data into four groups: SEAP cohort, SEAP female cohort, College of Science

freshman cohort, and the College of Science female freshman cohort. All data I collected only pertained to the freshman year because this was when the students participated in SEAP.

Grade point average. I selected grade point average as a variable because it was one of the determining factors when selecting the SEAP participants. The SEAP program selected participants based upon their high school academic performance, as indicated by their SAT scores and cumulative high school GPA, and their university math placement exam, which placed them in the mid-range academic performance level. According to the Associate Dean of the College of Science, "we felt the kids kind of at the top had certain opportunities" and the "kids who needed more help had other opportunities" but the mid-range group "didn't really have anything" in terms of support or resources from the college. The program also selected their cumulative freshman GPAs as a variable for comparison because a majority of freshman science students enrolled in the same introductory level science courses during their fall and spring semester.

During their freshman year, the College of Science and SEAP women outperformed their respective cohorts in GPAs earned. The College of Science female cohort earned an average 3.23 freshman GPA, which placed them .04% higher than the SEAP women, .09% higher than the SEAP cohort, and .10% higher than the College of Science cohort. The SEAP women earned the second highest average GPA out of the four groups: .06% higher than the College of Science Cohort, .05% higher than the SEAP cohort, and .04% less than the College of Science women's cohort. In regards to cumulative freshman GPAs, the women in the College of Science and SEAP on average outperformed their male counterparts. While more analysis would be required to fully understand the GPA earning patterns of these groups, the SEAP women's observations

about their male peers study habits, their self-reported dedication to their studies, and their sense of competition with their female peers may help to explain this phenomenon. What can be gleaned from these data is that the women enrolled in the College of Science at this mid-sized liberal arts university were academically outperforming their male science peers. Table 1 contains additional data.

Table 1

Mean First Year Cumulative GPA by Freshman Cohort

Cohort	College of Science	SEAP	College of Science Women	SEAP Women
2007	3.07	3.07	3.18	3.10
2008	3.02	3.05	3.16	3.15
2009	3.09	3.03	3.18	2.90
2010	3.23	3.13	3.34	3.22
2011	3.22	3.40	3.29	3.61
Total	3.13	3.14	3.23	3.19

Due to the selection process of SEAP participants based upon high school academic performance, this study also examined their high school GPA and SAT scores in relation to their freshman academic performance. The analysis of the high school GPA revealed a similar pattern amongst the four groups as seen in the freshman GPA. On average, the College of Science women earned the highest high school GPAs. Compared to the College of Science women, the SEAP female cohort was -.02% and the College of Science and SEAP cohorts were both -.07%. Table 2 contains additional data.

Table 2

Mean High School Cumulative GPA by Freshman Cohort

Cohort	College of Science	SEAP	College of Science Women	SEAP Women
2007	3.50	3.44	3.56	3.53
2008	3.53	3.50	3.60	3.51
2009	3.51	3.45	3.57	3.44
2010	3.62	3.68	3.71	3.70
2011	3.61	3.69	3.66	3.79
Total	3.55	3.55	3.62	3.60

While the College of Science and SEAP women tended to earn higher GPAs than their College of Science and SEAP peers, they did not tend to earn higher SAT scores. The SAT scores utilized in this study were comprised of the math and critical reading sections of the test and did not include the writing section score. The College of Science freshman cohort reported an average SAT score of 1211, which placed them 17 points higher than the College of Science female cohort and 44 points higher than the SEAP and SEAP female cohorts. Table 3 contains additional information.

Table 3

Mean SAT Scores by Freshman Cohort

Cohort	College of Science	SEAP	College of Science Women	SEAP Women
2007	1178	1095	1163	1099
2008	1193	1096	1181	1099
2009	1196	1188	1182	1192
2010	1252	1222	1234	1228
2011	1238	1233	1211	1216
Total	1211	1167	1194	1167

Despite their high school academic performance placing the SEAP women into the mid-level academic range for the incoming College of Science freshman cohort, the SEAP women academically outperformed a majority of their SEAP and College of Science freshman peers. Their ability to outperform their peers counters recent research that has found that students entering into STEM majors with lower SAT scores may not be as prepared to pursue their majors, which could negatively impact their grades and ability to persist in the sciences (Griffith, 2010). These data do suggest that the peer and faculty support provided to these women created an environment conducive to their academic success.

First year in-college retention. I selected in-college retention as a variable because it represented the percentage of students who remained in their intended academic college, defined as the academic college they entered into as a freshman, throughout their first year. This variable identified student change of academic major patterns across academic colleges and reflected the percentages of the SEAP and College of Science freshman cohorts who changed their majors to a non-science major located in another college.

I asked the women during the focus group and the one-on-one interviews if they ever thought about switching their major to a non-science major. The thought of changing their major had not occurred for a majority of the women and a few of them indicated they added non-science minors to their primary science major. Janis was the only participant in the study to consider changing to a non-science major. She attributed this to the fact that she never intended to be a science major and only ended up in the sciences because of her Occupational Therapy major. The fact she never switched to a non-science major was attributed to her SEAP community:

> I probably would be really homesick, oh my gosh, I probably would have switched my major, I don't know . . . Yeah because there were times when I didn't even want to be a science major like, there were people there to tell me, keep on trucking. Like, stay in it. (Janis, S.P.)

Janis's experience further highlighted the positive impact of the SEAP community on the women's freshman year experiences as discussed in themes three and four. The ability to turn to their peers to discuss and work through their academic and non-academic struggles resulted in these women feeling supported and feeling they could succeed at the university and in their science majors. Their statements were also reinforced by their in-college retention during their freshman year.

Since the inception of the SEAP program, the SEAP female cohort has continually averaged an in-college retention rate of 90.5%. Their retention rate has been 1.2% higher than the SEAP cohort, 5% higher than the College of Science freshman cohort, and 6% higher than the College of Science female freshman cohort. Despite earning the highest average freshman GPA of the four groups, the College of Science women have retained in their in-college major at the lowest rate. Their major switching pattern is indicative of the research on undergraduate women in STEM fields, which has found that a majority of the women who leave the sciences will do so during their freshman year (Brainard & Carlin, 1997; Hill at al., 2010). Kokkelenberg and Sinha (2010) found that the rate of switching out of the sciences could be as high as 50% for women at some higher education institutions. Unlike their College of Science female peers, the SEAP women retained at a much higher rate and many of them attributed this to the impact of the SEAP community on their academic and non-academic freshman experiences, as articulated in themes three and four. The community helped to counteract many of the factors attributed to women's lack of persistence in the sciences: feelings of isolation, lack of peer and faculty

support, low academic self-concept, and chilly classroom environment (Brainard & Carlin, 1997; Fassinger, 1995; Hall & Sandler, 1982; Hill at al., 2010). While an in-depth analysis would be needed to fully understand the experiences of the non-SEAP College of Science women, these data do suggest that the LLC experience positively impacted in-college retention. Table 4 contains additional data.

Table 4

Mean Percentages for In College First Year Retention by Freshman Cohort

Cohort	College of Science	SEAP	College of Science Women	SEAP Women
2007	82.0	89.5	82.4	100.0
2008	83.9	91.7	83.7	92.4
2009	83.9	81.0	83.7	69.3
2010	89.3	94.7	87.0	100.0
2011	88.4	89.5	85.9	91.0
Total	85.5	89.3	84.5	90.5

First year retention. I also selected first year retention as a variable because it represented the percentage of students who retained at the university after their freshman year. Similar to in-college retention, this variable was also helpful in determining women's persistence patterns in the sciences. By leaving the university, a female science student is in greater jeopardy of not graduating in the sciences. If a female science major leaves the university, she may enroll at another university as a science major, enroll at another university as a non-science major, or drop out of college.

The freshman year is critical to student success in college and is the greatest predictor in persistence to graduation (Chickering & Reisser, 1993; Upcraft & Gardner, 1989). When asked if they ever thought about leaving the university, all of the women except for Morgan indicated

no. Morgan stated that she had considered transferring to another institution because she was concerned about her ability to be successful in the Environmental Sciences program in the College of Science. During her discernment process, she consulted with her SEAP faculty to help her make an informed decision. As a result of her conversations with her faculty, she was personally introduced to the Director of the Environmental Sciences program and learned about the different opportunities she would be able to experience if she decided to stay:

> [The school] had a lot of opportunities that I probably wouldn't have had at Santa Cruz. Like for example, with [the Director of the Environmental Science program], I've had the opportunity to do my own research and to pick my own research and I've been able to be his TA for the past two years, I'm his research assistant. I probably would not have gotten all of those opportunities at Santa Cruz . . . But if I had gone elsewhere, I would have had to work underneath somebody. Which is not bad, everybody has to work under somebody at some point, um, I would have had to work under somebody doing research that you know, I probably wouldn't have wanted to do. I probably would have only been able to be a TA for one semester, and research assistant, that probably wouldn't have happened until I was in grad school. So I think I just saw the opportunities that were coming with the [director] and decided to stay. (Morgan, S.P.)

Morgan was able to utilize her SEAP faculty to gain access to the Director of the Environmental Sciences program. This resulted in her decision to stay at the university and to further engage in the sciences through her Teaching Assistantship and Research Assistantship.

Of the four groups, the SEAP cohort retained the highest percentage of its participants. The SEAP cohort retained at 94.8%, which was 6.8% higher than the reported freshman retention rate of 88% for the university. The SEAP women retained at 92.3%, which was .4% higher than the College of Science, 1.2% higher than the College of Science female freshman cohort, and 2.5% lower than the SEAP cohort. SEAP's high retention rate, as in comparison to the other groups and the university freshman cohort, suggested that the impact of the SEAP community, as discussed in themes three and four, might be positively correlated with student

sense of belonging to the university and desire to remain at the institution. Table 5 contains additional information.

Table 5

Mean Percentages for First Year Retention by Freshman Cohort

Cohort	College of Science	SEAP	College of Science Women	SEAP Women
2007	90.2	89.5	89.4	85.8
2008	90.4	100.0	89.4	100.0
2009	90.3	95.2	93.0	92.3
2010	94.7	94.7	93.2	92.3
2011	94.2	94.7	90.6	90.9
Total	91.9	94.8	91.1	92.3

Analysis

The overtly masculine nature of the sciences has resulted in reinforcing the invisibility of women within the sciences and the perception that women are better suited for non-science disciplines (Acker, 1992; Harding, 2004; Mills, 1998; Sadker et al., 2009; Tyler & Cohen, 2010). These perceptions have permeated the collegiate science classroom, resulting in many women experiencing a chilly classroom environment (Canada & Pringle; 1995; Hall & Sandler, 1982). Women in STEM often report feeling isolated from their peers and attribute these feelings to the intimidation and hostility they receive from their male peers (Rosenthal et al., 2011). In the science classroom, males tend to dominate the classroom environment and knowledge production process, which serves to silence women and negatively impact their academic self-concept (hooks, 1994; Brainard & Carlin, 1998; Sadker et al., 2009; Seymour & Hewitt, 1997). The inability to be heard and validated by their peers creates a chilly classroom environment that can cause women in STEM to feel isolated from their peers, believe they do not possess the

academic skills to succeed in STEM, and think they are the only ones struggling in their academic science environment (Brainard & Carlin, 1997; Kahveci et al., 2007; Rosenthal et al., 2011; Shapiro & Sax, 2011).

The research on single-sex female STEM LLCs has found that the community aspects of the LLC model help to counteract the negative experiences of women in STEM. In addition to providing women with a community where they feel emotionally supported by their peers, the shared classroom components of the LLC models have also been found to strengthen the bonds between the participants and reduce feelings of isolation (Hughes, 2010; Kahveci et al., 2007). The academic components of the LLC model, i.e. taking the same courses with the same level of difficulty, contributes to an academic community where women are able to share in their "state of confusion" about their course work and provides an opportunity for them to work together to "resolve the confusion" (Kahveci et al., 2007, p. 50). By working together, the students share their knowledge with each other and assist each other in succeeding in their science courses. The community also enables the students to better identify with other STEM majors because it allows the participants to witness their peers enduring the same academic experiences (Hughes, 2010; Kahveci et al., 2007). In doing so, this creates an academic support network that has been found to positively impact women's persistence in STEM (Hughes, 2010; Kahveci et al., 2007).

In addition to the importance of their peers in creating a supportive community, women participating in women-only STEM LLC's have also reported the positive impact of peer mentors in creating a more welcoming science environment. Kahveci et al. (2007) found that female peer mentors provided informal advice about the sciences that was integral to the female LLC participants' success in STEM. The ability to engage with upperclassmen who already

succeeded in successfully navigating the science environment provided the freshman LLC participants with knowledge about how the science community operated, resulting in an increased sense of belonging and confidence to pursue the sciences (Kahveci et al., 2007, Rosenthal et al., 2011).

Likewise, the SEAP female participants also reported similar positive outcomes associated with the academic and peer mentor components of the SEAP community model, but the outcomes reported by the SEAP women were inclusive of both their female and male peers. The SEAP women indicated that the residential and linked academic courses provided them with the ability to share in their academic struggles and work together to overcome issues regarding their coursework. This structure enabled them to see their female and male peers struggling with their academics, reinforcing the sensibility that they were not alone and positively impacting their classroom experience. The residential component also provided the women with an environment conducive to studying because they were surrounded by the other SEAP students taking the same courses and experiencing the same level of difficulty with the course work. They study participants also indicated the importance of the peer mentors in providing them with informal advice about the College of Science, reinforcing their academic struggles, and providing them with the confidence to succeed.

The inclusion of their male peers in the SEAP LLC aided in the demystification of male superiority in the sciences. When asked what the male presence added to the community, the women's initial responses focused on the social aspects of the community. As discussed in theme three, the women found the men provided a social outlet to the stresses of studying and the drama generated by the other women. When asked what the men added to the academic

community, some women felt they added a different perspective, but, for the most part, they felt the men did not really "add anything" (Chloe, S.P.). While the women acknowledged that some of the male SEAP participants were studious, they also indicated that the majority of them exhibited poor study habits. As discussed earlier in this section, living with their male peers provided the women with insight into their study habits that included waiting until the last minute to do their homework, misusing prescription drugs in order to stay up all night to complete their assignments, copying other's homework, and not pulling their weight in group projects. The women's observations mirror recent research that has found that male students tend to enter into college with lesser study habits than their female counterparts (Lederman, 2007; Noel-Levitz, 2011).

Despite entering into college with lesser study habits, male students tend to evaluate their academic abilities at a higher level than their female counterparts (Lederman, 2007; Margolis et al., 2000; Sax 2007). Noel-Levitz (2011) found that 53.4% of males compared to 42.4% of women indicated they had a good grasp of scientific ideas. In regards to intellectual self-confidence, more males than females ranked themselves as above average and in the top 10% even though they tended to earn lower cumulative GPAs than their female peers (Sax, 2007). When confronted with academic failure, males tend to view their failures in a more self-affirming way than women do (Margolis et al., 2000). This inflated sense of confidence in their academic abilities contributes to their ability to dominate the classroom environment and the production of knowledge process, serving to create a chilly classroom environment for their female science peers and reinforcing the perception of male superiority in the sciences.

However, the residential component of the SEAP LLC was able to counteract the perception of male superiority in the sciences. By living with their male peers, the women were exposed to the men in a more intimate way than if they had only encountered them during their classes. The residential component provided insight into their male peers' study habits and academic struggles. For the participants in this study, the ability to witness their male peers' poor study habits resulted in the women feeling a lack of intimidation, and they did not feel themselves to be academically devalued by their male science counterparts. The residential component also provided an opportunity for the women to see their male peers struggling with their assignments. When their male counterparts did struggle and would blame their low grades on reasons other than themselves, the women were able to counter their reasoning by blaming it on their lack of study habits. Without the residential component, the women would not have been aware of their academic struggles and may have inferred by their male peers inflated sense of their academic abilities that they were successful in their STEM courses. This lack of knowledge may have also resulted in the women feeling isolated and intimidated by their male peers' academic abilities. By participating in SEAP, the women were provided with a unique opportunity to see their male peers struggle with their course work and to see through the myth of male superiority in the sciences, resulting in the women feeling academically superior to their male peers.

The positive outcomes associated with the SEAP social community also extended to the academic experiences of the female participants in this study. The residential community provided a strong sense of solidarity amongst the SEAP students, resulting in the women feeling emotionally supported by their female and male SEAP peers in their academic and non-academic

experiences. In addition, the residential community aided in demystifying the male superiority in the sciences, and, therefore, it created an inclusive academic environment for the SEAP women participating in this study.

Conclusion

The findings and analysis of the findings discussed in this chapter provide insight into the gendered experiences of undergraduate women in STEM. The qualitative nature of this study and the utilization of standpoint methodology privileged the women's voices in the research, allowing for a deeper exploration of what it means to be a woman in the sciences. Through the focus groups and one-on-one interviews, the female participants in this study have been able to tell their stories, revealing the findings discussed in this chapter: the significance of social identity in a STEM LLC, heteronormative assumptions and feminism in a STEM LLC, the role of community in creating an inclusive environment, and the role of community in creating an inclusive academic space promoting female success in STEM. I discuss these findings and recommendations for practitioners and for future research in Chapter 5.

CHAPTER 5

DISCUSSION AND RECOMMENDATIONS

Introduction

The purpose of this study was to expand on the current research pertaining to women in STEM fields, better understand the experiences of undergraduate women in STEM, identify barriers to female persistence in their intended STEM major, and understand the impact of the co-educational LLC model on female persistence in the sciences. In recent years, women have made gains in the sciences at the high school level, but these gains have not been visible at the undergraduate level. Women are still entering into and persisting in the sciences at lower rates than their male undergraduate counterparts (Brainard & Carlin, 1997; Hill et al., 2010; Sax, 2001). If they do decide to major in the sciences, many of them will not persist in their majors beyond their freshman year (Brainard & Carlin, 1997; Kokkelenberg & Sinha, 2010). Their lack of persistence has been attributed to the overtly masculine nature of the sciences that serves to reinforce the perception that women are better suited for non-science disciplines (Acker, 1992; Harding, 2004; Mills, 1998; Sadker et al., 2009; Tyler & Cohen, 2010).

In an attempt to increase female persistence in the sciences, many higher education institutions have implemented LLCs. As a model for intervention, LLCs are a unique opportunity to synthesize the recommendations for encouraging female persistence in STEM disciplines through a systematic approach that can be incorporated at the start of their undergraduate experience. While previous research has highlighted several positive outcomes associated with LLC participation (Pascarella & Terenzini, 2005; Stassen; 2003; Zhao & Kuh, 2004), few studies have explored the impact of the LLC model on female persistence in STEM.

The current research on the impact of the LLC model on female persistence is a small and narrowly focused body of literature. A majority of the research has focused on the impact of the single-sex female STEM LLC model on female persistence in the sciences (Ghandi, 1999; Hathaway et al., 2001; Hughes, 2010; Kahveci et al., 2007; Szeleny & Inkelas, 2011), with the exception of Johnson et al. (2006) who examined co-educational and single-sex science LLCs. This research has also primarily relied on quantitative methods (Ghandi, 1999; Hathaway et al., 2001; Johnson et al., 2006; Szeleny & Inkelas, 2011), with the exception of Kahveci et al.'s (2007) mixed methods study and Hughes's (2010) qualitative study. The lack of research on the effects of the STEM LLC model, specifically the co-educational model, on female persistence highlights a need for more research to fully understand the experience of the female participants (Ghandi, 1999; Hathaway et al., 2001; Kahveci et al., 2007; Szeleny & Inkelas, 2011). While quantitative research has provided a plethora of variables indicating predictors to persistence, very little is known about what these women experience and what can be done to promote their long-term commitment to the sciences.

In order to better understand the impact of the co-educational LLC on female persistence in the sciences, this study examined how the co-educational LLC model served to create an inclusive environment that aided in counteracting the negative patriarchal culture of the sciences and promoting female success in STEM. The research question guiding this study was:

> What are the gendered experiences of women participating in a co-educational STEM LLC and how do these experiences affect their academic performance and persistence in STEM fields?

I utilized a mixed methods approach, grounded in standpoint methodology, to examine the impact of a co-educational STEM LLC on female persistence in the sciences. I collected the qualitative data for this study through focus groups and one-on-one interviews with the SEAP female participants. I analyzed these data through a critical feminist lens utilizing standpoint methodology and coded them utilizing inductive analysis, resulting in the following findings: (a) the significance of social identity in a STEM LLC; (b) heteronormative assumptions and feminism in a science LLC; (c) the role of community in creating an inclusive environment; and (d) the role of community in creating inclusive academic space promoting female success in STEM. I collected and analyzed the quantitative data utilizing a simple statistical analysis of key academic variables indicative of student success: cumulative high school GPAs, SAT scores, first year cumulative GPAs, freshman persistence patterns in their intended major, and freshman retention patterns at the university.

This chapter discusses the summary of the findings and is divided into the following four sections: (a) the significance of social identity in a STEM LLC; (b) heteronormative assumptions and feminism in a science LLC; (c) the role of community in creating an inclusive environment; and (d) the role of community in creating an inclusive academic space promoting female success in STEM. This chapter also discusses recommendations for K-12 and higher education practitioners in STEM and recommendations for future research in the areas of female persistence in the sciences and science LLC models.

Summary of the Findings

The summary of the findings will be discussed in the order of the four sections outlined above.

The Significance of Social Identity in a STEM LLC

The fears expressed by the women about joining SEAP and being perceived as a science geek or nerd derived from their fears about transitioning to their new collegiate environment. The transition to college requires these women to create new social communities and social identities that are sensitive to their peer's perceptions and acceptance of them (Chickering & Reisser, 1993). Prior to joining SEAP, the women viewed themselves as part of a larger societal in-group, non-science geeks or nerds, thus placing science geeks and nerds into an out-of-group category they negatively stereotyped as socially undesirable and lacking social skills. When deciding to join SEAP, the women were concerned their affiliation with SEAP would result in them becoming part of the out-of-group and being socially isolated by their non-SEAP peers.

Despite having negative pre-conceived notions about their SEAP peers, joining SEAP also presented a unique opportunity for these women to alleviate their transition concerns because it provided them with a social community and a sense of belonging. Compared to their non-SEAP freshman peers, these women would transition into their freshman year with a built-in social community. The ability to feel like they belonged to a group aided in displacing their concerns of being stereotyped as science geeks or nerds and of being socially isolated because it eased their transition anxieties about not finding friends. When making their final decisions to join SEAP, the emotional value SEAP provided these women outweighed their pre-conceived notions and concerns about the impact of their SEAP peers on their social transition.

Heteronormative Assumptions and Feminism in a Science LLC

The women's negative characterizations of a women-only science LLC as being a "bunch of lesbians" and having a "feminist vibe" illustrate a heteronormative assumption about women-

only academic groups, especially science groups. The science component carries its own societal gender connotations because the sciences have historically been gendered as male and have been dominated by a patriarchal understanding of society (Alvesson & Billings, 1992; Harding, 2004; Sadker et al., 2009; Weiler, 1988). This understanding has created a commonly held societal stereotype that women entering into the sciences are "butch," manly, and not viewed as feminine (Foor & Walden, 2009). In joining a co-educational community, the presence of men created a heteronormative assumption for these women that the co-educational community prescribes to heterosexual beliefs and practices; therefore, they felt they would not be perceived as being lesbians.

Their concern about being perceived as lesbians by their new peers represented the same threat to their new social identity as being perceived as a science geek or nerd. In this scenario, the co-educational SEAP LLC represented the in-group and the women-only science LLC represented out-of-group. The women affixed a positive value to SEAP because they created a heterosexual assumption of the community, of the relationships within the community, and of the positive impact of their membership on their social identity and status within the larger university community. They subsequently affixed a negative value to the women-only science LLC because they stereotyped it as feminist, lesbian, and lacking male interaction, resulting in a negative impact on their social identities and abilities to be accepted by their peers. Membership in a women-only science LLC would expose them to the stereotype threat of being perceived as feminists and lesbians. Within a heteronormative society, this perception could result in the women experiencing separation, status loss, discrimination, and isolation from their peers (Sartore & Cunningham, 2009).

In addition to their fears of being perceived as lesbians, the women also expressed concerns about a women-only science LLC as having a feminist vibe. When discussing feminism, the women's responses ranged from accepting feminist ideals to denouncing feminist ideologies and practices as outdated, aggressive, too focused on gender, and promoting a victim mentality. While all of the women in the study believed in gender equality, they were also critical of the feminist movement's focus on gender because they felt it reinforced a victim mentality that was not supportive of gender equality. They also viewed feminism that promoted women's success at the cost of male success as an outdated construct because, from their perspective, women have already achieved equality.

When it came to succeeding in society, the women uniformly agreed that individuals should not let gender be the determining factor in success, and they viewed their success as contingent upon their own abilities to perform. Even though they expressed a strong belief in individualism to achieve their own success, they also expressed an awareness of gender inequality. The women's awareness of gender inequality was not explicit but rather implicit in their definitions of feminism and how they viewed themselves as feminists. They were supportive of women's rights, understood that inequality still existed, and were aware of the social stigmas placed on women, but they were unwilling to join the global feminist movement and to be seen as aggressive and argumentative. Rather, they preferred a more passive approach to their feminism.

The Role of Community in Creating an Inclusive Environment

Within the male dominated field of STEM, women often feel isolated from their peers because of the intimidation and hostility they receive from their male peers (Rosenthal et al.,

2011). This feeling often results in women leaving the sciences because they feel isolated by their peers and feel alone in their struggles (Brainard & Carlin, 1997; Kahveci et al., 2007; Rosenthal et al., 2011; Shapiro & Sax, 2011). By participating in a co-educational science LLC, the women in this study were able to circumvent this issue by creating a support network of their female and male peers. The co-educational aspect of the SEAP community provided the women with the same positive social outcomes associated with women who have participated in a women-only LLC. The difference for the SEAP women was that these outcomes extended to their experiences with their male science peers, resulting in a demystification of male superiority in the sciences, which might still exist for the participants of a women-only LLC. This demystification was the result of the women's ability to engage with their male peers in a more socially intimate manner than they would have been able to had they just had class together. The residential and social community offered opportunities to befriend their male peers, engage in social activities with them, and share their academic and non-academic struggles with them.

The Role of Community in Creating an Inclusive Academic Space Promoting Female Success in STEM

The overtly masculine nature of the sciences has resulted in reinforcing the invisibility of women within the sciences and the perception that women are better suited for non-science disciplines (Acker, 1992; Harding, 2004; Mills, 1998; Sadker et al., 2009; Tyler & Cohen, 2010). In the science classroom, males tend to dominate the classroom environment and knowledge production process, thus silencing women and isolating them from their peers and negatively impacting their academic self-concept and their ability to persist in the sciences (hooks, 1994;

Brainard & Carlin, 1998; Kahveci et al., 2007; Rosenthal et al., 2011; Sadker et al., 2009; Seymour & Hewitt, 1997).

The community aspects of the LLC model have been found to counteract the negative experiences of women in STEM. The female participants in this study reported that the residential and linked academic courses provided them the ability to share in their academic struggles with their SEAP peers and work together to overcome their academic issues. The residential community provided a strong sense of solidarity amongst the SEAP students, resulting in the women feeling emotionally and academically supported by their female and male SEAP peers because they were able to see them struggling with their academics. This structure reinforced the sensibility that they were not alone and positively impacted their classroom experience.

Furthermore, the inclusion of their male peers in the SEAP LLC aided in the demystification of male superiority in the sciences. The residential component provided the women with the opportunity to witness the last minute, and sometimes unscrupulous, study habits of their male peers. The residential component also provided an opportunity for the women to see their male peers struggling with their assignments. When their male counterparts did struggle and would blame their low grades on reasons other than themselves, the women were able to counter this reasoning by blaming it on their ineffective study habits. Participating in SEAP provided the women with a unique opportunity to see their male peers struggle with the course work and to see through the myth of male superiority in the sciences, resulting in the women feeling academically superior to their male peers.

Recommendations for Practitioners

This section discusses recommendations for K-12 and higher education practitioners in regards to positively impacting the persistence of women in the sciences. The first recommendation focuses on the importance of addressing the emotional and academic binary in in STEM. The second recommendation focuses on the inclusion of feminist education and pedagogy in the sciences starting in K-12. The final recommendation addresses the importance of mixed-gender science LLCs.

Addressing the Emotional and Academic Binary in STEM

The first recommendation is for university STEM administrators and faculty to expand their myopic focus on academics to address the emotional and social aspects of the student academic experience. Throughout all four findings in this study, the emotional and social aspects of the women's academic experiences greatly influenced their ability to feel that they were part of the science community. Their perceptions of the role of the community in creating an inclusive social and academic environment reinforced the importance of their social and emotional wellbeing in conjunction with their academic success. These connections were conducive to their ability to persist. The experiences of these women indicated that students do not subscribe to a compartmentalized lifestyle where their emotional selves are kept separate from their academic selves. Yet, in academia students are often confronted with an environment that fails to recognize the connection between the emotional, the social, and the academic and that prefers to see the student experience as just an academic endeavor. Despite the importance of the emotional and social wellbeing on female persistence, the patriarchal nature of the sciences maintains an environment that devalues the emotional and social aspects of the

educational process by engaging in pedagogical practices that only address the academic aspects of education. These women and their experiences highlight the necessity for the educational environment to address the binaries in academia and to create an experience that equally addresses and melds the emotional, social, and academic selves of their students.

The Inclusion of Feminist Education and Pedagogy in the Sciences

The second recommendation is the inclusion of feminist education and feminist pedagogies in the K-16 classroom in an attempt to create more awareness and a better understanding of feminist ideologies. The SEAP female participants' negative perceptions of feminism and their heteronormative assumptions about the science academic environment suggests a patriarchal understanding of society that has been reinforced by negative feminist and LGBT (lesbian, gay, bisexual, and transgender) stereotypes perpetuated by the media. The negative perception of feminists as angry, outspoken, aggressive, anti-male, radical, politically liberal, discriminatory, and more than likely to be a lesbian (Houvouras & Carter, 2008; Twenge & Zucker, 1999) has been allowed to go unchecked in society because of the failure to expose women and men to feminist ideologies in the educational setting. By exposing them to the different faucets of feminism within the classroom setting, educators can work to counter the negative perceptions of feminism perpetuated by the media and reinforce the value and need of feminist ideologies in society. If women are exposed to feminist pedagogies in K-16 classrooms, they are often unaware of the feminist principles influencing their classroom experiences. Therefore, this study also recommends increased transparency when utilizing feminist pedagogies by making students aware of the feminist influences in their educational environment.

The Importance of Mixed-Gender Science LLCs

The final recommendation is for STEM university administrators and faculty to increase the presence of co-educational science LLCs. While the single-sex STEM LLC model has been found to positively impact female persistence in the sciences, this study has highlighted the ability of the co-educational science LLC model to also positively impact female persistence in STEM. This study also suggests that the co-educational STEM LLC model may provide a greater sense of inclusion within the academic science community for its female participants than the single-sex LLC model. The women in this study reported feeling academically and emotionally supported by both their male and female SEAP peers. Unlike their single-sex LLC female counterparts, the SEAP women were able to develop a support network with their male SEAP peers. Also, dissimilar from their single-sex STEM LLC peers, the SEAP women were exposed to their male peers' poor study habits and academic struggles. This component of the co-educational LLC model aided in the demystification of male superiority in the sciences for the SEAP women that might still be present for single-sex STEM LLC participants.

In light of the findings, this study also recommends the inclusion of mixed-gender STEM LLCs to accommodate those students who may identify as LGBT. In the current research on STEM, the persistence patterns and educational experiences of the LGBT population in the overtly masculine and heteronormative STEM environment is not fully understood, nor is it usually considered when creating interventions to positively impact the persistence of marginalized groups in STEM. Based upon this reality, it would behoove higher education administrators and faculty to consider the needs of this population when creating inclusive spaces that promote persistence of marginalized groups in the sciences.

Recommendations for Future Research

The findings from this study underscore the need for additional research in the area of female persistence in the sciences and of the impact of the LLC model on women's experiences in STEM. Specifically, this study highlights the need for more qualitative studies focusing on the experiences of women participating in single-sex and co-educational STEM LLCs. Similar to Kahveci et al.'s (2007) recommendations for future research in this area, this study also recommends the need for more "theory-driven qualitative" studies (p. 60). By increasing the number of qualitative studies, more opportunities for women's voices to be heard in the research will exist, resulting in a better understanding of women's experiences in the sciences and in the ability to create impactful interventions to increase their persistence.

This study also recommends additional research on the impact of the co-educational LLC model on female persistence in the sciences. While the current body of STEM LLC literature is growing, it is still primarily focused on the impact of the single-sex science LLC model. In addition to the contribution of this study's findings to the research, a need to further examine the many different ways the co-educational STEM LLC model impacts women's experiences and desires to persist in STEM still exists.

The last recommendation for future study is to examine the experiences of LGBT students in STEM. Similar to their female counterparts, this population is marginalized by the overtly masculine and heteronormative nature of STEM and very little is known about their experiences in the sciences and how these experiences impact their desire to persist. It is also a recommendation of this study to understand if the STEM LLC model positively impacts or further reinforces their marginalized experience.

Conclusion

This study sought to gain a better understanding of the experience of women in STEM and of the impact of the co-educational LLC model as an intervention to positively impact female persistence in the sciences. This study examined how the environment created by a co-educational LLC model served to create spaces for women to feel included within the overtly masculine nature of the STEM discipline. By placing the women at the center of the research and by privileging their voices in the research, this study determined that the residential and academic components of the co-educational STEM LLC provided an inclusive environment that engaged its female participants in a manner that positively impacted their persistence within their intended STEM majors.

REFERENCES

Acker, J. (1992). Gendering organizational theory. In J. M. Shafritz, J. S. Ott, & Y. S. Jang (Eds.), *Classics of organizational theory* (pp. 480-489). Boston, MA: Wadsworth.

Alvesson, M., & Billing, Y. D. (1992). Gender and organization: Towards a differentiated understanding. *Organization Studies, 13*, 73-103.

Auster, C. J., & MacRone, M. (1994). The classroom as a negotiated social setting: An empirical study of the effects of faculty members' behavior on students' participation. *Teaching Sociology, 22*(4), 289-300.

Barton, A. C., & Brickhouse, N. (2006). Engaging girls in science. In C. Skelton, B. Francis, L. Smulyan (Eds.), *The SAGE handbook of gender and education* (pp. 221-235). Thousand Oaks, CA: SAGE Publications.

Brainard, S. G., & Carlin, L. (1997). A six-year longitudinal study of undergraduate women in engineering and science. In EP Innovations (Ed.), *Proceedings of the 1997 Frontiers in Education Conference: Teaching, learning in an era of change* (Vol. 1, pp. 134-143). Champaign, IL: Stipes Publishing.

Branscombe, N. R., Ellemers, N., Spears, R., & Doozje, B. (1999). The context and content of social identity threat. In N. Ellmers, R. Spears, & B. Doozje (Eds.), *Social identity: context, commitment, content* (pp. 35-58). Oxford, UK: Blackwell.

Brody, L. E., & Mills, C. J. (2005). Talent search research: What have we learned? *High Ability Studies, 16*(1), 97-111.

Buschman, J. K., & Lenart, S. (1996). "I am not a feminist, but . . .": College, women, feminism, and negative experiences. *Political Psychology*, *17*(1), 59-75.

Canada, K., & Pringle, R. (1995). The role of gender in the college classroom interactions: A social context approach. *Sociology of Education, 68*(3), 161-186.

Chickering, A. W., & Reisser, L. (1993). *Education and identity* (2nd ed.). San Francisco, CA: Jossey-Bass.

Colbeck, C. L., Cabrera, A. F., & Terenzini, P. T. (2001). Learning professional confidence: Linking teaching practices, students' self-perceptions, and gender. *The Review of Higher Education, 24,* 173-191.

Cox, T. (2001). Creating multicultural organization: The challenge of managing diversity. In J. M. Shafritz, J. S. Ott, & Y. S. Jang (Eds.), *Classics of organizational theory* (pp. 489-495). Boston, MA: Wadsworth.

Fassinger, P. A. (1995). Understanding classroom interactions: Students' and professors' contributions to students' silence. *The Journal of Higher Education, 66*(1), 82-96.

Foley, D. (1990). *Learning capitalist culture: Deep in the heart of Tejas.* Philadelphia, PA: University of Pennsylvania Press.

Foor, C. E., & Walden, S. E. (2009). "Imaginary engineering" or "re-imagined engineering": Negotiating gendered identities in the borderland of a college of engineering. *NWSA Journal, 21*(2), 41-64.

Gandhi, C. M. O. (1999). *A longitudinal evaluation of factors associated with retaining women in science and engineering* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9950087)

Griffith, A. L. (2010). *Persistence of women and minorities in STEM field majors: Is it the school that matters?*. Unpublished manuscript, School of Industrial and Labor Relations, Cornell University, Ithaca, New York.

Gurian, M. (2005, December 4). Disappearing act: Where have the men gone? No place good. *The Washington Post*. Retrieved from http://washingtonpost.com

Hall, R. M., & Sandler, B. R. (1982). *The classroom climate: A chilly one for women?* Washington, DC: Association of American Colleges.

Harding, S. (1998). *Is science multi-cultural? Post colonialisms, feminisms, and epistemologies.* Bloomington, IN: Indiana University Press.

Harding, S. (2004). Standpoint theory as a site of political, philosophic, and scientific debate. In S. Harding (Ed.), *The feminist standpoint theory reader: Intellectual and political controversies* (pp. 1-16). New York, NY: Routledge.

Harstock, N. C. M. (1998). *The feminist standpoint revisited, and other essays.* Boulder, CO: Westview Press.

Hathaway, R. S., Sharp, S., & Davis, C. S. (2001). Programmatic efforts affect retention of women in science and engineering. *Journal of Women and Minorities in Science and Engineering, 7*(2), 107-124.

Hatch, J. A. (2002). *Doing qualitative research in education settings*. Albany, NY: SUNY Press.

Hill, C., Corbett, C., & St. Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics.* Washington, DC: AAUW. Retrieved from http://www.aauw.org/resource/why-so-few-women-in-science-technology-engineering-and-mathematics/

hooks, B. (1994) *Teaching to transgress: Education as the practice of freedom*. New York, NY: Routledge.

Houvouras, S., & Carter, J. S. (2008). The f word: College students' definitions of a feminist. *Sociological Forum*, *23*(2), 234-256.

Howard, J. R., & Baird, R. (2000). The consolidation of responsibility and students' definitions of situations in the mixed-age college classroom. *The Journal of Higher Education, 71*(6), 700-721.

Hughes, R. M. (2010). Keeping university women in STEM fields. *International Journal of Gender, Science, and Technology*, *2*(3), 417-436.

Inkelas, K. K., & Associates. (2008). *National study of living learning programs: 2007 report of findings*. Retrieved from http://www.livelearnstudy.net/images/2007_NSLLP_Final_Report.pdf

Inkelas, K. K., & Weisman, J. L. (2003). Different by design: An examination of student outcomes among participants in three types of living learning programs. *Journal of College Student Development, 44*(3), 335-368.

Jackson, S. (2006). Gender, sexuality, and heterosexuality: The complexity (and limits) of heteronormativity. *Feminist Theory*, *7*, 105-121.

Johnson, A. G. (2006). *Privilege, power, and difference* (2nd ed.). New York, NY: McGraw-Hill.

Johnson, D., Soldner, M., & Inkelas, K. K. (2006, June). *Facilitating success for women in STEM through living-learning programs* [White paper]. Retrieved from http://ojs.libraries.psu.edu/index.php/wepan/article/view/58467/58155

Kahveci, A., Southerland, S. A., & Gilmer, P. J. (2007). From marginality to legitimate peripherality: Understanding the essential functions of a women's program. *Science Education*, *92*(1), 33-64.

Kokkelenberg, E. C., & Sinha, E. (2010). Who succeeds in STEM studies?: An analysis of Binghamton University undergraduate students. *Economics of Education Review, 29*, 935-946.

Lederman, D. (2007, January 15). Clues about the gender gap. *Inside Higher Ed*. Retrieved from http://www.insidehighered.com/news/2007/01/15/ freshmen

MacLeod, J. (2009). *Ain't no makin' it: Aspirations and attainment in a low-income neighborhood* (3rd ed.). San Francisco, CA: Westview Press.

Margolis, J., Fisher, A., & Miller, F. (2000). The anatomy of interest: Women in undergraduate computer science. *Women's Studies Quarterly*, *28*(1/2), 104-127.

Margolis, J., & Fisher, A. (2002). *Unlocking the clubhouse: Women in computing*. Cambridge, MA: Massachusetts Institute of Technology.

Marshall, C., & Rossman, G. B. (2006). *Designing qualitative research*. Thousand Oaks, CA: Sage Publications.

Maxwell, J. A. (1996). *Qualitative research design: An interactive approach.* Thousand Oaks, CA: Sage Publications.

Mills, A. (1988). Organization, gender, and culture. *Organization Studies, 9*, 351-369.

National Science Foundation Division of Science Resources Statistics. (2009). *Women, minorities, and persons with disabilities in science and engineering: 2009* (NSF 09-305). Arlington, VA: Author.

Noel-Levitz. (2011). *2011 National freshman attitudes report*. Retrieved from https://www .noellevitz.com/papers-research-higher-education/2011/2011-national-freshman -attitudes-report

Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research* (Vol. 2). San Francisco, CA: Jossey-Bass.

Pryor, J. H., Hurtado, S., Sharkness, J., & Korn, W. S. (2007). *The American freshman: National norms for fall 2007.* Los Angeles, CA: Higher Education Research Institute. Retrieved from http://www.heri.ucla.edu/PDFs/pubs/TFS/Norms/Monographs/TheAmericanFresh man2007.pdf

Ramsay, K., & Letherby, G. (2006). The experience of academic non-mothers in the gendered university. *Gender, work and organization, 13*(1), 25-44.

Rose, H. (2004). Hand, brain, and heart: A feminist epistemology for the natural sciences. In S. Harding (Ed.), *The feminist standpoint theory reader: Intellectual and political controversies* (pp. 1-16). New York, NY: Routledge.

Rosenthal, L., London, B., Levy, S. R., & Lobel, M. (2011). The roles of perceived identity compatibility and social support for women in a single-sex STEM program at a co-educational university. *Sex Roles, 65,* 725-736.

Sadker, M., & Sadker, D. (1994). *Failing at fairness: How America's schools cheat girls.* New York, NY: Maxwell Macmillan.

Sadker, M., Sadker, D., & Zittleman, K. R. (2009). *Still failing at fairness: How gender bias cheats girls and boys in schools and what we can do about it.* New York, NY: Scribner.

Sartore, M. L., & Cunningham, G. B. (2009). The lesbian stigma in the sport context: Implications for women of every sexual orientation. *Quest, 61*(3), 289-305.

Sax, L. J. (1994). Mathematical self-concept: How college reinforces the gender gap. *Research in Higher Education, 35,* 141-166.

Sax, L. J. (2001). Undergraduate science majors: Gender differences in who goes to graduate school. *The Review of Higher Education, 245*(2), 153-172.

Sax, L. J. (2007). College women still face many obstacles in reaching their full potential. *The Chronicle of Higher Education, 54*(5). Retrieved from http://chronicle.com/article /College-Women-Still-Face-Many/33633/

Seymour, E., & Hewitt, N. M. (1997). *Talking about leaving: Why undergraduates leave sciences.* Boulder, CO: Westview Press.

Shapiro, C. A., & Sax, L. J. (2011). Major selection and persistence for women in STEM. *New Directions for Institutional Research, 152,* 5-17.

Shettle, C., Roey, S., Mordica, J., Perkins, R., Nord, C., Teodorovic, J., Brown, J., Lyons, M., Averett, C., & Kastberg, D. (2007). *The nation's report card: America's high school graduates.* U.S. Department of Education National Center for Education Statistics, Washington DC: U.S. Government Printing Office.

Sinnes, A. (2006). Three approaches to gender equity in science education. *Nordic Studies in Science Education, 2*(1), 72-83.

Smith, B. L., MacGregor, J., Matthews, R. S., & Gabelnick, F. (2004). *Learning communities: Reforming undergraduate education*. San Francisco, CA: Jossey-Bass.

Smith, D. G. (1977). College classroom interactions and critical thinking. *Journal of Educational Psychology, 69,* 180-190.

Snizek, W. E., & Neil, C. C. (1992). Job characteristics, gender stereotypes, and perceived gender discrimination in the workplace. *Organization Studies, 13,* 403-427.

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology, 35*(1), 4-28.

Stassen, M. L. A. (2003). The impact of varying living learning community models. *Research in Higher Education, 44*(5), 581-613.

Szelenyi, K., & Inkelas, K. K. (2011). The role of living learning programs in women's plans to attend graduate school in STEM fields. *Research in Higher Education: Journal of the Association for Institutional Research, 52*(4), 349-369.

Taifel, H. (1981). *Human groups and social categories: Studies in social psychology*. Cambridge, UK: Cambridge University Press.

Taifel, H. (1982). Social psychology of intergroup relations. *Annual Review of Psychology, 33*, 1-39.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago, IL: The University of Chicago Press.

Tyler, M., & Cohen, L. (2010). Spaces that matter: Gender performativity and organizational space. *Organization Studies, 31,* 175-197.

Twenge, J. M., & Zucker, A. N. (1999). What is a feminist?: Evaluations and stereotypes in closed- and open-ended responses. *Psychology of Women Quarterly, 23,* 591-605.

Upcraft, M. E., & Gardner, J. N. (1989). *The freshman year experience: Helping students survive and succeed in college.* San Francisco, CA: Jossey-Bass.

Valenzuela, A. (1999). *Subtractive schooling: U.S. Mexican youth and the politics of caring*. New York, NY: SUNY Press.

Van den Brink, M., Benschop, Y., & Jansen, W. (2010). Transparency in academic recruitment: A problematic toll for gender equality? *Organization Studies, 31,* 1459-1483.

Vogt, C. M., Hocevar, D., & Hagedorn, L. S. (2007). A social cognitive construct validation: Determining women's and men's success in engineering programs. *The Journal of Higher Education, 78*(3), 337-364.

Weiler, K. (1988). *Women teaching for change: Gender, class & power.* Westport, CT: Bergin & Garvey.

Weiler, K. (2001). Introduction. In K. Weiler (Ed.), *Feminist engagements: Reading, resisting, and revisioning male theorists in education and cultural studies* (pp. 1-12). New York, NY: Routledge.

Weiner, G. (2006). Out of the ruins: Feminist pedagogy in recovery. In C. Skelton, B. Francis, & L. Smulyan (Eds.), *The SAGE handbook of gender and education* (pp. 79-92). Thousand Oaks, CA: SAGE Publications.

Zhao, C., & Kuh, G. D. (2004). Adding value: Learning communities and student engagement. *Research in Higher Education, 45*(2), 115-138.