

2016

# Academic and social experiences of female community college transfer students in engineering fields at Midwestern University

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**Academic and social experiences of female community college transfer students in  
engineering fields at Midwestern University**

by

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A dissertation submitted to the graduate faculty  
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Education (Educational Leadership )

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Ames, Iowa

2016

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## ACKNOWLEDGMENTS

I was labeled the black sheep of my family. It was a running joke between my two older siblings that I would be the black sheep of the family. It is funny to me, because I actually started to believe it myself. I have always been interested in music and performing arts. However, school was never my most favorite thing to do. When it came to doing school work, average was my goal. When I received my acceptance letter to attend Iowa State University, my real journey began. My educational journey has been the most challenging yet the most rewarding.

I sincerely thank my two older siblings, Jamal and Ilundria, for motivating me. Although they were joking when they said I would become the black sheep of the family, they always supported me and were among my biggest cheerleaders throughout this journey. I am beyond grateful for the love and support from my mother and father, Eddie and Ila Cobb. Their encouragement never ceased when I found myself doubting my ability to finish school. The family support I received was paramount in my success. My daughters—Sanai, Sarai and Zyla—were born near the end of my educational journey. Nevertheless, their existence fueled my drive even more.

A sincere thank-you to my major professor, Dr. Larry Ebbers, and to Drs. Daniel Robinson and Frankie Santos Laanan. I appreciate your guidance, support, patience, and leadership. To my mentors, Drs. George Jackson and Carlos Lopez, thank you for your honesty and never giving up on me. I also want to thank my editors, Pat Hahn and Rebecca Shivvers, for providing assistance while completing this dissertation.



Finally, I am grateful to my friends and extended family who have supported me during this chapter of my life. I am excited that I will become the first person in my family to earn a Ph.D. I inspire to set an example for my daughters and demonstrate that you can accomplish anything if you put your mind to it!

**ABSTRACT**

Currently, there remains a shortage of women in science, technology, engineering and mathematics (STEM) fields despite recent efforts to increase numbers. The Department of Commerce is predicting that STEM job openings will grow 17% by 2018, which is a much faster rate than most other careers. These are among the highest-paying fields, in part because of the rising demand. Educational institutions in the United States will have to address this issue in order to compete economic leadership globally. High schools, community colleges, and four year institutions must increase awareness and efforts to recruit and retain more women in STEM majors.

The purpose of this study was to understand the experiences of female transfer engineering students at Midwestern University. Participants were asked what were their experiences as female engineering students at both the community college and the four-year institution? They were also asked to share about the community college transfer process, student involvement, relationship with faculty and advisors, sense of belonging, interaction with Faculty and staff/mentorship, peer interactions, and academic performance.

Qualitative methods were used provide in-depth information regarding each student's negative and positive experiences at both the community college and Midwestern University as a female transfer engineering student to provide a better understanding the different experiences of being an female engineering student at Midwestern University after transferring from a community college. Students reported how their interest in STEM was discovered early in their educational journey. They shared how their interest in STEM was

cultivated in high school, but not so much in college. They also shared how participating in more social academic groups helped them to be more successful.

Findings of the study suggested that there are common threads among the transfer process regarding their sense of belonging, interaction with faculty and staff, and family support. Students noted that, once they made the transition to college, there were not many individuals who continued to motivate them to continue in STEM. However, several participants shared that they had at least one mentor with whom they remained connected for guidance, motivation, and support. A few pointed to the lack of involvement of faculty and staff at both the community college and Midwestern University. Recommendations for practice include that it is essential to have services in place for students during and after they make the transfer to Midwestern University. Having a successful and smooth transfer experience can impact the student to turn a potential negative experience into a positive one.

## CHAPTER 1. INTRODUCTION

*“If there is no struggle, there is no progress.”*

Fredrick Douglas

As women continue to transition from community college to 4-year institutions, it is critical to identify the role and importance of the community college during this transition. Previous research has indicated that community colleges encourage their students to transfer and continue their education. Recent studies have argued that community colleges actually kindle the transfer intentions of many students (Alexander et al., 2008; Bahr, 2008). Consequently the role of the community college has played a part in decision-making of students to transfer. As noted by Starobin and Laanan (2010), community colleges play a vital role in STEM (Science, Technology, Engineering, and Math) education today, with more than 50% of students using community colleges as their entry point to higher education. Moreover, “Now that half of the nation’s college students pursuing STEM fields begin at community colleges, the potential for growing STEM talent via community colleges is larger than ever” (Starobin & Laanan, 2005, p. 2; Tsapogas, 2004). With this growing population and students starting their STEM degrees at community colleges, it is vital to gain a better understanding of transfer women who are now at the 4-year institutions and their experiences at the community college level. Research has indicated that the community college experiences can be very impactful for women pursuing male-dominated fields. According to Lester (2010), whose research focused on women pursuing male-dominated careers and technical education programs within community colleges, many women experience gender bias and lack of institutional as well as emotional and support.

Although there is a lack of women in engineering, particularly, it would enrich the data in the literature to explore and gain a better understanding of the background characteristics and the experiences of female engineering transfer students at Midwestern University. Questions that could be asked to gain a deeper understanding and more meaningful insight of female engineering transfer students at ISU: (1) Why did they choose to attend a community college; (2) When did they decide to pursue engineering, how long were they at the community college before they transferred to a 4-year college; (3) Who championed them to pursue engineering; (4) What were some of the positive and negative experiences being a female in a predominantly male major?

According to Fouad (2012) in *Stemming the Tide*, women comprise more than 20% of engineering school graduates, yet only 11% of practicing engineers are women, despite decades of academic, federal, and employer interventions to address this gender gap. A National Science Foundation (NSF) engineering indicators report (2008), predicted a 26% increase of job opportunities in science and engineering between the years 2004 to 2014. Research has revealed multiple reasons that can cause women not pursue engineering. A study conducted by McGrath Cohoon (2007) noted that a couple of the reasons women do not pursue engineering is their inability to solve technical problems and lack of confidence. Moreover, competing with men has also played a role in the lack of women in engineering.

Although over the years the number of women in engineering has fluctuated, there is still a low percentage of women pursuing a degree in engineering. According to the NSF (2011), a total of 471,920 undergraduate students were enrolled in an engineering program in the United States. Out of that total number, 87,825 of those engineering students were female and 384,095 were male.

Engineering has traditionally had fewer women than men. Research has indicated there are multiple reasons women do not pursue engineering. Lack of confidence, unequal pay in the industry, intimidation by male-dominated classes are some of the findings in previous research studies. In an article entitled Diversity in Academia, in *The Chronicle of Higher Education*, Klawe (2013) explained that, even when interested in STEM fields, young women often lose confidence when they take courses with small numbers of female students. With the community college student population growing, many students are starting their college careers at community colleges.

### **Statement of the Problem**

According to Gibbons, 2010, "...from 2000-2009, only 18 to 20% of all the bachelor degrees in an engineering science discipline were awarded to women. Moreover, in 2009, 60,885 engineering degrees were given to men; in that same year, only 13,502 engineering degrees were given to women" (p. 11). While there was a modest 1% increase from 2009 to 2010, the number of women receiving engineering degrees remains low (Gibbons). From the point of entry into higher education to the decision to transfer, what are the experiences sustained by women that contribute to the ongoing decline of their pursuit of engineering degrees? According to Starobin and Laanan (2010), research focused on STEM persistence in the community college transfer pathway is limited, and clearly needed.

Underrepresented groups also contribute to the lack of women in engineering. According to the National Academy of Sciences Crossroads (2011), underrepresented minority groups comprised 28.5% of our national population in 2006, yet only 9.1% of college-educated Americans were in science and engineering occupations. Moreover, *Rising*

*Above the Gathering Storm* (Arrison & Olson, 2012) documented this global leveling and argued that the United States was at a crossroads, stating that for the United States to maintain the global leadership and competitiveness in science and technology that are critical to achieving national goals today, we must invest in research, encourage innovation, and grow a strong, talented, and innovative science and technology workforce.

Due to low ranking placement of the United States in education and graduation rates, President Barack Obama put in place a goal to graduate five million students by the year 2020:

Community colleges are a vital part of our higher education system, enrolling 43% of all undergraduates and a disproportionate percentage of minority, non-traditional, older adult, low-income, working, parent and first generation students or students who are particularly vulnerable to dropping out. The White House Summit On Community Colleges (2011, p. 19)

In addition, research has indicated that the barriers women can face in a male-dominated area such as engineering. Such dominance is also known as hegemonic masculinity, "...a pattern of practice (i.e. things done, not just a set of role expectations or an identity) that allows men's dominance over women" (Connell & Messerschmidt, 2005, p. 836). According to *Beyond Bias and Barriers* (2007), scientists and engineers who are women or members of racial or ethnic minority groups have had to function in environments that favor sometimes deliberately but often inadvertently the men who have traditionally dominated science and engineering.

Historically, this "male dominance" started back in the early 1900s. Before World War II, women were banned from engineering college programs (Bix, 2004; Freehill, 2004). Nevertheless, now that women can both major and have careers in engineering, there are stereotypes and gender bias toward women who enter this discipline. Such stereotypes and

gender bias have resulted in women encountering negative experiences. Furthermore, these issues have affected women's decisions to both major and work in the field of engineering. Studies related to gender factors, such as social and cultural role expectations, have revealed the effect on women's career decisions (Frehill, 2004; Hakim, 2006; Powell, Bagihole, & Dainty, 2009). Moreover, according to Amelink and Creamer's (2010), undergraduate women in engineering have used the classroom as a glimpse into their future profession; if they could not see collegueship and respect modeled, they were less likely to anticipate working in the field.

Although studies have identified some reasons women do not pursue engineering careers in the industry, there remain gaps in the literature about the experiences of female engineering transfer students. In the current phenomenological study, this researcher posited that exploring and capturing these experiences would provide a deeper understanding of the impact gender has on the academic and social experiences of female engineering transfer students.

### **Purpose of Study**

The purpose of this phenomenological study was to understand the experiences of female transfer engineering students at Midwestern University. The research was conducted with female community college transfer students who were pursuing an engineering degree at Midwestern University. These female students were in an engineering program for two semesters or longer. Exploring the social and academic experiences of the female engineering students might provide a deeper understanding of how those experiences could impact and shape female students who aspire to pursue an engineering degree. Furthermore,



this study might be used to provide advisors, faculty, staff and administrators with a better understanding of how to enhance the transfer process of female engineering students prior to and after transferring from a two-year institution to a four-year institution.

### **Research Questions**

The following research questions were addressed in this study:

1. What are the lived experiences of female transfer engineering students?
2. What are the classroom experiences of female transfer engineering students?
3. What support systems help female transfer engineering students?

### **Theoretical Framework**

While female engineering transfer students have continued to enroll in engineering programs at colleges and universities in the United States, there is a gap in the literature that addresses how gender affects the academic experiences in this STEM discipline. This researcher sought to expand the current literature and gain a better understanding of how gender affects the academic and social experiences of female transfer engineering students. In this study I focused on Bronfenbrenner's ecological systems theory as my theoretical framework. I also applied Astin's theory of involvement and Rendon's validation theory to help understand real life student experiences. Allowing the female engineering transfer students to share their experiences provided me with rich data that could be discussed to gain a better understanding of this population and their experiences. My theoretical approach was based on a female engineering transfer student's perspective.

Bronfenbrenner's (2005) bioecological (formerly termed as "ecological"; Bronfenbrenner 1979, 1992) systems theory of human development was used to

conceptualize how systems, gender, and environment can influence social and academic behavior regarding this study. Bronfenbrenner's (1979) model is comprised of four subsystems: microsystem, mesosystem, exosystem, and macrosystem (see Figure 1). The microsystem is comprised of the person's interactions with the environment on a daily or

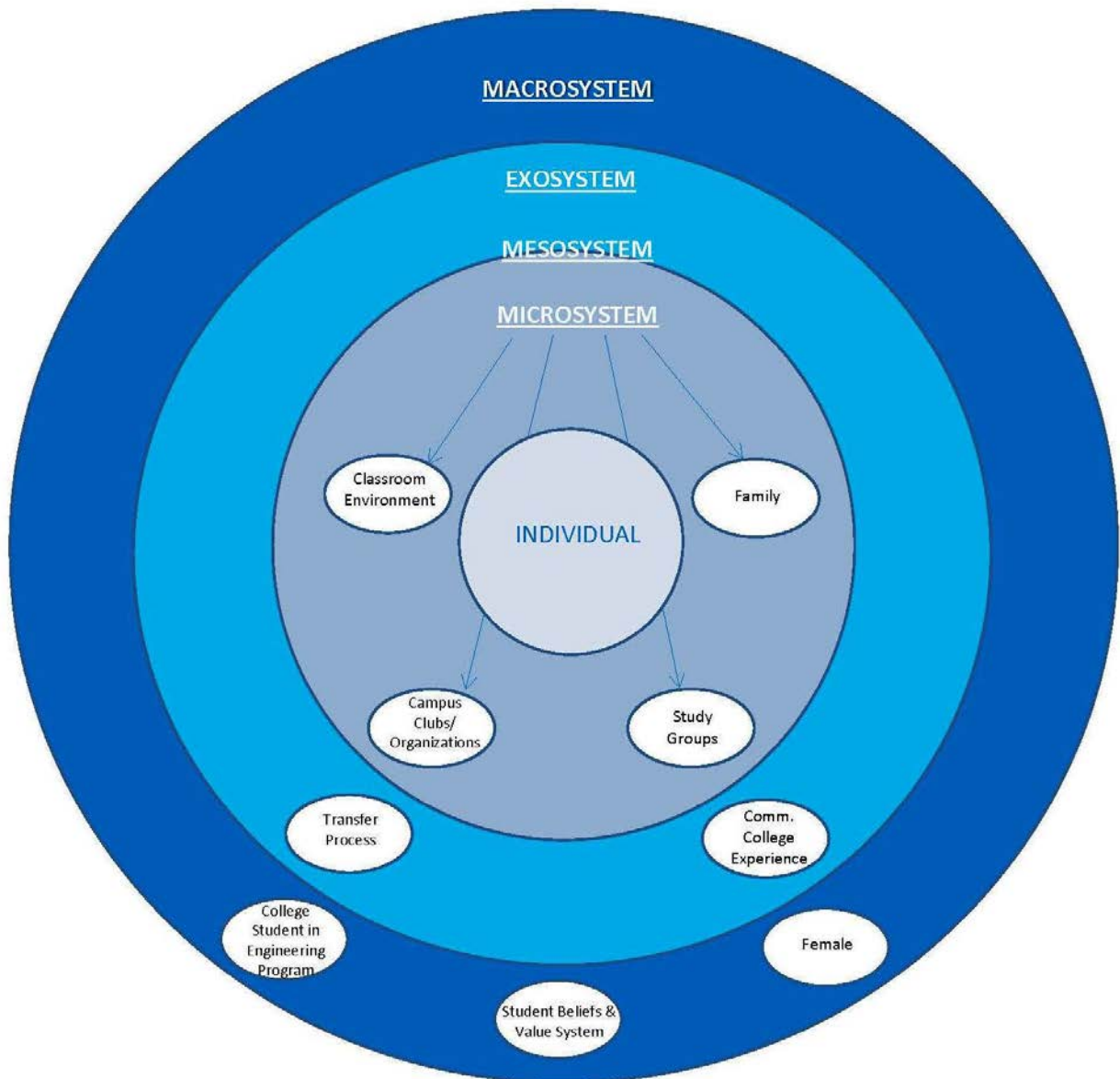


Figure 1. Bronfenbrenner's bioecological systems theory of human development

frequent basis, such as school, work, and home. The microsystems for this study includes classroom environment, campus clubs/organizations, study groups, and family. The mesosystem includes interactions and experiences that occur between the person's varied microsystems. The exosystem includes interfaces between the person's immediate environment and any external factors that impact the person and her environment. Lastly, the macrosystem is comprised of the global society in which the person lives and interacts, and the customs imposed on the environment.

Haverlo (2011) studied STEM development of 6<sup>th</sup>-12<sup>th</sup> grade girls interest and confidence in math and science, utilizing this model as a conceptual framework for the impact of specific contexts/environments in which middle and high school (grades 6-12) girls interact on a daily basis that may or may not impact STEM development. Haverlo's study identified factors that influence 6<sup>th</sup>-12<sup>th</sup> grade girls' interest and confidence in math and science by examining how microsystems influenced the STEM development of the girls. More specifically, Haverlo addressed how these environments impacted their interest and confidence in science and mathematics. According to Haverlo, identifying these factors would increase our understanding of the STEM developmental experiences for 6<sup>th</sup>-12<sup>th</sup> grade girls in Iowa. In turn, understanding their STEM developmental experiences as these experiences relate to interests and confidence in math and science could help to guide educational STEM practices and future opportunities.

### **Significance of the Study**

This study is significant because it provides additional literature on factors that have a direct or indirect effect on the academic and social influences on the experiences of female engineering transfer students. For over 100 years, society has allowed such an entity as male dominance to persist. Engineering is one of many fields that has perpetuated a stereotypical label of male dominance. This study explored the experiences of female transfer engineering students to bring to the forefront several stereotypes that are associated with women in engineering. Furthermore, the study examined the societal acceptance of male dominance. This researcher allowed female transfer engineering students the opportunity to tell their stories and share their experiences. In doing so, the participants were able to address some of the negative influences and stereotypes of being a female engineering student. The study evoked meaningful data for future research. Data collected from this study may be used by community colleges and universities in the following ways: (a) help female engineering transfer students experience greater academic success; (b) provide greater insight on resources and support services that can be offered at the institution; (c) provide ways that faculty and staff can collaborate to more effectively engage this population which, in turn, may positively affect recruitment and retention; (d) establish best practices to increase program offerings and initiatives geared toward women in engineering; and (e) shed light regarding the culture of engineering and how, over time, society has been allowed to continue to operate with bias towards women in engineering.

### **Definition of Terms**

The following definitions were applied within the context of this research.

***Community College:*** a two-year institution (government-supported) of higher education that offers a variety of associate degrees, certificates, and diplomas.

***Pre-engineering:*** Pre-engineering and lower division collegiate transfer courses are generally prescribed by the Accreditation Board for Engineering and Technology (ABET) and the institution. They are taken during the first two years of a baccalaureate degree and serve as a foundation for upper division courses and the engineering major.

***STEM:*** Acronym commonly used for Science, Technology, Engineering, and Mathematics.

***Phenomenology:*** The movement founded by Husserl that concentrates on the detailed description of conscious experience, without recourse to explanation, metaphysical assumptions, and traditional philosophical questions.

***Transfer Student:*** a student who moves from one institution or course to another at the same level.

***Gender:*** The state of being male or female.

### **Dissertation Organization**

Chapter 1 presents an introduction to the problems women engineers face in the industry as well as their academic experiences. It also discusses the initiatives that have been put into place to help create a level playing field for women in engineering. It introduces ways that may help recruiting, retention and engagement of women in engineering. The purpose, research questions, significance of the study, and definition of terms are also included.

Chapter 2 reviews the literature and introduces the theoretical framework applied in the study. It summarizes and connects the academic and social experiences of female engineering transfer students at Midwestern University. It also examines key factors that play a role in the retention of female community college transfer students in engineering.

Chapter 3 introduces the research methodology and design used in this research. This chapter includes research questions, research design, epistemology, theoretical perspective, methodology, research setting, participant selection, data collection and data analysis procedures and processes.

Chapter 4 presents the results of the data collection. Chapter 5 provides a summary of the findings, as well as the conclusions, limitations, implications, and recommendations for future research.

## CHAPTER 2. LITERATURE REVIEW

The purpose of this study was to understand the experiences of female transfer engineering students at Midwestern University. The review of literature introduces the theoretical framework utilized in the study, and summarizes, connects the academic and social experiences of female engineering transfer students at Midwestern University. The review also examines key factors that play a role in the retention of female community college transfer students in engineering.

Previous research has indicated that gender plays a huge role in student's success. Before World War II, women were banned from engineering college programs (Bix, 2004; Freehill, 2004). As history has revealed, Iowa State University played a significant role initiating an era of women in engineering. Through the Engineering Cadet Program established in 1942, the "Curtiss Wright Cadettes" emerged, which was a program consisting of 600 women from seven colleges: Cornell, Iowa State, Minnesota, Penn State, Purdue, Rensselaer Polytechnic Institute (RPI), and the University of Texas (Bix, 2004). Through this program, women experienced the value of performing patriotic services, and demonstrated their academic competency. Faculty members acknowledged the women's high academic achievement as well as their technical skill performance with equipment in machine shops. A second sponsor, Radio Corporation of America (RCA) also endorsed the Cadette Program, which resulted in 20 percent of women employees in RCA plants (Tallmadge, 1944).

Science, technology, engineering and mathematics (STEM) is a booming topic in today's society. The gender gap in certain STEM fields is apparent. The NSC reports: in 2013, women earned 19 percent of the engineering degrees. However, women earned 62

percent of the social science and psychology degrees in 2013 disciplines that do not fall under the traditional STEM definition. Although science and engineering degree completions for students over the age of 26 also experienced a significant growth, these groups of students still make up a much smaller portion of all science and engineering degrees, according to the NSC reports. As more non-traditional and traditional students begin to choose the public 2-year college as their first choice, community colleges will have to be prepared to serve these students in various capacities. The White House released its first summit on community colleges in June of 2011. President Obama has set a goal of graduating an additional 5 million community college graduates by the year 2020. For many students high school is the goal because they cannot afford college and many of their parents did not go beyond high school. Community college has become a great starting point for low income and first generation students. According to the Institute for Women's Policy Research, Student Parent Success Initiative, "In 2003–2004, about one in four community college students lived in families with very low incomes 125 percent of the poverty level or below" (2012 p.7). In 2010 President Obama launched the American Graduation Initiative. This initiative promised to end wasteful subsidies to big banks for student loans, and instead use that money to make college more affordable, and to make a historic investment in community colleges. From the downturn of the economy in 2008 many Americans decided to return to school. Moreover, community colleges saw the most increase in enrollment. According to the Chronicle of Higher Education (2011) in 2006, 41.7 percent of traditional-age students enrolled at two-year colleges; in 2009, 44.5 percent did so. Between 2008 and 2009, enrollments of traditional-age, first-time students at two-year colleges increased by 8.3 percent. The White House College Summit (2011) reports that in 2000, the Army created GoArmyEd, an online



network that allows soldiers to take classes at twenty-nine colleges and universities, 24 anywhere in the world, any time. GoArmyEd offers 24/7 support, tutoring, a virtual library, and college counseling. GoArmyEd's completion rate is 83%. 43% of all military undergraduates and 39% of those receiving veterans' education benefits have selected public, two-year institutions as the place to achieve their academic and career goals.

U.S. News reports that there are roughly 5.7 million openings in STEM fields in 2013. 4.4 million of these jobs required at least a bachelor's degree and 2.3 million were entry-level jobs that call for less than two years of experience. Many of these positions are going unfilled or they are being filled by men. The Department of Commerce estimates that the STEM workforce will grow 1.7 times faster than the non-STEM workforce between 2008 and 2018 (The Department of Commerce, 2012). To meet the projected workforce needs, the current Obama administration has put forth a goal of increasing the number of students receiving undergraduate STEM degrees by one million over the next decade (President's Council of Advisors on Science and Technology, 2012; White House, 2012). As part of an integrated approach to achieve these one million graduates, community colleges are highlighted as potential pathways for students to achieve STEM degrees (White House, 2012).

There are multiple factors that can negatively affect the number of women who choose to pursue STEM fields, in this case engineering. Campbell (1990) examined the relational differences between men and women regarding how they see themselves and define their success. The findings revealed that males tend to take greater ownership of their individual success whereas females attribute success to various external or environmental factors. This is significant in that the study concluded that students who experience a greater

sense of accomplishment will be motivated to seek further advancement in their own area of study (Stipek, 1988). Additionally, individuals who attribute success to external factors are challenged to repeat that same level of achievement based on self-doubt and are less likely to persist in that area of study (Pedro, Wolleat, Fennema, & Becker, 1981).

Furthermore, gender roles for men and women are established and reinforced early in childhood, and can impact how women assess their future career opportunities. Findings of a study conducted by Garrod and Taber (1991) revealed that women who did not pursue degrees in technical fields did so due to: (1) a lack of knowledge of career opportunities; (2) gender issues in the workplace; (3) the continued existence of sexual discrimination and harassment in the workplace in male dominated professions; (4) the pressure of meeting the responsibilities of family and personal commitments while engaged in a technical career; and (5) the long-term prospect of professional growth in a male-dominated field (Garrod, Taber, 1991, p. 21).

Numerous engineering job openings are expected to increase over the next 12 months, with the sector anticipated to remain the number one in-demand job for 2014 (*The Houston Chronicle*, 2014). However, female engineering students are still experiencing challenges that are causing them to change their major and not persist. The NSF has invested a great deal of resources in seeing that these areas in STEM do not dissipate. According to NSF, the National Science Foundation (NSF) is committed to continued implementation of a coherent, agency-wide investment approach to achieving goals for increasing the numbers, broadening the diversity, and improving the preparation of STEM professionals through undergraduate education. Recent reports of the President's Council of Advisors on Science and Technology (PCAST) and the National Academies support the critical importance of this

focus. The National Science and Technology Council Committee on Science, Technology, Engineering, and Mathematics Education (CoSTEM) identified undergraduate STEM education as a priority in its 2013 5-Year Federal STEM Education Strategic Plan. NSF's strategy will incorporate key approaches emphasized in these documents, such as the widespread implementation of evidence-based teaching practices, including the integration of discovery-based laboratories, as having strong potential to enhance retention, and the continued building of the knowledge and evidence base to improve STEM education. The literature review explored some of these disparities and identified key areas that are causing low female enrollment numbers in engineering programs. The literature also help gain a better understanding of the issues involving gender/race, identity and the impact it has on female community college transfer engineering students at Midwestern University.

During my Master's Degree program of study, I had the opportunity to work as a graduate assistant which afforded me the opportunity to conduct research on female students in the STEM fields. During some of the interviews, I remember students sharing their stories and explaining how they were not encouraged to pursue engineering. Instead they were questioned about pursuing engineering and asked was engineering something they really wanted to do. Gender issues have been detected in different studies as early as middle school. Being a female with interest in Engineering is not a new phenomenon. Young women across the world are interested in all of the STEM areas but some of them never pursue their interest. "Women aptly competent in mathematics often fail to pursue mathematics related careers because they have low self-efficacy perceptions about their competence (Zeldin & Pajares 2000)". Self-efficacy is defined as judgments regarding one's ability to organize and execute the courses of action necessary to attain a specific goal self-efficacy judgments are

related to specific tasks in a given domain (Bandura, 1997; Pajares, 2005; Zimmerman, 2000). Signs of lack of self-efficacy show up in early stages of academia. According to Hoopes (2007), children and girls especially develop beliefs that they cannot pursue particular occupations because they perceive them as inappropriate for their gender. Moreover, Hoopes explained that, in studies of high achievers in mathematics, women are more likely to pursue degrees in the humanities, life sciences, and social sciences.

These gender differences have caused an impact on female students. For this study, there were several components that were explored to gain a better understand of how gender affects the academic and social influences on the experiences of female engineering community college transfer students at Midwestern University. Background, high school preparedness, community college transfer process, student involvement, relationship with faculty and advisors and academic performance will all be discussed to help make meaning and gain an understanding of my study. During the qualitative case study I conducted for Central State Community College, these were several areas the female pre-engineering students credited to their overall experience in the pre-engineering program. For this study, these components were explored to help understand the various experiences of the female community college transfer engineering students while at the four year college.

### **Background**

Environment can often have a huge impact on an individual life and overall choices. The success of many college students is nurtured by their environment. Many female students are not encouraged to pursue engineering. Gender often plays a role in their education decisions. According to Shashaani (1994) parents exhibiting stereotypically gender

views may discourage women from pursuing careers in male dominated areas of study. Female students that decide to enroll in engineering often experience a sense of belonging. On an individual level, students seek affiliation, identification, and membership with a peer group. In turn, the peer group confers acceptance and dictates the norms and expectations of its members (Astin, 1993). Being aware some of these factors can help advisors, counselors, faculty and staff better serve these students. Furthermore, it will help with the planning and implementation of new programs and initiatives to aid with recruitment and retention. Pascarella and Terenzini (2005) documented the research supporting the idea that belonging to a peer group is related to persistence, degree attainment, and pursuit of graduate education. Many female engineering students experience pressures both in the classroom and at home. The background and foundation with some of these students can cause stress and pressure. Many times if a student has a line of doctors or engineers in the family it is sometimes assumed that they too will follow the family tradition. It is essential that advisors, counselors and staff are sensitive to student's background. Moreover, it is just as critical that these support services are aware and understand this population.

### **High school and community college experiences**

Studies have revealed that women who major in engineering lack confidence. However, more women are needed in this field. Nevertheless, leaders in the engineering community have agreed that the only way to increase the engineering labor pool is to diversify the current engineering workforce (Noeth, Cruce, & Harmston, 2003). Part of this challenge is finding women who are skilled and prepared to compete in this field. There is a lack of female students in high school who are pursuing engineering. Women take fewer

advanced mathematics and science courses in high school and they shy away from calculus and physics (Bleeker & Jacobs, 2004; Blickenstaff, 2005). Thus, women are often less prepared when they go to college especially as most first-year engineering students are required to take calculus (Noeth et. al., 2003). Therefore, it is essential that high schools have an aggressive outreach program to attract qualified students to the engineering profession via community colleges and four-year educational institutions Enhancing the Community College Pathway to Engineering Careers (2005 p.14). Moreover, community colleges need to have engineering courses with state-of-the-art technology and education supplemented with a variety of interesting design and build programs to motivate students to continue to the study of engineering leading to a bachelor's degree (Enhancing the Community College Pathway to Engineering Careers (2005, p.14). Typically, when female students arrive at college, they often struggle or have challenges maintaining persistence in engineering programs.

According to the National Science Foundation (NSF) (1998), the percentage of women earning degrees in engineering, at both the undergraduate and master's degree level, is approximately 19% annually. Approximately 20% of engineering doctoral degrees are awarded to women (Gibbons, 2004; NSF, 1998;). Community colleges and local high schools need to increase collaborative efforts to assist students in engineering particularly women. For example, Middle College High School at Contra Costa College is a highly acclaimed middle-early college high school. In 2008, 48% of graduating students had earned both a high school diploma and an associate degree. The average number of college credits earned by their graduates was 50. One reason for their success is the development of supports to assist students in the transition from high school to college.

As stated previously, it is necessary for community colleges and high schools to collaborate in efforts to better serve women in engineering programs. High schools should be offering classes that are rigorous enough to challenge female students in ways that will prepare them to persist and perform at a high level in college. It is also important that the transfer process from the community college to four-year institutions is smooth.

### **Community college transfer process**

Female engineering students who transfer to the four-year often change their majors or struggle academically. According to Svanum and Bigatti (2009), students who are more academically engaged tend to not only finish their academic degrees but also finish faster than non-engaged students. Transferring from a two-year community college to a four-year institution should be a smooth process. Most community college students finish their general education courses at the school and then transfer to complete their last two years to earn their bachelor's degree. This process can sometimes intimidate students. Class size often has an impact on student success. Most community colleges have smaller, more intimate classrooms. The average classroom size at a community college is between 15 and 24 students. These classes are often considered full at community colleges.

Making the transition from a 15 student class to a 300 student lecture class can sometimes be overwhelming. Moreover, these larger lecture style classes can cause students to shy away from participating in class:

*When I was in college I never raised my hand....never. I didn't raise my hand when I thought I knew the answer. I didn't raise my hand even when I knew the answer with 100% absolute certainty. And I didn't raise my hand when the professor was practically pleading for someone, anyone, to please participate.* (retrieved 2/28/2014, from <http://www.facultyfocus.com/articles/teaching->

and-learning/shy-students-in-the-college-classroom-what-does-it-take-to-improve-participation/)

It is important that students feel connected during and after the transfer process. When students are not experiencing a sense of belonging they often fail to persist. According to Pascarella and Terenzini (2005), the idea that belonging to a peer group is related to persistence, degree attainment, and pursuit of graduate education.

It is important that institutions are exploring options to enhance their transfer process and giving students a sense of belonging. In a research study in *Enhancing the Community College Pathway to Engineering Careers* (2005, p. 24), the importance of having an engineering transfer program was discussed. The study also highlighted the importance of the evaluations of transfer programs and noted that the evaluations of transfer programs should include definitions of positive outcomes of diversity, assessments of learning outcomes, and assessments of shared-learning outcomes-based objectives. Exploring the transfer process of female engineering transfer students at a Midwestern university may help gain an understanding and enrich the data that are collected from these student experiences.

Involvement in extra-curricular activities has been positively linked to improved outcomes for students (Pascarella & Terenzini, 1991). To help female engineering students who are making the transfer feel more connected, it is important that academic advisors and counselors at both the community and 4-year college keep abreast of the different clubs, groups and activities that are taking place at the 4-year college. Furthermore, it is just as important to create new activities and encourage these students to start their own clubs and groups to help keep them involved.



### **Student Involvement Theory**

Student involvement plays a critical role in a student's college career. Student involvement has been defined by Astin (1984) as "the amount of physical and psychological energy that student devotes to the academic experience" (p. 518). Being involved helps students feel connected and gives them a sense of belonging. This also helps with self-esteem, self-confidence and a better academic experience. Townsend and Wilson (2006) agreed, stating that "social and academic interactions contribute to a student's sense of belonging to the institution" (p. 440). There are numerous of activities offered for students in college. However, more initiatives could be added that are focused on female engineering students. Comments made by pre-engineering students at [Central State Community College] in 2012 stated: "*I wish there were more group activities for us girls in engineering here on our campus.*" ... "*More activities that would connect us with the Iowa State female engineering students would be awesome.*" ... "*It would also be very helpful to connect with an advisor before making the transfer to Iowa State University.*"

Moreover, Seymour (2000) stated that classroom activities and assessment lead to gains in the learning process as well as improved outcomes for both students and teachers. The current study may assist with collaborative efforts between faculty and staff at both the community college and 4-year institutions regarding how to encourage and create more opportunities for female students in engineering to be involved. The female engineering students would feel more connected and it would increase retention and persistence. According to Astin's (1984) theory of student involvement, colleges and universities that involve their students in their educational experiences not only enhance student learning

outcomes, but also increase student retention. Moreover, the findings of this study may also help faculty and staff find more creative ways to engage this population.

Astin's theory (1984, as cited by Evans, 1998) involvement theory has five postulates:

1. Involvement refers to the investment of physical and psychological energy in various objects. The objects may be highly generalized (the student experience) or highly specific (preparing for a chemistry examination).
2. Regardless of its object, involvement occurs along a continuum; that is, different students manifest different degrees of involvement in a given object, and the same student manifests different degrees of involvement in different objects at different times.
3. Involvement has both quantitative and qualitative features.
4. The amount of student learning and personal development associated with any educational program is directly proportional to the quality of student involvement in that program.
5. The effectiveness of any educational policy or practice is directly related to the capacity of that policy or practice to increase student involvement.  
(p. 298)

This approach focuses on factors that facilitate development rather than examining development itself. In order for student learning and growth to take place, students need to actively engage in their environment (Evans et al., 1998).

For the purpose of this study, I positioned student involvement theory within Bronfenbrenner's model as one potential way of interpreting the relationships between the individual student and the amount of time and energy spent within the campus environment. Student involvement theory may help highlight aspects of the mesosystem, which is comprised of the relations among two or more settings in which the developing person becomes an active participant (Bronfenbrenner, 2005). Astin's involvement theory includes both academic and social pursuits, which are essential aspects of this study.

**Sense of belonging**

College can be very intimidating for many students, especially students who choose difficult majors. According to NSF's (2013) Survey of Doctorate Recipients, engineering was ranked 1<sup>st</sup> out of the top five most difficult majors. Many students have high hopes and expectations of one day graduating with a degree in engineering. However, according to NSF's (2012) Science and Engineering Indicators, many students who start in engineering become a freshman drop-out before their second year. Thus, it is critical that students are feeling a sense of belonging early in their college career. Application of Rendon's (1994) validation theory played a significant role in the current study, although, Rendon's theory was designed to address experiences of low income, first generation as well as adult students returning to college after being away for some time. As originally conceived, validation refers to in- and out-of-class agents (i.e., faculty, students, and academic affairs staff, family members and peers). Rendon's theory can be used to shed light on some of the similar issues female engineering transfer students face at Midwestern University. It is important that students are feeling a part of their environment early on in their college career. According to Rendon (1994), the elements of validation explain that it is critical that validating agents actively reach out to students to offer assistance, encouragement and support as opposed to expecting students to ask questions first.

**Interaction with faculty & staff/mentorship**

Studies have revealed that students perform better when they have a positive relationship with their professor/instructor. Bryant and Harper (2009) found that, when students speak with faculty outside of the class, they most likely achieve better grades and

feel a sense of competitiveness. Positive interactions with faculty, staff, and mentors can be very impactful. There is also evidence that students who are successful in knowing even one faculty member closely are likely to feel more satisfied with their college life and aspire to go further in their careers (Rosenthal et al., 2000).

Interaction with faculty can often lead to mentorship between faculty and students. Mentoring can be very influential in helping students throughout their college career. Moreover, mentoring has previously been found to be positively related to several student outcomes, including student grade point average and decisions to persist in college (e.g., Campbell & Campbell, 1997; Kahveci, Southerland, & Gilmer, 2006; Pagan & Edwards Wilson, 2003; Salinitri, 2005; Sorrentino, 2007; Wallace, Abel, & Ropers-Huilman, 2000). As mentioned previously, students who are more involved in activities and clubs feel a sense of belonging that increases persistence. Students who have positive interactions with faculty and staff tend to do better in their classes and persist. Nora, Cabrera, Hagedorn, and Pascarella (1996) found that factors that predict female persistence at 4-year institutions were reflected in their social integration and interaction with faculty.

It is critical that engineering faculty and staff are reaching out and encouraging female engineering students. Schlossberg (1989) explained that involvement creates connections between students, faculty, and staff that allow individuals to believe in their own personal worth. This involvement also creates an awareness of our mutual relatedness and the fact that the condition of community is not only desirable but also essential to human survival. Therefore, the concern over involving students, although expediently related to satisfaction and retention, is the very process that creates community (Schlossberg, 1989, p.

6). These interactions help foster a sense of belonging culture. Furthermore, it helps with student overall performance academically as well as persistence.

### **Interaction with peers**

College is sometimes explained as the most fun years of a person's life. One way students have fun in college is through relationships with friends and peer interaction. Student life on college campuses consist of multiple things. Activities, social events, clubs and student organizations are just a few of many. None of these mentioned can take place without peer interaction. Students interact with each other on a daily basis in many different facets. These interactions can be very healthy and lead to positive student development outcomes. In small group and partner work students are expected to interact and learn from each other, and there is wealth of research in general education and special education literature investigating the social and academic benefits of peer interactions (Bowman-Perrot et al., 2013; Ginsburg-Block et al., 2006; Rohrbeck et al., 2004). It is very common for students to have negative experiences while in college which often leads to stress and ultimately dropping out. Peer interaction can sometimes help students cope with bad grades and stressful times. It can also help students achieve good grades and persist.

### **Academic performance**

Making the choice to major in engineering is a huge step for females aspiring to become engineers. This field has been traditionally dominated and stereotyped as a field for males. Students who choose to major in engineering know that the program is rigorous. They students are also well aware that they have to perform at a high level academically to be successful in this field. According to Bleeker and Jacobs (2004), self-confidence, or self-

perception is directly associated with career choice, and young women lack the self-confidence and grossly underestimate their ability to succeed in what they perceive as such a rigorous field (Bleeker & Jacobs, 2004; Kerr et al. 2004).

It is not well known why more women do not choose to major in engineering, other than the highly publicized notion that most engineering programs are very challenging and rigorous. Students majoring in STEM disciplines often spend more time studying, doing homework, and using the internet than non-engineering students (Nicholls, Wolfe, Besterfield-Sacre, Shuman, & Larpkittaworn, 2007). In addition, most entry-level jobs in engineering require a 3.0 GPA or higher. Students majoring in engineering know that they have to maintain a high GPA in order to pass their classes and successfully finish their program of study. Maintaining a high GPA will also increase their chances of securing employment after graduation. According to International Business Machines (IBM) (2013), GPA is one of the main qualifiers a hiring manager uses to compare potential candidates who are university level hires. It can be a challenge to overcome a GPA lower than what is set as a requirement for the role (retrieved February 28<sup>th</sup> 2014, from <http://jobipedia.org/Questions/Conversation/WHAT-DO-I-DO-as-an-engineering-major-who-graduates-with-less-than-a-3-0-GPA-and-wants-to-get-into-a-large-company-where-most-the-entry-level-position-postings-require-a-minimum-of-3-0>).

### **Summary**

This chapter provided a review of the literature relevant to this study. It highlighted the importance of the background, high school/community college experience, community college transfer process, student involvement, sense of belonging, interaction with faculty

and staff/mentorship, peer interactions, and academic performance of female engineering students. These components are relevant because they help to provide an understanding of what women in engineering experience. Moreover, these components help to provide an explanation as to why women in engineering decide not to continue pursuing an engineering degree upon entering college or after they have transferred. The background of this population provided context to how environment plays a role in decisions to pursue an engineering degree. A discussion of the high school and community college experience provided an understanding of this impact on one's decision to pursue engineering. The community college transfer process was also discussed to understand ways to increase this process and make the transition smoother for the student. Why women in engineering decide to change their major after they transfer was also discussed as well as the impact of transferring from a community college to the four-year institution.

The literature revealed that student involvement was a key component to gain insight on extra-curricular activities of women in engineering outside of the classroom. Sense of belonging was mentioned and explored to gain an understanding of how female transfer students in engineering feel during their journey as a female in engineering. There are many factors that contribute to women's decision making to change their majors and not persist. Interactions with faculty and staff and peer interactions was discussed to highlight the importance of staying connected and having building necessary support systems. A brief discussion of academic performance and the effect on women in engineering revealed industry requirements to hire are largely based on GPA and academic performance.

### **CHAPTER 3. METHODOLOGY**

The purpose of this phenomenological study was to understand the academic and social experiences of the female community college transfer students in engineering fields at a Midwestern university. The goal of this study was to explore these experiences and interpret how they have impacted their college career. This chapter outlines the research questions, research design, theoretical framework, data collection, data analysis, design, limitations and delimitations of the study. These topics are discussed to provide the theoretical framework, how the study was conducted, the research methodology employed, and analysis of the data.

#### **Research Questions**

The following research questions provided a framework for the study:

1. What are the lived experiences of female engineering transfer students?
2. What are the classroom experiences of female engineering transfer students?
3. What support systems help female transfer engineering students?

#### **Research Design**

According to Merriam (1988), “Qualitative research assumes that there are multiple realities—that the world is not an objective thing out there but a function of personal interaction and perception. It is a highly subjective phenomenon in need of interpreting rather than measuring” (p. 17). My intent was to conduct a qualitative study that would allow participants to freely speak about their experiences as female engineering transfer students. This methodology would evoke a rich description and narrative that emerges when individuals are allowed to tell their personal stories. The data may be used to help community



colleges and Iowa State University better serve women in their engineering programs and contribute to the current body of knowledge on this subject.

Historically, qualitative research has been associated with various social science disciplines, cultural or social anthropology, qualitative sociology, history, organizational behavior and so on. Qualitative research also has clear roots in certain philosophical traditions, notably phenomenology and hermeneutics (Rossman & Rallis, 2003, p. 7).

### **Epistemology**

Merriam (1998, 2002) defined epistemology as the study or a theory of the nature and grounds of knowledge especially with reference to its limits and validity. According to Crotty (1998), epistemology is the theory of knowledge embedded in the theoretical perspective and thereby in the methodology. The epistemology that is relates to this study is constructionism. Constructionism rejects this view of human knowledge (Crotty). Crotty also stated that there is no objective truth waiting for us to discover it. Truth, or meaning, comes into existence in and out of our engagement with the realities in our world. This would directly relate to my study, which was to help make meaning of the personal experiences of my participants.

### **Theoretical Perspective – Interpretivism**

Theoretical perspective is described as our view of the human world and social life within that world, wherein such assumptions are grounded (Crotty, 1998). For my theoretical perspective I will use the interpretive approach. From this perspective human beings are social beings who interact socially with each other and the outcomes of this interaction develop the fabric of society the cultural world in which individual live out their lives and an identification for individuals within that society (Blumer, 1972; Congalton & Daniel, 1976).

Interpretivism was relevant to my study because it enabled me understand the impact gender has on the social experiences of female engineering transfer students at Midwestern University. It also provided insight to the various challenges women face when pursuing an engineering degree.

It was important for my participants to understand and make meaning of their experiences as female engineering transfer students. Moreover, it was vital for them to be able to interpret how their experiences impacted their decisions and behavior. Use of an interpretive theoretical perspective provided a framework for understanding how female engineering transfer students make meaning of their experiences being a female in a male-dominated discipline.

### **Methodology – Phenomenology**

Phenomenological inquiry originated in the early 1900s. The goal of phenomenology is to describe and analyze the activities and meaning that persons attach to their experiences as they engage in organized social interaction (Patton, 1991). A phenomenological study focuses on the essence, or structure, of an experience by showing how complex meanings are built out of simple units of direct experience (Merriam, 2002). The goal is to describe and analyze the activities and meaning that persons attach to their experiences as they engage in organized social interaction (Patton, 1991).

Holloway (1997) noted that researchers who use phenomenology are reluctant to prescribe techniques. Hycner (1999) concurred, stating that “there is an appropriate reluctance on the part of the phenomenologists to focus too much on specific steps” (p. 143).

He went on to say that one cannot impose method on a phenomenon “since that would do a great injustice to the integrity of that phenomenon” (p. 144).

I utilized a phenomenological approach to gain a better understanding of the experiences of the participants of my study. According to Welman and Kruger (1999), “the phenomenologists are concerned with understanding social and psychological phenomena from the perspectives of people involved” (p. 189). It was my intent to allow students to share their experiences in the engineering program at ISU. A researcher applying phenomenology is concerned with the lived experiences of the people involved, or who were involved, with the issue that is being researched (Greene, 1997; Holloway, 1997; Kruger, 1988; Kvale, 1996; Maypole & Davies, 2001; Robinson & Reed, 1998).

### **Reflexivity Statement and Positionality**

I have been employed in higher education for 10 years—four years at my alma mater and six years as an academic advisor at a community college. As a 35-year-old, African American, I consider myself to be at the early stages of my career. Currently, I am a resource specialist for the Gateway to College program in the community college where I am employed and work with drop-out, at risk-high school students who do not have enough credits to graduate high school. I am also an adjunct instructor at the institution where I work. I have taught Study Strategies, The College Experience, Computer Essentials and Career Exploration. In addition, I am a part of the STEM council. I have always been interested in the topic of female students in engineering.

It is important to explain why a topic, more specifically, female students in engineering, interests me. Both my involvement as a graduate research assistant and being a

student at my alma mater have influenced many of my academic decisions. For example, while serving as a graduate research assistant, I was surrounded by research and worked on many projects that involved student development and women in Science, Technology, Engineering and Mathematics (STEM). I worked alongside of four other graduate assistants who were also part of the research team. In addition, one of my college roommates was an engineering major at the institution. While conducting research on women in the STEM fields, it was very interesting to hear a male engineering student's perspective and experiences. Research on women in STEM became a constant part of my life, and I have been intrigued by female students' experiences in the engineering disciplines.

When using qualitative research, it was not as surprised to hear the different female engineering student's experiences, because I have worked on similar studies as a graduate research assistant. Moreover, I had experienced my roommate's stereotype of females who majored in engineering. In this dissertation research, I believe my previous research experiences have served as an aid in my analysis of female transfer engineering students.

As a 35-year old researcher, I conducted my analysis differently than I would have 10 years ago. My past 10 years of employment at 4-year Research I institution and at a large community college have provided me with several years of work experience and educational classes as well as life experiences to conduct such as research study. My employment has also provided me the opportunity to encounter both female and male experiences in multiple engineering disciplines. My background and dissertation research have enabled me to study female transfer engineering students' experiences as well as their perspectives on being female students in a male-dominated field.

### **Institutional Review Board Approval**

Prior to starting my dissertation research, approval from the Institutional Review Board was requested and granted (see Appendix A). After the request was granted and consent documents were signed by each participant, I began the interviewing process.

### **Design**

#### **Research site/setting**

My study was conducted on the campus of Midwestern University. The interviews took place at a disclosed location in a private room on campus. The environment was relaxed so that the participant could speak freely and honestly about their experiences.

I employed a phenomenological approach because it was important for me to provide a comfortable environment and not make the students feel that they were being rushed. I conducted the interviews with a relaxed approach which enabled the students to also relax so that they could be open and honest about their experiences. Each student shared different experiences and had unique stories. It was important that avoid bias or judgment at any point during the students' interviews. Allowing students to freely share their stories enabled me to capture the richness of their experiences.

The participants had the option to do the interview at a location of their choice. According to (Rossman & Rallis, 2003), qualitative research is conducted in natural settings rather than controlled ones. It assumes that humans use what they see and hear and feel to make meaning of social phenomena, and it relies on a variety of data-gathering techniques. It is research that represents human beings as whole persons living in dynamic, complex social arrangements.

### **Participant selection**

The participants for this study were selected based on their status as (a) female, (b) currently enrolled as a transfer student at Midwestern University, and (c) majoring in engineering. Prior to conducting my study I contacted the Director of Student Development in the College of Engineering by email and explained my study. I also requested the email addresses of female engineering transfer students. After I received the female engineering transfer students' emails, I emailed requests (Appendix B) for participation in my study. Those who indicated willingness were provided with a protocol (Appendix C) and a consent form (Appendix D) to sign and return to me at the first meeting. Twenty students were selected initially, and eight completed the forms and participated in the study.

### **Data Collection**

I used a semi-structured interviewing method to gather data. This data collection method is one that is used frequently in qualitative research. "Interviews represent one of the most common ways of collecting data in qualitative research because they provide opportunities for the researcher to collect rich and meaning-making data" (Frels & Onwuegbuzie, 2013, p. 186). Semi-structured interviewing was the only method of interviewing used in this study. Each interview was 60-90 minutes in length. Data were recorded and transcribed for accuracy. Then each participant was provided with a copy of the transcribed interview to ensure honesty and accuracy of the transcriptions. The interviews enabled me to explore my participants' experiences as female engineering transfer students. Moreover, it helped me identify common themes and similarities during my analysis of the data.

## **Data Analysis**

As mentioned previously, the analysis process was conducted in two phases. First, each interview was transcribed verbatim and numbered chronologically by the date that the interview was conducted. In an effort to protect the identity of the participants, a number was assigned to each participant. Although each interview was transcribed verbatim, any use of slang terminology was removed for readability. The next step in the process was coding of the data. The data were coded using open coding and memoing.

### **Open coding**

Open coding is a system of naming and categorizing the phenomena by examination of the same phenomena (Merriam, 2002). During the coding process, emerging themes are color-coded in order to easily identify both the patterns that emerge during the coding process and the number of times that a particular theme is mentioned by the participants. Color-coding helped me facilitate the process of identifying the emerging themes that were mentioned most often by the participants. During the interviews, I also manually wrote notes to help me recollect my thoughts, questions, or ideas that arose.

### **Memoing**

It is imperative for a researcher to demonstrate rigor in order to legitimize the qualitative research (Whittemore, Chase, & Mandle, 2001). I made notes will be made in the margins of each interview that highlighted my thoughts and points of interest on various topics being shared by the participants. Additional comments were also noted and considered during the transcribing portion of the study. My reactions to a participant's answers to questions were also be noted during the interview phase. Common themes and recurring

phrases were examined during the review of the transcribed interviews. Any notes or comments that were written down during the interview were used to define the key themes and findings of my study.

### **Consent and Confidentiality**

Prior to the interviews, each participant signed a consent form. This consent form included the description and purpose of the study, potential benefits and risks of the study, as well as a statement of confidentiality. Students were also provided my contact information and I also explained that they had the right to drop out of the study at any time.

As mentioned previously, each participant was given a copy of their transcribed interview to ensure honesty, accuracy and member checking. The transcripts from this study were kept on a password-protected laptop and any hard copies were kept in a locked desk at my private home. Each participant was assigned a number to protect her identity. I also maintained a key with the names used to match each student participant number on a flash drive that was locked in a private desk at my home.

### **Validity and Trustworthiness**

According to Guba (1981), trustworthiness of the data should be addressed during a research study, and the four major concerns relating to trustworthiness are “truth value, applicability, consistency, and neutrality” (p. 80). I used member checking and peer review/debriefing to ensure that my study is valid and trustworthy.

### **Member checking**

Member checking is a strategy that is often used in qualitative research. It involves having the participants comment on the researcher’s interpretation of the data collected



(Merriam, 2002). As mentioned previously, I provided each participant with a copy of her transcribed interview for her to review for honesty and accuracy. Each participant was encouraged to make changes or add content to any portion of the narrative in her transcribed interview. Allowing participants to review their interviews satisfied my member checking strategy which added to the trustworthiness of the study.

### **Peer review/debriefing**

According to Sage research methods (<http://srmo.sagepub.com/view/sage-encyc-qualitative-research-methods/n312.xml> retrieved February 28th 2014), peer debriefing, also called analytic triangulation, is the process whereby a researcher calls upon a disinterested peer—a peer who is not involved in the research project—to aid in probing the researcher's around all thinking or parts of the research process. I also asked my committee and major professor to review my study. According to Merriam (2002), most graduate students automatically have peer review/debriefing due to the review of their findings by their committee. This method also enhance the trustworthiness and validity of my study.

### **Limitations**

My study was conducted in light of several limitations. As mentioned previously, there is a lack of women in engineering. There is also lack of female community college transfer students majoring in engineering. In addition, women of different races will have different background characteristics and socioeconomic status. The eight participants who participated in my study may not have reported stories that are completely generalizable to all women engineers. It should be noted that these factors may have contributed to the findings of my study.

### **Delimitations**

My study focused on the academic and social experiences of the female community college transfer students in engineering fields at Midwestern University. There are three other STEM disciplines that were not included in this study (i.e., math, science, and technology). This may have also delimited the findings of my study. In addition, Iowa State University has a predominantly Caucasian student population. Therefore, the lack of diversity of my participants should also be considered as a delimiting factor.

### **Pilot Study**

During the spring of 2014, I conducted a pilot study for my capstone project. For this study, I interviewed five female pre-engineering students at Central State Community College. During my interviews I encouraged the students to share their experiences being a female pre-engineering student. There were several differences in the results of both studies. The number of participants in this dissertation research was different from my pilot study. In my dissertation research I interviewed eight participants. One of the participants from my pilot study also participated in this study. Another difference was that all the female engineering students who participated in my dissertation research were from various community colleges whereas, in my pilot study, all of the participants attended Central State. The current participants were all transfer female engineering students who were attending Midwestern University. All were transfers from various community colleges. During my pilot study I found several areas that needed improvement. Specifically, one area needing improvement pointed to my research questions. Understanding the importance of my research questions was essential for me to gain richer and more meaningful data in this

current study. Furthermore, the focus of the research questions in this study not only enhanced the quality of my data, but it also allowed my participants to freely share their experiences.

## CHAPTER 4. RESULTS AND FINDINGS

The purposes of this study was to understand the academic and social experiences of female community college transfer students in engineering fields at Midwestern University, and how gender influences the academic and social experiences of female community college transfer engineering students at Midwestern University. Three conceptual frameworks were applied to validate the design of this study: (a) Bronfenbrenner's bioecological systems theory of human development; (b) Rendon's validation theory; and (c) Astin's theory of student involvement.

Three research questions guided the study:

1. What are the lived experiences of female transfer engineering students?
2. What are the classroom experiences of female transfer engineering students?
3. What are the support systems that help female transfer engineering students?

### Participant Profiles

A total of eight female community college transfer engineering students at Midwestern University participated in this study. All participants were full-time female community college transfer students majoring in an engineering field. These students represented several different disciplines in engineering. However, all were engineering majors in the program for two or more semesters. The profiles provide a brief synopsis of each participant as a basis for understanding her foundation, reasons for majoring in engineering at Midwestern University, and other personal information relevant to the study.

Table 1 provides a brief description of each participant, including her pseudonym, age, cultural background, class standing, discipline in engineering, campus activities, and

Table 1. Demographic characteristics and current status of the participants

Pseudonym	Age	Cultural background	Engineering discipline	Class standing	Job	Campus activities
Anika	24	White	Mechanical	junior	no	no
Bonita	24	White	Software	junior	no	no
Shelly	21	White	Chemical	junior	no	no
Kendra	21	White	Chemical	senior	no	no
Kelly	25	White	Civil	junior	no	no
Tammy	22	White	Mechanical	senior	no	yes
Elaine	23	White/Asian	Bio Environmental	senior	no	yes
Andrea	20	White	Aerospace	junior	no	no

employment status. These data were collected during the interview process. A more detailed profile of the participant was also incorporated.

### **Anika**

Anika is 24 years old and a junior majoring in mechanical engineering. She is from a small town that is 24 miles south of the Midwestern University. She explained her background and engineering influence:

*...was born and raised here and I have two older siblings that set a very bad pathway for me so my parents really didn't expect much of me or expected me to do the same thing my siblings did. It wasn't until my senior year in high school that my teachers started paying attention and realized that I was nothing like my sisters but by that point I was like I'm about to graduate and I'm out so peace. I left my town two weeks after my graduation and I haven't been back since. So I have been kind of a loner for a long time now. I think the fact that one of my sisters dropped out of high school sort of help motivate me to keep going because I would see her doing nothing all the time.*

Anika shared her experience as interested in engineering, but not having the support. She moved out of the house when she was age 16 and began living with her friend's family. She said, *"It is really hard to motivate yourself sometime when everyone around you keeps telling you that you are not smart enough or laugh when you tell them what you want to do."* She credited this experience as her primary motivator to pursue engineering:

*It just motivated me you know....like I just wanted to prove everyone wrong. I knew I was smart and could do it and the crazy thing was I was better at some of the stuff than the guys were. Every time someone said something negative it just made me want to do it even more.*

Transitioning from the community college to the four-year institution was a pivotal moment for Anika. She recalled being anxious and scared during her first week of classes at Midwestern University:

*It was crazy I felt anxious, excited and scared all at the same time. I knew it would be different and classes would be harder but I was determined to do it and prove everyone wrong. The buildings were very intimidating and the buildings alone can discourage you but once you overcome that then you just have to deal with the in class stuff [hahahahaha]. I mean it's almost like you go through phases of intimidation but once you realize it's really not that bad I mean okay the buildings are big and you may be 1 out of 5 women in a class room with 50 or 100 guys you begin to just get used to it and you almost forget it.*

Anika was not involved in any women engineering clubs or organizations at Midwestern University. However, she was involved with Skills USA of Machinists.

## **Bonita**

Bonita is 24 years old, and a sophomore majoring in software engineering. She is from a town 15 miles from Midwestern University. Bonita has a younger brother and enjoys sharing with people her experiences being a female community college transfer engineer student. Bonita explained her background and engineering influence:

*I have always enjoyed school and a good challenge. I took a liking to science early when I was in high school and my parents always supported me but they were just like yeah you can do whatever you put your mind to sort of thing you know. I wish they would have pushed me more you know. It was my high school science teacher that told me I should think about majoring in engineering when I go to college. I thought it was really cool that he encouraged me to pursue engineering giving that he was a man. I'm not sure but I don't think most men walk around encouraging women to major in*

*engineering [hahahahah] so he must have seen something or knew my potential beyond what I thought I could do.*

It seemed as if her high school science teacher empowered her to pursue engineering.

Making the transition to the four-year institution was very exciting for Bonita:

*I remember I was very excited and I never had a problem with telling people I majored in software engineering because they would look at me as if I were really smart. Some people actually would say oh wow you major in engineering you must be really smart. I do feel like I am smart but not that smart [hahahahaha]. My experiences at the 4-year institution were much more pleasant than at my community college.*

Bonita was not involved in any engineering club or organization. She also chose not to work a part-time job so she could focus primarily on school:

*I have no time for nothing else but school, and then more school and then more school on top of that [hahahahah], so you know it's just hard to have any type of job or social life when you are an engineer major. My social time happens when I am doing homework or a project with my engineering group from class. We take short breaks and eat snacks but we are still talking about the class project or some type of assignment so we never really take a real break away from it all you know.*

## **Shelly**

Shelly is 21 years old and a sophomore majoring in chemical engineering. She was born and raised in a fairly large city 127 miles from Midwestern University. Shelly graduated first in her class in high school and, while growing up, she had always been known as “nerdy Shelly”. Her passion for math and chemistry led her to an engineering major. She explained how support from her family and teachers was vital for her during the early stages in her education. Shelly explained her background and engineering influence:

*School was always easy for me you know like it was one of those things like some people are really good at playing an instrument or sports it comes natural to them. That's how it is with me. School comes natural for me. I have always enjoyed math and science and have always been good at both so my*

*friends and family knew I was going to do something nerdy in life. For me I have always enjoyed natural things of the earth and art and stuff like that.*

Shelly explained her support groups and highlighted those who were instrumental in her decision to major in chemical engineering:

*It would have been my family and my first chemistry teacher in high school that influenced my decision to major in engineering. I would really say my chemistry teacher though because she brought out the best in me and sort help me discover the passion I had for chemistry. She was the first teacher that called me out and said Shelly this is B work and I know you can do better. Like she called me out and I really appreciated that she didn't just let me fall through the cracks you know like not only did she show me that she cared about me but she told and showed me how to do better.*

She also shared her thoughts about being in a field primarily dominated by men:

*It was in high school that things started clicking for me and I knew that I would go into chemical engineering like I didn't even care if it was all guys I mean I didn't even think about the fact that it was all guys I just knew that that's what I wanted to do. It wasn't until I got to my community college that I started paying more attention to the fact that I was the only girl in some of my engineering classes. That's when I began to start questioning if this was for me and could I handle what all would come with majoring in this field you know.*

## **Kendra**

Kendra is 21 years old and a senior majoring in chemical engineering with a minor in biology. Kendra was born and raised 400 miles North of Midwestern University. She has two siblings who both support her studies in engineering. Her mother is a software engineer and, as Kendra explained, “*she was very happy that she chose a major that would lead to a good job.*” Kendra talked about her early experiences and how she had not thought about engineering until her senior year in high school. She explained her background and engineering influence:



*I was always interested in chemistry and biology. Those were the two things that came easy to me. It was actually my chemistry teacher who told me I really needed to take more advanced level chemistry classes. I took AP chemistry and loved it. It wasn't until my senior year when I became interested in engineering and my chemistry teacher told me I should look into chemical engineering as a major. When I told my mom that I was going to major in engineering she said oh that's good as long as it wasn't a broad major [hahhahah]. She thought majoring in biology would limit me to low paying jobs [hahahahha]. I know that both my parents wanted me to major in something that had a promising future.*

Kendra also shared her thoughts about being in a field dominated by men:

*I never really thought about it or noticed it until I got to college. At my community college it wasn't as obvious because at my community college I was taking prerequisites but in classes like calculus, I could tell that I was going to be surrounded by guys. When I made the transfer over to ... reality really kicked in and it was all guys. It was funny because like I minor in biology and in my biology classes it seemed like those were just a mix of students who were just trying to get a degree but in my engineering classes I would actually hold my head up when I walked in and it was like things were taken more serious and everything. It was like a whole different environment.*

## **Kelly**

Kelly is 25 years old and a junior majoring in civil engineering. Kelly was born and raised just 45 minutes from Midwestern University. She talked about her experiences in high school, community college, and transitioning to the four-year institution. Kelly also shared her story of being interested in engineering and her transition from high school into industry, and the decision to leave industry and pursue her bachelor's degree in engineering at Midwestern University. She explained her background and engineering influence:

*I have always been interested in engineering and maybe it's because my father like pushed and pushed me towards engineering. I mean I did like it but he made sure that I was going to like it [hahahahahahah]. In high school I was always good at math and I liked the design part of engineering so I decided to sign up for a cad cam class in high school thinking there is no way I am going to get in but hey what the hell you know and sure enough I got in.*

*It was crazy because when I walked in the class all of the guys were looking at me like [ummm] she is in the wrong class. After I pulled out my schedule and they saw that I was actually in the class they thought it was pretty cool but I could tell their initial reaction was what is this girl doing in here [hahahahahah].*

Kelly talked about the importance of family support and how her experience working in the industry prepared her the most when she returned to school:

*My dad pushed and pushed me on the engineering thing. With him it was almost like you don't have a choice you are going to major in engineering [hahahahahah], but he worked for a company and invited a couple of products for that company which turned out to be a huge success. He never really had the schooling but he was just with this company doing the engineering part for over 20 plus years and so he decided to set up a trust fund for me and the trust fund was to pay for my schooling. I was working in the industry doing heating and cooling well HVAC is what they call it for six years and they told me hey you have a time limit on your trust fund and it can only be used toward school. So I decided to leave the industry, which was a very difficult decision to pursue an engineering degree. Well it was tough and what made it really hard was the fact that I was making some really good money while in the industry and when you are making good money you feel like what the hell I need a degree for? [Hahahahahahahah], but I'm glad I made that choice because this degree will only make me better and more marketable.*

## **Tammy**

Tammy is age 25 and a senior majoring in mechanical engineering. She shared her background and experiences being home schooled, and her transition to both the community college and the four-year college. Tammy also talked about her support groups and experiences being a female in the male-dominated field of engineering. She explained her background and engineering influence:

*I was home schooled and was not involved in any activities. I had a few friends that lived around me but not many and that was mostly by choice. I always kept to myself and loved loved loved math and science. If I could have just done those two subjects I would have been happy all the time. I was fascinated with how things worked and why they worked. I never thought*

*about working in the field of engineering and to be honest I didn't even know what engineering was. I just know that I like to solve problems and try to figure things out. I was also really good in English and so I put all of my focus and effort in those three subjects.*

Tammy shared her experience transitioning from home school into the community college:

*My English teacher told me that I was really good at English and told me that I should look into majoring in English. I knew that English was not a very promising career path, so my major was undecided until I took a pre-calculus class. It was the professor in my pre-calculus class that told me that I should consider an area in engineering. I was confused because I didn't know what engineering was. I thought engineering was fixing cars or machines or something you know that kind of stuff. I had no idea that there were different types of engineering majors you could do. After successfully passing a couple of hard math classes at my community college I decided to major in mechanical engineering.*

Tammy explained the significance of family support, while in both the community college and Midwestern University:

*My family was very supportive and would always go out of their way to help me out and so that is really what kept me going and kept me focused on pursuing engineering. If it wasn't for my family I would have quit long time ago. They have been super supportive even when I told them I was going to change my major they insisted that I stick with engineering and I am really glad that they did. It's funny because as much I love math and science, some of these classes at ... will make you want to quit and say forget this crap this is too hard [hahahahahahaha]. So I credit my family big time for helping me get through some very challenging times during my time here at ....*

## **Andrea**

Andrea is 20 years old and a sophomore majoring in aerospace engineering. She shared her background and early experiences at the community college that led her into the engineering program at Midwestern University. Andrea shared her background and engineering experience:

*High school for me was fun. I worked hard but I was not your typical high school kid who was trying to figure out what I wanted to do when I got to*

*college. I knew I wanted to do aerospace engineering since I was in the 8<sup>th</sup> grade, but I didn't want to be an astronaut because I wanted to have a family and there are many people who have gone up and have not come back and so I just decided I would like to be the person to build them and make them as safe as possible. It was crazy being at my community college and on the first day of classes the instructor would have us do introductions and when I would say I am majoring in aerospace engineering everyone would look at me with this puzzled look as if to say why are you here [hahahahaha]. One of my female friends use to question me all the time about why I wanted to major in aerospace engineering and thought that I was weird for some reason wanting to major in a predominantly male field. You would have thought more guys would have questioned me or said that I am not going to make it but it was the opposite.*

In spite of the challenging nature of taking difficult classes in preparation for the aerospace engineering program at Midwestern University, Andrea shared how her family's support was critical in her determination to enter the engineering program at Midwestern University:

*I was never uncomfortable telling people that I wanted to major in aerospace engineering. However, my family were like my personal cheerleaders. At one point I was thinking about taking the easy route and thinking about teaching and culinary arts, but my family really pushed me on doing the engineering thing. My boyfriend was super supportive too and so I think having that full support from my immediate loved one's was really what kept me grounded and focused. Many nights I questioned myself like why am I doing this to myself and the homework is so hard like there are times in the middle of doing my homework that I just break down crying. So my family pushed me and it helped me to start pushing myself you know like yes I am a girl and I major in engineering and yes I am smart enough.*

## **Elaine**

Elaine is 23 years old and a senior majoring in Biosystems engineering. She was born and raised in a town 25 minutes away from Midwestern University. Elaine grew up with both parents and one older sibling. Elaine shared her background and experiences being a female transfer student in the engineering program at Midwestern University. She talked about a few

key factors that helped her stay focused and continue with her pursuit of an engineering degree. Elaine shared her background and engineering experience:

*I have always kept to myself in high school and I didn't mind not having many friends because I really didn't have time to be hanging out and all of that no way. I really enjoyed math classes early on and took a lot of the high math classes in high school. No one influenced my decision I didn't have a mentor. My high school English teacher warned me about going to a four-year institution right out of high school. She told me the dropout rates and that's why I decided to go to the local community college. My friends and a couple of my instructors were my biggest supporters. I made my decision to go into biosystems engineering during my senior year in high school. My family didn't know what I was going to school for like I really didn't have much support from them and I was on my own. My support came from my friends and a couple of my instructors while at the community college. That support has been great like it has really helped me to remain focus and it has given me a sense of hope you now like I can do this kind of thing.*

She also talked about the importance of time management being an engineering major:

*I figured out early on at my community college that I would not have time for this exciting social life [hahahah] you know, like some of the classes that I was taking required extra time for homework and it really prepared me for .... So I was not involved in any activities at my community college and to be honest I am glad that I did not get caught up in having fun and doing all of the things college students do because it is so easy to fall behind and then you don't get a good grade and then boom you have failed a class or you have to retake a class because you got a D in it and a D is not considered passing in your major at ....*

## **Summary**

Even though all the participants in this study came from different backgrounds, they revealed common similarities and traits. For example, Anika, Bonita, Shelly, and Kendra are from the same state and all chose to major in engineering, based on their early interests in math and science. A few of the participants shared they actually were told they should not major in engineering, which caused them to do the opposite and pursue engineering more aggressively. Three participants explained, if they finished college, they would be the first in

their family to complete a degree at a college/university. Others shared how their relatives are engineers and, because they have received so much support, it has made engineering courses more bearable.

All of the participants highlighted subjects of interest early in high school that led to their choice to pursue and major in engineering. It was during the early stages these students found themselves having to make a decision to pursue what they knew would be a male-dominated field. Having a guidance counselor/mentor was not always the greatest experience many of the participants shared. They all shared they wanted to be engineers, but at what cost? All explained how they felt comfortable sharing they were engineers and how proud they were of themselves. A few also shared how they chose Midwestern University based on school rankings and a cost effective in-state tuition. Others shared how it was important to choose an engineering school that would look good on their resume and land them a good job after graduation.

### **Themes and Analysis**

Four major themes emerged from the data collected: (1) support systems; (2) classroom experience; (3) sense of belonging; and (4) fear of failure. There were subthemes of experiences with classmates and support systems. Each theme is presented with supporting quotes from the participants. The subthemes and supporting quotes from the students help bring the participants' experiences to life. During the analysis process, these themes are also discussed to address the research questions. The findings are intertwined with elements of Astin's (1984) involvement theory and Rendon's (1994) theory of validation. One of the core aspects of Astin's theory is the belief student's academic and social interactions influence their success.

## Support systems

Having support was very important to all of the participants in this study. Each participant had different experiences with her respective support groups. While some of the participants experienced negative messages within their support groups, others shared very positive experiences with their support groups.

All participants shared their background and their family level of support with their decision to major in engineering. Anika, Bonita, and Elaine shared how they did not have good support from their immediate family members after sharing the news they would major in engineering. Anika explained having conversations with her mom and how she constantly talked about how hard classes would be and how difficult working in a male-dominated industry is. Anika said her mom would always say *“you are going to have a very hard time advancing in that field, honey; men are going to fight your advancement tooth and nail.”* She shared how frustrating it can be when the support you need is not there. *“It’s really hard to motivate yourself sometimes when everyone around you keep telling you that you are not smart enough.”* In spite of not receiving the family support, Anika explains how she uses the lack of support as motivation. *“It just motivated me you know....like I just wanted to prove everyone wrong. I knew I was smart and could do it and the crazy thing was I was better at some of the stuff than the guys were. Every time someone said something negative, it just made me want to do it even more.”*

Bonita also shared how the support she received was very negative and caused her to doubt her decision to major in engineering several times. Bonita said both her father and younger brother would tell her *“engineering will be too hard.”* She also said they would tell her she was not smart enough to be an engineering major... *“you have to be really smart to*

*major in engineering...like you are not that smart.” Bonita highlighted how she used these negative statements as “...motivation to press in harder. I knew if other women have done this then I can do it. I know it is not as hard as it seems.”*

Bonita also shared an experience she had with a male student at her community college, who told her she should switch her major because engineering was extremely difficult. She expressed her feelings:

*It’s crazy how people can just say whatever to you and not think about how sexist they are being, like what if I were to say to him hey your girlfriend should break up with you because you are not attractive.... Or maybe you should major in something else because you don’t look like an engineer.” Bonita explained how she is appreciative to people who doubt her. “I just keep moving you know, I use all of the doubt as motivation so that when I graduate with my engineering degree I am going Facebook them all and say what?..... this engineering degree I am holding..... not hard at all.*

Perhaps Bonita has found positive ways to use the negative experiences as motivation.

Elaine shared how she didn’t receive support from her immediate family. However, she was able to receive support from sources outside her family:

*My friends and a couple of my instructors were my biggest supporters. I made my decision to go into biosystems engineering during my senior year in high school. My family didn’t know what I was going to school for like I really didn’t have much support from them and I was on my own. My support came from my friends and a couple of my instructors while at the community college. That support has been great like it has really helped me to remain focus and it has given me a sense of hope you now like I can do this kind of thing.*

Although there were some negative experiences with regard to receiving family support, other participants credited their success to the support they received from their families. Tammy, Andrea, Kelly, Kendra, and Shelly shared positive messages from the support they received from family and friends.



Tammy explained how the family support she received was very good: *“My family has always been very supportive of me majoring in engineering and that really helped me continue in this major.”* She also talked about how she received more support from her family when she enrolled in the engineering program at Midwestern University: *“My family did everything they could to help me like they would buy me groceries and help me pay bills just so I wouldn’t be stressing about bills and stuff.”* She explained her doubts with majoring in engineering and how it would have been less stressful to major in an easier subject:

*I was really good at English and my English instructor at my community college told me that I should major in English. After talking to my family about it they encouraged me to follow my heart and pushed me to major in engineering. That was huge for me because I was looking for them to agree with me and almost give me permission to take the easy way out. When they pushed me to do engineering I knew that’s what I was supposed to be doing and I really appreciate my family for not letting me take the easy road.*

Kendra and Kelly shared similar experiences with the family support they received. Both grew up with parents who took education very serious. Kendra’s mother is a computer hardware and software engineer, and her father is an accountant. Kelly’s mother is a teacher and her father is an inventor. Both Kendra and Kelly explain how their fathers pushed them the most.

Kendra stated:

*My mom is a computer hardware and software engineer and my dad is an accountant and the funny part is that my dad has pushed me the most to finish my engineering degree. My mom was excited but I think she was more concerned with the how it is being a woman in the industry so she was being protective of me. She would say things like honey you have to have tough skin in this field. I knew what she meant but my dad would always say honey you have what it takes don’t quit.” So every time I am thinking about switching my major or things start getting hard I just replay my dad’s voice in my head you know.....don’t quit.*

Kelly stated:

*My family was very supportive of my decision to major in engineering. My mom was just happy that I was on a promising degree track you know like a liberal arts degree was broad. Engineering is very specific. My dad is an inventor so he was very happy that I was majoring in engineering and really pushed me the most. If it wasn't for my dad pushing me to finish I probably would have changed my major a while ago.  
Having the necessary support is essential and for many of the participants.*

The participants also shared how important support is even if it is not from an immediate family member. Shelly and Andrea shared how they receive the most support from their significant others. Andrea noted:

*My family has always supported me in everything I have done over the years so I knew this would be no different. My boyfriend has been a huge support for me. He always says to me how easy I make it look and how proud of me he is and to be honest I think he knows it's not easy but he is psyching me out so that I can start thinking that it is easy [hahahah] you know the old jet eye mind trick [hahahha]. The funny thing is that it is really helpful because when he says that to me it makes me feel good and I feel smart and you know like I am doing this.*

Andrea's comment is reflective of Rendon's (1994) theory of validation. Her boyfriend has validated her with words of affirmation. The positive feedback he provides her builds Andrea's self-confidence. Moreover, it is confirmation to Andrea she can succeed in this field.

Shelly noted:

*My family is very supportive and I love them for it. My boyfriend is my biggest cheerleader. He tells me on a daily basis how smart I am and how I am so much smarter than he is. He makes me laugh all the time and that really gives me the boost I need to keep going. It also keeps me calm and surprisingly it keeps me focused. But to be honest I think I could do this even with no support because I was built for this and I know I was built for this.*

Shelly's comment is also reflective of Rendon's (1994) theory of validation. When her boyfriend tells her how smart she is and how she is much smarter than he is, it validates her and makes her feel competent and increases her confidence.

### **Classroom experience**

The classroom experience was very interesting, since participants shared positive and negative experiences. Each participant was asked questions about her classroom experience at both the community and Midwestern University. Of the eight participants interviewed, all reported at least one negative classroom experience. The classroom experience was explored to gain an understanding of how interactions between students took place during class time. Even though there were negative experiences; overall, the participants stated they did feel safe while in the classroom.

When asked to describe her experience being the only female in class, Anika talked about her experiences both in the industry and in the classroom:

*While working in the industry, I was the only female in the store and so in the beginning I would get the double takes and guys looking at me funny. Some of the customers would walk in and I would be available to help them and they would wait for a guy to help them. So when I started taking classes, I was already use to being the only female and getting the weird looks. I just smiled and when it came time to speak that's when I shined because then the guys knew I knew what I was talking about and it was like they immediately relaxed or something [hahahahah].*

Each participant had similar experiences. Some of their experiences were worse than those of others. Bonita shared:

*I have had guys tell me flat out, you are not going to make it in this major because it is too hard and too stressful, so you might want to consider having a back-up major in place now and they are telling me this as if they are being supportive and helpful you know. I got to the point where I said I am not going to allow these guys to talk to me this way even if they were joking or acting as if they were joking. If I were to tell one of them that they were not going to make it I'm sure they would speak up for themselves so instead of laugh it off and say yeah whatever, I said I'm not putting up with that anymore. Some of them act as if they are superior to women.*

Other participants shared their classroom experiences as well. Other participants shared their disbelief of things said to them during the classroom:

*Oh let me tell you, I had one guy tell me that I was wasting my time taking this class and I was like wow did he really just say that to me.*

*One time the teacher asked a question to the entire class and one of the guys said out loud let's see what Tammy thinks as if I were asked the question directly.*

*I really haven't had any bad experiences here at Midwestern University, but I have had several at my community college from both the male students and the instructor ... One time my instructor said let's get the "lady's" point of view on this question. It made me feel like I was just a lady not a student, or a student who just so happened to be a lady, but I was just a lady in his eyes.*

*My experiences have not been that bad. However, I remember one time I was in a class and I was one of two female in the class and I raised my hand and said does anyone in here have a problem with us two women who are in this class [hahhahaha] and I can remember the guys and the instructor laughing and one of the guys said I'm glad that both of you ladies are here it's always good to have eye candy. The class laughed but I knew he was serious but after I spoke up I didn't have any major issues in that class. It was like I broke the ice or something and things were cool.*

*I have not had any guys say anything directly to me but I have seen smirks and you know guys whispering and giggling, and stuff like that so I knew they were talking about me or saying something slick.*

Although the participants shared their classroom experiences freely, it was still shocking to them there were still stereotypes associated with women in engineering in 2015.

A few of the participants shared their opinions:

*I just don't understand why these things are still happening all these years later you know like what difference does it make if a women can do the same thing a man can do and sometime do it better [hahahahahah].*

*I think part of the problem is that some of these men are afraid that us women will eventually dominate this field and the thought of that scares men.*

*Why is it that we as woman have to sweep things like this under the rug and nothing is really being done about it. I guarantee you if men were being*

*stereotyped in a female dominated area something would be done about it quick, fast and in a hurry.*

After the participants shared their classroom experiences, several seemed frustrated by some of the things that had taken place during their time at their community college and Midwestern University. Some of the participants explained how they were convinced things would not change with women being in engineering. Tammy shared:

*I just think that these things won't change you know like wages and how men perceive women in the field it won't change at all. You would think that out of all of these women engineering organizations and clubs, we could break some of the barriers but nothing will change.*

It was evident Tammy was not pleased with the overall status of women in engineering. She explained why she is not a part of any of the women clubs or organizations at Midwestern University. Even though she has strong opinions about women in engineering and the stereotypes associated with this topic, she is not willing to quit or give up. According to Tammy:

*I really enjoy my major and will finish my degree. I think that the all women engineering clubs and organizations are a waste of time. We should be trying to have clubs and organizations that include men so that they can hear some of the things we don't like and changes we want to see made. What good is it if it is all women talking about the changes they want to see things they want to see done differently if there are no men around to hear it. I just think that it is pointless to be in those types of clubs. I would be more interested in a club that has both men and women so that these guys can get used to having women around and it won't be this shock to them to see a woman taking an engineering class.*

Bonita shared her experience and how she handles such situations:

*You try not to let it get to you but sometimes it does you know? There was a sexist comment made to me one time by one of the guys in my class and when it was first said I was shocked more than anything and it caught me off guard because I thought he was just playing but he did not laugh after he said it [hahahaha] so I thought to myself oh this dude is serious. He asked me why would any woman want to major in a field that was created for men. I*

*couldn't even say wow I was so shocked. I said to him where does it say that engineering was created for men only [hahahahahah] and he gave me this weird look as if I asked him a stupid question or something so I repeated myself. His answer was very simple he said because engineering has always been seen as a male field.*

Kelly shared a similar experience and how she handled such situations:

*At first it really bothered me but now I have gotten used to the crazy looks and the guys staring at me. I am still shocked when guys actually speak their minds though. This one guy at Midwestern University told me that it would take me twice the time to finish an engineering degree because the classes will be hard. I still can't believe he said that to me. I just laughed and said I will see you at graduation.*

Although most of the participants explained reaching normal comfort levels in the classroom, a couple of the participants shared the personal challenges they currently have while in class. Elaine shared:

*There are times when I hesitate to ask questions because I do not want to be looked at weird or come off as if I am not understanding concepts. Funny thing is most of the other students have the same question and don't want to ask it either. So I force myself to ask questions even when I think it is a dumb question.*

Shelly shared some similar challenges:

*It is never easy to ask a question in a class full of people that you think are smarter than you. That's my problem you know sometime I over think things and make myself super nervous when it's really not that serious.*

Both Elaine and Shelly's statements are powerful because they address Rendon's (1994) Validation Theory and how students want to have the feeling of validation from their peers. It also sheds light on some of the issues that currently takes place at Midwestern University. Furthermore, these statements also speak to some of the challenges women in engineering face on a daily basis. These comments not only speak to the underlying truth of wanting to be validated, but also a sense of belonging.

## **Sense of belonging**

Sense of belonging can be perceived in many different ways. According to Lambert et al. (2013), social relationships provide an all-important sense of belonging, people feel life has more meaning. The participants in this study shared their experiences, challenges, goals, success stories, and fears. While sharing, the participants both directly and indirectly shared their feelings on being accepted as a female transfer student majoring in engineering at Midwestern University. It was important for participants to share their honest opinions and feelings about their program.

It is important to note that, even though they shared their feelings, the participants did not display frustration or anger as it relates to this emerging theme. As each participant shared her stories and experiences being a female transfer engineering student, the sense of belonging theme began to emerge and became very relevant. The following question was asked to each participant: Are you involved in any clubs or organizations at Midwestern University?

Anika responded:

*No I don't have time for anything but my classes. I did not even know that some of these clubs and organizations existed until I saw a flyer one time with some information on it. I think that I would have been interested and would have looked into it if I had known about the club when I was at my community college. It's weird because you have to seek some of the organizations out you know like they don't pursue you, you have to pursue them and for me I was just like how about 'no' I will pass. You would think that they would be glad that you are here at ... and they would welcome you. So that was one thing I heard about the four-year institution and that was you are just another number.*

*Bonita, Kendra, and Elaine shared similar experiences. Bonita shared: No I am not a part of anything outside of my in class group. It's funny because my classmates that are in my group, we have become very cool. I mean we are working on our group projects majority of the time but we have started*

*studying together and we all eat lunch together and it really works because we can bounce ideas off of each other and we can ask each other questions when we don't fully understand something and I am not a big fan of chasing down a club to be a part of it. Yes for some of the clubs you have to go to their events to see what they are about and show interest.*

Kendra shared:

*Other than in high school, I have never been involved in any activities or anything like that. I have always kept to myself for the most part. To be honest I heard about a couple of the all women engineering campus clubs here at Midwestern University, but you would think they would pursue you and they didn't. It was like wait so I have to search out your club? Why wouldn't you come looking for me? But it really didn't matter because once I got into my classes I didn't have time to breath [hahahahahah].*

Elaine shared:

*Honestly, I don't have time for anything outside of my classes. I was very active when I was doing my co-op it was great because I was working and wasn't taking classes and I was in California where it was nice weather all the time and then I came back here to 19 credits and cold weather and it was like ok this is not right hahahahah but I know I have to get this done in order to get back to the sunny days where after work I could actually have a social life.*

On the surface it appeared some of the participants were sharing how time consuming course work, load, and being an engineering student could be. However, after delving deeper into why some of the participants were not involved in some of the clubs and organizations on campus, a lack of interest played a part in their choice not to pursue extra curricula activities. Bonita and Kendra shared how they expected some of the all-women engineering clubs on campus to pursue them. Tinto (2012a) noted that sense of belonging results from the interactions students have with a variety of communities encompassing college settings and, in turn, how supportive these experiences are perceived by students: "...it is how you see your connections on campus vis-à-vis other groups. Students need to feel connected in ways that do not marginalize or ghettoize. They need to feel welcomed, not threatened" (Tinto, as



cited by Wolf-Wendel et al., 2009, p. 424). Other participants shared the activities in which they participate.

Tammy shared:

*I am a part of the (pseudonym) women rock engineering club here at .... It has really been great for me because I can ask questions and not feel like my question was stupid. It feels good to be surrounded by other women in STEM majors.*

Shelly responded:

*I feel like a lot of us are very shy individuals and so we are less likely to just join groups and clubs well at least for me I know I am not going to just up and join a club but I am interested in looking into some of the clubs here because the environment is different here at ... oppose to my community college so I have been thinking about joining one of the clubs here but only one because I don't have much free time at all.*

Andrea shared:

*I am a part of three different clubs here at .... I was not aware of all of them when I first got here. Well one of them I knew nothing about I heard about it through a friend and another one made themselves known at my campus visit. The club that I like the most was the one that was very outspoken and they were extremely helpful and just made me feel like they really wanted me to be a part of their club and I appreciated that. So now I am a team lead and it has been a really good experience for me.*

Kelly responded:

*No not at all. I have no time for that stuff. Don't get me wrong I don't knock it but it's just not for me. I am trying to hurry up and get finished so I can get back to working in the industry. I am used to having paid vacations and it's like who are we kidding I do not want to get tied up into extra stuff. Plus I commute to campus everyday so after my classes or a study group I leave campus. I don't stay on campus for any social events or any of that.*

Shelly shared:

*I have never been the club type of person you know....even in high school I just stuck to the academics and did my own thing. I was always weird like that. I didn't do sports or any of that so clubs and those sort of things have never been of interest to me.*

Among the eight participants, only one was involved in three different clubs on campus. It was interesting to hear how Andrea explained these different clubs. The club in which she seemed more invested was the organization that made a greater outreach effort to her, and made her feel accepted and welcomed. Hausmann et al. (2009) noted, “when students become integrated into the social and academic systems of the university, they develop a psychological sense of belonging to the university community” (p. 650).

### **Fear of failure**

Fear of failure is very real and oftentimes tangible. During the interviews, participants were asked: Has there ever been a time you were unsure about majoring in engineering? All participants answered “yes” to this question. However, their reason for answering yes evoked an emerging theme of fear of failure. Other aspects that contributed to this theme were campus size, architectural design, size of buildings on campus, and student population. Each participant explained her rationale behind her personal doubts of continuing in engineering.

Anika shared:

*Absolutely, all the time every day, there is always that fear that you won't succeed but after ever class I pass or get through like calculus one and calc two it's like it builds my confidence up and like all the times I thought I wasn't going to make it like God willing I got through and I just keep impressing myself and when some things seem really, really hard and I'm surrounded by what seems like geniuses and like they don't have to try and I'm the one who have to sit up until two or three in the morning trying to get my homework and assignments done and then my classmates are like oh that was no big deal and I'm like what but I think if it's easy you shouldn't really be doing it. It should be a challenge. The things in life worth having are worth working for.*

It was interesting to hear how things that intimidated Anika help contribute to her fear of failing, and ultimately caused uncertainty and doubt to continue in engineering. She explained:

*It was crazy I felt anxious, excited and scared all at the same time. I knew it would be different and classes would be harder but I was determined to do it and prove everyone wrong. The buildings were very intimidating and the buildings alone can discourage you but once you overcome that then you just have to deal with the in class stuff [hahahahaha]. I mean it's almost like you go through phases of intimidation but once you realize it's really not that bad I mean okay the buildings are big and you may be 1 out of 5 women in a class room with 50 or 100 guys you begin to just get used to it and you almost forget it.*

Anika's experiences correlate to one of the core concepts of Astin's Theory of Involvement. According to Astin (1984), the concept of the "student environment" accounts for all of the experiences a student would have during college. The student environment has a huge impact on students' overall experience and development.

Bonita shared:

*Oh my God yes all the time I always question my decision to major in engineering and if I should continue [hahahahha]. You don't really think about it much until you are up in the wee hours of the night still doing homework and working on projects and yeah it's crazy that anyone would major in engineering [hahahahha].*

Bonita also shared why she doubted herself and, sometimes, was unsure about majoring in engineering:

*I would hate to ever let myself down but more than just me my teachers who believed in me in high school and my family and friends you know. Even though I didn't have this amazing support from my family they still believed in me and I would hate to let them down and not finish my engineering degree and I can hear my little brother now saying oh so you weren't as smart as you thought you were [hahahahahah].*

Tammy shared:

*Yes all the time. I know it is not that serious but and I have an amazing support system so even if I did decide to switch my major they would support me but I know that they would be disappointed that I didn't finish it out. I think it started from the moment I got to .... Seeing 25,000 plus students and the extremely large campus really had me nervous and very intimidated. The funny part is that I am most calm when I am in the engineering building where I take a couple of my classes. The building is old and small so it feels like oh I can handle this, but then when I walk out of that building it's like boom back to the hustle and bustle and intimidation.*

Andrea shared:

*You can't show me one engineering major that has not second guessed themselves and questioned if they should continue to major in engineering [hahahahaha]. I'm always like why am I doing this to myself why did I have to choose one of the hardest majors of all time [hahahha]. I would feel bad though if I did not finish and didn't graduate. I know my boyfriend would be pissed if I didn't finish [hahahahaha] because he has been the one staying up late with sometimes helping me study and pushing me to do it.*

Elaine explained:

*Yes all the time but I know I am not going to quit now. I have come too far and as easy as it would be to quit, there is no turning back for me. I have too much riding on this and too much time invested but don't get me wrong I think about it all the time but I know it will pay off.*

Kelly shared:

*Yes everyday [hahaha] but I don't want to switch my major, I just want to hurry up and get back into the industry. It is hard when you making good money and then you return to school. It's like really.... I just want to get this done with as soon as possible so I can get back to the real world and making good money [hahahah]. Well, for me I have always viewed college as a place that could prepare me for the real world and after being in the industry for six years, I am not as intimidated as your freshman or sophomore in college would be. I have six years of experience in the industry and the industry is all the way male dominated. At least there are a hand full of other women in the program and in my classes so that's refreshing to see.*

Kendra shared:

*Yes me and my friends often talk about what we would be majoring in if we weren't in engineering and for me it was a no brainer because most of my peers where in engineering and had an engineering focus so once I made the*

*decision to pursue it I knew this is what I was going to do. I never thought I would be a minority but in this major I am the minority and it is a weird feeling because I am surrounded by mostly guys and so I am always pushing myself to prove to myself I am better than the guys.*

Kendra's comment is indicative of the theme of fear of failure. However, Kendra was not concerned with letting her parents or loved ones down; rather, her fear is letting herself down and being perceived as not good enough by her male counterparts.

Shelly shared:

*Of course, I thought about changing my major as I was walking over here to the library to meet you [hahahahahaha] but yeah all the time but when I think about the pay off and how happy I will be it makes it all worth it. I know I am going to scream or something when I graduate because I have put in a lot of work and done things that I never thought I could do. So when I start having doubts I just think about how happy I will be once I'm finished. It will go by fast and before I know it I will be at graduation thinking to myself...wow, I really did it.*

The next section explores how Bronfenbrenner's model provides a context for understanding the influences of the environments each participant occupies, as they relate to their personal profile and this study. Astin's theory also highlights contributions from environmental influences and engagements.

### **Bronfenbrenner's Bioecological Systems Theory of Human Development**

Throughout this study, several participants discussed unique environmental factors specific to their own development on all four levels of contexts (microsystems, mesosystems, exosystems, and macrosystems). Microsystems involve the people present within one's settings, the nature of these links, and their indirect influence on the developing person through their effect on those who deal with him or her firsthand (Bronfenbrenner, 2005b). Examples of microsystems include home, school, peer groups, and workplace.

“Microsystems for college students include classrooms, laboratories, athletic teams, living situations, friendship group, student organizations, on- or off-campus jobs, families of origin, partners or spouses, and possibly children” (Renn, 2003, p. 388).

One example of a relevant microsystem within the context of this study was study/project groups. All eight participants were part of a study/project group. Each participant shared her experiences being in a study/project group and how it has impacted her academics. Because Midwestern University is known for being one of the best engineering schools, these participants highlighted this fact as being one of the main reasons for attending Midwestern University. As a result, this institutional influence became even more salient because it helped shape her college choice and the primary environment in which they would function.

Bronfenbrenner’s model may shift and change over time. Study/project groups were a significant environmental influence for Kelly, but only for her first year. Another microsystem relevant to this study that emerged from the data was the presence of the (pseudonym) ‘The Women Rock’ club on campus. This club has been active on Midwestern University’s campus for several years. According to a few of the participants involved in this club, The Women Rock club provided a social outlet where they could bounce ideas off each other and ask questions without feeling marginalized. Indeed, some respondents did not see the purpose in having The Women Rock club because of the stereotype that can be associated with being in an all-woman’s club. As far as social life is concerned, it was evident in the data that The Women Rock club and study/projects groups had very strong influences on some of the participants’ social lives. These two entities also contribute to the outside peer group microsystem.

Exosystems are defined as settings that do not contain a developing person, but events occur that affect the setting containing the person (Bronfenbrenner, 2005b). An exosystem in regards to this study would be departmental/campus policies and procedures regarding engineering students. It would also include the academic culture of STEM fields as it relates to the educational system. All of the participating students, in varying degrees, shared similar experiences of gender bias and lowered academic expectations. These data are consistent with studies identified in the literature review (Campbell, 1990; Garrod & Taber, 1991).

Macrosystems encompass “the overarching patterns of stability, at the level of the subculture or the culture as a whole, in forms of social organization and associated belief systems and lifestyles” (Bronfenbrenner, 2005b, p. 47). Macrosystems are considered the most distal levels of environmental influence (Renn, 2003) that affect the nature of interactions within all other levels of the ecology of human development (Lerner, 2005).

Two important macrosystems emerged from the data in this study. Two of the participants cited being first generation college students. This was a salient aspect for both Anika and Bonita because it was one of their primary reasons for pursuing college and not quitting.

According to Anika:

*You know for me it's not a choice. My sister and I are the first in my family to go to college and so we know how important it is to finish well my sister just graduated so there is no way that I will quit and give up now. So that would be my biggest motivation or the one thing that keeps me going.*

Bonita shared:

*If I had to say one thing that keeps me going it would be the fact that I will be the first to graduate with a college degree in my family. That alone helps me not say forget this I'm done.*

The second macrosystem that emerged from the data in this study was socioeconomic/financial aid status. One student, in particular, highlighted her challenges attending Midwestern University and how it impacted her. According to Elaine:

*I always knew that I would go to college but I never thought that I would be able to attend .... My parents were not financially stable and so for me to be able to attend ... still blows my mind I mean don't get me wrong my student loans are going to be through the roof when I finish [hahahah] but the help from financial aid makes it all possible and when I finish with an engineering degree from one of the top engineering schools in the country it will be worth it.*

First generation and socioeconomic/financial aid status were both added to macrosystems to help illustrate the impact these factors have on the specific participant in this study. Receiving financial aid made it possible for Elaine to attend Midwestern University. Her economic challenges have caused her to understand the value of obtaining a college degree. Furthermore, it has been a key factor in keeping her focused and on track to graduate with a bachelor's degree in biosystems engineering.

Figure 2 illustrates an adapted theoretical model, based on Bronfenbrenner's bioecological systems theory of human development modified to include environmental factors that emerged from this study.

### **Astin's Theory of Student Involvement**

Astin's Theory of student involvement provided additional theoretical guidance to this study and reinforced the salience of environment for development. Astin (1999) defined student involvement as "the amount of physical and psychological energy that the student devotes to the academic experience" (p. 518). This theory contends it is not so much what the



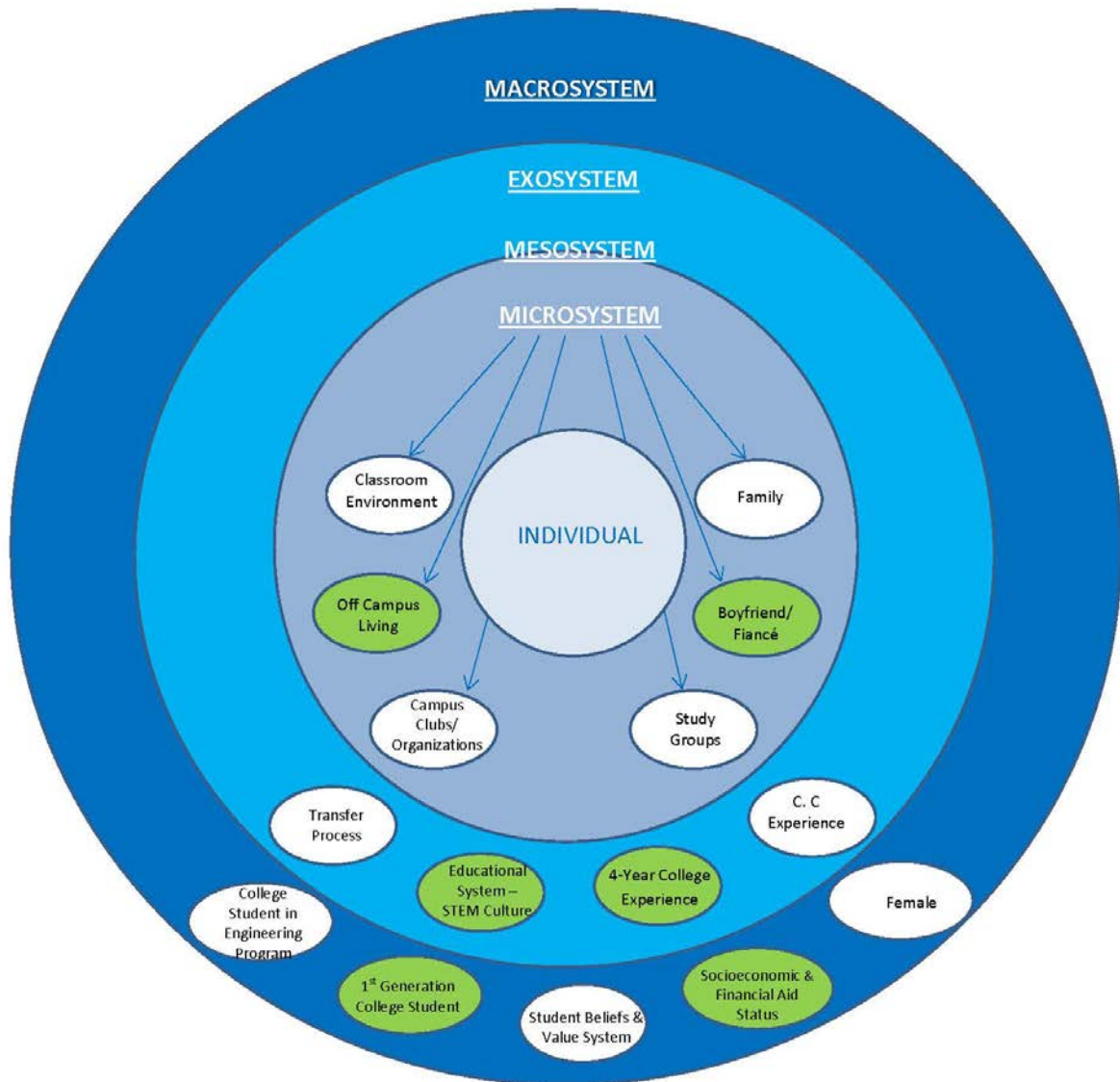


Figure 2. Adapted theoretical model based on Bronfenbrenner's bioecological systems theory of human development (Note: Items in green circles were added based on data)

individual thinks or feels, but what the individual does that defines and identifies involvement (Astin, 1984). Astin's involvement theory has five postulates (see Chapter 2).

The participants in this study devoted varying amounts of time to academics and campus activities. Two of the eight participants were members of engineering clubs on campus. All participants were involved in group projects as part of their specific class assignments. Group projects were the extent of a social life for many of the participants. Beyond group projects, they spent little time within the campus environment outside of classes.

Astin's (1984) first postulate is salient to this study because it refers to the investment of physical and psychological energy in various objectives. Participants were involved in specific groups or projects for their class. The majority of the participants were not very involved in any extra activities outside of class projects. Most participants established their social networks through these group projects and study groups. Two of the eight participants were very involved with engineering clubs/organizations and other social outlets. However, their overall investment in other social aspects was limited or non-existing.

### **Rendón's Validation Theory**

Rendón's Validation Theory also added depth and meaningful theoretical guidance to the study. Rendón's (1994) validation theory first came about as a result of the changing demographics in institutions where enrollment of women, minorities, and non-traditional students' was increasing, but the institutional structure was not changing to meet the needs of a diverse student population. The research explored both in- and out-of-classroom experiences. Validation was used to understand how students were being included or not in

classroom learning environments as well as the campus climate and co-curricular activities the institution provided. Validation focuses on how students obtain self-worth, confidence, and capability to succeed in higher education.

Rendón's validation theory emerged from the theme—sense of belonging—in this study. Many of the participants did not realize the level of validation they were seeking from their peers and various campus clubs/organizations. Validation theory places responsibility on faculty and staff to provide opportunities for validation instead of offering resources in a passive way. Many of the participants made mention of how the campus clubs/organizations' recruitment efforts were not sufficient. Some of the participants made the comment of feeling like a number at the institution and would have appreciated better outreach efforts from the various clubs/organizations. Although only a few participants were involved in a club/organization outside of their study group, all of the participants were involved in a group that social involvement and interactions took place.

According to Rendón (1994), "involvement in college is not easy for nontraditional students. Validation may be the missing link to involvement, and may be a prerequisite for involvement to occur" (p. 37). Rendón found "external agents" were invested in the student to build confidence in their abilities to succeed in the academic and co-curricular realms. Validation was also seen in students involved with activities on campus and established relationships with their professors. Two of the eight participants were considered non-traditional students and both shared their experience making the transition from working in industry to being a student. Other participants shared successful experiences with their relationships with faculty and staff. These relationships proved salient and helpful for

students' overall confidence and success. Some of the participants shared their excitement and experience having a female professor.

### **Themes Emerging from the Research Questions**

The purpose of this study was to explore and understand the experiences of the female transfer students in engineering fields at Midwestern University by examining their academic and social experiences within the male-dominated engineering environment at the institution. The four themes emerging as related to the three research questions that guided this study were:

1. What are the lived experiences of female transfer engineering students?
  - a. Theme 1 – Support systems
  - b. Theme 2 – Classroom experience
  - c. Theme 3 – Sense of belonging
  - d. Theme 4 – Fear of failure
2. What are the classroom experiences of female transfer engineering students?
  - a. Theme 2 – Classroom experience
  - b. Theme 3 – Sense of belonging
  - c. Theme 4 – Fear of failure
3. What support systems help female transfer engineering students the most?
  - a. Theme 1 – Support systems
  - b. Theme 2 – Sense of belonging

The findings of the research spoke directly to the research questions. For a majority of the participants, support systems played a vital role in their success as a female

engineering student. This support often came from family members; however, there were other support systems outside of family members that were just as important. Shelly and Kendra, in particular, received very strong messages from family regarding their decision to pursue engineering. For example, Kendra said that her family were her biggest supporters and kept her motivated to continue pursuing engineering. Shelly explained how support from her family and teachers was vital for her.

A few of the other participants shared that, although family support was not as strong, support from teachers and friends was there to help them get through tough times. For example, Bonita shared that her parents were supportive but it was her high school science teacher who pushed her and told her to major in engineering. Tammy was another participant who shared how most of her support came from the professor who taught her pre-calculus class. She also shared how her professor encouraged her to major in engineering. Andrea mentioned how her family was extremely supportive and kept her focused and grounded. To the contrary, Elaine exclaimed that she did not have family support at all.

There were many common threads with the lived experiences of the participants in the study. Many shared their classroom experiences and the effect it had on them. For example, Anika mentioned that, when she was in industry, men would often walk in and wait for a male clerk to assist them. Anika's perceptions were slightly different. In industry, she noted men would demonstrate how they were feeling with body language. In the classroom male students often spoke out about their perceptions of female students being in the engineering program. Bonita shared both positive and negative classroom experiences.

Negative classroom experiences were shared by some of the participants. Some participants shared how male students would utter sexually offensive words towards them.

Each participant shared her in-class experience and how it affected her. For example, one of the participants shared how her classroom experiences at her community college were worse than her experiences at Midwestern University. She talked about when she was singled out by a professor in her class as “the lady” instead of an engineering student. Overall, the participants’ experiences affected each in different ways. A few of the participants shared how their negative experiences motivated them, while others explained how negative experiences led to a fear of failure and a lack of a sense of belonging.

Throughout the study, each student made mentioned of her fear of failure. Several participants contemplated switching their majors many times. However, having a support system and having the feeling that they did belong helped some of the participants’ to persevere. For example, Elaine shared how she did not have any family support however, she had her personal friends and friends from her study group created balance and a sense of belonging. Bonita shared how her friends from her classes have been very helpful in motivating her to continue in engineering. Most of the participants shared similar experiences. These lived experiences are very salient. Although some of the participants were from different areas of the country, each experienced similarities in their journey as a female transfer engineering students.

### **Summary**

Several participants in the study shared that they had mixed feelings about how they felt when they first arrived at Midwestern University. Some participants shared how they felt like “just another number,” while others shared their perceptions of what college would be like. Tammy explained how she knew that classes would be difficult and that colleges were

businesses with no time for hand holding. One example provided by Elaine was the connection she made with one of her professors. Elaine shared the importance of this connection and how it made her feel like she was important. Having a connection with a faculty or staff member of the college was helpful to create a safe environment for the student. Other participants highlighted key family members and friends instrumental in helping them stay focused and continue pursuing their engineering degrees.

Classroom experiences varied since each participant had different experiences in their engineering classes. One of the participants mentioned how she overheard a student calling one of the female professors a cunt. She was disturbed by this because she knew the student would have never disrespected a male professor in such a manner. She shared her feelings and concerns about this incident and questioned if the male students felt that way about all female students and professors. According to Kelly, it appeared gender was always the underlying issue. She shared how she felt like she was ostracized immediately just because she was a female who just so happened to be pursuing a male-dominated field of engineering. Other participants shared both positive and negative classroom experiences. The impact of these experiences were explored and discussed. After some of their classroom experiences were shared, it became evident that each participant experienced negativity. Moreover, all of the negative classroom experiences shared were directly related to women in engineering.

Each participant shared her experience with level of involvement both on and off campus. Several participants shared their lack of involvement with campus clubs/organizations due to the rigor of being in the engineering program at Midwestern University. It was interesting to hear the participants talk about their disinterest in the various campus clubs/organizations geared toward women in engineering. It was also interesting to

note that all of the participants who were not a part of an engineering club/organization had similar reasons attributed to lack of a sense of belonging. It appeared they were unaware they wanted to feel as though they belonged. Each mentioned not being pursued by some of the women engineering clubs/organizations to become involved. One participant actually made the statement she was not interested in any club, even if she had to reach out to them.

Although each participant was involved in some type of student study group or club/organization, they all shared they were happy being in the engineering program and looked forward to finishing their engineering degree.

During the participants' interviews, it became obvious that all of the participants did not want to fail at their quest to obtain an engineering degree at Midwestern University. Most had some type of family member, friend, mentor, fiancé, or loved one whom they did not want to disappoint. It was evident they all had a fear of failing themselves and those in their close circle. Each participant acknowledged her fear of failing and used this fear as one way to push herself. According to Elaine, she knew how difficult the engineering program would be and how she would be devastated if she did not finish and graduate. Overall, each participant had both positive and negative experiences being a female transfer student in the engineering program. All seemed to embrace their experiences and accept some of the challenges that arose because they were female students in the engineering discipline.



## **CHAPTER 5. DISCUSSION**

The purpose of this phenomenological study was to examine the academic and social experiences of female community college transfer students in engineering fields at a Midwestern university. Bronfenbrenner's bioecological systems theory of human development was used as the conceptual framework that formed the design for this study. In addition, Astin's theory of student involvement and Rendon's validation theory provided complementary theoretical guidance for this study and reinforced the salience of environment and validation to development.

Through semi structured, electronically-recorded, individual interviews, information was obtained about the lived experiences of eight female transfer engineering students at Midwestern University. The data collected from their experiences provided insight into the ways the participants made meaning of their experiences in both academic and social environments. Thematic findings were presented in Chapter 4. This chapter presents conclusions, limitations, implications, and recommendations, based on the outcomes of this study. In addition, implications for future research and practice are presented.

### **Conclusions**

After participating in this study, it appeared that many of the participants had a good idea of how their experiences impacted them. Shelly had a very clear idea of what she wanted to accomplish, and understood the challenges and stereotypes associated with being a female student in engineering. She also seemed to embrace her experiences in a positive way. Elaine and Tammy accepted knowing this is a field dominated by men and how sometimes things may be said that may be sensitive to female students in the program. The participants

also shared their views on things not acceptable and things they would not tolerate. Bonita seemed to have discovered how it could be more empowering to not allow for certain things to be said to her. She expressed her concerns about how some men in this field feel superior to women. Bonita seemed to have reached her breaking point with how she was treated during some of her classroom experiences. Although she mentioned being “*used to all the guys,*” her experiences became more impactful when comments were directed specifically towards her. One could argue these experiences have a huge impact on self-esteem and sense of belonging. Interestingly, Bonita was the only participant who mentioned not accepting negative comments and speaking up for herself. Several of the other participants mentioned having at least one negative classroom experience and did not mention how it affected them. Instead, most mentioned “*you just get used to it.*” It appeared at times during the interview when participants would explain negative experiences they did not want to confront the issue head on. Instead, they wanted to keep the status quo and proceed through the program under the radar. For example Kelly mentioned how she just wanted to hurry up and finish her degree so she could get back to the industry.

Conclusions can be drawn about the ways in which participants made meaning of their experiences based on their behaviors. For example, with family support each participant shared her experience with the level of support received to major in engineering. Although there were a few negative experiences, none of the participants were affected sufficiently to quit or stop pursuing her engineering degree. Both Bonita and Elaine shared the lack of support they received from family. However, they also found other forms of support outside their immediate families. This support was, in fact, very instrumental and influential for both participants.

The social environment also provided evidence regarding the ways in which participants made meaning of their experiences. The majority of the respondents did not participate in the social environment at Midwestern University. Most of the participants explained how their lack of free time is what prevented them from being a part of extra curricula and different social events, clubs, and organizations. Instead, participants returned to or developed more comfortable social outlets in other settings, including various study groups from their classes at Midwestern University. Tammy and Andrea were the only two students involved in campus activities. Even though they both were involved in a campus club/ organization, both Andrea and Tammy expressed the lack of time they had for a social life outside of school. Andrea explained her reasoning for being involved with an engineering club on campus. She shared how important it was to have balance in her life and explained how when there is a lack of balance, it affects other areas in her life. Andrea seemed to understand balance. For Andrea, having balance in her life and making it a priority was essential to her overall well-being. Moreover, she made sure to incorporate other activities in her schedule that would take her mind off engineering assignments and projects. The other six participants all had similar reasons for not being involved in social activities outside of the classroom. Kelly and Kendra both mentioned they did not want to overwhelm themselves and overbook their schedules with “*extra stuff.*” Anika, Bonita, Elaine, and Shelly all shared their lack of time for any extra activities outside of school. It seemed each participant knew her limits on how much “extra” they could handle, while being an engineering student. Shelly explained how she knew she would be distracted and lose focus, if she was involved in any social clubs/organizations. Having this realistic understanding helped Shelly create a balance in her life that seemed to work for her. Although some of the students expressed a

desire to be involved in more social aspects of college life, most seemed to understand the rigor associated with being an engineering student.

While interviewing the participants, it appeared the social aspect of being in engineering was difficult for most of the participants. Taking field notes was very beneficial during this process. While discussing the specific discipline of engineering, the participants were very excited, while sharing some of their experiences. When questions were asked about the social aspect of their experiences, it seemed as though the mood of the interview changed. Participants seemed to be less talkative, as if they were sad by the fact they were not involved in more activities. Elaine eluded to wanting to do more social and recreational things, but just did not have the time. She mentioned wanting to play an intramural sport with one of her friends. However, the practice and game time was not doable for her because of various class projects and homework she had to complete.

It was noted in the field notes how students appeared sad, stressed, and overwhelmed at times. The pressure of being an engineering student has been shared numerous times. It appeared more pressure was added to these participants because they were female students majoring in a male-dominated field. Throughout the interviews, it appeared that participants continually acknowledged being in a setting with all men. As much as the participants stated how they were used to being around all men and how it became normal, the behaviors of all participants' revealed something different. When asked the question about their classroom experiences and how many females were in their classes, most of the participant's shared how they would generally gravitate toward the few females in the classroom.

It can be argued seeing another female and gravitating to the students who look like you could provide a sense of belonging or feel more comfortable. According to Rendon

(1994), some students are quite independent and can function within academic and social infrastructures quite easily, but many non-traditional students need active intervention from significant others to help them negotiate institutional life. The participants did share their experiences taking classes both when they first began and currently at Northwestern University. For many of the participants who had been at Northwestern University for a year or more, classes were now considered normal as they have gotten over the initial shock of being in large, predominantly male classes. Each participant seemed to share the same response when asked about being in a classroom with almost all men: *“you just get used to it.”*

This phrase *“you just get used to it”* surfaced a few times with each of the participants during the interviewing process. It was as if the participants felt helpless and gave up on wanting to know why there are only five or six females in a class of 50 to 60 students. None of the participants questioned the fact that many of the courses were saturated with men and had very few women. The field notes explained how participants are so focused on finishing their engineering degree, they either choose to not make a big deal about the ratio of women to men or they simply do not have time to address the obvious imbalance of males to females in their engineering classes. Although the participants mentioned being accustomed to seeing more men, it appeared to bother them. The fact that many of their negative experiences involved their male counterparts provided evidence that they choose to ignore male dominance.

It was also interesting that a few of the participants mentioned how excited they were when they noticed their professor was a female in a couple of their engineering classes. Elaine became extremely excited when she spoke about one of her professors in her engineering classes. According to Elaine, it was very refreshing to see a female professor

because you always see male professors. Bonita shared how some of the male students are very disrespectful towards female professors. She shared how some would call the female professor sexually offensive words. Bonita said these instances make her sad and upset because she knows the only reason some of the guys talk about the professor is because she is a woman. She also shared her feelings about guys talking about some of the other girls in the classrooms. *“I know that they probably talk about me as well but, oh well, it is what it is. You can’t control what people say you know.”*

Tammy also shared her frustration with male students who would bash the female professor of that class:

*It’s like they have no respect. I mean they would just say anything at times. They wouldn’t say it directly to the professor but they would say little smart comments during our group projects you know like why would she assign this dumb shit. She is stupid... you know stuff like that. That sort of stuff is not necessary and It really gets on my nerves.*

There has always been the underlying issue of discrimination and stereotypes in all areas of STEM. It has been argued the discrimination women have experienced has caused many to switch their majors and leave their jobs in the industry. It was evident the participants in this study have experienced both discrimination and stereotypes. As the participants continued to share their stories, it was noted some of their experiences could be early signs of the psychological effects various discrimination and stereotypes have on women in engineering. Tammy alluded to how the stereotypical behaviors of some of her male classmates affected her. Threatening STEM environments, such as stereotypical features within STEM environments (e.g., Murphy et al., 2007), women’s minority status (e.g., Cheryan et al., 2009), and the lack of female role models (e.g., Sadker & Sadker, 1994; Stout et al., 2011), might steer women away from entering STEM fields. It was very

interesting to see how the male dominance of engineering affected some of the female participants in this study.

All participants shared their specific negative experiences that impacted their behaviors. Although no one mentioned switching their majors or dropping out, many at some point had considered changing their majors. Many of the participants gave credit to those key individuals who helped them get through difficult times in the engineering program. Women's decisions to stay in engineering can be influenced by key supportive people in the organization, such as supervisors and co-workers. "Current women engineers who worked in companies that valued and recognized their contributions and invested substantially in their training and professional development, expressed the greatest levels of satisfaction with their jobs and careers" (Fouad & Singh, 2011, p. 6). Although, some of the participants had considered changing their majors, it was refreshing to hear all of them say that they would not quit until they graduated with an engineering degree from Midwestern University.

### **Limitations**

There were a few limitations to this phenomenological study. One limitation of this study was the number of participants. Initially, 10 to 15 participants were anticipated. However, only eight students were willing to participate. Another limitation for this study was the number of interviews conducted. Each participant was interviewed twice between 60 and 90 minutes in length. However, during the second interview with two of the participants, the interview had to stop after one hour due to their class schedule.

The next limitation was that the study focused on one institution. Also, all of the participants were white with the exception of one student who was by-racial and identified as

White/Asian. To speak more broadly about academic and social experiences of female community college transfer students in engineering fields at Midwestern University, this study would need to be extended to other universities and involve more participants. However, the design of this study provided insight into the academic and social experiences of a small group of community college transfer women in engineering.

It was very interesting for me, as a male researcher, to interview female participants about a male-dominated field. Even though I was not an engineering major, I was surprised when I came to realize that each participant was open and willing to share both positive and negative stories regarding their experiences. Two questions might be considered: (1) Would they have shared more if the researcher were a female interviewing them about their experiences? (2) Would more participants have responded to the initial invitation email to participate in this study?

### **Implications**

The findings of the study revealed that more intentional steps might be taken to include transfer women in engineering both at the community college and four-year institution. Many of the participants mentioned their lack of time for activities outside their classes. However, some of the participants were involved in some of the engineering clubs/organizations offered by the college. A few of the participants shared their concerns with some of the engineering clubs/organizations at Midwestern University. It was mentioned the student engineering clubs/organizations should make an effort into reaching out to newer engineering students. Moreover, it was suggested these clubs/organizations should reach out to female community college engineering students, while they are still at the



community college. Building a relationship with the community college and creating more outreach efforts geared toward female engineering students would help students feel more comfortable and provide a sense of belonging after they transfer to the four-year institution. It is vital to understand the academic and social experiences of female community college engineering transfer students to help cater to their needs. Findings from this study support the literature that “classroom activities and assessment lead to gains in the learning process as well as improved outcomes for both students and teachers” Seymour (2001, p. 86).

Moreover, it highlights how involvement plays a key role in the success of female transfer engineering students. Based on these findings, it is obvious female engineering transfer students’ experiences can be a challenge. It is also obvious female engineering students have just as much aspiration and hopes of obtaining an engineering degree as their male counterparts. The qualitative findings from this study draw attention to how important support groups are and how they influence a student’s decision to pursue a baccalaureate degree in engineering. Furthermore, it is essential to understand the role of the post-secondary institution in engaging students to remain in engineering and ways to make women, in particular, feel more connected in the engineering major.

It was noted many participants credited specific people from their support groups as reasons they have endured multiple negative experiences, while being a female transfer engineering student. It was also noted the participants of this study were all interested in pursuing careers on the industry side of engineering. None of the participants mentioned remaining in academia and becoming a professor. As highlighted in Chapter 2, *U.S. News* reported there were approximately 6.7 million openings in STEM fields in 2013. Of these jobs, 4.4 million required at least a bachelor's degree and 2.4 million were entry-level jobs

calling for less than two years of experience. Many of these positions go unfilled or are filled by men. Moreover, there is a push to graduate more than 1 million students in STEM areas. As part of an integrated approach to achieve these 1 million graduates, community colleges are highlighted as potential pathways for students to achieve STEM degrees (White House, 2012). It will be essential for community colleges and four-year institutions to continue to collaborate and create more efforts that will engage women in STEM fields.

## **Recommendations**

### **Community colleges**

Based on the finding of this study, it is recommended community colleges should increase collaboration efforts to enhance outreach programs for women in pre engineering. It is also recommended more collaborative events between the community and four-year institutions occur more frequently. This study's participants revealed the importance of feeling connected and engaged. It was also shared that the community college does a good job at engaging and maintaining them as students. However, there is a lack of intentional efforts to connect the student with the four-year transfer school early before they transfer. Participants also mentioned having to seek out advisors at the four-year institution where they were transferring. It was suggested these key personnel should be in place and the community college should provide students with the necessary contact information in the beginning of their programs. Community colleges should establish a comprehensive training program for advisors to enhance their understanding of the needs of transfer students, particularly the issues faced by female transfer students pursuing degrees in male-dominated fields. This should help advisors and instructors to become more self-aware of their own

personal bias and behaviors in the classroom during their interactions with students. This type of training could will also help to foster an academic environment that promotes gender inclusion rather than bias and discrimination.

Each participant was asked questions regarding her experience with faculty and staff at both the community and four-year institution. The participants had very positive responses and feedback about the faculty and staff in regards to the community college. In particular, one participant mentioned how she appreciated how her advisor would go above and beyond her job to accommodate her as a student.

### **Universities**

The participants in this study had several recommendations for universities. It was mentioned students do not like to feel like they are just a number. Many of the participants stated how they felt like a number and it appeared staff would shuffle them around from one person to the next. It is suggested the university do a better job addressing the needs of students rather than to just pass them along to other staff members. It was also recommended the university begin more out-reach efforts geared toward women in STEM fields, engineering, in particular.

Participants of this study mentioned not feeling connected and often being ostracized. As with community colleges, a comprehensive training program can help enhance professors' understanding of student experience and minimize behaviors that negatively affect student engagement and pursuit of a technical degree. It was stated as a female student being in the engineering program at one of the top ranked engineering schools in the country, more out-reach efforts should be made. Participants also suggested the need for some of the

engineering club/organizations on campus to increase outreach and recruitment efforts. A few of the participants in this study believed there should be more events to include all students in engineering. It was mentioned having events for women only plays into some of the stereotypical issues that separate women from men in engineering and, overall, it sends the wrong message. Finally, it is recommended the university focus on ways to make all students feel connected and engaged—not just another student on a large campus.

### **Program development**

The findings from, this study can be useful for community colleges and universities by faculty, academic advisors, financial aid advisors, academic and social groups, and recruiters. In addition, this study can be useful for programs related to recruitment, retention, and assistance of successful transfer women in all STEM areas. Academic advisors are responsible for registering students for classes, schedule building and helping students with graduation and transfer requirements. It is vital advisors are knowledgeable and understand course competencies of the programs they assign. It is the faculty's responsibilities to instruct and lead students in the curriculum to be successful academically. Moreover, it is just as important for faculty to understand their role as educators, and engage and connect with students to help them in their academic journey. These findings demonstrate students tend to enjoy their majors and their classes more when they have made a connection with faculty or a staff member. Moreover, the findings also demonstrate it is often the faculty or advisors/mentors that has the largest impact on a student's academic decisions.

**Future research**

This study can aid other studies related to the social and academic experiences of female transfer engineering students at other Midwestern universities. As STEM members continue to increase, replicating this study at other four-year institutions could add to the current body of literature. After conducting this research, there are several recommendations:

1. Replicate this study at other Midwestern universities to determine if there may be similarities in participants' experiences and responses.
2. Examine different disciplines within the engineering major to expand and enhance the study.
3. Explore different ethnicities to expand the study and produce rich data for examination and add to the current body of literature.
4. Conduct a study of female transfer engineering alumni who have been out of this setting for different periods of time and have them reflect back on their experiences as students and the meaning they made of these experiences then, and discuss how these experiences have influenced them now.
5. Look at female transfer engineering students after they graduate and enter the workforce. Review the experiences of female students working in industry after graduating and those working in the education sector of engineering.
6. Is a male versus female interviewer a factor? I found this an interesting point to consider.

### **Final Thoughts**

While working as a research associate, I developed an interest in women in engineering. My role as a research associate was to help conduct interviews for the research, transpose the data and retrieve emerging themes. Working as a research associate, prepared me for my own research study. It also was a motivating factor when it was time to conduct my own study. Conducting my study was not a difficult task for me, because I knew how to conduct a research study. There were times when I doubted my ability thinking that my study would not measure up to other scholarly work in the field. However, I wanted to conduct a study of my own on female transfer students in engineering. The experience that I gained as a research associate served as an aid that guided me in my study. I knew the importance of allowing this populations voice and experiences to be heard. My motivation to conduct my own study also came from the multiple studies that I was a part of as a research associate. After conducting my research study, I was excited about my findings and hearing the different experiences my participants encountered. In my opinion, my study resulted in meaningful data that can be used by other community colleges and university across the world. It was very exciting to interview eight female transfer engineering students. Their stories and experiences highlighted changes that need to be made in engineering and spoke to the stereo types that currently exist today.

Female engineers have always been a topic that has produced meaningful conversations and ideas. It has also produced numerous studies, articles and publications. My research study on female transfer students in engineering will become one of many studies to draw upon for data that speaks to the real life experiences of this population. After conducting my study, I feel proud of myself for completing a study on a topic that I am

interested in. I have also followed up with many of my participants to see how classes are going. The relationships that were established were a highlight of my study for me. I am extremely grateful for all of the female transfer engineering students who participated in my study. I give credit to them for bringing my study to life with their personal real life stories and experiences. It is my hope that all eight of my participants will graduate with a degree in engineering and continue to succeed in the field of engineering.

## APPENDIX A. INSTITUTIONAL REVIEW BOARD APPROVAL

**IOWA STATE UNIVERSITY**  
OF SCIENCE AND TECHNOLOGY

Institutional Review Board  
Office for Responsible Research  
Vice President for Research  
1138 Pearson Hall  
Ames, Iowa 50011-2207  
515 294-4500  
FAX 515 294-4267

**Date:** 12/18/2014

**To:** Darryle Bohanna  
1111 Easy Army Post Road  
Des Moines, IA 50315

**CC:** Dr. Larry Ebbers  
N256 Lagomarcino Hall

**From:** Office for Responsible Research

**Title:** The Academic and Social Influences on the Female Transfer Engineering Student Experience

**IRB ID:** 14-506

**Approval Date:** 12/17/2014      **Date for Continuing Review:** 12/16/2016

**Submission Type:** New      **Review Type:** Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- **Use only the approved study materials** in your research, including the recruitment materials and informed consent documents that have the IRB approval stamp.
- **Retain signed informed consent documents for 3 years after the close of the study**, when documented consent is required.
- **Obtain IRB approval prior to implementing any changes** to the study by submitting a Modification Form for Non-Exempt Research or Amendment for Personnel Changes form, as necessary.
- **Immediately inform the IRB of (1) all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) any other unanticipated problems involving risks to subjects or others.
- **Stop all research activity if IRB approval lapses**, unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- **Complete a new continuing review form** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. **Approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **IRB approval in no way implies or guarantees that permission from these other entities will be granted.**

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.



**APPENDIX B. INVITATION EMAIL**

Dear Student:

I am requesting your assistance with a study on the experiences of female transfer engineering students conducted by me at Midwestern University. There are many reasons that female engineering students are not persisting and changing their majors. You must be at least 18 years of age to participate and you must be a community college transfer student majoring in engineering. I would like to conduct two one hour long interviews to discuss your experiences being a female transfer engineering student. After the interview I will transcribe the interview verbatim and provide you with a copy for honesty and accuracy. If you choose to participate, I will assign you a number to protect your identity and ensure that you will remain anonymous. If you would like to make any changes after reviewing your interview, you will have the right to do so. Note that instructions on how to discontinue your participation in the study and stop receiving emails from me appear at the end of this message.

All participants will receive a \$10 dollar Wal-Mart gift card for their participation in this study after each interview.

I will keep all of your data confidential and you will remain anonymous throughout the duration of my study.

Participation in this study is voluntary and you may withdraw from participation at any time. If you have any questions you may contact me:

Darryle Bohanna  
1111 E. Army Post Rd, Ste 400  
Des Moines, IA 50315  
515-256-4926

**APPENDIX C. INTERVIEW PROTOCOL QUESTIONS**

1. Tell me a little bit about yourself. Background, high school background and experience?
  - a. Subjects of interest
  - b. Influential Individuals (guidance counselor, friends, advisors, teachers)
  - c. What encouragement or support did you receive from guidance counselors, friends, advisors, teachers and family to pursue engineering?
  - d. When did you realize that engineering was what you were interested in and wanted to do?
  - e. Are any of your family members engineers?
  - f. Have you ever felt uncomfortable telling people that you want to major in engineering?
2. Tell me about your experience as a female engineering student at your community college.
  - a. Tell me about your classroom experiences as an engineering student at your community college.
  - b. Has there ever been a time that you were unsure about majoring in engineering?
3. How did you learn about the engineering program at Northwestern University?
  - a. What was the application process like?
  - b. What was your impression of faculty and staff in your department of engineering?
  - c. Tell me about your experience the first time you entered your specific department of Engineering building.
  - d. Are there any clubs or organizations you are involved with related to engineering?
4. Talk about your experiences being in the engineering program at Northwestern University?
  - a. Cultural experience
    - Tell me about your cultural experience being an engineering student at Northwestern University.
  - b. Social experience
    - Tell me about your social experience at Northwestern University.
    - How many of hours a week do you have to study?

- d. Overall experience
  - Tell me about your experience overall.
5. How do you feel about continuing in the engineering program finishing your Bachelor's Degree in Engineering?
  - a. Have you considered pursuing a master's degree in engineering?
6. Do you feel the engineering program has been beneficial to you and your quest to earning a bachelor's degree in engineering?
  - a. How helpful are advisors and staff of the program?
7. What advice would you give to recruiters, mentors and other students who are thinking about enrolling in the engineering program at Midwestern University?
  - a. Is there anything you would like to see done differently?
8. Is there anything else you would like to add that we did not cover?

## APPENDIX D. CONSENT FORM DOCUMENT

**Title of Study:** Academic and social experiences of female community college transfer students in engineering fields at Midwestern University

**Investigator:** Darryle Bohanna-Student Dr. Larry Ebbers- Supervising Faculty

This is a research study. Please read carefully and decide if you are willing to participate.

### INTRODUCTION

The purpose of this study is to understand the academic and social experiences of female community college transfer students in engineering fields. This study will seek to provide a deeper understanding of how those experiences could impact and shape female transfer students who aspire to pursue an engineering degree. Furthermore, this study might be used to provide advisors, faculty, staff and administrators with a better understanding of how to enhance the transfer process of female engineering students prior to and after transferring from a two-year institution to a four-year institution. This study will also explore issues involving gender and other factors that can affect the persistence of female engineering transfer students completing their degree. Your participation in this study is voluntary. Please read the information below and ask questions about anything you do not understand, before deciding if you will participate or not. You are being asked to participate in this study because you are a Midwestern University female transfer engineering student.

### DESCRIPTION OF PROCEDURES

If you agree to participate:

1. You will be interviewed twice for approximately one hour and asked a series of questions that relate to your experience as a female transfer engineering student at Midwestern University. The questions will be semi-structured and will allow for you to have the opportunity to express what you feel about the questions being asked.
2. Your interview will be tape recorded for honesty and accuracy and transcribed afterwards.
3. If any additional interviews are needed you will be contacted at that time and asked to be scheduled for a third interview.

### RISKS

While participating in this study you will not experience any pain or danger. It is not expected that you experience any inconveniences or discomforts. However, if any of those should arise, please inform me and you will be giving the option to drop out of the study at any time.

### BENEFITS

There are no direct benefits for participating in this study. However, data will be shared to find better ways to serve female transfer students in the engineering department. It will also help the department find better ways to engage, recruit and retain more female transfer students in engineering.

**COSTS AND COMPENSATION**

You will not have any costs from participating in this study. You will be compensated with a Wal-Mart gift card.

**PARTICIPANT RIGHTS**

Your participation in this study is completely voluntary and you may refuse to participate or withdraw from the study at any time. If you decide to not participate or withdraw from the study, it will not result in any penalty or loss of benefits to which you have already received. During the interview, you can skip any questions that you do not wish to answer or feel uncomfortable answering.

**CONFIDENTIALITY**

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies, auditing departments of Midwestern University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information. To ensure confidentiality to the extent permitted by law, the following measures will be taken: Confidentiality will be maintained by means of a pseudonym for your name to let the principal investigator and supervising faculty know who you are. Your name will not be used in any of the information from this study or in any of the research reports. When the study is finished, the list that shows which code number goes with your name will be destroyed. Information that can identify you individually will not be released to anyone outside the study. The tape recordings and transcripts that we make will not be viewed or heard by anyone outside the study. The tapes and transcripts will be destroyed three years after the end of the study.

**QUESTIONS OR PROBLEMS**

You are encouraged to ask questions at any time during this study.

- For further information about the study contact:

Darryle Bohanna

Dr. Larry Ebbers

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