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Engineering transfer student leavers: Voices from the sidelines of the engineering playing field

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**Engineering transfer student leavers:
Voices from the sidelines of the engineering playing field**

by

Mary Elizabeth Darrow

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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DEDICATION

This dissertation
is dedicated to my parents,
Dr. Gerald and Sarah Darrow,
who instilled in me the value of lifelong learning and public education.
Their commitment to service as public educators has inspired me, as their daughter,
to make a difference in the world and in the lives of students.

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during my “defense.” He provided much needed encouragement and invaluable reminders which kept me focused.

ABSTRACT

The purpose of this phenomenological study was to understand and illuminate the experiences and stories of Midwestern Community College transfer students who entered and left engineering at a large Midwestern research university. Participants were invited based the following selection criteria: (1) Midwestern Community College transfer students who enter engineering; (2) completion of Calculus I and II, Physics, Chemistry, English I and II prior to transferring; (3) stayed in engineering at least 2 semesters; and (4) left engineering in the Fall 2010, Spring 2011, or Fall 2011 semesters for another major.

Eight students participated in this qualitative study. The researcher encouraged the participants to share their perceptions and experiences of the various transitions involved in this phenomenological sequence of events. The following themes emerged: (a) Community college is like an extension of high school; (b) Inadequate community college advising; (c) Academic rigor; (d) "I can't/don't want to do this anymore...;" (e) Lack of academic support; (f) Variable quality of student-faculty interactions; (g) Sense of belonging; and (h) Challenges of being an older student.

Students in this study described a clashing of cultures as they transitioned from a community college to a large research university. Further study is needed in order to understand the complexity of this student experience and to develop policies and programs which meet the needs of engineering transfer students.

CHAPTER 1. INTRODUCTION

Overview

Originally conceived as a result of the Truman Commission in 1947, the community college system has changed the landscape of higher education in the United States by increasing access to postsecondary education through open door policies and accessible classrooms and campuses (Boggs, 2010, Cohen & Bawer, 2008). Community colleges now enroll close to half of all US undergraduates (NCES, 2007). They provide an affordable option for a wide range of learners, with an average cost of just \$2,544 per year (College Board, 2009). Overall community college enrollments have grown steadily over the past 10 years as more people are turning to community colleges to fulfill the first two years of their college education (Phillipe & Mullin, 2011).

In July of 2009, President Obama called on community colleges to increase the number of graduates by 5 million over a period of 10 years. This goal reflects an increase of 50% (Obama, 2009). In order to accomplish these goals, community college student completion and transfer rates must improve. Improving transfer and educational attainment rates requires the attention of educators and administrators working together to improve course and program delivery, articulation, and student advising (Boggs, 2010). Four-year institutions and programs can increase their overall enrollment rates while enrolling and graduating more students of low socio-economic status, by increasing their numbers of community college transfers (Bowen, Chingos, & McPherson, 2009).

With 50% of the undergraduate population starting in a community college, engineering colleges and programs are presented with a new opportunity to connect in meaningful and effective ways to serve these students and to recruit more diversity to the engineering profession. While he was president of the National Academy of Engineering, William A Wulf (2001) called for diversity in engineering in broad terms:

When I speak of diversity, I mean, the kind of inclusion you probably think of instantly, that is, appropriate representation of women and underrepresented minorities. But my idea of diversity also includes the notion of individual diversity, that is, the breadth of experience of an individual.

He went on to frame an eloquent argument for the inclusion of different life experiences forming the gene pool out of which the most creative engineering solutions are born and claims that the quality of engineering is the result of the diversification of the engineering profession. Community college students bring a wealth of life experiences and diversity to the engineering gene pool. The question is whether the engineering culture will assimilate to their diverse needs and/or embrace this diversity.

The demographics of the engineering workforce clearly presents a challenge. About one-third of the school-age population in the United States consists of underrepresented minority students. Women constitute more than half of the U.S. population and 60 percent of the total workforce. Nevertheless, the percentage of females enrolled in engineering continues to hover between 16-18% of the engineering student population (ASEE, 2010). African American and Hispanic students combined comprise approximately 15% of the engineering student

population (ASEE, 2010). This extreme underrepresentation of major segments of the population presents serious moral and social challenges to the engineering profession.

The engineering transfer student experience includes personal, academic, and social influences, and comprises a complex and interwoven story with several points of decision, engagement, and transition. Career aspirations can often be affected by a variety of formal and informal interactions. The community college experience can be quite varied with some students experiencing very structured curriculum and support while other students do not. There are issues of academic rigor, social and personal integration, and new financial pressures that present themselves. Leaving engineering presents an additional transition which can be complicated and defeating to a student. Through this study, I hope to illuminate these experiences and better understand how students navigate the transitions in to and out of engineering from a community college.

As engineering curriculum evolves and changes, there is a continuing struggle to keep the community college engineering pathway seamless and articulated. A nonprofit, non-governmental organization that accredits college and university programs in the disciplines of applied science, computing, engineering, and engineering technology, ABET accredits engineering programs and drives most curricular frameworks in engineering and specializations. ABET accreditation presents individual challenges to developing and maintaining a seamless and articulated curricula (Dummire, Enriquez, & Disney, 2011). Students are often caught in the middle of this challenging landscape as they strive to navigate the pre-

engineering curricula and plan for a successful transfer into a specific engineering major. They often encounter misinformation and obstacles in their transfer pathway as they navigate an often confusing and at minimum complicated curricular pathway. Another challenge facing engineering students is that they are often recruited by the community college to complete an Associate of Arts (AA) or Engineering Technology Program. While these community college programs can provide technical skills and/or foundation general education foundation, they typically do not adequately prepare students for engineering, unless their transfer institution of choice offers Bachelors of Engineering Technology Programs which many do not. The key for all transfer students is that they successfully complete the core academic coursework prior to transferring (i.e., Calculus I and II, Physics, and Chemistry) to ensure adequate preparation for engineering.

The pathway to engineering through a community college presents unique challenges for students, educators, and administrators. Engineering has a long history of academic elitism and a culture which attracts and values traditional measures of achievement such as high SAT/ACT scores, high school rank, national merit scholar status, and AP test scores. Community college students bring a diverse academic credential to this system. They come from diverse backgrounds, are often older, may work full or part-time, may commute to school, and may have a family to support. The stories of community college transfer students are often complex and not easily captured through quantitative means. It is for this reason that I chose to conduct a qualitative study of engineering transfer student leavers. These students speak *“from the sidelines of the engineering playing field.”* It is

through their stories that we might understand their challenges and their decisions to leave engineering.

Statement of the Problem

The research on transfer students has focused primarily on transition, transfer adjustment, transfer outcomes, validation, and social connectedness (Laanan, 2007, Townsend and Wilson, 2006, Vogt, Hocevar, & Hagedorn, 2007, Hagedorn & Lester, 2006). These studies utilized quantitative methodologies in order to gather and analyze data related to the STEM transfer experience. In the past five years, attention has been paid to understanding the role of community colleges in the STEM Pathway (Hardy & Katsinas, 2010; Laanan, 2010; National Academy of Science, 2005; National Science Foundation, 2006). Some studies have used qualitative methodologies in order to understand the STEM student experience (Foor, Walden, & Trytten, 2007; Starobin & Laanan 2008), but there is a void in the qualitative literature and a lack of rich narrative data that illuminate the experiences of transfer students who leave engineering. There is a need to better understand this phenomenon within the larger context of STEM transfer students.

Purpose of the Study

The purpose of this study is to understand and illuminate the experiences and stories of Midwestern Community College transfer students who entered and left engineering at a large Midwestern research university, called Midwestern University (MU) for the purposes of this study.

Research Questions

The following research questions guided this study:

1. How do community college transfer students describe the people, experiences, and life events that influenced their decision to pursue an engineering degree?
2. How do community college transfer students describe the social, academic, and personal transition into engineering from a community college?
3. How do transfer students construct meaning of their decision to leave engineering?
4. What transition and academic experiences and perceptions are unique to these students?
5. What institutional policies and practices would best serve the needs of engineering transfer students?

Significance

Developing an understanding of the student narratives of engineering transfer students who leave engineering is important because it provides a deeper understanding of the transfer experience than can be obtained through quantitative inquiry. Individual student stories provide powerful insights into a phenomenon. Better understanding why students leave engineering can inform the next generation of students, practitioners, and administrators.

Theoretical Perspective

This study considered two theoretical and conceptual frameworks in order to frame the study and research design: (a) Predictive Model for Academic Transfer Adjustment or “Transfer Student Capital” (Laanan, 2010), and (b) the National Survey of Student Engagement (NSSE) Benchmarks for Effective Educational Practice (2012). Through this bi-fold approach of framing this work, I was able to organize both the structure of my interviews and also conceptualize themes that might be useful in organizing the data analysis for this study. Table I provides an overview of each of these constructs. This overview not only outlines the basic components of each theory or construct, but also provides a view of the combined bi-fold approach.

Research Strategy

According to Jones et al. (2006), the intent of qualitative research is to illuminate and better understand in depth the rich lives of human beings and the world in which they live. In addition, Lincoln and Guba (2000) described constructionism as an epistemology where knowledge and existence are perceived and constructed through human interaction with an emphasis on understanding. A phenomenological framework was applied in the current study in order to conduct interviews and focus groups with engineering transfer students who have left engineering for other majors.

Table 1. Conceptual frameworks used in the study

Predictive Model for Academic Transfer Adjustment (Laanan, 2010)	The National Survey of Student Engagement (NSSE) Benchmarks for Effective Educational Practice (2012)
<p>Background</p> <ul style="list-style-type: none"> • Mother's Education • Father's Education • Parental Income • Motivations for Transfer • Reasons for Transfer <p>Community College Experiences</p> <ul style="list-style-type: none"> • Experiences with General Courses • Course Learning <p>Transfer Capital</p> <ul style="list-style-type: none"> • Academic Counseling Experiences • Perceptions of the Transfer Process • Learning and Study Skills <p>University Experiences</p> <ul style="list-style-type: none"> • General Perceptions of the University • General Perceptions of Faculty • Course Learning • Experiences with Faculty • Stigma as a Transfer Student 	<p>Level of Academic Challenge</p> <p>Challenging intellectual and creative work is central to student learning and collegiate quality. Colleges and universities promote high levels of student achievement by emphasizing the importance of academic effort and setting high expectations for student performance.</p> <p>Active and Collaborative Learning</p> <p>Students learn more when they are intensely involved in their education and are asked to think about and apply what they are learning in different settings. Collaborating with others in solving problems or mastering difficult material prepares students to deal with the messy, unscripted problems they will encounter daily during and after college.</p> <p>Student-Faculty Interaction</p> <p>Students see first-hand how experts think about and solve practical problems by interacting with faculty members inside and outside the classroom. As a result, their teachers become role models, mentors, and guides for continuous, life-long learning.</p> <p>Supportive Campus Environment</p> <p>Students perform better and are more satisfied at colleges that are committed to their success and cultivate positive working and social relations among different groups on campus.</p> <p>Enriching Educational Experiences</p> <p>Complementary learning opportunities inside and outside the classroom augment the academic program.</p>

Summary

Transferring from a community college into an engineering major is a huge leap for many students. Success depends upon a variety of social, environmental, and academic factors. Successful transfer programs at both the 2- and 4-year levels should include career specific recruitment, learning which includes engineering

problem solving and active learning, academic support and transition programs, articulated curriculum, student advising, and social and academic connections for students (National Academy of Sciences, 2005). Students entering engineering face considerable transition issues in order to be successful. Leaving engineering adds another layer to this transition story. This study was conducted to illuminate these stories in order to increase the understanding of these students' transfer and leaving experiences in engineering.

Chapter 2 presents a review of the research literature associated with the institutional practices and student development theories and concepts associated with the engineering transfer student experience and programming. It includes with a description of Laanan's (2010) Model for Academic Transfer Adjustments, and The NSSE Benchmarks of Effective Educational Practice (2012) and concludes with a brief discussion of this bi-fold theoretical and conceptual framework for studying engineering transfer students.

Chapter 3 presents the methodology including epistemology, theoretical frameworks, and methods for the study. Participant selection and human MSubjects approval (including confidentiality, and privacy concerns) are addressed. This chapter also discusses trustworthiness and authenticity as well as ethical considerations, delimitations, and limitations. As a qualitative researcher, I also define my role as the researcher. Chapter 4 will present participant narratives. Chapter 5 will present thematic and unique findings of the study. Finally, Chapter 6 will discuss conclusions, limitations, and ethical issues, and will also present implications and recommendations for future research and practice.

CHAPTER 2. LITERATURE REVIEW

STEM Community College Pathway

Success of transfer students from our nation's community colleges determined by academic and transfer success, retention, graduation, and employment is of critical importance to our economic and social prosperity. Tsapogas (2004) clearly articulates the need to continue to invest in community colleges as a pipeline for female and underrepresented students pursuing science, technology engineering, and math (STEM) degrees. Community colleges serve as an important bridge for underrepresented groups that might not otherwise have access to educational opportunities (Laanan, 2001; Starobin, 2004, Starobin & Laanan, 2008). These educational opportunities include technical education, academic/transfer coursework towards a baccalaureate program, remedial education, and continuing education (Cohen & Brawer, 2008; Laanan, 2003). As more students begin their education in community colleges, it becomes increasingly important to have a deep understanding of the factors and strategies that influence engineering transfer success. This study strives to build upon previous work to understand and give voice to the stories of engineering transfer students who leave engineering. It is through narrative and student stories that we gain a deeper understanding of their engineering transfer experiences.

Community College Pathway to Engineering

When reviewing the work of Handel (2007) and a 2005 National Academies report, *Enhancing the Community College Pathway to Engineering Careers*, it is

clear that there are persistent issues which affect the success and aspirations of transfer students. Research suggests that a key part of increasing the number of engineering students from a pre-engineering pool of potential transfer students hinges on building connectivity and a “sense of community.” These vital connections strive to enhance community college students’ engagement by building a bridge between community college pre-engineering students and their 4-year programs and institutions of choice. Increasing pre-engineering student engagement prior to transferring is intended to increase both the likelihood of a successful transfer, consideration and preparation for an engineering major, retention, and graduation of these students.

Academic Preparation

Concerns regarding students’ academic preparation for engineering has been studied by many (Jacobs, 2005; Epperson & Kahn, 1998; Schuman et al., 1999). For example, Astin and Astin (1992) concluded that preparation in quantitative and analytical skills in high school was a positive indicator of interest in engineering. Zhang, Anderson, Ohland, and Thorndyke (2004) posited that high school grade point average and quantitative scores on the SAT can be used to predict engineering graduation rates. Felder et al. (1993) and Suresh (2006) noted that performance in key introductory undergraduate courses (i.e., calculus and physics) is related to engineering persistence. Related literature pertaining to students who transfer into engineering is thin. These students transfer into engineering with a range of academic preparation making generalization across the population nearly

impossible; however, it is clear that academic preparation in calculus and physics are critical to success for all populations who enter engineering. Engineering transfer students should be advised to take all of their core program in their community college in order to ensure the best possible academic preparation coming into engineering. This includes Calculus I and II, Physics (calculus-based), and Chemistry. Too often, the claim is made that community colleges do not provide enough academic rigor to prepare students for engineering when in reality students often have not been advised or required to successfully master these courses prior to transferring.

Early Transfer Advising and Career Development

Community college students often do not have access to or do not take advantage of quality career information and/or transfer advising resources. Too often, students are focused on degree completion rather than transfer and consequently only look at transfer requirements and transfer majors at the time of transfer. In a study of 400 students from nine community colleges in Los Angeles, Hagedorn et al. (2008) concluded that ineffective advising and extremely high student-to-counselor ratios led to a lack of information among students pertaining to transfer requirements. Other studies have also noted that limited advising resources often results in transfer delays and misinformation among students in the transfer process (Handel, 2007; Hoffman & Wallach, 2005; Ornelas & Solorzano, 2004). This gap in quality advising services is critical to engineering transfer success due to the complexity of the transfer curriculum. With rapidly escalating tuition costs,

students don't have the luxury of taking extra time to graduation, so backtracking and starting over just are not options for many students. In addition, this lack of information can cause students to enter engineering without prerequisite coursework completed, especially calculus and physics, which puts them at a distinct disadvantage compared to other 2nd and 3rd year students.

Engineering Career Development is critical to successful engineering transfer students. According to the National Academy of Sciences (2005), "students continue to enter community colleges without realizing they can obtain a four-year degree in engineering by beginning their studies at a community college and transferring to 4-year engineering program. To significantly increase the number of students who embark on the community college pathway to engineering, four-year schools will have to use their brand images to promote the community college programs, perhaps by developing joint admission and recruitment programs with two year schools." As stated previously, too many students are not aware of the community college to engineering pathway and/or they find out late in their community college career. Finding out too late results in a lack of academic preparation or understanding related to engineering fields. Students need to know early and set a clear course towards engineering transfer that includes research on the various majors and significant academic preparation in the core courses of Calculus, Physics, and Chemistry.

Transfer Process

While preparing students to transfer to a four-year institution and assisting in that transfer has traditionally been primarily the responsibility of community colleges, four-year institutions are increasingly sharing the responsibility of students' successful transfer and transition (Berger & Malaney, 2003; Kuh, Kinzie, Shuh, Whitt, & Associates, 2005; Weschler, 1989). There are a range of services often provided by the 4-year institutions to assist students in the transfer process including orientation, advising, and academic and social support services and programs. These services provide opportunities for academic and social integration which ultimately lead to retention in the major and/or the university (Tinto, 1993). Unfortunately, transfer student retention efforts often fall short both in the percentages of students served and, consequently, in their results (Kuh et al., 2010).

Defined by Laanan (2010), Transfer Student Capital (TSC) explains how community college students accumulate knowledge in order to navigate the transfer process. This knowledge might include understanding credit-transfer agreements, grade requirements for admission into a desired major, and course pre-requisites. Additionally, TSC is a concept that describes students' ability to accumulate knowledge, expertise, and skills to increase their ability to successfully navigate the transition into a new and often complex transfer college culture. Information channels extend through and beyond the student's friends, family, and advisers. Agents in these information channels serve to help students bridge the gap to matriculate to baccalaureate-granting institution. The extent to which these

channels are accessed and the students acquire and put into the action information and skills (capital) is paramount to the success of the transfer enterprise.

Student Engagement

According to Kuh et al. (2010), engagement is demonstrated by the investment students make in the college experience specifically related to academic challenge, student-faculty interaction, and active and collaborative learning. Academic challenge is the “amount of time and efforts students devote to: (1) studying and other academic work, (2) preparing for class, (3) reading assigned and other books, and (4) writing” (Kuh et al., p. 177). This concept of academic challenge involves challenges that occur throughout the academic experience, from orientation (transfer) to graduation (Kuh et al.). Student-faculty interaction includes engagement both inside and outside the classroom such as discussions about career paths, work on research projects, and other conversations outside of class. Increased engagement with faculty is consistently found to positively impact student retention and persistence (Braxton, Milem, & Sullivan, 2000). Kuh et al. (2010) further defined student engagement to include active and collaborative learning that involves both the individual student’s application of learned material in varied situations along with the interaction with peers to solve problems and tasks. Active learning involves classroom participation and discussion as well as group work and consistently shows a positive relationship with student persistence (Braxton et al., 2000; Terenzini, Springer, Pascarella, & Nora, 1995). Enriching educational

experiences include complementary learning opportunities inside and outside the classroom that augment the academic program.

Over the past two decades, higher education leaders have recognized the importance of academic and social integration in fostering student academic success and degree attainment, particularly at institutions whose student body is traditional-age and primarily residential (Astin, 1993; Braxton, Sullivan, & Johnson, 1997; Pascarella & Terenzini, 1991, 2005; Tinto, 1993). Consequently, institutional leaders across the country have supported the development of institutional practices such as learning communities and first and second year seminars. These practices create connections for entering students with faculty, staff, and students that are not traditionally formed in large lecture halls. The underlying student development theory is that the more students are involved in or integrated into college life, the greater the likelihood they will stay in college and attain their degree (Pascarelli & Terenzini, 2005; Tinto, 1993, 1997). It is also important to note that most of the student engagement literature looks at the direct from high school populations. There is need to look more closely at how we define engagement for transfer students as they come from different college experiences, are often older, and look for both social and academic engagement within the classroom environment. Programs and services created based upon the direct from high school student engagement literature have often failed because they do not meet the diverse needs of transfer students. Academic and social engagement for transfer students is best implemented within the classroom which requires shifts in classroom pedagogy.

Transfer and Adult Student Engagement

The literature on student engagement of transfer students is thin. Most of the literature focuses on the student experiences, policies, and services leading up to transfer and not on the experiences of students following transfer. One study (Townsend & Wilson, 2006) focused on the success of community college transfer students to a large research university and found that transfer students tended to make fewer social connections because they were older and may need more assistance in the beginning because of the many adjustments that they need to make coming into a large research university. Townsend and Wilson (2006) suggested “a hand hold for a little bit” in order to help transfer students through these adjustments.

While the research on student engagement in higher education is vast supporting work by Kuh et al. (2010) as well as that of the Center for Community College Student Engagement (2012), some research suggest that transfer students are less socially engaged and rely heavily on the classroom and related work as their primary means of engagement (Borglum & Kubula, 2000). Given that community colleges are predominantly commuter colleges where students typically come to campus for classes only, this view of engagement mirrors transfer students' previous college experiences and merits further study and consideration within the classroom environment. In this view, faculty need to embrace instructional strategies such as project based, collaborative, and active learning which integrates social and academic engagement into the instructional design. These approaches also strive to engage all students earlier in engineering content as a means of

teaching core math and science courses such as calculus and physics. According to the National Science Board (2007), "Engineering students often develop little identity as engineers in their first 2 years of college because they take math and science courses and have little exposure to engineering practice."

For the purposes of this study, I allowed the participants to self identify as older or adult students. Four of the eight described themselves as older; therefore, consideration of the literature pertaining to adult or nontraditional students is relevant. Numerous researchers (Choy & Premo, 1995; Graham & Gisi, 2000; Kasworm, 1980; 1994) have concluded that older students of all ages perform as well as if not better than traditional-aged students; however, Kasworm (2008) stated, "college for most adults is not a physical separation from the past worlds" (p. 27). In other words, adult students often have more current responsibilities such as bills and/or families and past experience which cause them to approach the educational process differently than their younger counterparts. Hagedorn (2005) offered a framework for adult student engagement and likened the experiences of older students to the concept of "square pegs fitting into round holes." Hagedorn used this analogy to illustrate adult students' experiences and difficulties fitting in and adapting to campuses designed for traditionally aged students. Within this framework, Hagedorn describes four points of friction for adult students: access, success, retention, and institutional receptivity.

Engineering Climate

The perceived “climate” in engineering programs contributes to students’ feelings of belonging and can be either detrimental or enabling to retention programs and efforts. Rogers and Summers (2008) defined campus climate as the attitudes, perceptions, and expectations associated with an institution. Classroom or program climate, however, focuses on interactions within the classroom settings among students and between students and faculty. Of particular concern in terms of retention efforts are that some of the reasons for switching out of engineering point to the pedagogy and programmatic structure through which engineering is traditionally taught and delivered: hard “weed out” classes rather than nurturing, learning focused environments; strong emphasis on individual achievement and competition; and a lack of close and interpersonal relationships with faculty and peers (Seymour & Hewitt, 1997; Goodman et al., 2002). Astin and Astin (1993) ventured further by asserting that interaction with engineering faculty may actually backfire and prove to be negative influences on persistence in a major. Sandler, Silverberg, and Hall (1996) coined the term “chilly climate” to describe learning environments and classrooms that treat various student groups differently or that use male-oriented pedagogy. Focus on the engineering climate as it is defined in the literature should be of particular relevance when seeking to understand transfer student transitions and persistence.

The cultural shift that transfer students experience coming into a large research university and engineering more specifically are immense. While community colleges are focused on teaching and learning and student success,

foundation coursework in engineering are termed “gateway” courses and often serve to “weed out” students. Students often describe classrooms environments in the community college as nurturing and supportive while foundational coursework in engineering are often taught in large lecture halls with limited interaction among students or between students and faculty. Engineering climates are often described as competitive with an emphasis on individual achievement. This competitive climate often intimidates students who are less confident or less prepared academically.

Leaving Engineering

The literature on why students leave engineering is vast and well established, but it seems that the path to changing student behavior and engineering culture to improve persistence is an elusive task. The quality of the students’ learning experience and their decision to stay or leave the engineering field is a complex phenomenon based on interactions among students, faculty, and the environment. Seymour and Hewitt (1997) recognized the critical importance of understanding these experiences and student perceptions. In a summary of their work, Seymour and Hewitt (1997) present the problems or concerns influencing students to switch from engineering (and to some degree, by all Science, Math, and Engineering (SME) students:

1. Other majors became more interesting and/or offered a better experience;
2. Loss/lack of interest in SME;
3. Rejection of SME careers and associated lifestyles;
4. Shift to a more appealing career option (non-SME);
5. Poor teaching by SME faculty;

6. SME career not worth the effort; and
7. Discouraged/lost confidence due to low grades.
8. They also concluded that the decisions not to switch often involved the chance intervention of some person or event. (p. 31)

Overwhelmingly, the literature cites instructional pedagogy as a possible deterrent to student persistence among engineering students. Large classes and traditional lectures that often dominate in the lower level engineering programs can be a deterrent to success because they can create a barrier between students and faculty and offer limited opportunities for engagement or involvement with other students or faculty. Levin and Wycokoff (1991) stated that academic ability is not enough and that there is a complex interaction between academic ability and interest. Many others have considered motivation as a central explanation for positive academic outcomes. Characteristics of motivated students include persistence, goal setting, and resilience (Bandura, 1997). In the engineering context, students with heightened levels of motivation will seek out and utilize available resources in order to satisfy their goals of desired grades and an engineering degree. Bernold, Spurlin, and Anson (2007) followed a first-year cohort of engineering students for three years and analyzed how learning styles related to academic outcomes. They found that students whose learning styles focus on “Why” and “What if” exhibited lower grades and higher attrition rates in engineering coursework than the students whose learning styles focus on the “What” and “How.” It is interesting to note that older students who enter engineering from the workforce and students with applied and contextual learning styles may be motivated by the process of learning new and interesting things relevant to its usefulness to

engineering work. Students who are motivated by the process of learning rather than grades may therefore lack the motivation to persist in the first and second year foundational coursework.

Conclusion

Literature serves to ground and frame a research study. It is only through looking back, around, and through the literature that we can begin to understand what others have learned and begin to frame a study that considers the surrounding research. A research project can become an island in a sea of dissertations or it can become part of an interconnected web that relates to and builds upon previous work. My goal is the latter, and this chapter serves to create that web. Of particular importance to this study are two pieces of literature cited previously which formed the bi-fold theoretical framework for this study: Laanan's (2010) Predictive Model for Academic Transfer Adjustment or "Transfer Student Capital (TSC)"; and The NSSE Benchmarks for Effective Educational Practice (2012). This framework has been used throughout this study to guide the research process. It has guided the inquiry and analysis and provided structure that builds upon these important pieces of work. As with any qualitative work, I have also allowed unexpected findings to emerge beyond this framework based upon the participant narratives and results which follow in Chapter 4 and 5.

CHAPTER 3. METHODOLOGY

The focus of this study was to examine the phenomenon of community college transfer students who leave engineering. I selected a qualitative research approach in order to gain an understanding of the stories of these students' experiences leading up to leaving engineering. This chapter provides information about the researcher's role, the epistemology, theoretical framework, participant selection, data collection and analysis, trustworthiness and authenticity, ethical issues, and limitations. Prior to collecting data, applications to conduct research involving human subjects were submitted to and approved by the Office of Research Compliance (Appendix A). This study took place in the Spring of 2012.

Researcher's Role

In this research study I was the primary data gathering tool, and it was impossible to separate myself from the research process and presume objectivity (Esterberg, 2002, Meriam, 2002). Esterberg (2002) stated, "who you are and what qualities you bring to your work matter" (p. 62). For this reason it has been important for me to identify and be aware of my positionality and biases as I conducted this research.

I have worked with transfer students and programming at the high school, community college, and 4 year levels throughout my career. Through these experiences and through my study as a community college scholar, I have encountered many theories and factors that are believed to either hinder or help the transfer and educational experiences of students in transition. Through my work I

have developed a great passion for community college transfer students and have often marveled at their stories. Quantitative researchers have often tried to homogenize the transfer population to fit a particular set of descriptive criteria or demographics. Unlike direct from high school students, it is difficult to do this because of the nature of this population. Having worked with transfer students for over 20 years, I have observed and witnessed the rich and often complicated stories of these students and look forward to uncovering the stories of engineering transfer student leavers through this phenomenological study.

Over the past 5 years, I have worked as a project manager for a large National Science Foundation STEM Talent Expansion Program (STEP) grant between a large community college and a large public research university with the goal of increasing engineering graduates and to also increase the numbers of underrepresented minority and female students entering and graduating from engineering. Through this program extensive work was done to build a transfer enterprise between the two institutions and to analyze quantitative data related to engineering community college transfer student success. Through this project we studied transfer student success data and implemented proven strategies in order to meet the project goals and objectives. Through this project and related research, we have learned a great deal about transfer student success in engineering. This work has set the stage for this qualitative study.

In my most recent position, I served as an engineering transfer coordinator at a large research one university. In this position, I managed transition programming, met with community college faculty, and assisted students in the engineering

transfer process. This work provided me with an insider perspective of the issues facing engineering transfer students. I encountered many students' diverse and complicated stories, varied social, personal, and academic backgrounds, and often financial hardship. My knowledge of this diversity also has led to my decision to do a qualitative study in order to give voice to the experiences of these students. I also understand, again, my inability to be objective given the extensive and rich experiences that I bring to the research process.

Midwestern University (MU) is a broad-based public university of international stature with more than 26,000 students from all 50 states and nearly 120 other nations. Iowa State, a Carnegie Doctoral/Research-Extensive university, has led the development of several fields of study that are central to the land-grant movement, including engineering, agriculture, family and consumer sciences, and veterinary medicine. Today, Iowa State is a recognized leader in many areas of science and technology, including plant and animal genomics, materials sciences, analytical chemistry, behavioral studies, physics, computer science, and many areas of engineering, with new initiatives in food safety and food security, human/computer interaction, combinatorial chemistry, and bioeconomy. The College of Engineering at MU enrolled over 5,500 total students in eight departments and twelve undergraduate majors in 2010-11. In addition, in 2010-11, new student (first year and transfer) enrollment was at 1,758, and the total who graduated was 806.

Epistemology

The experiences of engineering transfer student leavers is complex and can best be described through the students' words and perceptions. I have investigated the perspectives of eight students' engineering transfer and leaving experiences. A constructionist epistemology gave voice to the deeper meaning making (or stories) of student experiences based in their social constructs. The epistemology of social constructionism posits that people construct meaning and knowledge through their interactions with the world and in light of their own specific social and cultural influences (Crotty, 1998).

Theoretical Research Framework

Since this study sought to understand a complex transition for engineering transfer students both into and out of engineering, I have chosen to use a bi-fold theoretical and conceptual framework to guide this study. This bi-fold approach included the Predictive Model for Academic Transfer Adjustment or Transfer Student Capital (TSC) (Laanan, 2010) and the NSSE Benchmarks for Effective Educational Practice (2012). Using a dual lens, this study applied a semi-structured approach in the interviews, focus groups and data analysis in order to understand the students' experiences and organize the narrative around this framework. Engineering transfer students who leave engineering are navigating a complicated series of events. The first is their transition from the community college to a 4-year institution. The second is the transition into an engineering college and/or major; and the third is their transition out of engineering. This is a complicated process with many influencing

and overlapping factors to consider and having these frameworks were helpful in framing the phenomenon of engineering transfer students leaving engineering.

Selection of Participants

“Qualitative researchers usually choose research participants for the specific qualities they can bring to the study” (Esterberg, 2002, p. 93). Creswell (2007) discussed site and sampling approaches at length attributed to various methodological approaches. Based upon this discussion, I used criterion sampling or sampling based upon the criteria of having entered engineering from a community college and then left engineering after transferring. This is also known as purposeful sampling. Merriam (2002) stated that it is critical to select a sample from which the most can be learned. It is important for a phenomenological study to purposefully select participants who have experienced the phenomenon of interest, in this case transfer students who leave engineering.

Participants were invited based the following selection criteria: (1) Midwestern Community College transfer students who enter engineering; (2) completion of Calculus I and II, Physics, Chemistry, English I and II prior to transferring; (3) stayed in engineering at least 2 semesters; and (4) left engineering in the Fall 2010, Spring 2011, or Fall 2011 semesters for another major. These selection criteria were selected in order to focus the study on the leaving experiences of adequately prepared engineering transfer students. Based upon these criteria, a list of students was generated by the registrar and invited to participate via email and phone calls. These criteria produced a list of seven

students to recruit from, so I requested a list of students that had completed some but not all of the pre-engineering courses. This list produced a list of 35 students, including students who had completed between two and six of the required courses. From this list, eight students were recruited to participate.

Methodological Approach: Phenomenology

For this study, I chose a phenomenological approach. Phenomenology “involves a return to experience in order to obtain comprehensive descriptions that provide the basis for reflective structural analysis that portrays the essence of the experience” (Moustakas, 1994, p. 13). According to Moustakas, “In phenomenological studies the investigator abstains from making suppositions, focuses on the specified topic freshly and naively, constructs a question or problem to guide the study, and derives the findings that will provide the basis for further research and reflection (p. 47).” Creswell (2003) posited that phenomenology seeks to uncover and to understand the meaning of events, experiences, and interactions of ordinary people and instructs the researcher to bracket, or put aside, personal beliefs and attitudes about the particular phenomenon being studied in an attempt to understand the purest form of the phenomenon.

Creswell (1998) outlined the core components of a phenomenological research project:

1. The author builds a framework for the key phenomenon examined in the study.

2. The study conveys a basic philosophy that will serve as a structure for the specific phenomenology.
3. The research limits the study to one phenomenon.
4. The research “brackets” preconceived notions about the phenomenon.
5. The research analyzes the data with specific and proven techniques appropriate to a phenomenological study.
6. In the study’s conclusion, the research again explores and synthesizes the study within the context of its philosophical underpinnings.

Human Subjects Approval

Appropriate forms including research, participant recruitment, and interview protocols were submitted to the Institutional Review Board (IRB) for review and approval (Appendix A). As stated in this IRB application, Participants were invited based upon the aforementioned criteria.

Data Collection

Data were collected in the Spring of 2012. Five primary data collection procedures were used for this study: semi-structured interviews, member checking, a focus group, journaling, and methodological review.

Interviews

According to Seidman (1998) the purpose of interviewing “is an interest in understanding the experiences of other people and the meaning they make out of that experience” and “that at the heart of interviewing research is an interest in other individuals’ stories because they are of worth” (p. 3). It was significant for this study

that participants understood the worth of their stories to me as a researcher and to the larger research and engineering community. It was not easy for these students to agree to participate due to feelings of failure, so it is for this reason that I emphasized the “worth” of their stories both in recruitment and in the research process.

Dolbeare and Schuman (1982) outlined a three-interview series which were used as a framework for my modified three-interview design. The modified design implemented these stages through the following data collection methods:

1. Interview one: Life History Focus
2. Interview two: The Details of the Experience
3. Interview three: Reflection on the Meaning

This framework was applied when using a demographic survey to begin the process, followed by a two-hour interview in order to discuss each participant’s “life history and details of the experience” (of entering and leaving engineering). Interviews were followed by member checking and a focus group of all participants to provide group reflection and meaning making within the group. The focus group also served as a means of verifying emerging themes with participants which added to the rigor and trustworthiness of the study design.

Journaling and field notes

Journaling and explicit field notes are an important part of the research process in order to ensure credibility and transferability of the research design, implementation and results. Journaling and explicit field notes also ensure

transparency of the research process. Transparency in terms of data collection and analysis was instrumental in final dissertation and publication writing and in establishing trustworthiness (Clandinin & Connelly, 2000; Leiblich, et al., 1998).

Data Analysis

Qualitative data analysis is “the process of bringing order, structure, and meaning to the mass of collected data” (Marshall and Rossman, 1995, p. 111). Creswell (1998) named the elements of data analysis in a phenomenology:

Phenomenological data analysis proceeds through the methodology of reduction, the analysis of specific statements and themes, and a search for all possible meanings. The research also sets aside all pre-judgments, bracketing (see epoche) his or her experiences (a return to “natural science”) and relying on intuition, imagination, and universal structures to obtain a picture of the experience. (p. 52)

Data analysis occurred in tandem with data collection in order to identify emergent categories, themes, and concepts as they presented themselves throughout the process. A research journal was kept along the way of my perceptions, observations, and of the research process itself. This ongoing process of data comparison enabled patterns to emerge. These patterns were coded, or named, and constantly adjusted, re-adjusted, and filtered through the research project (Merriam, 2002).

Trustworthiness and Authenticity

Shram (2006) described trustworthiness as “the degree to which we can depend on and trust the lessons learned” (p. 7). Unlike quantitative research which claims the reliability, validity, and generalizability of its findings, the qualitative claim

is based upon a different research agenda” (p. 7). Trustworthiness and authenticity have been critical considerations in the design and implementation of this qualitative study. Qualitative research is not a positivist stance seeking truth, instead it seeks a deeper understanding of experience and acknowledges the “interactive and intersubjective nature of constructing knowledge” (p. 7). In this study I used dependability, credibility, transferability, and confirmability to establish trustworthiness. Shram (2003) defined these constructs:

Dependability is defined as the ability to know where the data in a given study come from, how it was collected, and how it was used (p. 114). Credibility is established by producing consistent and cohesive data through genuine and honest interactions with the participants. Transferability provides readers with sufficient descriptions of the research design so as to create the ability to transfer the research to a different setting or population. Confirmability is achieved when a clear picture of the methodology and a clear map for creating a similar study are provided. (p. 116)

These constructs were used throughout the design and implementation of the study in order to establish trustworthiness of the results. In particular, methods and processes were meticulously documented so as to maintain research transparency throughout the study. Member checking provided participants an opportunity to verify transcripts, initial findings and review the overall phenomenology that emerged through the study. Peer methodologists were also be used in order to verify the data analysis processes, emerging themes, and to ensure accuracy.

Ethical Considerations

When designing this study and while working with IRB to get Human subjects Approval, several ethical considerations were considered. Informed Consent and

participant anonymity were the primary ethical concerns addressed (Esterberg, 2002; Merriam, 2002). The Informed Consent document was developed in order to assure the transparency of the research process and to inform participants of the specific methods and expectations involved in the study. The Informed Consent form and pre-survey was presented and collected in an initial meeting with each participant. There were also FERPA concerns because of the participant selection process. A list of potential participants was requested from the registrar to ensure a purposeful sample of participants that meet the study criteria. Special permissions was obtained from the registrar to obtain this list without first obtaining consent from the students. Consent was obtained after they agreed to participate and before data collection began. Confidentiality of the participants is something of great concern given the size of the study and the potentially sensitive nature of the narrative. Every attempt was made to avoid the disclosure of participant identities including the use of pseudonyms and the withholding of demographic information that might identify the participants by association. In addition, I have not disclosed the educational institutions involved in the study or other information that might identify the participants by association.

Delimitations

This research study was conducted in a single large research university setting in the Midwest. Participants were invited to participate based upon the study selection criteria, including: (1) Midwestern Community College transfer students who enter engineering; (2) completion of Calculus I and II, Physics, Chemistry,

English I and II prior to transferring; (3) stayed in engineering at least 2 semesters; and (4) left engineering in the Fall 2010, Spring 2011, or Fall 2011 semesters for another major. Some flexibility was allowed in this criteria due to the small number of students who fit the criteria. Specifically, I was flexible with regard to the course completion criteria which resulted in participants that had taken as many as 6 and as few as 2 of these courses prior to transferring. An unintended consequence of the recruitment process was that seven out of eight of the participants come from one department (including two majors).

Limitations

Since data collection for the project occurred over a 2-month period, prolonged engagement with the participants was not possible. It was also difficult to schedule multiple meetings with participants due to their busy school and work schedules. Interviews were carefully constructed in order to gain maximum content for the study; however, time together was somewhat limited.

Summary

The phenomenological data collection and analysis can be used to increase the understanding of the stories of transfer students who leave engineering. Faculty, staff, administrators, and scholars need to hear the voices of transfer students that leave our programs and institutions. Student stories are valuable narratives which provide us with rich details about the student experience that cannot be captured through quantitative means.

CHAPTER 4. RESULTS

The purpose of this study was to examine the phenomenon of eight Midwestern Community College (MCC) transfer students who had entered engineering at a large, Midwestern, research university (called Midwestern University or SU for this study), and then left engineering for other majors. The researcher encouraged participants to share their perceptions and experiences of the various transitions involved in this phenomenological sequence of events.

Research Questions

The following research questions guided this study:

1. How do community college transfer students describe the people, experiences, and life events that influenced their decision to pursue an engineering degree?
2. How do community college transfer students describe the social, academic, and personal transition into engineering from a community college?
3. How do transfer students construct meaning of their decision to leave engineering?
4. What transition and academic experiences and perceptions are unique to these students?
5. What institutional policies and practices would best serve the needs of engineering transfer students?

Individual Participant Narratives

Eight students informed this study. Participants were identified using a purposeful sampling method. The participants brought a variety of personal, social, and academic experiences to the study. They included 5 males and 2 females ages 20-30. Six participants were Caucasian and one was Native American. None of the students were currently married and one was a single parent. A variety of majors were represented, although four participants entered into Computer Engineering. A summary of student demographics is provided in Table 2.

Participants were assigned pseudonyms in order to protect their identities. The narratives that follow emerged from the interview process which included a 60-90 minute interview, member checking, and a group focus group. Each of the following narrative is framed around the phenomenon being studied. This phenomenological framework is being used to situate the study and provides the researcher with a lens in which to view the individual stories.

Maggie

Maggie is a 20-year-old white female transfer student who transferred into Computer Engineering. She was heavily influenced to study engineering by her father and her Project Lead the Way (PLTW) teacher in high school:

It all sort of started with my dad. He's always been in like technical, not necessarily engineering, but he's worked for a couple of different companies working on the technical support teams and like that kind of got me interested in the beginning, and then I went to high school and they had a PLTW program, so I got involved with that and I started off in my freshman year taking the intro class and I liked it and I had a female teacher and she really pushed me towards engineering. And for some reason, I liked working on computers and thought, oh, I'll be a

Table 2. Demographics of the participants

Name*	Age	Housing	Work	Current major	First major	Core courses	Transfer degree
Kevin	27	fraternity	no	MICR	EE	Comp I, Comp II, Pre-Calculus	AA
Pete	26	dorm	on	MIS	CPR E	LAN	AAS
Sam	30	off/with parents		ACCT	EE	English I, English II, Calculus I, Calculus II, Physics, Chemistry	AA, Pre- engineering
Jay	20	commute	off	MIS	CPR E	English I, English II, Calculus I, Calculus II, Physics	AA, Pre- engineering
Eddie	21	dorm	on/off	MIS	CPR E	English I, English II, Calculus I, Calculus II, Physics, Chemistry	AA & AAS
David	22	dorm	on	BIOCH	CH E	English I, English II, Calculus I, Physics, Chemistry	AA, Pre- engineering
Maggie	20	transfer LC		HDFS	CPR E	Physics, Calculus I, English	Pre- engineering
Kris	30	off	off/on	PHYS	EE	Physics, Calculus I, English	AA

*Pseudonym.

computer engineer without really knowing what that was. That was just something that I stuck with ever since then.

Maggie talked about how she liked the attention that she received when she told people that she was going to be a computer engineer:

Well, technically speaking, I wasn't in engineering until I got into college, because you can't really have majors like in high school, but I guess I considered myself a computer engineer in high school because I was taking those PLTW courses and I had decided my freshman year that computer engineering was what I wanted to do, and so when people asked me "oh, what are you going to do when you go to college?" ...I never thought of anything else because I made that decision young in high school and that was the only decision that I felt was for me and so I never even bothered to explore my options because, I thought, "oh, I'll just be a computer engineer and make lots of money and call it good" and everybody seemed impressed by that and I liked that reaction so I wanted to stick with that where as some of my friends would say, "oh, I'm going to be a teacher" and people would say, "oh, typical" There was nothing exciting about that , but with computer engineering people would say, "Whoa, you don't see that everyday", so I liked that attention so I kept it that way, so I guess probably since my freshman year I've been saying that.

She described her experience at MCC as not quite as difficult as MU, but that it prepared her for the responsibilities of college:

I guess as far as difficulty-wise, it wasn't quite as difficult as it is here at MU, but it kind of prepped you for that just having it be responsible to be able to get your assignments in on time, whereas in high school they sort of hold your hand through it and say, "you need to get this done now and you need to get this done, but at MCC, they didn't do this at all and it's like, I guess in that sense it gets you ready for MU and the instructors having their office hours and students like that, but that's about it.

Maggie described her transition to MU as a "big adjustment" academically, socially, and personally.

It was a pretty big adjustment for me. It was my first time living away from home because when I was at Midwestern Community College (MCC), I still lived with my parents cause it was cheaper and I was right there. It was just different not having any family around or anything. ...I had a few friends that like came here to MU, but we just kind of like lost connection after high school, so I was like making all new friends and rooming with people that I'd never roomed with before, so that was an experience, but we all get along now, so it's really good.

Academically, I guess I wasn't prepared for how much different it would be. I was like, "Oh I've been through like two years of college. It's not

going to be any different, and like I got all A's. It's not going to be difficult " whatever – and it was a nice slap in the face, like right around mid-terms I was like, "oh, I actually need to do something." Other than that, you know, I love the atmosphere here and I was able to adjust as far as like location-wise.

She named her academic adviser and learning community as resources that helped her a lot in her transition”

[Um], I guess, before I came to MU, I had contact with my adviser, and that kind of helped me a lot, cause she would say well this will transfer in and like just sort of helping me as far as this whole class thing goes and like she had helped me with my schedule, so like when I got here it was all set up.

I guess making friends wasn't too hard. I had help because I was placed in a learning community, so I was placed with other (female) transfer students. So we were all able to adjust and be in it together. That was really helpful.

As a female in Computer Engineering, Maggie described the academic environment from her perspective. She describes classrooms that were predominantly male. In one class the ratio of male to female was 120:7: in another class, it was 25:3; in her lab section she was the only girl. She described her experience as being intimidating and noticed certain behaviors directed towards herself and other females in the classes:

I do think it's a little intimidating, like there wasn't a lot of encouragement coming from my instructors or my peers. It's like in these classes, just because it is mostly male dominated, and the professors are all male. I mean, they don't necessarily single us out, but they don't like try to encourage us like they just try to treat everybody the same.

I didn't necessarily feel like I didn't belong, I just didn't feel like they were trying to like help me feel like I belonged, but I didn't really have that problem personally where I didn't feel like I belonged.

Well, I did notice there's a lot of times when in lab if I needed help that they'd kind of roll their eyes, but they'd come help me cause the TA's were males too, where as if the males asked for help they didn't really seem to mind it. They never really directly said this to me but I kind of felt like "oh, you're a girl, why am I helping you type thing," like that kind of came off that way. I also talked to other friends in other lab sections and they had noticed the same thing. So if it was a pair of girls and they'd raise their hands a lot they're just kind of rolling their eyes and thinking, "they can't figure this out" type thing. I guess in that sense in lab I did feel that a little bit. At the same time, I was the only one in my lab section that was a girl, so it was like I had to be paired with a guy no matter what. Where with the other girls, there was two of them in each class, so they got paired with the other girl, but I got left out. It felt weird at times like I almost wish I had another girl to talk when we're not doing lab work like I made some friends who were in other sections so like we did our labs together on the side together.

Maggie described her decision to leave engineering as stressful, but also thought that it had more to do with her lack of passion than it did the academic environment:

I guess I've kind of had that small doubt all along, but I didn't bother to look into it until recently, like, probably at the beginning of this semester. Kind of like, "is this what I really want to do?" "can I do this?" Like I discovered that it wasn't like what I wanted to do at all like after going to career fairs and like asking them about internships and it just didn't sound interesting to me at all. I was just like "eeeh!"

Yes, it was stressful. I was just more scared about what everybody else was going to think like my family, my friends, and some of my instructors. I was more worried about what they're going to say. That they're going to think I can't do it. It's not that I felt like I couldn't do it. I just felt like it wasn't right for me. So I was just scared to tell my family, "hey, I don't want to do this anymore," and after I talked to them, I found out that like my dad already had his doubts, because I'm a lot like him and he couldn't do programming and stuff and he saw how much I struggled with it, so he had his doubts and so he wasn't shocked that I decided to change.

Maggie changed her major to Human Development and Family Studies after two semesters in Computer Engineering. She described this as a better fit for her and said that she “just didn’t feel right in engineering:”

I think it was just the wrong environment for me. I just didn’t feel right in computer engineering or engineering in general and I started looking at the other options. Actually last semester I picked up a second major in sociology and I pictured myself in a major like that and I saw it being a lot more me. And when I told my family and friends about that they all said, “yeah, I can see you doing that more than computer engineering” because I’ve always had like babysitting jobs and at MCC I was really involved in non-profit organizations, volunteering and working with people and I guess that is what they saw me doing and it’s not what I chose to do...

David

David is a 22-year-old white male transfer student who transferred into Chemical Engineering. He said that he was most influenced by teachers to study engineering and also had the support of his family.

I’d say the biggest influence was probably teachers. When you’re in elementary, junior high, and high school and your teachers see that you’re good in science and in math, they’re pretty much going to push you in that direction. I was like, well yeah, I guess that sounds pretty cool, and no parent is really going to object to their kids saying, yeah, I want to be an engineer, so they definitely supported me there. Several of my friends that were in the same class as I was in high school and performed at about the same level I did were all thinking about engineering too, so we were all kind of on the same page.

David described his community college experience as much easier than MU:

It was much easier. It felt like just a continuation of high school, and part of that might have been that I lived at home, because it was a 5 minute drive to the campus, but the classes were not any more difficult if not easier at the CC than they were in HS. I’d say it wasn’t preparation for when you come to MU and things are definitely a lot more serious. My physics professor at my CC was a professor at MU teaching physics and he even told me, “The way I teach it here is much

easier than how I taught it at MU. I always wondered, “Why? Because you know - there were six of us that were – like in the pre-engineering program – like six of us taking all the same classes and obviously, if your pre-engineering you’re going to be transferring to a university anyway, so why would you not...”

He lived in the residence halls, and talked about how his first placement was isolating, so he switched dorms. This change helped him to make friends and feel connected to campus:

I didn’t really know anyone up here at MU and they stuck me in – I don’t know why – I put like my first 8 choices were in Frick and they stuck me in Frack and if you don’t know what that is, it’s the one way down south. And they’re all singles. They’re mostly meant for upper lever students who already know people. I didn’t really know anyone there and everyone kind of stayed in their own room, so socially it was a bit of an adjustment. I went from knowing everyone at my high school and knowing quite a few people at the community college to knowing pretty much no one up here.

About 2 months in [October] was when I moved out of the dorm that I was in and into the other dorm where there’d be a lot more people and I had a roommate, and I knew one of the guys who ran on the same cross country team at community college, so that was a lot more inclusive. I met a lot more people in those dorms.

David talked about the academic rigor of the engineering curriculum and how helpful faculty were. He also thought that group work was very helpful in his transition as it helped him to make friends in his classes:

Academically, it was a lot more difficult, because that was when I started taking the engineering classes. So those were definitely the most difficult thing I’d ever experienced up to that point, so it was definitely a big shock for me.

Professors were great. I was able to go in and talk to them whenever I needed help with anything – academically. My classmates were pretty much the first friends that I – I kind of knew the people in the dorm, but the classmates were the first, because when you’re working on the same assignment together for hours each night you get pretty close.

This was like the whole semester you worked with a group, so you got to know them pretty well, so I wish more classes would assign group work and make it a little more mandatory. Sometimes it feels more like it's an afterthought.

...Also the engineering classes are nice, because a lot of professors will force you – the homework isn't individual – it's group work, so you're forced to work in groups like in the real world. You get to know the people in your group and things like that.

He described his involvement on campus as below average. He didn't really participate in activities, clubs, or study groups while in engineering:

I was not really – definitely below average for involvement. ...We'd just get together to do our homework. We'd spend quite a bit of time on that, but um, outside of those classes I don't think I really formed study groups – like went of my way to form a study group. SI (Supplemental Instruction) you kind of see the same people going to those and it's a much smaller section of the class, so that was definitely helpful.

I really didn't get involved in all the dorm floors and the houses and when they have their cabinets since I had moved in after all of that was formed. We had meetings every week, so you felt like you were part of the group. I didn't get involved in any of the positions. I didn't participate in any clubs.

I worked right next to my dorm actually. When I lived in Frick it was right next to my dorm. And when I moved I continued to work there for the first two years – for 3-4 semesters at dining services. They serve food now, but they didn't used to. They make all the food for the cafés and things like that.

He talked about getting frustrated with the level of math required in his engineering courses and described how he really did not understand the concepts in his Chem E classes:

It was ChemE357. I think was the biggest thing that – or 356 – fluid dynamics – I was taking that. You take your very basic ChemE course then you take like a series – it's like fluids and then heat or something and mass transfer – something like that. It's like these three you take in a sequence. I was in the first one and I didn't understand. There is

so much math, so many variables. I didn't really understand what was going on half the time and I was like I don't understand, you know, what's happening and I thought, "this isn't really what I want to do. I like chemistry and I thought I liked math, but I don't like math this much." It was a lot more math than I had thought. A lot more physics than I had anticipated, so I was just thinking I just want to do science.

It seemed like some of my group members, I could tell they really got the stuff and they – sometimes I'd be working in a group and I'd contribute almost nothing and they'd be like, "It's okay, we got this." And I thought, "I don't want you to get it, I wanna get it too."

David described losing interest in engineering and realizing that what he really wanted to do was hard science:

...People would ask me what my career goals were and what kind of work I want to do – you know if I like a chemical or biochemistry research or something like that – and I thought, "I really don't want the engineering background." Then they'd ask why are you studying engineering? "Oh, that's a good point." Why get the engineering degree when all I want is the hard science? I talked to some friends and I knew quite a few that had switched out of ChemE. My original study group when I started in ChemE – all three of us had transferred into different majors. I actually knew somebody who had transferred from ChemE to Biochemistry and they said it was so painless and said, "everything just transfers right over. But the further you go the more painful it's going to be, so you might as well transfer now."

He talked about feeling more connected and more successful in Biochemistry and how he could help other student learn it as well. He is planning to graduate in one year and will then go to graduate school, possibly studying human nutrition:

I feel a lot more connected. But it could also be that I've been at the university a lot longer when I switched over. I was different. It's not the same thing. I think I was more willing to make new friends and I got to know the people in my Biochemistry classes a lot more quickly than I had in my engineering classes.

And I think the programs maybe – I don't- it just felt smaller – like I know – I felt like I was seeing the same people like in all of my classes and so I felt like I got to know some more people, so maybe the program is smaller, I don't know exactly off the top of my head.

I just felt more connected and I think a big part of this had to be because just because I had been at the university longer. I had already adjusted to IMU's lifestyle and so it was much easier. It felt like I was kind of coming in not as freshmen – I already knew what I was doing. ...Once I'd gotten to Biochemistry, I understood the material. There wasn't as much group work, but I felt like I got the material. I could help other people learn it and things like that.

Eddie

Eddie is a 21-year-old white male transfer student who transferred to MU into Computer Engineering. He said that he was influenced to study engineering by his community college adviser and faculty:

I would say my advisors at MCC helped with that decision because I went for a computer science degree, and then I went for engineering which wasn't too many more classes it kind of was up my alley and I thought problem solving classes were fun. I thought Computer engineering would be a good fit because I do like computers and I have pretty good knowledge of computers and how they work so I thought it would be a good fit.

He described his community college experience as quite a bit easier than MU:

Honestly at MCC I didn't read the book ever I still had the book and I used it but I never read the reading assignments for class because we never really had any except for some classes and other classes it was just like spoon fed to you out of the book, so it wasn't really worth reading it again. It was going to be right there presented to you in class. I really like that. I mean it wasn't bad I just didn't see the point in doing double the work but comparatively MCC was about the same difficulty as our high school maybe a little bit harder in some aspects some classes were obviously a lot harder and others were a joke but I had to take them to get through my 2 AA's.

Eddie described the Midwestern University programs and services as helpful to his transition. In particular, the Admissions Partnership Program (APP), access to an adviser, and Transfer Student Visit Days were helpful:

I would say the transfer visit days were very helpful, and also what I got out of the EAPP program was helpful. I was only in EAPP for the 6 months before I transferred in but getting the connections started with my advisor made it more comfortable to come in at the beginning of the semester if I needed to talk her. I knew the classes I was going to take and what was going to be expected out of those classes. The transfer process was extremely easy and I can't make any complaints about it. I did like campus visits a lot because you got to meet people and I'm still friends with them on Facebook. It was just a good way to see campus and learn the traditions of IMU because when you start here you don't know things like the fight song or what they do at football games. It was a lot of fun to get that experience.

Everybody that I have talked to like my advisor when I first got here was great! I had no problems getting a hold of her when I needed to talk to her about things. She would always email me back right away. Services for financial stuff, I never had an issue, and getting my ID card was all just a breeze. I really have no complaints about people or services.

Eddie has been very involved in his church. Soon after arriving to campus, Eddie started attending weekly young adult meetings, doing technical work for the Sunday service, and attending services on Sunday:

I got involved right away with my church and they sent me stuff over the summer which I was excited to come down here and then I started doing tech work for them and see what other opportunities they had for me to be involved in. I liked doing technical work because it was something that I did at my last church and currently I spend an hour on Thursdays at a planning meeting preparing for next Sunday then on Sunday it takes about 3 hours to get everything together for the service that day. With all the opportunities that they have it was pretty much a club for me because they did so many activities and did fun events that you could volunteer for like their famous Mid-Night breakfasts.

He also lived in the dorms and found this helpful for finding friends, being involved in activities, and getting help with academic work:

I mean other than that if I had anything with projects I would work with people on my floor in my dorms or other people I met through an online chat called Wimba Pronto that was on web CT. Mostly though I didn't have whole lot of projects and if I did I always worked with other people

from my floor because we were in the EE, Computer E learning community. It was just assigned to our house. There are two houses next to mine that are all like-minded majors. There were no activities, just like minded people with like minded majors housed together. You would find out you have classes together and stuff like that and you would automatically make friends when you needed help. It's definitely nice to walk out in the hallway and get help with something. I mean you have the same ideas same mind set you know you're all busy with engineering work so you're not messing around constantly. It's just really easy to get along with other people.

He talked about how it was difficult to understand international faculty and that some faculty were completely unapproachable:

To be honest I really love it here. It's just you have to put in the time and effort and you do earn the grade. The one problem I don't like with MU is the foreign professors because they are really hard to understand compared to my community college. They were people in my town we all knew who taught the classes no foreign people and it was a culture shock maybe I would say, but not so much it was just hard getting used to that which affected my grade. Some TA's like my TA in Computer 281 that just didn't care at all what you did or how you did it was just get the grade and get out which made it hard. Just the big lectures and sometimes the professors in the Computer E department don't seem like they have the time or want to help you, but then there are others who absolutely want to help you and make you succeed.

I felt some were completely inapproachable and if you didn't have a good question or didn't understand it I felt like they wouldn't really help you they would pretty much just say go back and read the book and there were just a few cases where they were extremely hard to approach so I just didn't approach.

Eddie described the process of leaving engineering as “not a fun process:”

I passed 227 with like a C+ just because the class moves so quick I wasn't used to that and then on 228 It just moved so quickly and had so many assignments we were completely lost on. I think half the class - there was some stat that was given to us - that a lot of people were retaking that class so I mean It was definitely a road blocking class. After seeing my friend take EE 201 I'm like there is no way I'm

going to be able to do it and then I was just kind of struggling through things and 228 was definitely my decision factor.

I did take it (228) pass fail but I don't know if I could have ever passed it, I don't know what my grade was when I switched. I just knew I was either close to failing or I would have been ... that was the only class I would have failed in the college of engineering but the process was extremely unpleasant and, thanks to the ladies in the classification office, I don't think of them fondly and I don't mean to be mean because I'm not a mean person. but they deserve it after that.

...The pass/fail was because it was a required class for the major. The problem is if you take a class as pass/fail that means you can never take the class again for credit so let's say I reconsider computer engineering this summer, after I've had some time to sit and go through a book or two and learn it, I can never come back into computer engineering, computer science, or software engineering. I would have to go to another university for that which I don't think is right at all.

Eddie also talked about how his time in engineering hurt his GPA and that recovery was a challenge. In particular, he was concerned about how employers through career services would not even look at him for an internship unless he held a 3.0. He appreciated that Business lists both your semester GPA and cumulative GPA. This has enabled him to get an internship for the summer:

Well, I wish my GPA would have transferred from the community college I had a 3.7. I could have really used that buffer I probably would have been down at a 3.0 if I would have had that to help which I wouldn't consider that hurting me at all but the college of business now is just taking awhile to get it back up. When I transferred out of the college of engineering I was at a 2.1. I'm at a 2.3 right now and its going to be above a 2.5 by the end of the semester because my grades are really good right now. It just hurts you when you go to career management services especially cause the system just limits you on what you can view and who you can talk to just through the system which I don't believe is right because a lot of employers if you can explain your story they will listen and they will at least give you an interview. I don't know how many I've had like 2 or 3 interviews this semester after I have explained that story to them. It's never been a problem and then even with Daktronics they were like "you have all the

experience the only thing that's hurting you is your GPA," and they turned me down all semester because of that. Second semester I contacted them again and they said let's give it a shot and see what happens and I finally got an interview and then I got an offer.

One thing I do like though with the college of business is they have a college of business GPA. My college of business GPA as of last semester was a 3.4. I don't know what it is now, but it was listed separately on my degree audit. I have heard of with other people that have gone to career fairs are asked, "What's is your college of business GPA compared to your cumulative?" You can kind of hide it and kind of not so it all depends on who the employer is and what they want, but it does suck and it hurts.

Jay

Jay is a 20-year-old white male who transferred into Computer Engineering. He didn't really know what major to go into, so he chose Computer Engineering during the transfer process. Jay decided to become an engineering student after talking to an adviser at MU during the transfer process:

She tried describing the major to me because I wasn't quite MUre on what computer science was about and what she said didn't quite fit what I wanted to do. It was just kind of off by yourself and you just programmed all day. So then I told her what I wanted to do and that I wanted to do more hands on like build computers, she kind of advised me over to computer engineering thinking that's kind of what I wanted to do. When they described it, it fit more of what I wanted to do, but I didn't quite grasp it all when they told me it so that's kind of how I got into engineering. I didn't know about MIS or BET or any of the other kind of computer related programs that's just kind of where I fell at when I came to Iowa State.

He described his community college experience as not much different from high school. He was surprised at the difficulty of the courses in engineering:

It was kind of more laid back I should say it was kind of a continuation of high school in a sense. I mean the course work wasn't that much different, in other words, wasn't that much harder. It was the same town so I really didn't change living situations or relationships with friends and all that. It just felt like moving right along like high school.

When I came to MU I commuted instead of living on campus it was a little bit of an adjustment getting used to the difficulty of courses and getting used to the way classes were structured for homework. It started off not too bad the first couple weeks was ok it was about what I've been used to and as it got further along in the semester the difficulty started getting a lot more intense than what I'd been used to and then commuting back and forth rather than living on campus made it worse. It was just way different than I had expected it to be. Coming into it, I just wasn't used to the difficulty level.

Jay grew up on a farm 40 miles from MU. He commuted to campus in his first year and was also responsible for some chores at home. He described his adjustment to MU in terms of several academic challenges that he faced including, commuting, access to faculty and study groups, and time management:

The first year I was in engineering for both semesters and commuted back and forth and it was about an hour drive here and an hour drive back.... A lot of it was just the time because I would have to get up early to make it to class. When I started getting behind in class it was harder to meet with professors meet with study groups and stay later. It just made it harder I guess to communicate with people in my classes and just working along with people who knew their stuff. That was the biggest part of it - was just trying to get people I knew or friends in the major that could help me understand it better. That was the biggest challenge of it really. It [commuting] took time from my studying and then I had to help my family because we had a farm back home too, so the time I had for homework started shrinking a bit more.

I think a lot of it was just coming into the courses I had no experience in programming at my CC did nothing really involving electrical engineering or no in depth class, I mean I had a lot of the broad stuff. I think a lot of it was just shellshock coming into stuff that I have no background on.

The second semester was the hardest of all. I was still trying to understand and adjust to what MU. It really became a catch up game and I couldn't keep up with it anymore is how academically I felt like the whole time. I kind of met people more through friends I had on campus. They lived in the dorms so I could kind of meet people through them and in the WebCT chat thing when they had it. That was kind of how I was able to keep up with some people and talking about classes and homework and everything.

I mean my parents tried to not get me to work as much but it seems like my sibling weren't really keeping up with it either so it varied for me like 1-3 hours a day maybe more depending if there was something big going on; 2 hours seemed about roughly what it seemed like just with chores getting done.

He talked about how it was hard for him to be involved in campus life because of his commute and his obligations at home. He also talked about how access to faculty was difficult for him in large lectures. He strongly preferred smaller classes:

I didn't really do much in the clubs. I think the distance was the thing that hurt a lot of that. There were clubs I would have been interested in but when they met I didn't have time to stay late enough or go after classes. I really didn't get involved in anything.

The classes I took were the big lecture ones. You saw the teacher in the front of the classroom and that's all really, I mean I would send emails if I really had problems but that was about it, for the most part I never met really one on one unless the class was small and I felt like the teacher knew me well enough that I could go in and ask for help.

For the smaller ones like my differential equations, I felt more like I could go in there anytime and I knew the professor better than just a big lecture. I go in whenever I need help and my teacher would be able to help me with it, but I think the larger the class got I just felt like a face in the crowd. I mean I'm sure he had office hours but I just felt it wasn't worth trying to go there.

It seemed for engineering I like the smaller classes better. It just felt like the teachers were talking more to you, you can understand them better and the smaller ones they usually do more. You can see how they worked it out and ask them questions easier in class if you need to. With the big lecture halls, some of the material wasn't bad for covering it. It was just it didn't feel really personal. You were just sitting in there and they were just talking. They're just up front kind of talking the whole time and they do examples it just varied from class to class; some like chemistry would be easier it wouldn't be too bad to be in a big lecture but I mean for like the computer science ones its harder too because the guy was just going through them all and only the people that really ask question were the ones right there in front of them. The further you were away from them the less I felt like you

were able to communicate. We weren't as much part of the conversation.

Jay struggled with his programming classes and then switched to MIS after his second semester at MU:

The 2 big ones were my electrical engineering and computer science 228. Those are the 2 big ones. I mean I would go to class then go home and it seemed like as the semester went on I was spending more hours working on it and I would be up until midnight or 1 in the morning trying to finish up assignments. Then it started being 2oclock in the morning 3oclock in the morning 4oclock in the morning. Then had to stay up that late every night of the week trying to keep up with homework then wake up the next morning at like 6 or 7 to get ready to go to class. I wasn't getting any sleep. I just felt like I was trying harder to get ahead of it but I wasn't getting anywhere with it. I felt like I was getting more frustrated as I went along. I felt more behind like I wasn't going to do well anyway.

I started looking around for computer majors at MU. Maybe I was making a mistake with computer engineering. I saw MIS. I kind of looked it up a little bit and it sounded more like the hands on building computers and working with people about solutions. It seemed like it was more what I wanted to do in the first place and then as the semester went on it seemed more enticing to go to that. I think with engineering I just got so far behind I wouldn't do well if I stayed here so I just felt like I might as well ditch it and go somewhere else. I could at least try to find a better fit for me - something I could excel in. I talked to the people in MIS about it. I was already better set for that than engineering. I would have gotten out a year earlier than I would in engineering to start off with. I think once I got frustrated enough I just thought I couldn't do it anymore and it wasn't worth it so I just went to MIS.

Jay described how it felt in Computer Engineering vs. MIS. He was keenly aware of his own personal fit in MIS and not feeling this same fit in engineering:

I felt a better fit over in MIS I mean engineering it just felt like the culture in engineering just felt more like you're on your own. You had to do stuff by yourself. It didn't feel like you communicated a whole lot with other people, even like when you graduated too it didn't seem like it would be one where you would help people. You just focused on your own project and just kind of moved along with it. MIS just seemed

better because at least you can communicate with people and work in groups a lot easier. It was more it just seemed like it fit a little bit nicer because I like economics too on the side, so I was going back in my field of interest kind of. I felt like personality wise I felt similar with MIS compared to engineering. It just felt like you had to give up all your free time in order to get your homework done in engineering then to stress through it to try to get finished.

He also described an individualistic work environment that, again, did not fit him personally:

In engineering, it seemed like your homework and your tests were more focused on the individual. They wanted you to work on a program and not get in a group where each of you works on parts of it together to make a whole. I just felt like you focused more on individual achievement rather than group work together like you would see I think in the real world. In engineering, you're more alone. I'd see people that were engineering that just seem like all they did was just do homework all the time or they didn't have any time outside of that really without doing bad in classes. So, just the way everything was set up it just felt like you could get hints of each other but that was about it. You just kind of sat to yourself it seemed like and sat in front of your own computer, and did your own programming.

Sam

Sam is a 30-year-old white male who transferred into Electrical Engineering. He is a journeyman electrician who has worked with his father with several electrical contracting companies. He was influenced by his experiences as an electrician to pursue Electrical Engineering:

So, my Dad's general interest in electricity was probably the biggest driver. But my Grandpa on my Dad's side is also either a chemical engineer or a metallurgist. He'll never give you a straight answer on that, and my parents have no clue. I think the real reason is that I always thought electrical engineers were pretty smart. I always wanted to go out and find the answers.

He described his experience in the community college as completely different from MU. He said that at MCC there was a “cap” on what one could learn where at MU everyone was struggling beyond their limits. He described his transition to MU in terms of his business experience with small and large companies:

MCC seemed more relaxed. It just...it didn't seem in depth at all compared to what MU does and it just seems that they had a limit. They wanted you to succeed but, there was some sort of cap at which they are willing to go to. Here at MU it seems like everyone is struggling to push everyone else beyond their limits. That's obviously a good thing for the engineering school, but it seemed like everything – not that it was cut throat - because everybody was really nice, and very helpful, but it just had the big business persona while MCC had the small business familiarity. I really like the small business familiarity. It felt like you really got to know everybody. Where here it just feels like high school where you have cliques. I really don't know how to describe it – it's just that I was a lot more comfortable at MCC. Probably because there wasn't so much expectation - because everyone knew you were going to go on.

Sam struggled to get the grades that he wanted and often retook classes both at MCC and MU:

Okay. Well, I was at MCC to two years and then I came to MU and I was in EE for 5 semesters and I was still at a point where I had two years left of college. So, even though I was only in college for 4 years total, I realized that I'd been in school for 10 semesters and I still had a minimum of 4 semesters left.

I was taking things over. I never felt like I got the grade that I needed. It seemed like there was so much pressure on getting good grades and so much pressure on being able to conform to this set type that was going to get you a job that was what I was concentrating on. I was concentrating on “I gotta get these grades”. It sucked all the fun out of it. It wasn't what I thought it would be.

I always figured that I would come in here and I would learn about different problems – learn about stuff I'd never heard before – think about things I'd never thought about before – and to an extent, a lot of that I did, but it became more so that the grades were more important than the process. It was a struggle for me because I had this dream of

becoming an engineer for about 8 years. It was about 2-3 years after I started to be an electrician that I wanted to learn more. So for 8 years I had been working up to this and was finally doing it and it wasn't what I thought it would be.

Sam was not involved in campus life and talked about his interactions with other students who were usually much younger. It was hard for him to relate to younger students and to find any meaningful common ground. In several cases he described himself as an outsider in the traditional aged culture and found it difficult to fit in:

So, there wasn't too much socially to interact with people younger than me because I just generally didn't have to do it. A couple of the students at MCC were actually my age and we were in the same program, so I knew them and I'd meet up with them and talk about school and stuff like that. And I had a girlfriend at the time. So, really, as far as being socially adjusted it wasn't too hard. It really wasn't much different than MCC, because you had a pretty wide range of ages there too. I really didn't make too many friends that semester because I was pretty much studying most of the time or hanging out with my girlfriend. Really, that's pretty much all I did.

I went to NECA, The National Electrical Contractors Association, I thought that would be the easiest transition from never having been part of a group to going to a student group. The first semester I went was Spring 2011 and I went to three meetings and all they did was have three different electrical contractors come in and give the same spiel over and over. So this past fall, they had a joint barbeque with the other major construction engineering groups. I cornered the president and said, "are we just going to have electrical contractors coming in doing the same thing over and over again, because if we are, let's move away from the big businesses, because we've already heard that over and over again. ...So, eventually, I got him talking. I sent him an email with a bunch of ideas. I thought "If you jump on these, I'll stay in it". It was kind of nice – it may have had something to do with the faculty adviser pushing all of her students to go, but people are showing up now.

...I didn't want to be an officer. It's their group – their thing. I'd just ruin it. If I was it wouldn't be their thing it would be my thing. I don't

want to run it. I wanna see what they're doing. I wanna place ideas in their heads and see what they do with it.

Sam found that most students have a “narrow view” which made it hard for him to relate to them:

Even when I bring up bigger topics myself and ask them about things I heard them say or that they said directly to me. It seems like it goes on for about two minutes – a simple conversation – and then it's over. Which is fine – if that's the way they want to live. It's gonna be kind of a hard awakening for them when they get real bored in real life. Maybe that's a product of Facebook, who knows??

He also mentioned that most of the people his age were married and had families, so he didn't fit in with them either:

I didn't fit in with the younger crowd who were single and I didn't fit in with the older crowd because they were all married and/or have kids and most of my friends from around here are all married or have moved off; for example, I've got friends that live in Idaho; I've got friends that live in Colorado, and there's one couple left that lives in a neighboring community, but they work all the time. Other than that I really don't have any friends here from my former life. I'm kind of glad that I'm introverted, because if I were this isolated and extraverted, I would probably be struggling a lot more than I am.

Sam was in engineering for five semesters. When he was placed on academic probation, it began his progression out of engineering:

So, I was technically on academic probation and I was facing dismissal, because, even though I passed all of my classes, my GPA was still below a 2.0. So I had to take a summer course and that's when I questioned myself “why am I taking courses that are engineering related when I could take an easier course get my A and bring up my GPA and still be in college?” So I looked around at – at the time I decided that maybe EE wasn't the best thing for me, so I was looking around at other colleges trying to find a course that would boost my grade point and be applicable to a new degree if I decided to change, so that's when I found ACCT284. I took that and it was an easy A. IT was interesting to me to think about that side of business vs. what I hadn't learned at current and I had to learn on my own.

That's when I pretty much decided that it was either going to be ConE because I had so much construction background or accounting. When I met with the ConE adviser I had gone through everything. I had gone through and mapped out the classes that I was going to have to take and all of this and the biggest kicker was that since I transferred in on a 2007-09 catalog, I could still be on that catalog here through the 2013 cycle or something like that. I knew that Iowa State was implementing a university wide foreign language requirement for catalog 2011-2013. I needed to graduate under the 2007-09 catalog and when I met with the adviser she advised me that some of the courses listed in that catalog were no longer offered. I thought that was a little ridiculous because this is 2011. How do you drop a course in 4 years? But – so when it looked like it was impossible for me to graduate with a construction degree without taking a foreign language course – which I knew there was no way I'd be able to focus enough energy on. I mean I was struggling in something that I had an interest in – EE. I just didn't know how I was going to do that. I talked to the accounting adviser too and it was possible, so I figured I might as well do something else that I enjoy and that I can actually graduate in.

Peter

Peter is a 26-year-old Native American male who transferred into Computer Engineering. He was heavily influenced to study engineering by a MU faculty member who was very involved in cyber-security competitions with high school and community college students. At the time of his transfer to MU it was anticipated that there would be a Bachelor of Engineering Technology (BET) Program. Peter was recruited to enter this program:

They were in the works of starting the BET Degree and it was like a dream come true – like a hands-on technical field that completed all four years and you had some hard math like Calc I and II and you had your Chem and Physics and everything else was hands-on technical from there and it sounded great, but it never came in to fruition. They wanted me to come as an engineer because it would be easier to transfer from one program to another once I got going

So I followed that route and first year I played engineer, it was a little more difficult because I was like all jazzed about it, like, “Oh yeah, I'm

an engineer!” And then, first semester was a little tough and then I was still pressing the idea of the BET and it was coming in the summer, it was coming in the spring,...then when spring hit I was told it was going to be Dec. 2011, I guess, and then eventually I heard that it was going to be Dec. 2012 and then I was told to just wait. I couldn’t even get a date anymore. But I got to the point to where my grades were falling because there was nothing that I wanted to do. It just plain was not what I wanted to do when I came here

He talked about working with his adviser in order to transfer his credits from a vocational program:

The thing is, having the adviser was great because she did know exactly where I came from and what classes that I took and what were allowed. I felt better because they were trying to make all my classes fit because I was coming from a vo-tech degree. There was signing of waivers, trying to push the dean to allow classes to be accepted for other classes. If I went through admissions I’m pretty sure I wouldn’t have had that level of care. By doing it this route, I was able to talk one-on one and decide where I wanted to go as soon as I got here.

Peter discussed what it was like moving to town, not knowing anyone, and living on campus as an older student:

Yes. I really enjoyed the option of living on campus because moving here, I didn’t know anybody. So it was nice to actually get thrown into the pot right off the bat so I could actually start to make new friends. I’m not actually anti-social, it’s just difficult for me find new friends, because the age difference between being a nontraditional student – since I was taking all freshman classes, it was a lot different trying to find common ground with people who are 7-8 years younger than I am. I did find some other nontraditional – some older students, so most of the friends that I have now are seniors who are graduating so next year’s going to be a little difficult because all the friends that I made my first two years will be gone now because they’re all graduating. Social-wise it wasn’t bad. I’ve made a lot of new friends. I still feel like I haven’t made enough friends. I still have a lot of personal/down time to myself. And I don’t really know anyone – on the wym – go call up and go do something – unlike when I was at home, but I did live there for like 15 years, so got to know friends fairly well.

He had competed in the Cyber-Defense competition while he was a community college student, so he had made connections with MU that would be important to him when he became an MU student:

Yeah, cause the first friends I met was through an MU faculty member and his research group through the MU competition because I had to come on campus twice before, so I got to know those that were already working on the research, so when I came here, it was easy to transition because I already had known most of them.

... I was working for MU faculty member. I moved in Aug. 25 and by the 1st I was working for him. I tried to work with other jobs here on campus, but nobody hired me, so I exploited my connections.

Peter discussed what it was like being an older student and how he found friends through his work in a research lab. He identified with the TAs who were teaching his classes and found upper class students with whom he could relate:

I was taking like 90% freshman classes because that's where I had to come in to, so finding friends was hard. It was daunting because I've been a freshman like three times now. I met most of the older gentleman through TA's cause I ran into them because they would teach labs or after class assignments. It was easier to strike up a conversation with them than it was someone younger. And also at work because I'm a research assistant for a graduate program, I meet a lot of graduate students through there – and working for a faculty member. That's really about the only way I've been able to meet people my age.

...I have a few younger – by younger I mean 21-22 – so they're older than most freshman – but still younger than I am – and it's easier for them. I've met them through my classes since we meet in classes 2-3 times per week anyway – I kind of met friends like that. Usually they just kind of happen into them from class. I'm also VP of the information assurance student group. I meet a lot of student through there too. Their age range is anywhere from 18-upper 30's.

But for me the difficult thing was the social factor – because when I got here I knew nobody. The first couple of weeks it was – “let's find some friends, let's find some friends” – and I was too busy looking for work and getting my financial aid set up and getting my books and stuff – by

that time this whole frenzy of making friends was done, was when I started looking for friends because I had to get things done first. And then by then, they were all, "oh, I have friends and nobody started talking and they were already hanging out outside of class so it was kind of lonely, I guess, because they had already found friends and segregated themselves and I was kind of like, "oh, man, I missed the boat on friendship apparently." I've noticed that every semester the first two weeks or something that classes meet everybody looks for friends as soon as they can and when they find them they're done. So, throughout the semester my schedule changes, I have other things to do – I guess I feel like I have to work harder at it because I have to adjust my schedule to meet the friend time that it just feels like a get left out because by the time I get all of my requirements for like car insurance – apparently most kids don't pay their own car insurance – cell phone they don't pay for – I have a lot more bills that I feel like I have to get taken care of before I can go out and do other things. By that time, they've already done out and I'm like ahhhhh, sad face...It's just different because I feel like I'm playing by a different set of rules.

But now since I've been here for 3-4 semesters now, that I have that connection but I might come across someone I know from club, someone I might know from work, or just people that I've seen around now that I've been here long enough to just visually know people. It's just so different, like, I don't know the person, but visually I've seen them a lot, so there this notion that I know you, but, no, I don't... Yeah, I've seen you enough that I should know you, but I don't.

He also talked about being Native American on a predominantly white campus and how he wished there was an organization that would assist him in finding "other students like him:"

See, it wouldn't even have to be like anything like a club, but if I could know who else is an actual Native American, cause, not to be rude, but I have a lot of people who are like oh, I'm like half Native American or I'm a quarter Native American. I'm like I want to find a – I don't know if I'd have to have a percentage limit, but like 75% or better – or somewhere – or at least visually Native American – that I can at least talk with.

...If there was a connection where I could get to know like five out of the 20 or maybe just 2 – someone I could hang out with. Knowing my NA background – knowing all of the other people I know. We're not really social people. We just like to know there are others out there

like us so we can visually say hi, but never really talk to one another. I don't even know that they're out. Like I said, I've been told that there's like 20 on campus out of 27,000. That's what I've been told that there's probably less than 20 that have actually claimed NA through admissions. I've seen people who I believe are NA, but never actually met them.

Peter talked about his decision to leave engineering. Engineering was not really what he wanted to do. He came to MU for the BET Program that never happened:

Yeah, I was sort of lured here under false pretenses. I don't know. I really enjoyed the experience that I had being an engineer for a year because I think I have a lot of friends who were engineering. I have one who's working on his masters' in ME and another who is going for her PhD in ME at the U of I. Growing up with them and being around them I thought I might be an engineer too and I would go into computer engineering, so there's a little part of me that said, "Yeah, I'm going, I'm going to do to." And then I actually got here and tried it, and was like, "no," In itself that was a good experience, because then I knew what I can't do and I can't do engineering easily. If I sat down and really buckled through it, I could stumble my way through engineering, but it's not what I wanted to do. It's a little too much work for something that I only kind of meagerly wanted to do. So that's why I didn't put forth the effort that first year because for one, it was supposed to be stop gap and it just wasn't what I wanted to do and after that year I now know that I don't want to be an engineer.

I didn't want to actually buckle down and have two years in as an engineer and the BET does happen and at that point it would actually be better for me to stay in engineering than to move over. There were a lot I didn't know that I had to get out of the way before I decided to go. When I got enough information I decided to just move to MIS, because I also wanted to do the information assurance masters' program which I found out is actually an opened interdisciplinary degree, so I actually had a couple of friends in the MIS department transfer back to engineering and get their masters in computer engineering even though they have their undergraduate in business. That's what I plan to do – finish my undergraduate here. I'm hoping to graduate in the Dec. of next year and then I can enroll and transfer back and become an engineer at the Master's level.

Kevin

Kevin is a 27-year-old white male who transferred into Electrical Engineering. He was influenced to study engineering by friends and teachers. He completed his AA at MCC and took only two of the basic core engineering classes:

It was probably more friends and teachers than probably my family. My family just wanted to me to go college, they really didn't care what I went for. Friends just kind of made it towards engineering. A couple of my other friends were – they actually did go to Iowa State for engineering. It just seemed like something that I wanted to do, so eventually I just took the plunge. My friends who were engineers had graduated by the time I decided to go into it. This was after CC when I decided to do that.

As far as people at Iowa State in reference to transferring, I did pretty much everything on-line. I mean I had a general knowledge. I wasn't really transferring credits, I was transferring a degree, I guess. I had the AA. I really didn't think about going into engineering before, so I really didn't do any engineering classes before, so transferring of classes wasn't a huge concern for me, so that's why I did everything online. But I just talked to people at MCC. I said I'm going to be transferring, what do I need to do and they just told me. That's pretty much what it was, so I really didn't deal with MU personally that much.

He talked about the transition to MU being daunting and exciting and that joining a fraternity really helped him in his transition.

Academically, it was like going to college from the first. It was just weird because, you know, it's a beautiful campus. I was never exposed to that before at all. It was always just kind of a smaller campus and smaller classes and everything like that. I never really had that before. Socially, I literally knew nobody coming down here. It was just kind of overwhelming really. I've never been in that situation before – either situation, so at first, it was kind of daunting, but then it was kind of exciting, knowing you could just see – there were just so many people, I was just like "wow."

Definitely, I joined a fraternity. My dad was in a fraternity and he really, really liked it, so since I didn't know anybody here I could just join it to figure out what was going on with it. I had a chance to figure things out right away. It turns out that it was a really good thing. Especially since

it really focused on academics, so that helped out too, because before I was by myself. You don't have quite the motivation that you do with other people who are just saying make sure you get your homework done.

Two things that were helpful in the transition were an Engineering 101 (orientation to engineering for transfer students) class and a Psychology 131 (study skills and orientation to campus resources) class:

It was overwhelming. I will say that the classes that they had like the intro to engineering. Those classes seem mundane, but I thought they were pretty helpful. It really was because I really didn't know anything. I knew just general college stuff, but I didn't know how many drops you get, or where to go, what buildings are what, actually figure out the campus, because I didn't do a campus visit or anything like that, so that was really nice for me.

After my first semester, I took that (Psych131) and that helped out. The next semester I started studying more effectively and, again, being in the fraternity helped out also. Because you have a couple of guys that were in – there were two engineers all ready to graduate and there was one EE that was two years ahead of me, so it was just easy to run up to their room and ask questions. They've obviously been through it, so that was really useful.

Kevin was not involved in activities outside of his fraternity and classes and he did not work on campus. He mentioned meaningful connections with certain faculty, but said that not all were accessible or approachable:

They were. There was one professor – actually a couple of professors that I really, really liked. They just kind of stood out. One was for like beginning classes –faculty name– he's just an awesome guy. And then the other one was for a programming class, faculty name. There are just certain things that I'm looking for in a professor and they just hit had them. They're just really smart and know what they're talking about and they go on tangents about relevant things. I think that's just really interesting. You can't be bored in their classes. It's just awesome. Everybody gives office hours and you can go there. Which is nice.

Kevin talked about how the math load wore him down and how he coped:

It was probably a year – year and a half. When I started thinking about not staying in engineering. Just because of the math load. You take this really hard class of math and then after that you have to take another hard class of math and after that and whole time during that class – for me it was like, I'd be like, "if I could just get through this class – if I could just get this class and I won't ever have to think about that ever again." And then I'd say there's that other class that has to come that's even harder than this one and finally I was like, "I don't even want to do this anymore."

After transferring into Microbiology, he felt that he had found a much better personal fit. Kevin added he has a natural interest in the subject and is finding success, and he talked about how he can now help others with the content.

So, now I'm in microbiology. It's a much more natural fit for me. I've always, always, just loved biology in general, and microbiology has been just fascinating for me, so going into microbiology, it's like – it's always my fall back. If I just want to read an article or something, it will always be biology-based – or at least science-based – and that's just free-reading or whatever. I figured, if I'm naturally interested in this, why wouldn't I go into a career like that?

It's just naturally interesting to me and it's just – I'm genuinely interested in what the professors are teaching. Sometimes in the other (engineering) classes, they'd have Powerpoints and they'd say all this stuff and I'd be like, "Okay, what do I have to know for the test?" That's all I really cared about. But here, I'm more like I really want to learn it, because I've always kind of wondered about it. "Why is it like that?" and they actually explain it and I'm like "oh, okay." So I know that. Plus you get a whole bunch of like useless knowledge which is just fantastic. I love useless knowledge. So, that's always nice.

Kris

Kris is a 28-year-old white female who transferred to MU into physics and then electrical engineering. She is also a single parent of an 11 year-old son. She has always had an interest in math and science and before studying at MCC, she

received a certification in avionics and worked as an avionics technician. She described her community college experience as “close knit.”

... There is a shock, and I had actually come to MU for about a semester when I was like nineteen, which was a long time ago, but it's so different and I didn't think that it was going to be so dramatic because it's just at MCC it's much more close-knit and you know I was really close with all my instructors. I had time, you know I kind of lived on campus. I mean I have a family and stuff but when I was there I was there, I was doing work and there were people to help me everywhere I needed. And everywhere I turned there was someone there to help me, and here it was like thrown into this pot of “Here ya go! Figure it out!”

No one at MCC talked to her about majors. She completed her AA and did not formally enroll in the pre-engineering program.

She talked about having a female physics instructor at MCC that was her friend, mentor, and “go to” person. Faculty [name] also helped her with the transition to MU and continues to advise and encourage her to continue:

Nobody at MCC had talked to me about that (engineering). They didn't really talk to me much about physics either, besides my physics instructor but the advisers didn't seem to know much. And I just knew that and accepted it, that if I needed to know I'd have to find out myself.

But I had an amazing physics instructor, amazing. And she just, she was just connected, she was just also a Phi Theta Kappa, regional coordinator, so she just has connections to everyone. She just knew what to do. Ok, this is...yeah. [laughs] I have a girlfriend now who's at MCC now and she's trying to figure out if she is going to go on to get her bachelor's degree and She's like “I just don't know how I'm going to pay for it. “and I said “We're gonna call Rebecca (not real name)! She knows – she's is gonna get this for us!”

... well and Rebecca is who introduced me to Steve (not real name). And helped a lot too in the facts of just um, well, I mean in the simple fact of meeting him and him just saying, do you have a job, do you need money, do you...yes, I need, yes,

I was fortunate enough to work in ELPS and so I had Steve and people here but they weren't quite, they didn't know much about the areas that I was going into. They couldn't help with the transfer, and it's funny that I was researching about transfer students and not realizing that it was happening to me. You know, like the transfer shock I realized later, I was like "Wow, that is what I was experiencing." So, yeah, just having somebody, some anchor, an ally that you can go to...

She also talked about the people that she worked with in both engineering and physics, and commented on how they were so different.

When I talked to her (engineering adviser) it was like, "whoa," she had money and she's like if you do this and you're gonna get that and we're gonna have this... and I'm like, "wow, this is just so different," you know, in physics it's just like, there's just none of that. I think, it just seems like the physics advisor doesn't have a lot of hope in me. ...he doesn't say this, but it just seems like, I don't fit. I'm not a typical physics major. I don't look like one, I don't act like one, I don't talk like one, I don't care. I'm still gonna do it and I still have every right to do it like anyone else.

Kris left engineering because at that point it was just going to take her too long to finish. She said that if she'd been encouraged to pursue engineering sooner, she probably would have stuck with it, but no one at MCC or in her life talked to her about engineering until much later. She just needed to graduate. She also decided in the process that she wanted to teach in the community college, like her mentor, Rebecca:

Right, because although, you know, I have a life, a lot of life going on at home with my son and stuff I think I would have been able to find more support in engineering so, it may not have, you know, that still would have been going on but I think I still would have been able to push through, but yeah it was mostly the daunting fact of four more years, you know I really need to get out of here so that I can make some money and you know do something for my family, so that's kind of what it was and plus at that point I had lost interest in working in the field I mean, I just had decided that I wanted to teach and so physics kind of seemed like a good option and I had Rebecca to look to.

I'd already wanted to teach but it helped me more to want to work in a community college. And because of Rebecca and what I'd experienced at MCC, what she does to my life if I could just do that to help somebody else then I think it will be really valuable. There are lot of people that just kind of forget about the community college group, but there's people in there that are just gems, and not saying that I'm a gem. I have girlfriends too who are doing the same thing, and you know they're single moms, they have kids, and they just feel like there isn't anything for them. But somebody like Rebecca can see this person, pull them up, and show them what they really are. And I want to do that.

Summary

The participants in this study were diverse in terms of their age and life experiences. They all left engineering after struggling academically and/or losing interest in engineering; however, there were other factors that influenced their decisions and the processes of leaving. Chapter 5 will present the themes that emerged from this study as well as the advice that these students offer to other students and to engineering programs generally in terms of increasing student persistence and/or making improvements to engineering programs.

CHAPTER 5. FINDINGS

The narratives in Chapter 4 explored the individual phenomenological narratives of eight engineering transfer students' entering and leaving experiences. This chapter examines these narratives to identify themes across the narratives as well as differences among the eight participants. I looked at these stories through the lens of my theoretical perspective which includes Laanan's Predictive Model for Academic Transfer Adjustment or "Transfer Capital" (2010), and the NSSE Benchmarks for Effective Educational Practice (2012). Using this dual lens in data analysis enabled me to view the student narratives in a way that is grounded in the literature pertaining to transfer student success and engagement.

The narratives in Chapter 4 were organized around the phenomenon of eight engineering transfer students' entering and leaving experiences and perceptions, Organizing the narratives around this phenomenon provided structure to the narratives and a system through which further analysis could take place. After creating the narratives around this structure, based upon the interview transcripts, I was able to chunk the data across all narratives by each of the sequential pieces of the phenomenon. Moustakas (1994) referred to this step *horizontalization* and then described how the researcher develops *clusters of meaning* (or themes) from the transcripts. Creswell (2007) suggested that significant statements and themes can then be used to write a *textural description* of what the participants experienced.

Themes

My interpretations of the data emerged over time as I interviewed participants, took notes, read and re-read the transcripts and consulted with my participants and peer methodologists. Early in this process, I conducted a 2-hour focus group with six of the eight participants to discuss the early emerging themes. I also provided the chunked transcripts to three peer methodologists in order to garner their interpretations of the data. I met with each of the peer methodologists to discuss their interpretations and themes. Based upon this process, I presented my interpretations of the rich stories and perspectives of these eight students; however, I was also aware of my positionality and biases as a researcher, and understood that other interpretations may exist. The following themes are presented in this chapter through the voices of the eight participants:

1. Community college is like an extension of high school
2. Inadequate community college advising
3. Academic rigor
4. "I can't/don't want to do this anymore..."
5. Lack of academic support
6. Variable quality of student-faculty interactions
7. Sense of belonging
8. Challenges of being an older student

Community college is like an extension of high school

When asked about their community college experience, participants often compared community college to high school. There were several reasons given for this comparison including: academic rigor, support and nurturing, living at home, and an “intermediary step.” All participants spoke positively of their community college experience, and several defended their choice to attend a community college and the value that it presented to them based upon class sizes, instructional quality, caring faculty, and support services.

It was much easier. It felt like just a continuation of high school, and part of that might have been that I lived at home, because it was a 5 minute drive to the university, but the classes were not any more difficult if not easier at the CC than they were in HS. I'd say it wasn't preparation for when you come to MU and things are definitely a lot more serious. My physics professor at my CC was a professor at MU teaching physics and he even told me, "The way I teach it here is much easier than how I taught it at MU. I always wondered, "Why? Because you know – there were six of us that were – like in the pre-engineering program – like six of us taking all the same classes and obviously, if your pre-engineering you're going to be transferring to a university anyway, so why would you not... [David]

I guess as far as difficulty-wise, it wasn't quite as difficult as it is here at MU, but it kind of prepped you for that just having it be your responsibility to be able to get your assignments in on time, whereas in high school they sort of hold your hand through it and say, "you need to get this done now and you need to get this done, but at MCC, they didn't do this at all and it's like, I guess in that sense it gets you ready for MU and the instructors having their office hours and students like that, but that's about it. Kris]

"Obviously, when you transfer it is going to be tougher at MU for a couple of reasons. First, when you are at the community college you are taking 100 and 200 level coursework and then when you transfer you are taking 300 and 400 level coursework, so while it was easier, I think this is important to remember." [Eddie]

“But, ah, the actual experience at CC was – it’s an extension of high school pretty much. It’s not quite as difficult as college now – like at an actual university – but it was still more independent driven than high school. I actually kind of enjoyed it, because I had the opportunity of a university, but with a laid back feel of a high school.” ...I feel like the smaller class sizes made a difference. The professors seemed to notice who wanted to actually learn and those students got extra help and attention. ...They knew your name. It was a nice transition from high school – sort of an intermediary step to college.” [Peter]

“It was kind of more laid back I should say it was kind of a continuation of high school in a sense. I mean the course work wasn’t that much different in other words wasn’t that much harder it was the same town so I really didn’t change living situations or relationships with friends and all that. It just felt like moving right along like high school.” [Jay]

It is clear that, while community colleges provide a supportive and nurturing educational experience and access to higher education for students who may not otherwise pursue a bachelor’s degree, the transition into engineering from a community college presented unique challenges for these students. It is critical that engineering transfer students are adequately advised and instructed in terms of rigorous pre-engineering coursework, engineering majors, and the academic rigor that lies ahead for them.

Inadequate community college advising

Community college students entering engineering need early career information and transfer advising in order to navigate the transition to engineering. They need to enter their majors with a clear sense of the requirement of their major as well as having taken the first year engineering core courses. A majority of the students in this study either did not understand the specifics of their major and/or were not prepared academically for success in their major. Five of the eight

participants talked about getting little or no advising at the community college in terms of engineering careers and/or transfer coursework. Maggie talked about deciding to be a computer engineer in high school, but added that she really did not understand what that meant and had done little research to determine why she had made this choice. Kevin chose engineering when it was time to transfer to MU. He had completed his AA and never spoke with any advisers or faculty about engineering careers and/or associated coursework. Peter transferred from a career and technical program and was recruited for a projected new Bachelors of Engineering Technology (BET) program that never happened. He did not take any of the core engineering courses and was not advised to do so. Kris was completing her AA and planned to study physics. No one at her community college spoke with her about engineering. She said that if she would have known sooner, it would have changed her plans. Because she learned about engineering after transferring with an AA, she could not afford the extra time that it would take at that point to finish an engineering degree. Jay decided on his engineering major at the time of transfer. He did complete most of the engineering core courses, but had gotten no career information prior to transferring. He decided a major during registration. In their words:

Yeah, nobody at MCC had talked to me about engineering. They didn't really talk to me much about physics either, besides my physics instructor, but the advisers didn't seem to know much. I just knew that and accepted it, that if I needed to know I'd have to find out myself.
[Kris]

Yeah, I had the AA. I really didn't think about going into engineering before, so I really didn't do any engineering classes before, so transferring of classes wasn't a huge concern for me, so that's why I

did everything online. But I just talked to people at MCC. I said I'm going to be transferring, what do I need to do and they just told me. That's pretty much what it was, so I really didn't deal with anyone personally that much. [Kevin]

It is clear that these students needed more advising about careers in engineering, a rigorous pre-engineering curriculum, and preparation for the engineering pathway. Having not had this put them at a distinct disadvantage in terms of engineering success.

All participants in this study spoke favorable about their MU engineering advisers. They talked about how helpful it was to know what would transfer in to their major, getting their transfer schedules set up, and having a “go to” person whenever they needed it to get their questions answered. Several talked about how their adviser was readily available with the door opened at all times.

Academic rigor as a reason to leave

Academic challenges were clearly a motivation for leaving engineering. Math, chemistry, physics, and computer sciences coursework were mentioned specifically as points of decision to leave engineering. Half of the participants in this study entered engineering after completing their engineering basic program in their community college (Calculus I & II, Physics, Chemistry, and English I & II). Four participants completed an Associate of Arts (AA) degree, two completed an Associate of Applied Science (AAS), and four considered themselves “pre-engineering” while at the community college.

There is so much math, so many variables. I didn't really understand what was going on half the time and I was like I don't understand, you know, what's happening and I thought, “this isn't really what I want to

do. I like chemistry and I thought I liked math, but I don't like math this much. [David]

I couldn't focus on any of my class work because I'm like, I don't even know if I'm going to do this. I was in Physics 221 at the time and Comp Sci and all of these like difficult classes and I was like "I can't do this. [Maggie]

The 2 big ones were my electrical engineering and computer science 228. Those are the 2 big ones that were really I mean I would go to class then go home and I seemed as the semester went on it seemed I started spending more hours working on it and I would be up until midnight 1 in the morning trying to finish up assignments and programming then it started being 2 o'clock in the morning 3 o'clock in the morning 4 o'clock in the morning and then had to stay up that late every night of the week trying to keep up with homework then wake up next morning at like 6 or 7 to get ready to go to class I wasn't getting any sleep. I just felt like I was trying harder to get ahead of it but I wasn't getting anywhere with it so I felt like I was getting more frustrated as I went along. [Jay]

...but those two classes were just, beat me down, I mean proofs, it seems like it's just a two hundred level course, like it should not be that big of a deal, but no, it was a whole different way of doing math that I had never even been introduced to before. [Kris]

I passed 227 with like a C+ just because the class moves so quick I wasn't used to that and then on 228 it just moved so quickly and had so many assignments we were completely lost on. After seeing my friend take EE 201 I'm like there is no way I'm going to be able to do it and then I was just kind of struggling through things and 228 was definitely my decision factor. [Eddie]

It's a lot more math-oriented, obviously, then I was – I guess I should have expected it, but it was just like this level of math that you've already taken – you should already know this – and I was taking those classes at that time. I kind of know what you're talking about, not really, so. I was a little weary with some of that stuff. [Peter]

It probably would have been even if just to know the concepts themselves, maybe not understand them completely, but at least kind of know what they're talking about to begin with. At first it was just all jargon and I was like, "I don't know what you're talking about – I don't know what that means [whispers]." [Kevin]

As discussed previously, academic preparation coming into engineering is a key to successful transfer to a 4-yr college. Students should be advised to take all of their core courses (Calculus I and II, English I and II, Physics, and Chemistry) prior to transferring and learn about engineering majors early in their community college career.

I can't/don't want to do this anymore...

In addition to academics, several talked about the sacrifice required to be an engineer. Several were just not willing to forego the other parts of college in order to be an engineer. Jay talked about never getting any sleep and Sam described engineering as “sucking the fun out of learning.” Eddie, Jay, Peter, and Kris described a very “individualistic” learning environment where students worked off by themselves at computer screens for long hours with minimal social contact. It is clear that they had a hard time fitting into this culture because they were more people oriented than their peers and preferred other modes of learning such as active and collaborative learning and/or group projects. Eddie, Jay, Sam, and Peter all came from technical backgrounds and were seeking hands-on learning environments and opportunities to learn and practice engineering problem solving that related to their backgrounds in electrical and computer fields. Eddie, Jay, and Peter were seeking the Bachelor of Engineering Technology (BET) degree that was promised but never materialized. This degree would have provided them with an avenue to utilize and practice their technical expertise.

One thing I didn't like and I still don't like about like my floor and computer E and EE people in general is they are not social it's not that

they are lacking people skills but some of them completely are. I've done managing of my business where I talk to people, consult with people. I guess I'm just a social person. Those things just kind of turned me off completely Also just not having a life because you have to study all the time for your 3 problem solving classes and then some people are even taking 4 or 5. I don't know how they are doing it. They are completely nuts and I couldn't do it I guess my mind just doesn't think that way. [Eddie]

In engineering, you're more alone. I'd see people that were in engineering that just seem like all they did was just do homework all the time or they didn't have any time outside of that really without doing bad in classes. So, just the way everything was set up it just felt like you could get hints of each other but that was about it you just kind of sat to yourself, sat in front of your own computer, and did your own programming. [Jay]

I was taking things over. I never felt like I got the grade that I needed. It seemed like there was so much pressure on getting good grades and so much pressure on being able to conform to this set type that was going to get you a job, that job was what I was concentrating on. I was concentrating on "I gotta get these grades." It sucked all the fun out of it. It wasn't what I thought it would be. I always figured that I would come in here and I would learn about different problems – learn about stuff I'd never heard before – think about things I'd never thought about before, but it became more so that the grades were more important than the process. It was a struggle for me because I had this dream of becoming an engineering engineer for about 8 years. [Sam]

I felt like you were limited on free time and the only thing you could do was engineering, nothing but engineering all the time. Unless you were like gifted or talented which there were a couple people I knew that really knew their stuff really well and they had free time and they could still do really well on homework. I mean if you were new to it and you had no experience I felt like you were just on your own trying to get through it. That's what it felt like. [Peter]

For these students engineering seemed unattainable and became unattractive to them. Based upon their impressions of the learning environments, it seems plausible that engineering favors certain types of learners. It is also interesting that these students sought a college life outside of engineering. They

wanted to be find balance in their college experience and felt that engineering did not afford them the opportunity to do so.

Lack of academic support

Lack of academic support was mentioned by most of the participants in various forms. Several mentioned large class lectures as a problem in terms of support and involvement with faculty both in and outside of the classroom. One participant said that some faculty were “just unapproachable.” Several talked about how accessing friends for help was just not enough and that while they could be helpful, they could not provide the level of support needed. The two female participants both felt that they were not supported as females in the classroom. One talked about eye rolling from fellow students and TAs when she asked questions and the other talked about faculty who just did not support her aspirations and was not helpful when approached.

One problem that makes that a challenge for me is I don't like with MU is the foreign professors, because they are really hard to understand verbally compared to my CC. [Eddie]

...and the instructor was not the greatest and he was pretty arrogant and like, and I tried, I went to his office multiple times and I said “I'm just not getting this” like this is a whole different way of thinking this is completely different math, and he said, “This is real math... [Kris]

...you're going to classes that are 300+ and I don't even know if the professor knows your name let alone what you look like after a while. Even after asking for help – you don't get help from the professor –you get help from a TA. And TA's can range from anywhere from terrible to they should be the professor. [Peter]

Well, I did notice there's a lot of times when in lab if I needed help that they'd kind of roll their eyes, but they'd come help me cause the TA's were males too, where as if the males asked for help they didn't really

seem to mind it. They never really directly said this to me but I kind of felt like "oh, you're a girl, why am I helping you type thing," like that kind of came off that way. I also talked to other friends in other lab sections and they had noticed the same thing. So if it was a pair of girls and they'd raise their hands a lot they're just kind of rolling their eyes and thinking, "they can't figure this out" type thing. I guess in that sense in lab I did feel that a little bit. [Maggie]

I felt some (faculty) were completely unapproachable and if you didn't have a good question or didn't understand it I felt like they wouldn't really help you they would pretty much just say go back and read the book. There were just a few cases where it was just extremely hard to approach so I just didn't approach. [Eddie]

For the smaller ones like my differential equations I mean when it's a smaller class I felt more like I could go in there anytime and I knew the professor better than just a big lecture. I go in whenever I need help and my teacher would be able to help me with it but I think for the larger the class got, I just felt like a face in the crowd. I mean I'm sure he had office hours but I just felt it wasn't worth trying to go there. [Jay]

They're just up front kind of talking the whole time and they do examples it just varied from class to class some like chemistry would be easier it wouldn't be too bad to be in a big lecture but I mean for like the computer science ones its harder to because the guy was just going through them all and only the people that really ask question were the ones right there in front of them and the further you were away from them the less I felt like you were able to communicate. We weren't as much part of the conversation really. [Jay]

...and I didn't think that it was going to be so dramatic because it's just at MCC its much more close-knit and you know I was really close with all my instructors, I had time, you know I kind of lived on campus, sort of, not really, I mean I have a family and stuff but when I was there I was there, I was doing work and there were people to help me everywhere I needed. And everywhere I turned there was someone there to help me, and here it was like thrown into this pot of "Here ya go! Figure it out!" [Kris]

I mean, just, well the longer I'm here the more I realize that I really have to seek it out, and so I'm making more connections. So, in that beginning it's just like, you don't know where to go or who to turn to. [David]

Academic support for these students was inconsistent at best. Most sought out assistance from faculty and TAs, but could not find the level of support needed. Three of the eight students were part of a learning community and they all spoke highly of these experiences; however, none of those in learning communities found the level of academic support needed through their learning community. They talked more about the social connections and general information that they received through their learning communities.

Variable quality of student-faculty interactions

When applying the NSSE Benchmarks for Effective Educational Practice (2012), it was revealed that most of the participants were heavily involved in academic challenge through their engineering coursework. Several students mentioned the challenges of large lecture classes in terms of active learning and interaction with faculty both inside and outside the classroom. One student said that several faculty were readily accessible to him and that he felt comfortable going to their offices anytime (David). Three students named specific faculty who provided needed support both inside and outside of the classroom (Kevin, Sam, and Peter). One of these also worked in a research lab with this faculty member, and still does. Kris talked extensively about the importance of her mentor and friend who is a female math and physics faculty at her community college. She still talks to her on a regular basis. Three students had trouble engaging with faculty and cited the impersonal nature of large lectures as a challenging situation in terms of interaction and involvement with faculty.

I felt some [faculty] were completely unapproachable and if you didn't have a good question or didn't understand it I felt like they wouldn't really help you they would pretty much just say go back and read the book. There were just a few cases where it was just extremely hard to approach so I just didn't approach. [Eddie]

...and the instructor was not the greatest and he was pretty arrogant and like, and I tried, I went to his office multiple times and I said "I'm just not getting this" like this is a whole different way of thinking this is completely different math, and he said, "This is real math..." [Kris]

...you're going to classes that are 300+ and I don't even know if the professor knows your name let alone what you look like after a while. Even after asking for help – you don't get help from the professor –you get help from a TA. And TA's can range from anywhere from terrible to they should be the professor. [Peter]

Overwhelmingly, the literature has linked faculty-student interactions to retention in a major or college. Frequent and positive interactions of students with faculty have been found to be the most important factor in students' satisfaction, sense of belonging, and retention (Astin, 1993; Berger, 1997; Kuh et al., 2010; Pascarella & Terenzini, 2005). Astin (1993, 1999) further defined student-faculty interaction to include being a guest in a faculty member's home, working with a faculty member on a research project, assisting in teaching a class, and talking outside of the classroom. Clearly, the interactions experienced by these students were variable. Although a couple of faculty were clearly effective in their interactions with these students, too many were not.

Sense of belonging

According to Tinto's (1993) theory of departure, a student's sense of belonging contributes positively to retention. Tinto proposed that positive formal and informal academic and social systems are critical to the academic experience and

reduce the likelihood of departure. The theory of departure is addressed briefly as several students did not find this sense of belonging in engineering and it is also embedded in the other themes. For example, female students talked about not feeling supported, and several participants talked about not fitting into the academic culture due to workload and the individualistic environment. In this section the students talked about finding fit and success in other majors. One student talked about how engineering is still his academic home and he plans to return to engineering for graduate study. Two of these students were older students with several years of work experience. They talked about how their work experiences were not valued in engineering. They found that, in their new business major, these experiences were valued and they were often sought out by fellow students as a resource. Their experiences added to their sense of worth and belonging in their new majors:

It seemed like some of my group members, I could tell they really got the stuff and they – sometimes I'd be working in a group and I'd contribute almost nothing and they'd be like, "It's okay, we got this." And I thought, "I don't want you to get it, I wanna get it too." It felt like some people really got the stuff and I just didn't so then I didn't feel like I was contributing. I felt like dead weight. Once I've gotten to Biochemistry, I understood the material. There wasn't as much group work, but I felt like I got the material. I could help other people learn it and things like that. [David]

So, now I'm in microbiology. It's a much more natural fit for me. I've always, always, just loved biology in general, and microbiology has been just fascinating for me, so going into microbiology, it's like – it's always my fall back, like if I just want to read an article or something, it will always be biology-based – or at least science-based – and that's just free-reading or whatever. I figured, if I'm naturally interested in this, why wouldn't I go into a career like that? [Kevin]

One thing I noticed that when I came here I had to find a home and that was the engineering department. It was my home for an entire year, because that's where I work, that's where my advisers are, my professors, all my homework and classes were there. I grew attached to it and now that I have gone to business, I don't feel at home there. I still have my research assist position, I still have my office there (in engineering), and I spend the same amount of time now as I did then in engineering. Now that I'm in business, I don't feel welcomed. As an engineer, I could just walk up to my adviser because their doors were just right on the hall. If they were free, I could just stop in, talk to them, one on one, classes were smaller, and it just seemed like it was the actual college feeling. Now that I've gone to business, I feel like a number. I don't feel like an actual student while I'm there. I can't talk to the advisers when I want to because they're blockaded by the office and in the back – they're all hidden back there. Class sizes are huge, no one is really tech savvy, so I have nothing to really talk to with them. [Peter]

... Being in all of these tech classes. I get the feeling that since I have my degree, I have experience, real life experience. Not that I get idolized or anything, but when we do group projects or something (in business) I always get people to coming to me because they expect me to already know this or they know that I'll be doing well and they just kind of want to tag along. That's what I get in business is that people are just sort of drawn to me because of my experiences while when I was in engineering, they're all like boy, you don't know anything and they're just kind of dissing and tongue and cheek joke about you. In business they're like really impressed. [Peter]

I'm actually putting myself out there to help other students now. A lot of accounting is about team exercises and I don't know if it's because most of them are white collar families or if there is just this zone that they're living in, but whenever they get stuck in team exercises, I'm usually the first one to say, "I've seen something like that let's look this up here, or I think it's this way, let's do this." I'm actually putting myself out there now whereas in engineering I didn't do that because I just didn't feel like I needed to. ... I think I've found that spot where I can actually help people and not expect anything at all, but it's interesting to me to help them. Whereas in engineering I kind of felt like I was in the median. I don't think I am stupid, but I don't think I am as smart as some of these kids. I just felt like if anything, I was the one who was supposed to be learning from them and not me teaching them. Whereas in ACCT, it just seems like they have never dealt with these kinds of issues before and I have, so I feel like I can put something out there for them to learn from. [Sam]

I perceive one can argue that these students have found a better fit and a sense of belonging in their new major based upon their statements; nevertheless, one might also wonder why these students' diverse experiences, gender, perspectives, and learning styles were not valued or supported in the engineering environment and if they had been, would they have stayed?

Challenges of being an older student

Half of the participants in this study self identified as older students. They all talked about how this was a challenge to them socially. It was hard for them to find common ground with the younger peers. Conversations were difficult, schedules often didn't mesh when looking for study time, and faculty often did not recognize the differences between traditional and non-traditional students' needs. In particular, older students tend to have more financial and personal responsibilities and, as Peter stated, "...are playing by a different set of rules."

I did feel very different just because most of the classes that I was taking right away were freshmen level classes, so, I mean, I'm older and they're all coming from high school and the age difference – it was just way different. It was just weird. [Kevin]

...but he (faculty adviser) doesn't understand being a non-traditional student, first of all, and then secondly you know, transferring into this physics program, you know, there's a lot of people who are born and raised into physics. Young eighteen year olds who have been, that's their life. Well, that's not really mine, I mean I have a lot of interest in it, but there seems to be a barrier, like, it's just difficult. He doesn't understand the life-side of it, I guess. [Kris]

I guess really, and then, that other female that was in my physics class, she was a nontraditional student as well. She was actually a graduate student taking it, to have it for something, but most of the time it just feels like, I just don't fit. It's like when you get in a group and you're trying to figure out when things are gonna work and,

someone barely twenty-years old says, “Oh I have all these things I have to do” and I’m like, “You don’t know what you’re talking about...”
[Kris]

I met most of the older gentleman by TA’s cause I ran into them because they would teach labs or after class assignments. It was easier to strike up a conversation with them than it was someone younger. And also at work because I’m a research assistant for a graduate program, I meet a lot of graduate students through there – I guess I feel like I have to work harder at it because I have to adjust my schedule to meet the friend time that it just feels like a get left out because by the time I get all of my requirements for like car insurance – apparently most kids don’t pay their own car insurance – cell phone they don’t pay for – I have a lot more bills that I feel like I have to get taken care of before I can go out and do other things. By that time, they’ve already done out and I’m like ahhhhh, sad face...It’s just different because I feel like I’m playing by a different set of rules.
[Peter]

And the was another thing was that most of the people that I went to school with that are my age do have families where as I don’t and so I always felt like the odd guy out because I didn’t fit in with the younger crowd who were single and I didn’t fit in with the older crowd because they were all married and/or have kids and most of my friends from around here are all married or have moved off. [Sam]

Understanding and recognizing the needs of these older students is an important step towards helping them integrate into a culture that is predominantly traditional-aged. Older students tend to bring additional responsibilities, Such as bills to pay and/or families to support, to their educational experience. They also have life experiences that cause them to approach the educational process differently. In addition to social challenges, the older students in this study faced the reality of being away from math and science courses for as many as 10 years. This academic gap, while not the focus of this study, surely created academic hardship for the older students as they struggled to recall the basic math and science foundational information and terminology.

Participants' Recommendations

Within the interview format, study participants were asked at several points if they had recommendations for students, faculty, and/or administrators/policy makers pertaining to the engineering transfer process and programming. Based upon their experiences, these students had the following recommendations.

...to students

Jay thought students coming into Computer Engineering needed to know more about major and more about what a Computer Engineer does. He felt that he did not have enough career information coming in to his major.

I would tell them that Computer Engineering is more focused on the hardware aspects like actually building the pieces that go to the end user. You build the chips, the circuitry, and the wiring and all the complexity that went into it. I wasn't told that specifically. [Jay]

...I would say if you're not getting the material in the first couple weeks of class, get study help pretty frequently. It's a lot easier to ask a TA about the material than it is to ask a professor in those big lecture halls. I would also say try to ask as many questions as you can in class too they always say there's more people in there that doesn't understand it. [Jay]

Sam had suggestions for facing one's own fears:

I honestly think that if you're able to figure out what you're afraid of at MU, pick one day and do exactly what you're afraid of - as long as it's within reason, of course. Say, if you're afraid of being in a 400 person lecture classroom, drop in on a class and sit in on a lecture. It doesn't even have to be your class, because most of the time people don't all show up anyways, so you could find a seat and sit in there. You have nothing to lose. [Sam]

Kevin emphasized a focus on effective study skills:

Definitely, learn how to study and more importantly, learn how to study effectively. I mean, you can just look at a book and stare at it, especially with engineering. It's mostly just problem-based stuff. Keep practicing, practicing,

practicing. If only an hour a day or however long – if you do it every single day that's going to pay off rather than doing it just during the weekend or something. That's what I would say the biggest thing is to do. [Kevin]

Eddie encouraged students to seek early advising and career information:

I would say talk to your adviser often before you come in and make sure it's a right fit. Know your major and talked to people in the field about it. I would have liked to sit in a couple classes before I even took them just to see what they were like I mean because it's a completely different with coming from MCC to a completely different educational experience. [Eddie]

...to faculty, administrators, and policy makers

Peter wished there was some way to meet the other Native American students on campus:

If there was a mechanism where I could get to know like five out of the 20 (Native Americans) or maybe just 2 – someone I could hang out with. Knowing my Native American background – knowing all of the other people I know. We're not really social people. We just like to know there are others out there like us. I've seen people who I believe are Native American, but have never actually met them. [Peter]

Eddie talked about how when he was in engineering, he wanted to take a class pass/fail and was told that if he did that, he would never be able to take it again. He felt that this policy inhibited his ability to find success in this class and/or major down the road:

To be honest maybe I can see if you drop it or take it as pass/fail then maybe you can't take it within a year or two years, but I don't think you should be completely eliminated from that option. First of all, it's a bad business standpoint for MU. They could be making money off of me taking those classes. Second of all you, this policy pretty much shoots down students' future potential. If they really can do it later on and things aren't right, right now for it. In other words, if I ever want to do it again, I think I'm going to have to go to another college. I don't think that's right. [Eddie]

Jay remarked:

Some of the classes like ComSci 227 and a few others seemed like there should have been in introductory class to them because a lot of my friends came in with prior knowledge or had prior knowledge of basic programming compared to what I had, I struggled a bit and if there were those introductory courses to those classes I think it would have made the whole academic transfer a lot easier.

These recommendations were part of the students' narratives and serve to inform messaging to students and future practice. It is important to not only understand why students leave, but also allow their perspectives to inform transfer engineering students, programs, and policies.

Summary

Chapter 5 presented and discussed eight themes that emerged from an exploration of the participants' engineering transfer and leaving experiences based upon transcripts from interviews, member checking, a focus group, and conversations with peer methodologists:

1. Community college is like an extension of high school
2. Inadequate community college Advising
3. Academic rigor
4. "I can't/don't want to do this anymore..."
5. Lack of academic support
6. Variable quality of student-faculty interactions
7. Sense of belonging
8. Challenges of being an older student

These themes revealed the complexity of the engineering transfer process for these eight students and provided a broad view of their collective experiences. The

majority of these themes are supported in the Science Technology Engineering, and Math (STEM) transfer student literature which adds additional credibility to these results. These themes will also serve as a framework for considering implications for policy, practice, and future research. In Chapter 6 presents the conclusion of the study, and addresses the limitations of the study, ethical considerations, implications, and recommendations for policy, practice, and future research.

CHAPTER 6. DISCUSSION

Summary

The purpose of this study was to understand and illuminate the phenomenological experiences and stories of Midwestern Community College transfer students who entered and left engineering at a large Midwestern research university, called Midwestern University (MU) for the purposes of this study. The study focused on eight engineering transfer student leavers' experiences and perceptions of this phenomenon in order to inform scholarship, practice, and policy. Creswell (2002) posited that phenomenology seeks to uncover and understand the meaning of events, experiences and interactions of ordinary people, and instructs the research to bracket, or put aside, personal beliefs and attitudes about the particular phenomenon being studied in an attempt to understand the purest form of the phenomenon. The participants in this research, and students like them, speak from the sidelines of the engineering playing field. As outsiders, they offer a point of view that can be painful for those inside to hear. According to LeCompte (1993), the words of the silenced can serve to shine an unflattering light on existing social and institutional structures. Too often, we listen to those who persist and graduate, and craft programming around what has worked for them. Listening to those who have left provides a critical view of what does not work as well as insights as to how students, programs, and institutions might shift their thinking, practice, and policies.

Conclusions

The research protocol for this study was framed around the following questions:

1. How do community college transfer students describe the people, experiences, and life events that influenced their decision to pursue an engineering degree?
2. How do community college transfer students describe the social, academic, and personal transition into engineering from a community college?
3. How do transfer students construct meaning of their decision to leave engineering?
4. What transition and academic experiences and perceptions are unique to these students?
5. What institutional policies and practices would best serve the needs of engineering transfer students?

Additionally, this study considered two theoretical and conceptual frameworks in order to frame the research protocol and analysis: (a) Predictive Model for Academic Transfer Adjustment or “Transfer Student Capital” (Laanan, 2010), and (b) the National Survey of Student Engagement (NSSE) Benchmarks for Effective Educational Practice (2012). The combined overview outlines the basic components of this bi-fold framework (see Table 1).

A summary of the interpretations from the eight students’ narratives follows in a two-part summary: (a) Part I is organized around research questions 1-4; and (b) Part II is organized around the theoretical and conceptual frameworks. This

summary is also substantiated within the text of the participant narratives in Chapter 4, and analysis and findings in Chapter 5.

Part I: Research questions

Research Question 1: How do community college transfer students describe the people, experiences, and life events that influenced their decision to pursue an engineering degree?

Interviews revealed that these students were influenced by a variety of people in their decisions to pursue engineering, including: parents, teachers, advisers, and friends. However, the majority of the informants did not exhibit an in depth understanding of engineering as a career field or of the rigorous nature of engineering at the time of entry into the program. It is interesting to note that none of the participants in the study mentioned being influenced or mentored by people in engineering fields. For three students engineering was a long-term goal (3-10 years). Four of the participants decided on engineering at the time of transfer, and one was recruited specifically for the Bachelor of Engineering Technology program that was never approved: *“was recruited under false pretenses.”* One of the participants was a journeyman electrician and was influenced to study engineering through his work in the field. None of the participants had a parent who is an engineer; although a couple knew friends who were studying or had graduated in engineering.

Research Question 2: How do community college transfer students describe the social, academic, and personal transition into engineering from a community college?

The interviews revealed that the transition from the community college into engineering in a large research institution was daunting. Students often described this transition as overwhelming and they talked at length about the social adjustment of not knowing anyone and breaking into the social culture of predominantly traditional aged students who had already established themselves socially. This was illustrated in the individual narratives in Chapter 4 and themes in Chapter 5. The following themes emerged from the transcripts and many of these relate to this transition into engineering in a large research university.

1. Community college is like an extension of high school
2. Inadequate community college advising
3. Academic rigor
4. "I can't/don't want to do this anymore..."
5. Lack of academic support
6. Variable quality of student-faculty interactions
7. Sense of belonging
8. Challenges of being an older student

Academic challenges were insurmountable for these students, coupled with an inability to get the academic and social support that they needed. Quality faculty interactions were inconsistent, with approximately half of these interactions being positive and half being negative in terms of finding supportive and mentoring relationships. Students who lived in the dorms or a fraternity found more connections than those who did not. One student commuted which made all connections more challenging. Most mentioned large class sizes as a problem,

especially as it relates to quality interaction with faculty. Most, if not all, participants were discouraged and lost interest in engineering due to the academic rigor and demands. Several talked about wanting to have a college life outside of engineering which was not possible given the academic demands placed upon them in engineering.

Research Question 3: How do transfer students construct meaning of their decision to leave engineering?

For the most part, students left engineering for academic reasons. They struggled with math, physics, chemistry, and computer science courses. As stated previously, the participants also mentioned they were not able to find the help needed to find success and often felt that some faculty were not approachable in terms of finding help. It is important to note that the majority of these courses are taught outside of engineering; therefore, implications regarding faculty interactions and student support reach beyond the scope of the engineering college. The majority of these core courses are taught within the College of Liberal Arts and Sciences. Several also talked about engineering not being a good fit for them. They expressed concerns that they did not fit with other engineering students, they were not excited about the major, and/or they wanted more hands-on engineering learning. Half of the students said they did not like the individualistic nature of their engineering department. They mentioned that students did not interact; they basically sat at computer screens by themselves day after day. It is also worth noting that all of these students found a better fit after leaving engineering. They talked about feeling more comfortable and more interested in their new majors;

therefore, while leaving behavior can generally be viewed as a negative outcome for engineering, there is something to be said for students' finding a better fit through leaving.

Research Question 4: What transition and academic experiences and perceptions are unique to these students?

Four of the eight students were older, and expressed concern that this affected their transition and academic experiences. They had a hard time connecting with other students socially and academically, and had additional responsibilities that limited their ability to participate fully in college life. In addition, since most of these students did not take the pre-engineering curriculum at the community college, they were placed in freshman level engineering classes even though they were designated as juniors. This juxtaposition created a juggling game with students because their academic pathway was not seamless but comprised largely of backtracking. Students who entered engineering with an AA, and had not completed the core pre-engineering curriculum, faced four additional years after they transferred. This was discouraging to several students. One student was a single parent which created another level of complexity to her college life. She left engineering because she could not afford four more years of study.

Midwestern University had planned to implement a Bachelor of Engineering Technology (BET) program at the time that these students transferred. This program would have offered a seamless "2 + 2" program that focused on computer technology. The program *also* promised to offer a more hands-on and technical approach to engineering for students interested in computer networking and

cybersecurity. At least three of the participants in the study were interested in this option and expressed that they were looking for a more technical program. All of these students transferred to the Management Information Systems (MIS) major although were not satisfied with the technical side of this option. They felt the MIS degree was much more focused on business and economics, with very little technical computer content which was what they were seeking. Based upon these students' narratives, there is a demand for the BET for students interested in computer technology fields.

Part II: Theoretical frameworks

Predictive Model for Academic Transfer Adjustment or “Transfer Capital”

Using the Predictive Model for Academic Transfer Adjustment or “Transfer Student Capital (TSC)” Model (Lannan, 2010), several areas of deficiency emerged from the interviews and focus group. First, and foremost, the students described their community college coursework as easy compared to MU. This assessment is troubling given the rigor of the engineering curriculum. However, it is worthy to note that half of these students did not take pre-engineering coursework prior to transferring; thus, regardless of their educational pathway, these students struggled academically after transferring.

Absent from the interview transcripts was any significant discussion about these students' TSC (Transfer Student Capital). While this did not emerge as a theme, the absence of this content in the narratives is telling. There were very few

community college academic counseling experiences mentioned, and most of these students generally accumulated little transfer capital. Preparation for transfer was minimal in terms of seeking out information, understanding the rigors of engineering, and acquiring learning and study skills needed for engineering. Over half of these students did not do a campus visit and did most of their transfer planning and orientation on-line. Only two of the eight students were a part of the Admissions Partnership Program (APP) intended to help students build connections and TSC prior to transferring. It is clear that these students started thinking about transfer and engineering at or around the time of transfer. In order to build TSC, engagement with the transfer institution and with engineering should have happened much sooner in their community college experience.

NSSE Benchmarks for Effective Educational Practice

In order to establish a basis to understand transfer student engagement, the National Survey of Student Engagement (NSSE) Benchmarks were applied as a theoretical framework for this study. These benchmarks are widely accepted in the literature and by colleges and universities as measures of effective practice in higher education. The NSSE benchmarks include broad conceptual categories or clusters of benchmarks encompassing student behaviors and institutional factors. Kuh, Kinzie, Schuh, Whitt, and Associates (2010) utilized the NSSE Benchmarks to describe effective educational practice. According to Kuh et al, student engagement is demonstrated by the investment students and colleges make in the college

experience specifically related to academic challenge, student-faculty interaction, active and collaborative learning, and enriching educational experiences.

It is clear from the themes which emerged from the interviews that, while these students clearly found academic challenge at MU, they did not find sufficient student-faculty interactions, or a supportive campus environment in support of their academic needs. In addition, it is clear that these students did not find sufficient academic challenge at their community colleges to prepare them adequately for engineering study. Academic and developmental readiness [or the lack of it] for transition to MU was evidenced in different forms for these students because they entered with varying degrees of preparation. Although several who entered with the core pre-engineering curriculum completed, they struggled in courses for which they had no pre-requisite or foundational community college course offered. Others who did not take the core at the community college struggled in those courses. Since half of these students were older, the time lapse in terms of the academic preparation could clearly be a factor. In all cases, these students were under-prepared and lacked support in order to be successful in engineering.

Recommendations for Practice

The following recommendations for practice are offered based on the findings and conclusions of the study:

1. *Develop a culture of evidence around transfer student success in engineering.*

Developing a culture of evidence around engineering transfer student success (including leavers) requires sustained attention and includes collecting and analyzing quantitative as well as qualitative data. It is also complicated. The variability in community college students' intentions, course-taking patterns, and enrollment intensity (part-time vs. fulltime) often exasperates researchers who are more accustomed to conducting studies using databases of high school populations and distinct cohorts of students. Bashford and Slater (2008) presented a framework for creating a culture of evidence through a project at Miami Dade Community College. The authors outlined a process that was used by a team at Miami Dade to improve mathematics instruction and performance: (1) Identify problem areas; (2) Gather more data; (3) Build forums for collaboration; (4) Share data broadly; (5) Identify strategies; (6) Implement and assess strategies; (6) Establish accountability; and (8) Institutionalize the process.

There is a need to Institutionalize a similar process at both 2-year and 4-year institutions in order to develop engineering pathways for transfer students that work. These processes should be part of the collaborative conversations that occur between 2- and 4-year faculty, advisers, and administrators. Putting student success data on the table and discussing interventions at all levels will move institutions and partnerships on a path towards improvement. These conversations may lead to changes in curriculum, delivery methods, pre-requisites, and/or advising that serves to improve student success. The Student Enrollment and Engagement through

Connections (SEEC) project has done exactly that. One activity of this collaborative NSF project between Iowa State University and Des Moines Area Community College was to create SEEC Data Briefs for the purpose of engaging in conversation and planning around student success. The SEEC Data Briefs can be retrieved from the project's website at

<http://www.eng.iastate.edu/seec/index.shtml>.

2. *Develop and require a rigorous and articulated pre-engineering curriculum for incoming engineering transfer students.*

Engineering transfer students need a clearly defined community college to four-year pathway that is clearly understood by all and required by the receiving institution. While this is often a challenge for community colleges due to their varying capacity to provide second year courses, the National Academies of Sciences (2007) suggested a tiered approach to articulated engineering curricula including the following:

Level 1: calculus sequence, physics, inorganic chemistry, and introduction to engineering (including design)

Level 2: calculus sequence, physics, introduction to engineering statistics, dynamics, fluids, thermo, circuits I and II, digital logic, mechanics, materials, organic chemistry, perhaps introduction to process design.

Level 3: same as Level 2, but with a strong engineering-design and fabrication component in each course and with calculus and physics taught as engineering classes, perhaps at least partly by engineering faculty. (pp. 48-49)

This approach recognizes varying institutional capacity and enables all community colleges to develop a pre-engineering pathway based upon their capacity to do so. It also assumes that pre-engineering students will often

transfer without completing an AA. When attending community colleges with limited capacity to offer either 2 and/or 3 level courses, students should be encouraged to transfer after their first year. Several participants in this study completed the AA which only served to lengthen their time to graduation in engineering. Not requiring a rigorous and articulated pre-engineering curriculum creates a sense of false hope for incoming transfer students who are accepted into engineering majors without the adequate academic background and TSC to succeed. Laugerman (2012) found that it is advantageous in terms of engineering transfer student success rates to take: (a) Calculus I, Calculus II, and Physics I or (b) Calculus I and Calculus II at the community college before transferring. She notes that particular focus should be placed upon success in Calculus I and Calculus II by earning a 3.0 GPA or better.

3. *Facilitate regular collaborative activities among 2 and 4 year faculty, staff, advisers, and administrators regarding early engagement and academic rigor for STEM transfer students.*

The National Academies (2007) has encouraged frequent communication between faculty members, students, support staff, and administrators of two- and four-year programs. Relationships among faculty, staff, and administrators lead to greater cooperation and awareness of the issues facing the respective groups. For example, regular curricular cooperation between two- year and four-year faculty can lead to an awareness of the impacts of changes in lower division coursework on pre-

engineering programs and, ultimately, engineering transfer students. Regular collaborative activities, professional development, and grant activities can increase collaboration, articulation, and early engagement activities aimed at community college STEM students.

The Washington Council for Engineering and Related Technical Education is an example of a statewide council that serves this function in the State of Washington. It includes 17 community colleges with engineering transfer programs, and 4 community colleges with engineering technology programs, 5 universities with programs leading to a B.S. in engineering, and 3 universities with programs leading to a B.S. in engineering technology. According to their webpage (<http://lists.engr.washington.edu/mailman/listinfo/wcerte>), "The Washington Council for Engineering and Related Technical Education is a voluntary organization of postsecondary educational institutions within the State of Washington who are involved with some portion of the total spectrum of engineering and engineering related technical education." This type of infrastructure provides for ongoing and systemic communication and collaboration.

- 4. Implement Intentional early engagement programs to help STEM transfer students understand engineering careers, academic rigor, the engineering climate, and accumulate transfer capital.*

Early engagement of community college STEM students is critical to their success. According to Laanan (2010), students need to accumulate Transfer Student Capital (TSC) in order for them to be successful at their

transfer institution. In the case of students transferring into engineering, the need for accumulated TSC is greater than in many other transfer majors.

Accumulating TSC includes significant academic preparation, multiple visits to the transfer institution, regular communication with advisors and faculty at both the sending and receiving institution, career research, and career specific transfer planning. Preparing for success in engineering also includes making deliberate plans for housing that allows for access to supportive resources specific to engineering as well as knowledge of support services. In the case of engineering, students need to successfully complete Calculus, I & II, Chemistry, and Physics prior to transferring into engineering.

Too often, as was the case for several of the participants in this study, students have not accumulated enough TSC to ensure their success in engineering prior to transferring and they have not been required to do so. Encouraging students to accumulate TSC throughout their time in the community college needs to be part of pre-engineering and STEM programs at the community college level. Special programs may be available which encourage early engagement, including but not limited to admissions partnership programs, summer research programs, and/or summer bridge programs. These programs help students build TSC by acquiring information and connections that will aid in their success as an engineering transfer student.

Partnerships programs which encourage early engagement of community college students with the transfer institution are becoming

common across the nation. Georgetown University, the University of Central Florida, Texas A & M, and Iowa State University have developed early admissions programs that link community colleges more closely to the four-year institution (College Board, 2011). These programs include dual admissions strategies, early advising, peer mentoring, career development and career planning, and campus visits. The key with these programs is to help students develop TSC and to acquire a transfer student identity early so that participating students will begin their community college education with the end in mind. Laugerman (2012) found that participation in an Engineering Admissions Partnership Program serves as a bridge for a smoother transition into engineering.

5. *Offer STEM bridge programs to help STEM transfer students' transition into the rigor of engineering studies and the large research university culture.*

For nearly half a century, institutions of higher education have implemented bridge programs in order to increase the retention and graduation rates of at-risk students (Eggleston & Laanan, 2001; Pascarella & Terenzini, 2005). These programs generally target at-risk populations such as first generation college students, underrepresented minority students, and transfer students. The goal of these programs is to systematically facilitate incoming students' academic and social integration into the receiving college. In the case of engineering transfer students, a large part of this program focuses on academic preparation and assimilation into a large research

university culture. It is clear that the participants in this study would have benefited from such a program.

Bridge programs for community college students come in many forms. They vary in length, location (2- and 4-year campuses), and target audiences. Some bridge programs target high school students entering the community college, and some target transfer students entering the 4-year institution. Regardless of the approach, the goal is the same: to engage community college students early in the transfer process in order to increase their likelihood of transfer success, retention and baccalaureate degree graduation. Table 3 summarizes two bridge programs targeting STEM transfer students.

Table 3. Components of bridge programs at MESA and San Diego community colleges

Program Information	Program Components
Math, Engineering, Science Achievement (MESA) Community College Program (MCCP) (http://mesa.ucop.edu/programs/mesaccp.html)	<ol style="list-style-type: none"> 1. Academic excellence workshops 2. Orientation course. 3. Academic advising/counseling. 4. Student study center. 5. Assistance in the transfer process. 6. Career advising. 7. Links with student and professional organizations. 8. Professional development. 9. Industry Advisory Board.
San Diego City College Academy for STEM success (http://www.sdcity.edu/AcademicPrograms/ProgramsofInstruction/AcademyforSTEMSuccess?2899Nav= &NodeID=7364)	<p>Student objectives for this program:</p> <ul style="list-style-type: none"> • Learn about the City College STEM culture of success and language of success • Be trained on the best learning strategies and develop necessary study skills • Take the StrengthsQuest assessment to learn their five most dominant strengths • Meet professors from STEM departments • Receive guidance from City College Counselors about educational planning • Be mentored by successful City College students in STEM majors • Receive career advice from local STEM professionals • Meet City College staff and learn about available student services • Receive sample school supplies for organizing class notes and materials • Make new friends and build community with 99 other STEM majors • Have fun!

6. *Reward and value effective practice in terms of teaching and learning (quality student-faculty interactions, active and cooperative learning, and enriching educational experiences).*

Student success and engagement literature overwhelmingly supports the NSSE Benchmarks outlined by Kuh et al. (2010); however, implementation of these strategies in the classroom has been sluggish in

many educational environments, and particularly in large research institutions where faculty face large lecture hall assignments and juggle the demands of research and teaching. There are no easy answers to making student success a priority in engineering within a large research university. There are those who may say that not all students should be engineers and that weeding out is part of the game. Others believe that outdated weeding practices stifle diversity within the engineering profession. While volumes have been written on this topic, only a few are mentioned here as this as a critical component of a larger strategy that supports and welcomes transfer students with various work/life experiences and learning styles into the engineering pipeline. Finding ways to reward faculty and staff who demonstrate commitment to these practices in and outside the engineering classroom is a critical step towards making student success a priority for engineering education and transfer students more specifically.

- 7. Offer Bachelors of Engineering Technology (BET) Programs to meet the needs of community college transfer students seeking high level technical degrees.*

Bachelors of Engineering Technology (BET) degrees provide an articulated engineering option for students seeking a more technical and hands-on degree. The following differentiation is offered by ABET in order to distinguish engineering and engineering technology programs:

Engineering programs often focus on theory and conceptual design, while engineering technology programs usually focus on application and implementation.

Also, engineering programs typically require additional, higher-level mathematics, including multiple semesters of calculus and calculus-based theoretical science courses. Engineering technology programs typically focus on algebra, trigonometry, applied calculus, and other courses that are more practical than theoretical in nature. (<http://www.abet.org/engineering-vs-engineering-technology/>)

Given that participants in this study struggled with the rigor of math in their engineering majors, it is feasible to suggest that an engineering technology program might have offered an option with less math rigor and more technical applications. It is also worth noting that BET programs are typically well articulated with community college engineering technology programs allowing for a seamless and articulated engineering pathway. Three of the participants in this study who left engineering were seeking this kind of degree.

Implications for Future Research

The literature related to engineering transfer students and engineering transfer student leavers is sparse and, within that literature, researchers who have applied qualitative inquiry is next to nonexistent. More study in this area is needed in order to understand the complex phenomenon of engineering transfer students and leavers. There is a wealth of research in the area more broadly defined as Science, Technology, Engineering, and Math (STEM); nevertheless, it can be argued that these studies are not transferrable to engineering due to the engineering's unique curricular demands, rigor, and climate. Following are several

research questions that might be considered for future studies (National Academy of Sciences, 2007, pp. 69-70).

1. Do engineering students who begin at community colleges perform as well, better than, or not as well as other students?
2. What factors influence their success rate?
3. What is an appropriate minimum transfer GPA for engineering transfer students?
4. What factors in the culture, student services, and learning environments of 4-year engineering programs correlate with the retention of transfer students through completion of a B.S. degree?
5. What can community colleges and four-year engineering programs learn from bridge programs? Can exemplary bridge programs be scaled up to improve recruitment and retention outcomes for both two and four-year institutions?

The current study presented a critical view of engineering transfer student leavers and considers voices from the sidelines of the engineering playing field. It is critical to include these voices in the engineering literature in order to better understand the students' experiences and to shed light on programs, services, and interventions that did not work for these transfers.

Personal Reflections

The process of conducting research and writing this dissertation has been a journey of several years that has included extraordinary experiences working with students, faculty, administrators, and researchers involved in the community college

STEM and engineering pathway. I have learned a great deal and have come to appreciate research and research processes as a tool for transformative work on the individual, program, institutional, and national levels. I am also reminded that all researchers view data through their own personal lenses and, therefore, it is critical to engage in meaningful conversations about data and our interpretations of it. With increasingly complex and powerful data analysis tools at our disposal, we are inundated with data every day, yet rarely do we have opportunities for meaningful discussions and discourse regarding the data that we see and use daily. In my mind, research and data without discussion and action serve no purpose.

I chose qualitative inquiry for this study because of my lifelong need to know more than what quantitative data can provide. I am drawn to the stories of students that emerge behind the data points. Having worked with transfer students throughout my adult life, I know that their stories are rich and complicated. In order to understand engineering transfer students, we must continue to listen to their stories. More specifically, I am drawn to the stories of students who have left engineering, because it is through their stories that we learn about what is not working. This research capturing the ***voices from the sidelines of engineering*** strived to uncover these individual truths. I have had the honor to get to know eight extraordinary students who left engineering. I hope that I have captured their stories and that others can learn from our collaboration.

**APPENDIX B. INTERVIEW AND FOCUS GROUP QUESTIONS,
AND RELATED CORRESPONDENCE**

Pre-Interview Survey

Directions: Please complete this survey and email it to mdarrow@iastate.edu before...

1. Name
2. What institution did you transfer from?
3. When did you transfer to ISU?
4. Engineering Major
5. Current Major
6. How many engineering credits did you bring in? Which ones?
7. At the time of transferring:
 - a. Did you live on campus?
 - b. Did you commute more than 5 miles?
 - c. Were you able to get to campus via Cyride from home?
 - d. Did you work on campus?
 - e. Did you work off campus?
 - f. Did you work in another town other than Ames?
8. How were you engaged in Iowa State prior to transferring (check all that apply):
 - a. Engineering Admissions Partnership Program (EAPP)
 - b. Working with an ISU Advisor
 - c. Campus visits.... If yes, which ones?
 - d. Campus events If yes, which ones?
 - e. Other
9. What factors influenced your decision to leave engineering?

Leaving Engineering: Sample Interview questions for University Students

Theme	University Students
Social Factors: Family, Friends, Teachers & Mentors	Please describe the influences in your life that have contributed to your choice to pursue an engineering degree. How were you influenced? By whom (family, friend, teachers, others)? What would you like to tell others about studying engineering?
Community College/Transfer Experience	How would you describe the following: <ul style="list-style-type: none"> • Your community college experience in relation to your experience at ISU? • Your first semester or year at ISU. What was the adjustment like (academically, socially, and personally)? What helped or hindered you along the way? What was the adjustment like (shocking? Easy? Scary? Overwhelming?)
Programs & Services	Describe how the people and/or services at ISU and/or your transfer college have helped you in the following areas: <ul style="list-style-type: none"> • Make career decisions, • Prepare for transfer, and/or • Helped you develop knowledge and skills toward graduation. Describe the transfer process in terms of what was difficult and/or easy for you. How did you access resources, programs, and services in this process? What advice would you give future transfer students in terms of accessing resources, programs, and services?
Academic Environment	Please describe the following in terms of your classroom experience: <ul style="list-style-type: none"> • Classroom/college environment in terms of being welcoming to transfer students. • Classroom instruction – what did you like/dislike? • What was hard? What was easy? • What advice do you have for future students in terms of academic preparation for students coming from a community college?
Leaving Engineering	Describe your decision to leave engineering. What influenced this decision including timeline, process, and people who helped you along the way. <ul style="list-style-type: none"> • Career Choice Aspiration Change • Academic considerations • Psychological Factors (stress, anxiety, fitting in, etc.) • Personal fit (fitting into the culture, social integration and support) • Social and Family Life Concerns (social isolation, competing demands from family, spouse(s), and/or children, etc.)

Sample Telephone Interview Follow-Up questions for Students

During our previous conversation, you mentioned [.....]. Could you please tell me more about that?

The last time I spoke with you, you felt [.....]. do you still feel the same way?

To clarify, you stated that the following things influenced your decision to leave engineering [.....]. Could you tell me more about these? Please be specific.

Focus Group Protocol

1. Discuss the factors that influenced your decision to leave engineering
2. Describe the people and/or experiences that influenced this decision
3. Discuss what your community college and/or ISU could do differently to retain students in engineering.
4. What other comments would you like to make about the how and why community college transfer students leave engineering? What do you want people to know about your experience

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