# Institutional and major persistence among first-generation engineering students in a first-year program: A grounded theory study

by

David Fredrick Hoffman

B.S., Kansas State University, 2009
M.S., University of Missouri – Kansas City, 2012

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Special Education, Counseling, and Student Affairs
College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2020

# Abstract

This research study examined the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering undergraduates that participated in a first-year program at Kansas State University, a large, land-grant, public, and four-year institution in the Midwestern United States. Historically, both first-generation college students and engineering majors have lower rates of persistence when compared to other populations. In order to provide sufficient context for the study, previous work on college student retention, engineering major persistence, first-year program participation, and the experience of first-generation undergraduate students was examined. Through these efforts, it was determined that the first-year persistence of first-generation engineering students that had participated in a first-year program had not been sufficiently examined. The purpose of this study was to explore the factors that positively influenced the institutional and major persistence efforts of first-generation engineering undergraduate students in a first-year program through a qualitative design and a grounded theory methodology. The following research question at the center of the study was addressed: What were the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program? Through the incorporation of a grounded theory methodology, first-generation engineering students that participated in first-year program and had persisted in engineering from their first to their second year were interviewed. Within the interview setting, the research participants provided considerable insight into their experiences and persistence efforts throughout their first year in the engineering program. The collection and analysis of data led to findings that suggest the existence of six primary elements that positively influenced the first-to-second year institutional and major persistence of first-generation

engineering students. By adhering to the grounded theory methodology, a theoretical model, which can be identified as the First-Generation Engineering Student First-Year Persistence Model, was developed. The First-Generation Engineering Student First-Year Persistence Model illustrates the six primary elements that positively influenced the first-to-second year institutional and major persistence for first-generation engineering students and the various subcategories of factors that contribute to each element. Furthermore, a summary of and further discussion of the primary findings were provided. Finally, recommendations for future studies concerning first-generation engineering students and first-to-second year institutional and major persistence efforts were offered.

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Major Professor
Dr. Christy Craft

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# Acknowledgements

Without a doubt, this educational journey would not have been possible without the support, encouragement, knowledge, and dedication of family, friends, colleagues, students, and mentors. It is my sincerest hope that this dissertation is a reflection of their inspiration. I am so very fortunate to have so many incredible individuals that have taken the time to be a part of my educational, professional, and personal life.

To the love of my life, Elsie Shogren. You are this life's greatest gift, and I would not be where I am today without your relentless support, encouragement, enthusiasm, intellect, and understanding. One day, those of us fortunate enough to have you in our lives will collectively figure out what we have done right in this world to have deserved your presence. Thank you for finding a way to amaze me each and every day we are together, and I cannot wait to help you defend your dissertation in the very near future.

To my parents, Tom and Cindy Hoffman, my brother, Dennis Hoffman, and sister-in-law, Mallory Lafargue Hoffman. Family has always been and will always be the foundation upon which everything else is built. The support, admiration, and love the four of you have provided since the very beginning has enabled me to succeed along this long and winding road. Thank you for believing in me every step of the way, and for always emphasizing the importance of our education. All I have ever wanted out of this life is to make you all proud.

To my professional mentor, Dr. Emily Lehning. Somehow finding a way into the Blue Key Honor Society my senior year of college and getting to spend time with one of the brightest and sharpest minds on campus set the course for both my educational and professional aspirations. Thank you for continuing to inspire, support, and advise me as throughout this incredibly fulfilling journey.

To my current supervisor and colleague, Dr. Callie Rost. Working alongside you in the pursuit of recruiting the next generation of veterinary medicine graduates and professionals is an exciting challenge each day, and you inspire me with your positivity and knowledge. Thank you for your encouragement, enthusiasm, and support in creating and fostering such a rewarding professional environment in the College of Veterinary Medicine.

To the Engineering team of Dr. Bette Grauer, Dr. Gary Clark, Dean Craig Wanklyn, and Leanne Reineman. My time serving in the College of Engineering has forever shaped the trajectory of my educational and professional aspirations, and I will always be grateful for the opportunity to assist prospective and current undergraduate students. Thank you for providing me the opportunity to grow within one of the flagship programs at Kansas State University.

To the members of my doctoral committee, including Dr. Lydia Yang, Dr. Doris Wright Carroll, and Dr. Julia Keen. Having such a diverse array of backgrounds and experiences assisting me throughout every step of the dissertation process has made this such a rewarding five-year journey. Thank you all for being so willing to share your thoughts and ideas to help hold this dissertation to the highest possible standard.

To my major professor, Dr. Christy Craft. For five incredible years, you have provided the support, guidance, and advice I needed to complete this journey in such a positive and encouraging manner. The College of Education and Kansas State University are both incredibly fortunate to count you among its ranks. Thank you for always being so willing to answer my e-mails, calls, and office visits, and for challenging me to make the most out of this experience.

To my two personal mentors, Mrs. Shana Easley and Mr. Patrick Kies. When I arrived at the University of Missouri – Kansas City, the two of you demonstrated the work ethic, drive, and passion that was needed to be successful in higher education, and provided unrelenting support

for all of my goals and aspirations. Thank you both for showing me the way, for always being there despite where life takes us, and for challenging me to be my absolute best.

Finally, to all of the students – undergraduate, graduate, and professional – I have ever worked with throughout my educational and professional tenure in higher education. The opportunity to be able to (even slightly) change the trajectory of a student's life in a positive way has set the foundation for an incredible rewarding career in the collegiate atmosphere. Thank you all for your support and for providing the inspiration behind the design of this particular study.

# Dedication

This entirety of this dissertation is dedicated to (the very soon to be Dr.) Elsie Shogren, the love of my life and the brightest star in my constellation. The greatest privilege in this life is never having to wonder what it would be like without you.

# Chapter 1 - Introduction

During his 2016 State of the Union Address, United States President Barack Obama highlighted the importance of educational reform at the federal, state, and local levels to provide equal opportunity and access to courses in mathematics and computer science (Office of the Press Secretary, January 2016). Throughout his tenure in the Oval Office, President Obama invited elementary, middle, and high school students to participate in the White House Science Fair; at the 2016 edition, the President made note of several initiatives developed as a response to his State of the Union Address, including funding and programming from public and private firms to encourage computer science and STEM (science, technology, engineering, and mathematics) education across the entire K-12 spectrum (Office of the Press Secretary, April 2016). As a part of those initiatives, the President reported that recent increases in graduates in programs including engineering were the result of legislative efforts (Office of the Press Secretary, January 2016).

The former President's call to action comes at an opportune time for the nation's educational and financial health, as growth among architecture and engineering occupations is projected to climb to seven percent between 2016 and 2026, adding over 193,000 new professional positions to the American workforce, the majority of which will fall within the engineering category (Bureau of Labor Statistics, October 2017). Among individuals considering enrollment in college as an investment in their financial future, engineering may prove an enticing academic proposition, as projections show a median annual wage of $77,900 among those holding professional positions in the field, as compared to the $37,040 median annual wage among all of the economy's occupations. Overall, the financial potential of careers in the field of engineering is encouraging for individuals weighing their postsecondary options.

Additionally, academic and professional authorities have recently identified 14 separate "grand challenges" for engineering, including those that focus on quality of life, sustainability, security, and health for the planet's global citizenry (Scientia, 2018). Providing access to clean water, securing cyberspace, and developing methods for sequestration of carbon dioxide are among the challenges that are most pressing, prevailing, and pervasive. In order for the 14 outlined and established grand challenges to be met and overcome, engineering students must become graduates, and engineering graduates must become professionals with a critical and analytical approach to solving current and future problems.

## Background to the Study

Although the urgency for an increase in opportunities to pursue engineering majors and degrees at the postsecondary educational level for a variety of populations is sincere and admirable, several challenges exist as legislative leadership looks to fulfill the anticipated and necessary growth. Persistence rates and the programs associated with student success have the potential to influence the number of engineering students successfully transitioning into the professional field after their academic tenure. Additionally, the current educational landscape provides the foundation for opportunities regarding applicable and impactful research that could assist educational and professional stakeholders in the quest to increase the diversity of individuals pursuing and eventually completing a degree in an engineering field.

### College Student Retention

One of the most significant challenges that institutional administration and staff must overcome at the postsecondary educational level centers on retention and the comprehensive combination of factors that determine whether or not a student persists until graduation. The earliest research regarding retention for undergraduate students focused on the psychological

characteristics of individuals, as well as the comprehensive environment of the postsecondary institution (Tinto, 2007). During this particular period, the interaction, community, and resources made available to students throughout the first year of their collegiate tenure were seen as essential to combating attrition. As research in the field progressed, incorporating the length and breadth of institutional settings (two- and four-year colleges and universities, residential and commuter campuses) provided further opportunities to observe a more comprehensive picture of retention at the postsecondary educational level. As researchers and collegiate administrators look to further increase retention, Tinto (2017) suggested that current efforts should not be abandoned, but should be adjusted and updated to encourage both the opportunity and motivation for undergraduate students to succeed year after year. Furthermore, administrators, faculty, and staff should make an effort to visualize the experiences of undergraduate students, which could lead to a greater understanding of how programs, initiatives, and resources are designed to achieve higher levels of persistence.

Even with the advances that have been made in student persistence from its beginning to present day, graduation rates of undergraduate students at both two- and four-year institutions remain relatively low; one study found that approximately 60 percent of individuals that began at a four-year college or university had completed a bachelor's degree within six years, and less than 30 percent of those at community colleges had completed a degree four years later (Burrus et al, 2013). Factors with the potential for influencing college student retention include the institutional environment on campus, demographic characteristics students bring with them to college, levels of student commitment to the goal of graduation and the institution in which they are enrolled, differing levels of academic preparation achieved before entering college, the push of their current major and the pull of other academic programs, confidence and self-efficacy, and

whether or not the individual student successfully integrates with the institution and finds their fit, both academically and socially.

As professional opportunities and vacancies for those with engineering degrees and backgrounds continue to grow in the United States, colleges and universities with engineering departments and majors find themselves in need of initiatives and programs focused on improving upon first-to-second year retention (Veenstra, 2009). Previous work in the field of persistence efforts for engineering majors and college student in general emphasize the importance of first-year experiences in regards to their overarching academic success (Hutchison et al, 2006; Kuh et al, 2008). Furthermore, Veenstra (2016) found that, with specific institutions that offer programs in the field, the higher the first-year retention rate among engineering majors, the higher the graduation rate within that same subset of students, providing further evidence in favor of robust programming within the first two semester of students' collegiate tenure.

While many students begin their respective undergraduate careers with the intention of pursuing and completing an engineering degree, a significant number of these individuals do not persist within their intended academic program (Litzler & Young, 2012). Among undergraduate students that enter college as first-year students, only 57 percent of those with engineering as their major of intent are still associated with that program four years later (Hall et al, 2015). While these figures are higher than the 52 percent persistence rate associated with all STEM majors across that same four-year timeframe, it is lower than the 60 percent national college completion rate (NSC Research Center, 2020; Rogers, 2013). Of those in engineering that persist across that four-year timeframe, 93 percent began in engineering as first-year students, suggesting that only in rare cases do individuals transfer into engineering after their first year.

Increased adversity is faced by those engineering undergraduate students from underrepresented populations, as these individuals have historically had limited access to engineering-related programs and resources (Bosman et al, 2017; Burress et al, 2013; Litzler & Young, 2012; Long & Mejia, 2016; Navarro et al, 2014). Historically, significant gaps have existed between the educational attainment percentages of underrepresented minority groups in engineering and other STEM-related fields and their majority counterparts (Bosman et al, 2017). In addition to encouraging and engaging these underrepresented engineering students, Long and Mejia (2016) recommended that institutional policies and practices be updated in order to foster higher levels of persistence.

## Goals for K-State 2025

When he was hired to succeed Dr. Jon Wefald in early 2009, one of the very first initiatives that then-Kansas State University President Dr. Kirk Schulz developed was the comprehensive K-State 2025 plan, which incorporated strategic goals and outcomes for nearly every office and department found within the Manhattan, Polytechnic, Olathe, and Global campuses. For the College of Engineering, the development and dissemination of the K-State 2025 plan meant the implementation of programming that would serve the state of Kansas and the entire nation with faculty, coursework, and research opportunities that would prepare future leaders and innovators in the professional field of engineering (Kansas State University, 2012). Through a combination of academic and research-related pursuits, an environment would be created on campus that would benefit society as a whole.

**Table 1-1: Undergraduate Student Demographics from Kansas State University (2019)**

| | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|
| Total Undergraduates | 20,327 | 19,859 | 19,472 | 18,488 | 17,869 |
| Full-Time | 18,258 | 17,935 | 17,699 | 16,770 | 16,230 |
| Part-Time | 2,069 | 1,924 | 1,773 | 1,718 | 1,639 |
| In-State | 15,577 | 15,314 | 15,003 | 14,316 | 13,856 |
| Out-of-State | 4,750 | 4,545 | 4,469 | 4,172 | 4,013 |
| Men | 10,607 | 10,348 | 10,179 | 9,743 | 9,451 |
| Women | 9,720 | 9,511 | 9,293 | 8,745 | 8,418 |
| Aged 19 and Under | 6,921 | 6,685 | 6,535 | 6,279 | 6,219 |
| Aged 20-24 | 11,272 | 11,196 | 11,135 | 10,543 | 10,180 |
| Aged 25-39 | 1,814 | 1,674 | 1,512 | 1,394 | 1,233 |
| Aged 40 and Over | 320 | 304 | 290 | 272 | 237 |
| Non-Resident Alien | 1,467 | 1,269 | 1,137 | 961 | 828 |
| Black | 793 | 728 | 695 | 619 | 568 |
| American Indian | 75 | 77 | 86 | 90 | 74 |
| Asian | 265 | 281 | 291 | 282 | 303 |
| Hawaiian/Pacific Islander | 26 | 23 | 25 | 17 | 19 |
| Hispanic | 1,220 | 1,311 | 1,304 | 1,299 | 1,343 |
| Multiracial | 612 | 623 | 661 | 674 | 656 |
| Unknown | 288 | 266 | 200 | 180 | 197 |
| White | 15,581 | 15,281 | 15,073 | 14,366 | 13,881 |

From an enrollment standpoint, the K-State 2025 plan for the College of Engineering meant that total enrollment among its undergraduates would need to exceed 3,750 individuals to meet the projected goals for financial and institutional stability. Additionally, the 2025 plan called for efforts to grow the underrepresented and female population to 360 and 560 students, or approximately 10 and 15 percent of the total engineering population, respectively. Furthermore, as a part of these comprehensive plans, the College of Engineering at Kansas State University expects to implement the following components to achieve the goals and aspirations set forth by the initiative: retention programs for underrepresented populations, comprehensive advising and resources, and additional support from individual departments and units.

At Kansas State University specifically, engineering student enrollment grew from 3,503 students in the Fall of 2014 to 3,666 in the Fall of 2015, edging closer to the benchmark of 3,750 engineering students enrolled at Kansas State University by the year 2023 (Division of Communications and Marketing, 2015). In order to meet the demands and expectations set forth by the K-State 2025 strategic plan, administrative leadership within the College of Engineering established a strategic enrollment management plan, combining a wide array of majors and programs of study, specific recruitment processes, and vibrant programming directed towards bolstering retention efforts (College of Engineering, 2017). Since the overarching K-State 2025 strategic plan was implemented, the engineering enrollment at Kansas State University has increased beyond the projected figures each year, successfully adjusting to the fiscal and educational climate of the state of Kansas. However, additional efforts are still needed in order to provide effective programming directed towards first-generation students as they make the transition to a challenging college major.

## Strategic Enrollment Management Plan and Huron Consulting Group Partnership

Prior to the start of the Fall 2018 semester, Kansas State University, in conjunction with the Huron Consulting Group, revisited the K-State 2025 goals in order to better serve its various constituents (Kansas State University, 2018c). In order to continue moving the institution in a forward direction, administrative and executive leadership established the Strategic Enrollment Management plan to increase measurements regarding the recruitment of prospective students and retention of current students. Within the overarching structure of the Strategic Enrollment Management Plan, seven distinct themes were developed to help guide the decision-making process: data, technology and systems, financial sustainability, marketing and communications, undergraduate recruitment, retention and student success, the Global Campus, and the Graduate

School. The fifth theme addressed, retention and student success, recognized the potential for growth in identifying and impacting certain student groups, advocated for the continued development of K-State's First Year Experience, and suggested an increase in the communication among various offices and departments across the institution in order to best serve the needs and interests of its enrollees. While the suggestions and goals of each of the seven themes are important to its comprehensive sustainability, retention and student success, for the purpose of this particular study, are both of great importance and influence.

## First-Year Program the College of Engineering

In the Spring semester of 2016, the collective faculty of the College of Engineering, in an effort to encourage the success of specific incoming student populations, passed an initiative at their bi-annual meeting to implement a selective admissions process that would include criteria meant to go above and beyond those instituted by the university as a whole. As a part of this initiative, the new process for incoming, first-time college students would require at least a 3.0 (on a 4.0 scale) high school grade point average and at least a 24 composite score on the ACT (or the SAT equivalent to that figure) to begin in a specific engineering major. Prospective applicants that met the high school grade point average threshold and had either a 21, 22, or 23 composite score on the ACT or its SAT equivalent (since a 21 ACT or its SAT equivalent was the minimum requirement for admittance) would be selectively admitted as General Engineering majors in order to provide additional resources, advisors, and programming designed to foster a successful transition from high school to college. Each student selectively admitted into General Engineering would be enrolled in the one-credit hour DEN 160 course called Engineering Orientation, which is designed as a first-year program intended to educate its enrollees on all of the various majors, academic programs, and professional opportunities available to engineering

graduates from Kansas State University. Upon successful completion of Analytical Geometry and Calculus I with at least the grade of a "C" during their first semester on campus (which is the first mathematics course recommended for 10 of the 11 engineering degrees), those selectively enrolled in the General Engineering program are then eligible to coordinate with advisors in the department of their choosing to declare one of the 11 majors found within the College to continue their pursuit of a degree in engineering from Kansas State University. Additionally, the General Engineering first-year program (and enrollment in DEN 160) is also made available to any fully-admitted engineering undergraduate student who may be unsure of their major of choice, which makes for a very diverse enrollment in DEN 160 each Fall semester.

Prior to enrollment for the incoming, first-time college student population admitted to engineering at Kansas State University, which traditionally occurs in both June and August leading up to the start of each Fall semester, the Office of Student Services within the College of Engineering engages in an extensive review process, examining the academic credentials of every individual before the admitted student meets with an advisor to select their semester coursework. Each student that has either voluntarily chosen or has been selectively admitted into General Engineering is then enrolled in DEN 160, the College of Engineering's comprehensive first-year program. The overarching purpose of the one-credit hour Engineering Orientation class is to provide an additional level of support and programming for selectively and fully admitted engineering students to navigate the often tumultuous transition to the university atmosphere. For the purpose of this particular study, reviewing the roster of DEN 160 will enable the examination of first-generation students who participated in the first-year program throughout their first semester on campus as an engineering major.

## Statement of the Problem

Considering the inherent difficulty of coursework heavily embedded with a foundation of calculus, physics, and chemistry, concern regarding the persistence and success of engineering undergraduate students has become more prevalent in the wake of an increased awareness of professional engineering position vacancies (Drew, 2011). With significant challenges ranging from clean water to cyberspace security facing national and global citizenries, more focus is being placed on the resources provided by respective institutions to aid engineering student persistence in order to produce more graduates and professionals. With the opportunity for funding provided through tuition from current students and monetary gifts provided by graduates, institutions with engineering programs must consider the financial implications of increasing retention and graduation rates among their respective undergraduate populations.

However, across the United States, fewer than five percent of all undergraduate degrees conferred at colleges and universities are in engineering, which lags behind the 13 and 23 percent figures reported in specific European and Asian countries, respectively (Thursby, 2014). In order to simultaneously meet the occupational demands that currently and will exist in the engineering profession and entice more high school graduates to pursue an engineering degree, institutions of higher education must employ a creative methodology to encourage a broader and more comprehensive educational experience without sacrificing the necessary difficulty of a curriculum based on math and science. Given the overarching dependency on engineering-related professions for innovation in areas as diverse as business and science, encouraging more individuals to pursue and complete an engineering degree can have significant ramifications for advances made in technology, natural resources, communication, and food production that are utilized on a national and global scale.

In Kansas, the primary challenge faced by executive and administrative leadership is an ever-changing population of high school graduates ready and willing to pursue a degree like engineering at a four-year institution inside of state lines. According to projections of high school graduates across the United States collected by Ruffalo Noel Levitz (2014), the state of Kansas will experience a 7.6 percent growth in graduates from 2014 to 2019, and a 12.9 percent growth from 2014 to 2024. Furthermore, Hispanic and Latino Kansas high school graduates will increase by 37.5 percent from 2014 to 2019, and 75.2 percent from 2014 to 2024, signaling a noticeable shift in the racial, ethnic, and cultural composition of those looking to pursue higher education following completion of high school. However, these projections are met with the challenge that fewer high school students within the state of Kansas are electing to enroll at a four-year institution of higher education following their high school graduation (Kansas Data Central, 2018). In the 2013-2014 academic year, 33,302 individuals graduated from high school in the state of Kansas, with 14,362 (just over 43 percent) electing to enroll at a four-year university. In the 2015-2016 academic year, 33,852 students graduated high school, and 13,815 (just under 41 percent) of those went on to enroll at a four-year institution. Despite an increase in the number of individuals graduating from high school in Kansas, the number of students then enrolling at a four-year university has been decreasing during the same time period. Table 1-2 provides an overview of these demographic projections from Ruffalo Noel Levitz (2014).

**Table 1-2: Projections of Kansas High School Graduates from Ruffalo Noel Levitz (2014)**

| | Academic Year 2013-2014 | Academic Year 2018-2019 | Change in % from AY 2013-2014 to 2018-2019 | Academic Year 2023-2024 | Change in % from AY 2013-2014 to 2023-2024 |
|---|---|---|---|---|---|
| White, Non-Hispanic | 22,400 | 23,201 | 3.6% | 22,532 | 0.6% |
| Hispanic/ Latino | 3,409 | 4,687 | 37.5% | 5,973 | 75.2% |
| Black, Non-Hispanic | 2,016 | 1,981 | -1.7% | 2,237 | 11% |
| Asian/ Pacific Islander | 897 | 1,136 | 26.6% | 1,438 | 60.3% |

Given that the number of high school graduates in the state of Kansas is increasing but the number of those electing to start at four-year institutions of higher education is decreasing, the retention efforts of collegiate leadership have become more critical to their respective mission statements, enrollment figures, and outcome benchmarks. Furthermore, a report from the University of Washington suggested that a disproportionate percentage of minority and historically-underrepresented students are also first-generation students (Office of Minority Affairs & Diversity, 2016). Considering the projected shift in the demographic makeup within the state, Kansas State University can expect a larger percentage of historically-underrepresented students to arrive on campus in the near future, many of whom will be first-generation students, as well. With such a wide array of factors influencing the retention of undergraduate students, opportunities to provide additional resources and support can bolster retention statistics through purposeful demonstrations of various programming and resources tailored specifically towards engineering persistence.

## Purpose and Rationale of the Study

The purpose of this study was to explore the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation undergraduate students in a first-year program in the College of Engineering through a qualitative design and a grounded theory methodology. A grounded theory methodology allowed for the development of an entirely new theory, drawn from the data collected through interviews with the research participants, which assisted in the exploration and examination of this unique population of individuals. Current and projected increases in the amount of first-generation enrollees at the collegiate level, increased focus on the successful transition of first-generation students through unique programming, and the projected vacancies in professional engineering fields are just a few of the factors that helped influence the design of this particular study (Fernandez & Trenor, 2008; Verdin & Godwin, 2015). Furthermore, this study was initiated with the intention of adding to the body of literature focused on understanding the overarching experiences of first-generation engineering students and their participation in a first-year program designed to assist with the transition to the collegiate level. Considering that I examined those students that had persisted as an engineering major, the individuals associated with this study would have already completed the first year of their collegiate tenure.

## Research Question

This particular research study looks to add to the existing body of literature regarding the persistence efforts of first-generation engineering undergraduate students who participated in a first-year program at the college or university level. Utilizing a qualitative, grounded theory design, the research question at the center of this study is the following: What were the factors

that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program?

## Significance of the Study

Given the importance of a robust enrollment and higher levels of student success for colleges and universities with engineering undergraduate programs, the collection of rich data associated with the factors that positively influenced the institutional and major persistence of first-generation engineering students who participated in a first-year program could have significant benefits to institutional health and sustainment. Additionally, through comprehensive conversations and initiatives, colleges and universities across the nation could further develop their own respective understanding of the persistence of first-generation engineering students who participated in a first-year program by examining the data collected through the parameters of the design.

## Limitations of the Study

Within the parameters of this particular qualitative, grounded theory research, certain limitations should properly be identified, including the following:

- The study includes engineering undergraduate students who have already met certain criteria that were determined prior to the start of the research. The students who were fully or selectively admitted into the College of Engineering at Kansas State University therefore met the high school grade point average and minimum ACT score requirements.
- Additionally, each of the research participants would have been a first-generation, first-year student of a more traditional age group for college enrollment. Therefore, any conclusions made from the results of this study may not be as easily applied to

those individuals outside of the aforementioned parameters, nor is qualitative research intended to accomplish such a goal.

- Given the inherent structure of the research design, the opportunity for response bias should be addressed. Response bias refers to either general or specific components that have the potential for affecting the way responses are given and eventually collected as a part of the overarching research design (Villar, 2011). Considering that the interview process will occur after the research participants have successfully persisted in engineering from first to second year, the possibility of misremembering or misinterpreting certain experiences could lead to the existence of response bias. In order to combat response bias, it is suggested that I engage in a purposeful vetting process to select appropriate research questions, and that the questions are placed in an order that will maximize the opportunity for accurate responses (Villar, 2011).
- The study involves a small section of individual students who exist within a larger student community of engineering majors at the collegiate level. However, given the importance of enabling the success of first-generation student populations, especially those pursing degrees in engineering, the research, while narrow in focus, can provide a unique lens in which to examine the persistence of individual students.
- Considering that the initial and follow-up interviews were the only source of data for the research design, the lack of a triangulation of data should also be addressed as a potential limitation of the study. The triangulation of data refers to the incorporation of several data sources and methods within the parameters of a qualitative research design (Carter et al, 2014). While a lack of data triangulation could pose a threat to the collection and analyzation of rich data that examines the phenomena at the core of

this study, it is my intention to utilize a comprehensive coding process and member checking as means to mitigate the challenges associated with a lack of data triangulation.

- As the sole individual conducting both interviews with the research participants and reviewing the transcribed conversations that will result as a part of the comprehensive data collection and analysis procedures, the absence of peer debriefing could be identified as a possible limitation to the scope of the research design. Within the field of qualitative research, peer debriefing refers to the purposeful engagement, on the part of the researcher, to converse and discuss the findings and development of a research design with an impartial colleague to support the overarching credibility and trustworthiness of the study (Spall, 1998). In order to address the concerns associated with the lack of peer debriefing within the confines of this research design, I intend on employing a constant comparative data analysis technique that will allow for careful consideration of the data that will be collected from the interviews with the research participants. Furthermore, it is my intention to reinforce the transferability, dependability, credibility, and confirmability within the methodology of the study, as addressing the aforementioned components can strengthen the trustworthiness of the results and findings that emerge from the collection and analyzation of data.
- Finally, researcher bias should be identified as a potential limitation. The research focuses on the factors that positively influenced the first-to-second year institutional and major persistence of first-generation engineering undergraduate students who participated in a first-year program. Since the beginning of my professional career in higher education, this is a population of individuals with whom I have spent

significant time. While this experience and enthusiasm could be seen as a potential limitation to the overarching design of the study, I intend on instituting a number of measures in which to increase the trustworthiness of the results and strengthen the methodology to curtail any impact of that bias.

## Key Definitions

*College of Engineering* refers to one of the nine different academic colleges within Kansas State University, which at the time of this report enrolls 3,732 undergraduate students across its majors and programs and makes it the second-largest academic college behind the College of Arts and Sciences (Kansas State University, 2018a).

*First-generation* refers to students at Kansas State University who will become the first members of their family to graduate from a four-year college or university upon successful completion of the academic requirements of their major (Kansas State University, 2018b).

*Persistence* refers to the effort of the individual student to remain within their academic studies until they have completed all of the necessary requirements to be awarded their degree; this is different from retention, which is recognized by The National Center for Education Statistics as an institutional measure, while persistence is individual (Hagedorn, 2005).

*Retention* refers to the fulfillment of specific goals and aspirations related to the postsecondary educational aspirations of students, which requires the observation and monitoring of institutions to measure whether or not the student has indeed enrolled and whether or not the educational goals and aspirations of their students have changed throughout the course of the students' respective tenure at the college or university level (Seidman, 2005).

*Selectively admitted* refers to students that applied to and were matriculated to the College of Engineering at Kansas State University and met the high school grade point average

threshold and had either a 21, 22, or 23 composite score on the ACT (or SAT equivalent) in order to provide additional resources, advisors, and programming.

## Implications for the College of Engineering

Considering the aforementioned K-State 2025 and Strategic Enrollment Management Plan benchmarks that were set in place regarding enrollment, persistence, and the population of undergraduate students, the examination of the factors that positively influenced the first-to-second year institutional and major persistence of first-generation students who participated in a first-year program could have significant implications for the College of Engineering at Kansas State University. Sustainable growth in enrollment equates to increases in revenue collected from tuition, fees, and other costs associated with the pursuit of an undergraduate degree, as well as the projected increase in financial gifts from institutional graduates and professionals. A comprehensive understanding of the experiences of first-year, first-generation engineering students could provide a greater comprehension of the factors that positively influenced their persistence efforts.

## Summary

Local, state, and federal leadership throughout the United States has, in recent years, increased the amount of focus and attention on the professional vacancies inherent to the field of engineering. Additionally, these constituents have amplified the educational opportunities that exist to enable greater numbers of individual student persistence in a traditionally challenging academic major at the postsecondary educational level. In the College of Engineering at Kansas State University, initiatives are made available with the intention of supporting individuals with additional resources and programming to assist with the transition from high school to the university atmosphere for first-time, first-year engineering students. With the combination of the

fiscal climate in the state of Kansas and the benchmarks set in place by the K-State 2025 and Strategic Enrollment Management Plan initiatives, certain programs and resources serve as a proactive approach to meeting goals related to the enrollment, persistence, and graduation of engineering undergraduate students at Kansas State University. Given the traditionally difficult task of pursuing an engineering undergraduate degree and the current vacancies in industry, greater pressure regarding engineering student success has been placed on postsecondary educational leadership. Considering the existing body of research on the retention of college and university students at institutions of higher education, the examination of the factors that positively influenced the first-to-second year institutional and major persistence of these first-generation engineering students has the potential to add a volume of rich data from among those who have found a way to be successful. Through this study, I intend on addressing the potentially wide array of experiences, programs, resources, and conversations that led to successfully enduring the academic and social integration necessary for persisting at the collegiate level.

# Chapter 2 - Review of Literature

Upon examining the literature on the retention of undergraduate students and the efforts of institutions through various programs and initiatives, several areas of research and development arise as significant, including factors related to persistence, influences of departure, peer and institutional climate, and challenges related specifically to engineering undergraduates. To develop a greater understanding of the factors that positively influence the first-to-second year institutional and major persistence of first-generation engineering undergraduate students who participated in a first-year program, the aforementioned areas of focus and research will be further examined.

## Undergraduate Student Retention

Administrative and executive leadership at postsecondary educational institutions across the United States, in addition to legislators and lawmakers at the state and federal level, have given precedence to various efforts directed towards the comprehensive subject of college student retention since colleges and universities first came into existence (Braxton et al, 2013). Considering that approximately 25 percent of first-year, first-time college students do not persist into their second year, institutional representatives across every level will continue to be impacted by the threat of college student attrition well into the future. Early efforts to increase retention at the collegiate level focused on developing theory into practice, turning information collected at institutions of every variety into sustainable measures that increase the likelihood of both persistence and graduation among the enrolled population. In order to effectively and efficiently combat college student attrition at colleges and universities across the nation, arguments have been made for a greater understanding of the factors that affect student

persistence, a comprehensive body of literature comprised of empirical evidence, and the development of theoretical frameworks that can consistently increase college student retention.

## Foundational Research on Student Retention

In the field of postsecondary education, William Spady (1971) can be credited for his work developing one of the very first theoretical models for examining college student retention, known as the Undergraduate Dropout Process Model. Within the parameters of the Undergraduate Dropout Process Model, Spady, with his background in sociology, brought together the concepts of undergraduate attrition and social integration on the part of the student to the overarching body of literature on the subject. By further examining the process by which college students drop out and abandon their studies, Spady began a more in-depth exploration of attrition by focusing on the dynamic between the individual student and the environment on the college or university campus in which they were enrolled. Spady then argued that the length and breadth of the inherent interaction between student and environment affected the amount of academic and social integration the student incurred, thus leading to whether or not they would persist at their respective college or university. The Undergraduate Dropout Process Model demonstrated that an individual student's likelihood of persistence was contingent on the success, support, and integration into both the academic and social arenas present at the collegiate level.

After Spady's model, the work of Vincent Tinto (1975) established a different theoretical model explaining why college students drop out of the collegiate experience prior to graduation, based on specific characteristics and factors possessed by individuals that were related to persistence at the postsecondary educational level. The early model developed by Tinto concluded that the most significant factor related to the persistence of individual students is their

immersion into the academic and social systems established at a particular college or university. Additionally, the presence of external factors affecting attrition were identified, including the prospects of the job market, the family obligations students may or may not have to manage in addition to their studies, and the financial considerations of continuing one's education in the short- and long-term. Furthermore, among the individual characteristics of students that have been shown to relate to persistence, those associated with their family, academic ability, prior educational experiences, and commitment to certain educational attainments are those that were considered the most important. Institutions also acquire and are associated with certain characteristics that relate to student persistence and retention, including but certainly not limited to its programming, resources, facilities, and faculty community. For example, Tinto identified that public institutions of higher education tend to have higher attrition rates than those of their private counterparts. Arguments have been made that administrative and executive leadership should distinguish differences between voluntary withdrawal and academic dismissal as it relates to student persistence, as the former and the latter involve different individuals, behaviors, factors, and patterns of relationships established and developed at the postsecondary educational level. Although his early work is not without critique, Tinto offered a set of comprehensive suggestions for future research in the field of college student attrition, including the examination of race and ethnicity as it relates to dropout rates, the differences between institutions of higher education in various settings, and the existence and influence of groups comprised of both students and faculty.

As this early model gained traction, additional contributors in the field of retention at the postsecondary educational level, through the examination of related studies, found Tinto's framework to be pragmatic in relation to the factors associated with college student attrition

(Terenzini & Pascarella, 1980). Specifically, early studies provided support for the influence of both the psychological and sociological factors associated with adjusting to the environment and atmosphere of postsecondary educational pursuits. Terenzini and Pascarella concluded that the importance of the traits and characteristics that students bring with them to their collegiate experience should not be undervalued, but should also be taken in consideration with the extent of programming, policies, and resources made available at the students' respective institutions. Additionally, the early studies demonstrated the importance of interactions with professors and faculty members at the college level, as first-to-second year retention rates were shown to have a positive relationship with the frequency at which students participated in these informal conversations and meetings with those overseeing their respective classrooms and learning spaces. In terms of programming that colleges and universities strive to develop with the goal of increasing retention among their student population, these early studies highlight the importance of efforts that are fluid and flexible, as a methodology that may provide positive results for one student at that institution may not necessarily enable the persistence of another.

As a critic of both Spady and Tinto's earlier work in the field, John Bean (1980) entered the historical record of theoretical frameworks related to college student persistence through the development of the Student Attrition Model, which incorporated processes similar to other frameworks that focused on employee turnover at the professional level. By focusing on components ranging from grade point average to educational value, Bean discovered the importance of institutional commitment and an overarching satisfaction with the institution as factors related to individual student persistence. Further work conducted by Bean (1982) included a holistic review of Spady and Tinto's earlier student attrition models with the intention of developing a theoretical model and framework with a flexibility that would allow it to be

applied to various institutions, populations, and settings. Overall, this second model was developed with the intention of identifying factors related to what Bean believed to be the primary gauge of student dropout: whether or not the students had significant intentions to leave the institution. Given the overarching focus on the students' backgrounds, their interaction with the organization, their own unique outcomes and attitudes, as well as their individual intentions, one of the most important characteristics of the second phase of Bean's Student Attrition Model is its ability to be applied to a wide array of institutions, populations, and environments.

Through a comprehensive blending of the theoretical models developed by both Bean and Tinto, Cabrera et al (1993) added the Integrated Model of Student Retention as their contribution to the existing body of literature on the subject. Factors including grade point average, academic integration, financial attitude, institutional commitment, and social integration from earlier models were among those that, through the results of the study conducted by Cabrera et al, were confirmed as influential to college student retention. Further examination of the results of the study conducted by Cabrera et al provided for a strong foundational argument that a combination of the two aforementioned college student retention models allowed for a more thorough and in-depth comprehension of the phenomena surrounding college student retention. Additionally, the blended model developed and incorporated by Cabrera et al provided strong evidence in support of the influence of the overarching campus environment. Administrators and executive leadership developing future studies regarding college student retention, Cabrera et al argued, should look to provide support for the respective academic endeavors of their students and identify the pre-college factors related to institutional commitment in order to best serve those enrolled at the postsecondary educational level.

Further work undertaken by one of college student retention's pioneering authors established the argument that, as leadership at the postsecondary educational level looks to supplement their respective retention efforts, institutions must recognize a certain obligation not only to the health and well-being of their entire student body, but also to the individual students that comprise the overall collegiate population (Tinto, 1993). In order to establish an atmosphere of commitment directed towards individual student success, Tinto asserted that institutions of higher education need to make the establishment of a caring atmosphere a priority on campus and one in which the institution clearly stands identifies the placement of student success and welfare as its primary aspiration. Furthermore, the contracts that are established, signed, and maintained by both institution and individual student, whether social or educational in nature, should be clear and transparent prior to the students' arrival on campus. Again, Tinto reiterated the importance of the time and effort that both faculty and staff at the collegiate level dedicate towards their students in formal classroom settings and informal on-campus events and activities.

In his continued work on the subject, Tinto (1993) established and conceptualized what he referred to as the paradox of institutional commitment, in which he argued that colleges and universities that adopt policies and programs that acknowledge a willingness for students to depart will also have a higher volume of students that persist. In addition to identifying the aforementioned paradox, he also calls for administrative and executive leadership at the collegiate level to recognize the limitations of institutional action, and that there is only so much that a college or university can do in the way of programming and policy; in the end, not every individual that arrives on the first day of the new semester will possess the skills and attributes necessary to persist until graduation in their respective major or academic program. With opportunities to get involved in a variety of organizations and activities that allow for the

personal and educational development of its students, institutions must also recognize that the immersion and integration of students is directly related to and impacted by its own efforts regarding the education of the enrolled population. In order for institutions to establish a sense of commitment to its educational goals and aspirations among its student population, Tinto stated that those same institutions must first display a commitment to the students and the values they wish to disseminate. Rather paradoxically, he also advises that collegiate staff and administration should strengthen bonds with students that have failed to earn their degree or meet their educational goals rather than sever ties completely, providing opportunities for continuing and non-traditional pathways to educational aspirations. Every component associated with a particular college or university – faculty, staff, and community partners – should play a role in the health and welfare of their institution, which could then lead to a greater commitment from individual members of the student population.

Additional research and development in the field of college student attrition taken on by Tinto (1997) focused on studies related to classrooms and learning spaces as communities and argued that the networks students develop in their scholarly pursuits are essential to their attendance, participation, and success at the postsecondary educational level. The studies that served as the foundation for this community-based research suggest the importance of students being exposed to and influenced by a wide array of perspectives and viewpoints from multiple faculty members and professors. In more difficult educational environments, characterized by selective institutions, challenging majors, and rigorous coursework, the relationships students establish are more likely to be an integral part of their success at the collegiate level. Given the importance of and attention directed towards efforts related to the first-year persistence of college students, the studies examined under the lens of community development found that

students tended to place more emphasis on their social integration into the institution rather than on their academic involvement. Instead of seeing them as two different spheres, social and academic systems should be seen as aggregated components that affect the creation and development of communities in which students engage throughout their academic tenure.

Further testing and critiques of the early models of college student attrition led to the establishment of several propositions deemed to be interconnected with one another in a logical format, which upon further examination suggested that social integration, and not academic integration, was essential to better understand student attrition (Braxton et al, 2000). By examining its influence on the process of college student retention and attrition, arguments were made that classroom activities incorporating active learning could provide additional support for students looking to establish a peer network that would then lead to a greater community at the collegiate level. Through a comprehensive longitudinal design involving over 700 incoming first-year college students to a highly-selective private institution, the authors of one study in particular focused on factors related to institutional commitment and persistence, finding evidence that both classroom discussions and social integration led to an increase in institutional commitment. Additionally, the data collected suggest that the presence of classroom discussions in the style of active learning leads to an increase in institutional persistence, as well as faculty involvement and how their participation in active learning concepts could be influential on the commitment and decision-making process of college students.

Continued work in the field of influential theoretical frameworks related to college student persistence led to the creation of The Model of Influences on Student Learning and Persistence, developed by Reason (2009) through a comprehensive review of the work of Terenzini and Reason (2005). The Model of Influences on Student Learning and Persistence

provided an effective and appropriate method in which to further examine the persistence efforts of individual college students. By building upon previous research related to undergraduates, Reason (2009) developed this model as an effort to incorporate all of the various components that impact and affect the persistence of individual college students. The first section of the model addresses the various experiences and characteristics that individual students establish prior to the start of their academic career at the collegiate level, including their academic preparation and performance, specific dispositions, and sociodemographic factors. Additionally, the model highlights the organizational structure of the college or university where the students attend, which could relate to on-campus resources, academic programming, and opportunities for connections with faculty. Furthermore, this particular model addresses the environment on campus awaiting the individual students, including their interactions with their peers and the encounters in and out of the classroom that compose the comprehensive college experience. Each of the four components – pre-college characteristics and factors, the institutional organizational context, peer environment, and individual student experiences – are then shown to individually and collectively influence the persistence of students.

## Primary Factors Influencing Persistence

When examining the primary factors that influence college student persistence, several key themes emerge from the literature: institutional culture and commitment, student engagement and integration, academic preparation prior to the start of college, psychosocial characteristics, and educational and career expectations students acquire before and during their respective collegiate tenure. The very culture of a college or university is comprised of a variety of factors that are established and reestablished through certain interactions that happen among institutional partners and constituents (Habley et al, 2012). Within a collegiate environment,

culture can be examined across several distinct levels, including artifacts, beliefs and values, and assumptions that become the core of institutional policy and practice. Examples of artifacts include campus traditions, physical buildings and classroom spaces, as well as the organizational structure of faculty, staff, and departments. Beliefs and values can incorporate components ranging from institutional programs and policies, while assumptions include admission practices and teaching strategies, which have become embedded within the institution and may be difficult to change or update. Furthermore, elements ranging from the institutional mission and socialization processes to the dissemination of information and professional leadership employed by the college or university can come to define and shape the institutional culture.

In addition to the overarching culture that exists on campus, commitment on the part of both the student and the institution plays a significant role in persistence and academic success (Braxton et al, 2013). When an individual student perceives a higher level of commitment on the part of the academic institution, that student's likelihood of persistence and academic success then moves in a positive direction. Similarly, higher levels of perception on the part of student regarding an institution's commitment to the welfare of its enrollees then leads to increases in the likelihood that that student will persist, suggesting a relationship between institutional commitment on the part of the student and student commitment on the part of the institution.

Among institutions examined that produced higher levels of student graduation and measures of effective educational practices than had been previously anticipated, several common themes emerged regarding factors related to student engagement: professional leadership, effective coalitions between the employees on both sides of the academic and student affairs spectrum, and the development of an institutional atmosphere that focused first on conditions that encouraged the success of their respective student populations (Habley et al,

2012). Furthermore, the colleges and universities examined also displayed a significant ethos, which was believed to have strengthened the connections between institution and student, developed under a foundation of traditions, policies, and practices that aligned with an institutional mission of serving student constituencies. Additional common themes of a campus culture that encouraged student engagement include knowing information about the students beyond strictly demographic characteristics; establishing programs that enable the students to engage with one another; developing relationships between academic and student affairs personnel; and understanding that each individual employed by the college or university has a part to play in encouraging and fostering student success. Continuous assessment of practices, programs, and policies on the part of administrative and executive leadership is also an essential function of establishing an environment on campus that strengthens opportunities for engagement across the entire student population. By adhering to the ever-changing needs of students and providing avenues for enrollees to voice their thoughts and opinions to institutional employees, collegiate leadership can work to meet and exceed the expectations of their student constituencies, further fostering a culture that permeates across campus.

Social integration to the institution in which the individual student is enrolled also plays a significant factor in the likelihood of persistence and academic success, and includes components ranging from institutional commitment, various psychosocial characteristics, and institutional integrity (Braxton et al, 2013). In terms of collegiate assimilation, a positive relationship exists between the level in which an individual student believes that the institution is invested and committed to student welfare and the likelihood of that student's social integration. Additionally, the likelihood that a student will experience a greater level of social integration is also related to their perception of the institution's integrity and commitment to its educational mission and

purpose. Engagement with the psychosocial characteristics of students, on the part of the institution, was found to be similar to the two aforementioned factors, leading to increases in the likelihood of social integration. Furthermore, students who lived on campus during the first year of their collegiate tenure experienced greater levels of academic integration.

When examining factors that positively influence the institutional and major persistence of students at the postsecondary educational level and the extent of academic preparation that occurs before the start of their respective collegiate tenure, higher grade point averages in high school, higher levels of Advanced Placement and dual-credit coursework, and higher rankings among members of a graduating class persist at rates that are greater than those individuals who had lower levels of accomplishment in the aforementioned factors (Habley et al, 2012). Considering that individuals who enter college with lower levels of academic preparedness are far less likely to succeed than those with higher levels of preparation and achievement prior to the start, administrative and executive leadership at the collegiate level share a responsibility to ensure that their future enrollees are given the opportunity to properly prepare to succeed at their respective institution. Among several institutional recommendations highlighted, the first focuses on bringing attention to the disconnect between the content and format in which students are taught at the high school level and what they experience in the postsecondary educational environment. The second recommendation centers on the development of proper preparation for teachers and instructors to oversee their classrooms and manage the disparity that exists between the learning standards of high school and the expectations faculty members hold students accountable for upon their arrival to the collegiate environment. The practice of course placement, which serves as the third recommendation for collegiate administrators, requires a significant amount of maintenance in order to provide the proper academic assistance to students

who met some but not all of the educational benchmarks prior to the beginning of their college tenure, as the right intervention can set students up for success in coursework that is familiar as opposed to failure in that which is unfamiliar.

While administration at the collegiate level may have similar goals related to the persistence and academic success of their respective institution's student population, it is essential to understand that each individual student brings with them a bevy of traits, characteristics, behaviors, and attitudes that comprise a comprehensive set of psychosocial factors (Habley et al, 2012). The range of psychosocial factors that college students acquire before the start of and develop over the course of their collegiate tenure include: self-efficacy, achievement motivation, commitment to both the degree and institution, social support and engagement, and the size and selectivity of the institution in which the student is enrolled. When controlling for more traditional performance and demographic factors, motivation, study skills, determination, and a commitment to college were all found to have been significant predictors of college grade point average. Furthermore, academic discipline and a commitment to college were found to be among the strongest predictors of retention, which can help highlight the differences between the more traditional measurements of standardized test scores and the influence of motivational factors students possess upon their entry into the collegiate atmosphere. In order for administrative and executive leadership at the postsecondary educational level to engage with their respective student population through efforts to increase retention and academic success, the vast array of psychosocial characteristics that their enrollees acquire before and develop throughout their time as students must be given proper attention.

As previously mentioned, the engagement of psychosocial characteristics by the institution can lead to greater levels of integration and commitment to the college or university

on the part of the student, which can then lead to higher levels of persistence and academic success (Braxton et al, 2013). Possible positive sources of influence on psychosocial engagement include the potential for the development of a community on campus and the opportunity for acquiring cultural capital. When a student believes to have found a college or university that adheres to their respective values, aspirations, and beliefs, they will be more likely to engage in a variety of organizations and activities, thus increasing the chances of persistence and success.

The educational expectations of individual students can also potentially influence undergraduate student persistence and academic success (Braxton et al, 2013). During the process in which individual students engage in their respective college search process, images begin to form in their mind regarding the institutions in which they intend on applying, which in turn determines the educational expectations they hold for those various colleges and universities. Current students, staff, and administration at these institutions shoulder a significant responsibility for the images and expectations that students develop in the search process. The ways in which information about their campuses is disseminated and distributed can alter how prospective students absorb and consume examples of what all encompasses student life at that particular institution. When expectations are met and exceeded, individual students' perceptions of institutional integrity could increase, leading to greater levels of psychosocial integration, which can then impact persistence and academic success. Collegiate administration should make the fulfillment of expectations a high priority through the development of responsible and sustainable enrollment management practice and policies.

While various factors related to educational expectations may motivate why students choose a particular college or university to continue their education, expectations related to career and professional opportunities post-graduation also influence the persistence of

individuals at the undergraduate level (Habley et al, 2012). Collegiate staff and administration at every level should strongly consider and evaluate the programs and policies in place that encourage an effective and comprehensive career decision-making process on the part of the student, as it can have significant influence over their expectations for successfully transitioning to college from high school, and from college into the professional field of their choosing. Student affairs-related departments and offices should ensure they have a strong program in career preparation and planning in which to foster conversations that encourage commitment on the part of the students enrolled at their respective college or university. Just as students should develop a sense of fit and belonging at the institutional level, so too should they be provided opportunities to align their values, beliefs, skills, and attributes to their respective professional field, which can encourage their persistence and academic success. From a strategic enrollment management standpoint, the presence of alumni that have found fulfilment and success at the professional level could mean additional financial stability in the form of gifts and donations, which could then be utilized to fund programming directed towards college student retention.

Upon an examination of the factors related to the persistence of college students enrolled in STEM-related majors, findings from one author in particular led to the conclusion that both academic and social integration were essential to the persistence and academic success of this particular population (Xu, 2018). Furthermore, a comprehensive institutional environment, which includes factors such as the accessibility of faculty members and the quality of majors and academic programs available, was found to have been a strong indicator of persistence and academic success. In order for institutions of higher education to foster and encourage persistence and success among the student population enrolled in STEM-related majors, quality

professors and faculty should be employed which could strengthen the academic environment and the variety of resources designed to increase the likelihood of persistence and graduation.

## Engineering-Specific Factors

While a comprehensive understanding of factors that lead to the persistence of college students in majors and programs across the entire academic spectrum can be regarded as integral knowledge for strategic enrollment managers and institutional leadership, it is essential, for the purpose of this particular study, to explore the empirical evidence that relates specifically to the factors that positively influence first-to-second year retention and academic success in engineering. Several of the primary themes regarding engineering-specific factors of persistence include: higher levels of confidence and self-efficacy in engineering-related skills and attributes (Atman et al, 2010; Eris et al, 2010; Matusovich et al, 2010; Navarro et al, 2014; Veenstra et al, 2009; Wang, 2013), commitment to both graduation and to the institution (Litzler & Young, 2012; Navarro et al, 2014), academic satisfaction, a feeling of finding one's fit at the institution, and the development of community among peers (Atman et al, 2010; Litzler & Young, 2012; Navarro et al, 2014), pre-college factors related to high school grade point average and standardized test scores (Hall et al, 2015; Honken & Ralston, 2013; Veenstra et al, 2009), engaging in discussions with professors and faculty members (Honken & Ralston, 2013; Litzler & Young, 2012; Navarro et al, 2014), higher levels of academic preparation prior to the start of their collegiate tenure (Hall et al, 2015; Honken & Ralston, 2013; Veenstra et al, 2009; Wang, 2013), the availability of resources and programming offered outside of the classroom (Honken & Ralston, 2013; Navarro et al, 2014), increased willingness to participate in peer group settings (Honken & Ralston, 2013), and increased levels of qualities and attributes associated with a sense of conscientiousness (Hall et al, 2015).

## Influences on Engineering Persistence and Departure

First-year engineering students at the University of Michigan were a part of a comprehensive study that eventually led the researchers to conclude that standardized test scores, specifically the math section scores on the ACT and SAT, were significant predictors of academic success in the form of first-year college GPA, which serves as a predictor of first-to-second year engineering persistence (Veenstra et al, 2009). Additionally, increased levels of confidence and self-efficacy were also found to be significant predictors of engineering persistence. Furthermore, study habits developed prior to the students' arrival on campus were discovered to have been a significant predictor of engineering persistence. The researchers of this particular study strongly recommend, from the results of their analyses, that models for predicting engineering persistence should be developed in ways that are significantly different from those established by the early pioneers of college student dropout.

Among the first-year engineering students at the epicenter of one study in particular, the researchers noticed that students who left the university within their first year on campus, when compared to those that persisted within engineering, had significantly lower high school grade point averages and ACT composite scores (Honken & Ralston, 2013). Recommendations on the part of the researchers, directed towards K-12 educators, suggest that students with interest areas in engineering should be encouraged to take higher-level math and science courses and to develop study groups with their peers. Additionally, strong self-efficacy in mathematics and a willingness to work in a group setting were both found to be significant predictors of first-year engineering persistence. For faculty and staff at the collegiate level, the researchers of this study recommend that opportunities be provided for students to communicate with professors and for information regarding resources to be disseminated among the students, as the opportunity to

engage in peer tutoring and faculty collaboration could strengthen self-efficacy in mathematical and scientific ability, which could predict higher persistence.

Regarding engineering student persistence and pre-college measures, Hall et al (2015) argued, based upon the results of their study, that high school rank and standardized scores (ACT/SAT) are significant predictors of college grade point average. These results are significant, as college GPA was found to have been a significant predictor of persistence and retention among engineering majors. Furthermore, the study included evidence suggesting that, consistent with previous research, strength regarding academic preparation in courses like mathematics, as well as high school grade point average and standardized test scores, were predictors and factors of persistence in engineering. Among various personality traits involved within the parameters of the study, the presence of conscientiousness was found to have significantly predicted engineering persistence; conscientiousness implies actions and efforts from a sense of organization, responsibility, determination, planning, and aspiration. Efforts to bolster a sense of conscientiousness, on the part of institutional faculty and staff, could provide significant dividends in the pursuit of higher engineering retention, especially if messages can be relayed as early as before or during the first year of college.

A longitudinal study involving engineering undergraduate students conducted by Navarro et al (2014) suggested that self-efficacy was a significant predictor of academic satisfaction, which could help influence persistence in an engineering major. The findings also seem to suggest that the presence of support systems like peer mentoring and tutoring could reinforce the students' individual educational expectations, which could then have the potential to predict persistence. The researchers, based upon the results of the longitudinal study, suggest that introductory coursework and professional mentors be offered at the high school level, especially

for those who struggle or suffer from lower levels of self-efficacy in the skills directly related to success in engineering as a way to increase individual student persistence. Support and encouragement from faculty and staff at the collegiate level could bolster individual students' outcome expectations for graduation, which could lead to positively predicting persistence.

In a comprehensive, longitudinal undertaking examining a cohort of 160 students surveyed multiple times across four years with the intention of recognizing and identifying factors that could impact engineering attrition, those who did not persist in engineering were found to be less confident in their skills related directly to success in engineering, including math and science, when compared to the confidence levels of those that did persist (Eris et al, 2010). Commitment to the goal of graduation is also evident among the participants of this particular study, as those students who did not persist in engineering were shown to have less confidence in their ability to complete their degree and eventually graduate than those who did remain within their engineering major. Similar to other studies in engineering undergraduate persistence, results suggested that efforts should focus on conversations and experiences that will encourage and foster an informed decision on the part of the student.

Through the utilization of surveys administered to over 10,000 engineering undergraduate students across 21 different institutions that participated in the Project to Assess Climate in Engineering (PACE) program, Litzler and Young (2012) compiled data that not only confirmed previous research regarding engineering student attrition, but provided insight into the persistence efforts that engineering students endure throughout the first year of their respective programs. One of the most surprising findings the authors discovered, through the completion of surveys, was that just over 40 percent of those studied expressed a desire to graduate in engineering, but were not entirely sure that their engineering major was the right fit for them

during their collegiate tenure. Among the students surveyed that were at the lowest risk for dropping out of engineering, several trends emerged from the data collected, including such factors as a genuine, positive contribution to society through their scholarly pursuits, a feeling of belonging and community among their fellow students, engaging discussions with faculty members, and a higher level of confidence in their academic abilities related to engineering-specific courses in math and science. Through the utilization of specifically-targeted learning outcomes that cover the various practical applications of engineering in the professional field, the authors of this study believed that engineering students who are more reluctant about their major and thus at a great risk of attrition could be better served by becoming more aware of the opportunities at their disposal. Additionally, the study noted that faculty members play an important role in establishing a classroom and community on campus that is inclusive of a wider array of learning styles among engineering students.

In order to create a more diverse population of engineering students at the undergraduate level and professionals in the industry, Atman et al (2010) argued that further research should be conducted on the individual college experiences of these students, with increased focus on that which occurs during the first year of their academic tenure. Influences ranging from their respective levels of self-confidence, the motivational factors behind why they chose engineering, and how they feel they fit within the overarching institutional environment are believed to be important areas regarding engineering undergraduate students. On the other end of the spectrum, among those that did not persist in engineering, further analysis discovered a disproportionate number of individuals from certain underrepresented populations, including women, racial and ethnic minorities, and first-generation college students. Further research in the field of first-year student persistence efforts and how best to prepare individuals for the rigor of pursuing

engineering could not only positively impact retention and enrollment figures for various institutions, but also improve upon the population of underrepresented individuals out in the professional field.

Gender could also be considered an additional factor regarding the persistence of engineering undergraduate students, as female students tend to have higher attrition rates in engineering and STEM-related fields when compared to their male counterparts (Griffith, 2010). One of the earliest and most influential studies related to attrition in STEM-related fields concluded that, among a population of students with similar standardized test scores from a variety of institutions, women were more likely to depart from STEM-related majors and programs than the male students within that population (Seymour & Hewitt, 1997). Further research into the subject by Chen (2013) concluded that women were more likely to change their major out of a STEM-related field when compared to their male counterparts. Additionally, one study that presented employment applications that were identical in every way save for the gender of the applicant for academic positions within a STEM-related department found that the applicants labeled as male had higher scores, were offered higher financial packages, and provided with more opportunities for developing connections with faculty and peers (Moss-Racusin et al, 2012). Possible explanations for higher attritions rates among women in engineering and STEM-related fields could be associated with factors ranging from unconscious bias from faculty and peers (Hill et al, 2010; Moss-Racusin et al, 2012) to chilly environments where women may have felt unwelcome in a particular major or program (Blickenstaff, 2005; Seymour & Hewitt, 1997). In the pursuit of higher rates of persistence among undergraduate students, collegiate administration should be cognizant of the differences that may exist between the experiences of male and female students in engineering and other STEM-related fields.

However, not all studies that sought to explore the differences in male and female persistence in engineering and other STEM-related fields have found discrepancies, and instead encourage a focus on homogenous outcomes (King, 2016). When men and women have similar persistence rates in engineering and other STEM-related fields, King (2016) argued that this could enhance the recruitment and outreach efforts of collegiate administration, as it demonstrates the existence of equal treatment and opportunity for success despite one's self-identified gender. Such results could assist in efforts to adjust the behaviors and beliefs of faculty, professors, and advisors at the collegiate level, who may be initiating an unconscious bias when targeting male students for encouragement under the false pretense that male students, when compared to those that identify as female, are more likely to persist in engineering and other STEM-related fields (King, 2016).

## First-Generation Engineering and Other STEM-Related Students

Without a family member that graduated from a four-year institution of higher education, first-generation college students face a unique set of challenges unlike any other enrolled population (Stebleton et al, 2014). Given that they are not as likely to persist and graduate as those that have parents with degrees from four-year institutions, the positive influences on the persistence efforts of first-generation students should be examined in greater detail to provide the resources and programming necessary to encourage and foster their success through specifically tailored academic and social integration (Engle & Tinto, 2008). When including students enrolled at all types of postsecondary educational institutions, the first year of an undergraduate education was found to have been incredibly crucial to the success of first-generation students, as more than one in every four drop out after the first year, compared to seven percent of those who are neither low-income nor first-generation. Clearly, considering how essential the first year of

college is to the success and persistence of first-generation college students, further research is necessary in order to establish strong academic foundations for this particular population.

Within the parameters of higher education, one of the most significant developments has focused on efforts primarily directed towards the success of engineering undergraduates that are first-generation students (Trenor et al, 2008). Given the potential absence of mentors in the field, the educational development of first-generation engineering students could benefit from an increased awareness of the social capital associated with a career in the engineering profession. When they occur prior to the start of their undergraduate degree, first-generation engineering students could potentially benefit from interaction with role models, mentors, and current members of the engineering profession, as well as the opportunity to explore institutional campuses to immerse themselves in the collegiate atmosphere and environment. Although traditional theoretical frameworks highlight the importance of social interaction with fellow students, involvement in clubs and organizations, and participation in an on-campus living community, future research should recognize that off-campus living situations and part-time employment can potentially inhibit first-generation engineering students from fully engaging in opportunities for social integration with peers and classmates. Instead, institutional administration and faculty should strive to create an environment on campus that encourages opportunities for social and academic integration that are cognizant of the persistence efforts of first-generation engineering students, which could mean alternative programming, purposeful scheduling, and services that cater directly to the needs of this particular population. When colleges and universities employ purposeful strategies to address the challenges first-generation engineering students must incur during their undergraduate tenure, substantial steps are being taken to promote the experience and persistence efforts of this unique set of individuals.

In a qualitative study conducted by Fernandez et al (2008) that sought to understand the persistence efforts of first-generation engineering students and the primary challenges this unique population faces at the postsecondary educational level, the authors of this particular design discuss six major themes relates to those challenges, which include the following: a lack of understanding regarding admission processes and criteria, financial difficulties, an absence of mentors and role models in engineering, the balancing of work, school, and family, the inherent difficulty of engineering-related classwork, and family members who do not fully comprehend the taxing nature of pursuing an engineering degree. Among the six aforementioned barriers, three of them – lack of understanding regarding the admission processes and criteria, financial difficulties, and the inherent difficulty of engineering-related classwork – were described as institutional barriers, while the other three – an absence of mentors and role models in engineering, the balancing of work, school, and family, and family members who do not fully comprehend the difficult nature of pursuing an engineering degree – were labeled as personal barriers. Overall, the findings of this particular study demonstrate that first-generation engineering undergraduate students contend with a variety of significant barriers of both an institutional and personal nature. Given the significantly higher volume of coursework that frequently requires semester course loads of 18 or more credit hours, first-generation engineering students that were charged with paying their own way through their education found it difficult but necessary in order to avoid the cost of a fifth year as an undergraduate student. Furthermore, the lack of role models and mentors in the field of engineering means fewer opportunities to learn about professional and educational options, which also happen to occur late in the postsecondary educational search and preparation process. Based upon the existing literature, suggestions regarding potential interventions to increase the likelihood of academic success and

persistence for this unique group of individuals include earlier opportunities to develop mentor-mentee relationships, increased outreach and recruitment on the part of collegiate administration to help explain and address their respective admissions processes, and developing programming to help educate parents and family members on the rigors their students face when majoring in engineering (Fernandez et al, 2008; Verdin & Godwin, 2015).

## First-Year Programming for Engineering and Other STEM-Related Students

In the academic field of engineering and other STEM-related majors at the collegiate level, a variety of programs, resources, and initiatives exist to offer additional support for first-year students that could greatly benefit from such an investment in their academic, personal, and professional future. For example, within the College of Engineering at the New Jersey Institute of Technology, incoming, first-year students have the opportunity to start off as an undecided engineering student (Borgaonkar et al, 2015). One of those additional resources is a first-year seminar course called Fundamentals of Engineering Design 101, which enables students to be introduced to the length and breadth of engineering options available to NJIT's enrollees. As a two-credit hour course that addresses preliminary concepts of engineering and provides an overview of what it takes to be successful in engineering both academically and professionally, FED101 is a relatively low-cost and high-reward program for both students and administrators within the College of Engineering at NJIT. Through interaction with peers in group projects and presentations from faculty on career and research opportunities, enrollees in FED101 are placed in a position to make a more informed and engaged decision regarding their academic future within NJIT's College of Engineering. Considering the inherent difficulty of engineering-related programs and the wide array of backgrounds and previous experiences that first-year students bring with them to college, FED101 takes time out of its curriculum to teach its enrollees about

software programs like AutoCAD and MATLAB, both of which have become crucial to the academic and professional fields of engineering. Culminating in a final project that incorporates all of the various components introduced and taught throughout the length of the semester, the Fundamentals of Engineering Design 101 course within the College of Engineering at the New Jersey Institute of Technology strives to provide first-year and academically undecided engineering majors with a support system that will better equip them to navigate the transition from high school to the more rigorous collegiate atmosphere and environment.

As a part of a comprehensive grant from the National Science Foundation, faculty at the University of Cincinnati focused on the development of a Scientific Thoughts and Methods course, designed as a complementary effort to encourage successful transition from high school to college and increase retention among their enrollees in STEM-related majors (Koenig et al, 2012). The intro course, SM 101, was 10 weeks in length with two meetings per week that combined lecture and lab sections with an overarching learning design that was empirically shown to develop the analytical reasoning ability of enrolled students. Through consultations with faculty members in subjects ranging from physics and chemistry, certain skills that were seen as essential to success in STEM-related majors and fields were incorporated into the introductory first-semester course, including science proficiency and critical thinking. Over the course of 10 weeks, the introductory course was broken down into three distinct sections, including an overarching discussion on the nature of science, followed by a section on abilities related to scientific reasoning, concluded by mathematical modeling, argumentation, and other science-related advanced tactics. When examining first-year biology majors who participated in SM 101, the authors of the research found that enrollment in the course led to a positive influence regarding first-to-second year retention. Furthermore, through pre- and post-course

assessments, those who participated in the program were shown to have increased their scoring averages in Lawson's Classroom Test of Scientific Reasoning. Considering the similarities between those who did and did not persist in STEM-related fields and majors, the SM 101 class served as an intermediary with the intention of shaping and developing skills early enough for students to change the trajectory of their study habits in a positive direction. Although participation in SM 101 had initially shown to have a positive impact on the retention of students in biology and other STEM-related fields, the authors advised that further work must be developed that addresses the overarching nature of first-year science and mathematics classrooms, and their influence on the persistence efforts of students that require those courses.

Further efforts on the part of collegiate administration to bolster engineering and other STEM-related major retention include the incorporation of purposeful communities that foster positive relationships through a variety of projects and educational outcomes (Ricks et al, 2014). One study in particular examined a specific learning community that was created on the foundation of opposing three primary factors associated with lower rates of persistence among engineering undergraduates. Those components included the monetary challenges of remaining enrolled in college, an absence of a supportive environment and atmosphere on campus, and lower levels of academic preparedness in subjects like mathematics and science. In order to determine how combating the three aforementioned threats would affect the experiences and persistence efforts of the individuals involved within the study, each student was provided with a wide array of support and programming, including financial aid in the form of scholarships, access to tutors, mentors, and study groups, and participation in a summer bridge program to ease the transition from high school to the collegiate environment. Additionally, a sense of community was manufactured among the research participants through engineering-related

courses taken by the entire cohort, the implementation of various learning styles and techniques, group meetings and study sessions where attendance was required, and specifically-selected faculty mentors and advisors to guide them through the initial transition to the expectations of collegiate success. When compared to similar groups of students at the same institution where the study took place, the authors found that those who participated in the engineering learning community had higher rates of persistence and graduation. Furthermore, those that were brought into the engineering learning community based upon the results of the first-year math placement exam and were found to be academically underprepared in that subject were found to have had higher graduation rates when compared to similar groups of students.

As previously mentioned, self-efficacy and self-confidence among first-year engineering undergraduate students have the potential to serve as significant influences on their respective experiences and persistence efforts (Ernst et al, 2016). Data was collected from research participants from the College of Engineering at a university in the upper Midwestern United States, which in this case were first-year students across two separate academic years. By utilizing high school grade point average as a measuring stick for determining whether or not a student should be considered "at-risk," the authors of this particular study examined 103 total research participants: 22 determined to be at-risk, and 81 that met the grade point average threshold. Among those who participated in the study, the authors found that, compared to those who were determined to be at-risk, higher levels of self-efficacy related to learning existed within those that met the grade point average threshold. Academic successes in both high school and college can significantly impact levels of self-efficacy and self-confidence in both the at-risk and not at-risk student populations, and should be a consideration of any future research regarding its influence on the first-year persistence efforts of engineering undergraduate students.

Discovering ways and means to strengthen the self-efficacy and self-confidence of engineering undergraduate students should be of paramount importance to collegiate administration, as higher levels of the two aforementioned components can lead to increased amounts of determination, resolution, and other motivators.

In addition to self-efficacy and self-confidence, factors associated with motivation are also essential to the success of students looking to pursue a degree in the field of engineering (Kassaee & Rowell, 2016). At Middle Tennessee State University, researchers set out to explore the experiences and persistence efforts of 36 first-time first-year engineering students that were enrolled full-time and participating in the university's FirstSTEP program. The FirstSTEP program was designed to increase the mathematical skills and abilities of STEM majors with lower scores on the mathematical section of the ACT. Each research subject participated in the university's Mathematics Summer Bridge program, a two-week experience that incorporated various learning programs and sessions; enrollment in this program allowed the authors of the study to assess the levels of motivation inherent to each study participant. When matched with a similar control group, those who participated in the FirstSTEP program had higher rates of success in their pre-calculus grades calculated at the end of the semester. Additionally, the participants in the FirstSTEP program had a higher major retention rate than those in a similar control group; 48 percent in the former group compared to 34 percent in the latter. Overall, FirstSTEP participants at Middle Tennessee State University had higher rates of first-to-second year persistence, higher grade point averages, and higher levels of academic achievement in pre-calculus coursework when provided with academic guidance and motivational support.

## Summary

The origins of college student retention and the factors that affect whether a particular student persists throughout their educational tenure focused on the individual characteristics they bring with them and how they interact with the institution in which they are enrolled. Both social and academic integration by the individual student are essential to their success in the classroom, on campus, and in the surrounding community that houses the college or university where the student is pursuing their degree. However, institutions of higher education and the administrators associated with them owe a certain obligation to the students to provide an atmosphere on campus that encourages and fosters social and academic integration among its enrollees at a crucial point in their personal and professional lives. The foundation of research related to college student persistence also demonstrated the importance of the environment on the campus of a particular institution, and how strides should be made to help students find the best fit as they transition to the next phase of their educational journey.

Research into factors that influence the persistence of college students shows that increases in a commitment to their goals and the institution in which they are enrolled are both linked to higher rates of retention. Considering that college student retention is a multi-faceted challenge for collegiate administration and leadership, those associated with institutions of higher education must be creative in their initiatives, as no one solution solves the problem of student attrition. Overall, the effective dissemination of information related to the expectation of what it takes to be successful at the collegiate level and a realistic preview of the environment awaiting prospective students must be made a high priority. Throughout the current body of research related to the retention efforts specific to engineering undergraduate students, major themes ranging from self-efficacy, proper academic preparation prior to beginning college, a

willingness to enter a group atmosphere, and the opportunity to interact with faculty and professors, among other factors, significantly impact whether or not students are retained year after year.

As first-year college students prepare for transitioning to the institution they have selected to continue their education, the current body of research in the field of first-generation and academically undecided engineering and other STEM-related majors shows the influence of additional support and programming. Introductory classes geared towards first-time, first year students can provide support systems that set a solid foundation for learning in a traditionally challenging academic degree program. Furthermore, learning communities developed among this unique population of engineering students could incorporate both mandatory and voluntary programming with the intention of bridging the gap between the expectations for success in high school and the differences at the collegiate level. Factors related to motivation, self-efficacy, and self-motivation are found to have been essential to their academic success as an engineering major at the undergraduate level.

In conclusion, increases in projected vacancies and opportunities are driving demand for individuals with college degrees in engineering. The threat of college student attrition serves as a significant challenge for strategic enrollment managers and those employed by colleges and universities with engineering majors and departments. Engineering students traditionally tend to have higher attrition rates when compared to their academic peers studying other majors, due primarily to the challenging and rigorous coursework required for degree completion. Academic and social integration, among a bevy of other factors that occur during the first year of college, are crucial for the first-to-second year retention of college students, especially those pursuing an engineering degree. In the field of engineering, the opportunity to examine the factors that

positively influenced the first-to-second year institutional and major persistence efforts of first-generation undergraduate students that participated in a first-year program could assist in providing a realistic preview of the environment and expectations necessary to be successful at the collegiate level through the collection of rich data from a diverse array of students that associate with the aforementioned characteristics. With a greater demand for engineering graduates in the United States and an increased scrutiny of strategic enrollment management practices in the wake of financial constraints and budgetary shortfalls, examining the factors that positively influence the first-to-second year institutional and major persistence efforts of these individuals could provide insight into the academic and social success of engineering undergraduate students.

# Chapter 3 - Methodology

The following chapter details the methodology that I employed in this study, the purpose of which was to explore the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering undergraduate students who participated in a first-year program at Kansas State University, a large, land-grant, public, and four-year university in the Midwestern United States. To do so, I utilized a qualitative, grounded theory approach with a constant comparative data analysis technique. In this chapter, I will detail the overarching purpose, design, setting, participant population of the study, and the methods for collecting and analyzing data, in addition to issues related to the trustworthiness of the study, ethical considerations, and existing limitations.

## Research Question

In an effort to develop a greater understanding of a unique subset of students at the postsecondary educational level, this study addressed the following research question: What were the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program? I addressed this question by asking first-generation engineering students who had enrolled in and completed the DEN 160 first-year program and who remained enrolled in an engineering major about their overarching experiences related to their persistence efforts. Furthermore, this particular research question allowed me to pursue a greater and more complex understanding of the factors that positively influenced their persistence efforts in the pursuit, through a grounded theory methodology, of a new theoretical model developed from the rich data collected through interaction with those involved in the parameters of the study.

## Qualitative Research Design

Qualitative studies should incorporate questions that are associated with unique populations, individuals, or challenges and should be established under the premise that their intended purpose is closely associated with actions ranging from an exploration of a certain topic to the examination of a specific subject (Creswell, 2007). Considering the inherent nature and purpose of qualitative designs for research, one of the most effective ways of envisioning the study is to see the process as a kaleidoscope; the colorful shapes inside of the device are representative of the data, the interior mirrors serve as the various categories, and the comprehensive category of the design is represented by the flat plates found within the device. Just as an observer through the lens of a kaleidoscope is enveloped in various colors, shapes, and reflections, so too should the qualitative researcher immerse themselves in the rich data collected through the overarching nature of the research design. Tracy (2010) outlined eight distinct criteria for determining and measuring the quality of qualitative research, including the existence of a worthwhile topic, rich rigor, sincerity, credibility, resonance, ethics, meaningful coherence, and a significant contribution to existing literature. Throughout the course of my research, I made it my intention to work towards addressing all eight of the aforementioned criteria in order to positively contribute to the overarching field of qualitative research.

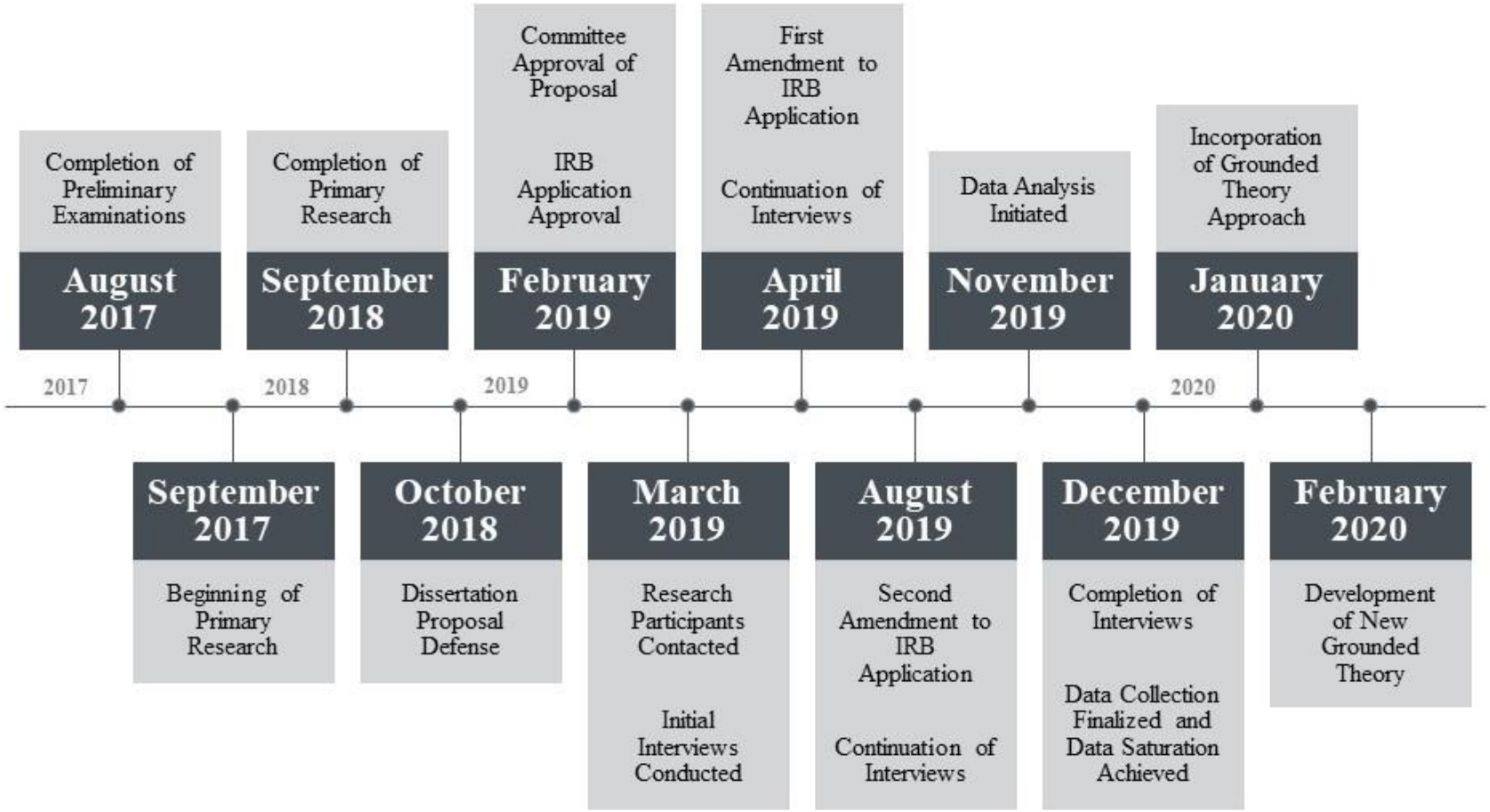
## Grounded Theory Methodology

Within the field of qualitative studies, researchers should make an effort to choose a methodology that best answers their research question. One qualitative methodology in particular, grounded theory, focuses on the development of a new theory that is grounded in the data that are collected from the study participants and eventually reviewed and analyzed by the researcher (Strauss & Corbin, 1994). While grounded theory shares some similar qualities with

other methodologies, including the collection of data through interviews and observations and its utilization in the field of social science, several key differences set it apart in qualitative research. For one, grounded theory is explicitly concerned with the development of a new theory when the researcher is examining a unique population or subject. Additionally, grounded theory provides access to what is known as conceptual density, which refers to the opportunity for codes, themes, and an overarching theory to emerge that collectively have rich and insightful findings that are supported by the data gathered from the research participants (Strauss & Corbin, 1994).

When grounded theory is employed within a research design, it allows for the creation or revision of a theory that could assist in the development of practices, policies, and programs that impact the research participants, who have experienced the processes at the focus on the grounded theory design (Creswell, 2007). Within my own research design, I have created a new theory that was developed through the exploration of the factors that positively influenced the first-to-second year institutional and major persistence efforts taken by first-generation engineering students in a first-year program, and will be addressed in later chapters. In addition to conducting a pair of interviews for each research participant, I also kept a diligent set of notes and memos to strengthen the argument for employing a grounded theory methodology, as memos kept throughout the data collection and analysis procedures are critical for recording concepts and themes found among the dataset. For the purpose of my research, this methodology process was designed, developed, and implemented with the intention of creating a new theory that addresses the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program. Figure 3-1 below demonstrates a comprehensive visual representation of the chronological timeline of the research.

**Figure 3-1: Chronological Timeline of the Research**



## Setting

At Kansas State University, a large, land-grant, public, and four-year institution in the Midwestern United States, the faculty and staff within the College of Engineering set out to establish and develop a first-year program that would ensure a quality experience for incoming, first-time engineering undergraduate students. In order to provide additional resources designed to combat the risk of attrition for first-year students, the College of Engineering enrolls students who have either been selectively admitted into the College or have been fully admitted and voluntarily select General Engineering as their major in a one-credit hour course called Engineering Orientation (DEN 160) taught by professional academic advisors and overseen by the Assistant Dean of Retention, Diversity, and Inclusion.

## Research Participants

By working with the Assistant Dean of Retention, Diversity, and Inclusion within the College of Engineering, I was able to view a list of first-generation students who enrolled in DEN 160 during their first semester on campus and had been retained in an engineering major, which Kansas State University reported to the Board of Regents upon the twentieth day of the following Fall semester. During the initial inquiries with potential study participants, I disseminated information regarding their participation in the qualitative study, which involved two interviews with each participant. In order to maximize data collection within a grounded theory design, I continued to interview students until a saturation of data had been achieved (Creswell, 2007). The participants in the research were a) first-generation students, b) had participated in the first-year engineering program, and c) were still enrolled in an engineering major upon the twentieth day of the aforementioned semester. All of the participants in the study

had completed their first year of college at Kansas State University, and each of them had successfully persisted from the first to their second year as an enrollee in an engineering major.

## Data Collection Methods

In this research, engineering undergraduate students who participated in a first-year program provided the opportunity for the exploration of the factors that positively influenced their persistence from the first to their second year in an engineering major at Kansas State University. Methods of data collection that can be implemented into grounded theory designs range from observations to interviews, the latter of which is the most commonly utilized for research purposes (Creswell, 2007; Merriam, 2009). Through careful examination of the participants' responses related to experiences, influences, actions, and behaviors, I was able to work towards comprehensive discoveries beyond those at the surface level. Effective interviews within a grounded theory design are those that make a concerted effort at the beginning to gather a wide array of data and then begin to narrow the focus as the data collection process starts to conclude, eventually leading to a fully developed or saturated model (Creswell, 2007).

For the purpose of this study, the primary source of data collection included a pair of interviews with each research participant, which is consistent with an overarching qualitative design and recent studies concerning first-generation students, engineering majors, and a grounded theory methodology (Barry, 2015; Strauss & Corbin, 2008; Creswell, 2007; Knaggs, 2012; Simmons, 2012). The first interview was approximately 60 minutes in length, and was designed to address introductory topics and to establish a connection between myself and the research participant. The second, follow-up interview was also approximately 60 minutes in length, and was built upon the information covered and rapport established during the initial interview, which allowed for research participants to provide clear and honest responses to the

questions, the subject material of which focused primarily on their levels of self-confidence, interactions with peers, faculty, and advisors, as well as transition to the collegiate atmosphere (Creswell, 2007).

## Sampling of Participants

Within the field of qualitative research, purposeful sampling can be a beneficial starting point for researchers, as its use within qualitative methodology is well established and tailored towards studies with an abundance of content and researchers with finite resources at their disposal (Palinkas et al, 2015). The study of individuals with very specific experiences or knowledge, the willingness on the part of the research participants to be involved within the study, and whether or not those individuals will be able to effectively describe their experiences in ways that contribute to the overarching goal of the study are a few components that may encourage a qualitative researcher to consider purposeful sampling within the confines of their design. Researchers looking to achieve a deeper level of understanding among the subject material and to maximize opportunities for data saturation could utilize purposeful sampling to enable them to achieve their research goals and aspirations. Furthermore, the utilization of maximum variation sampling, a specific technique within purposeful sampling, can enable a researcher to encapsulate a diverse array of perspectives related to the subject material at the core of the design (Laerd Dissertation, 2012). Within a particular research design, maximum variation sampling can provide the necessary steps for a researcher to examine a specific subject from a wide range of angles For my study, I incorporated a purposeful sampling of participants, as I wanted to maximize my opportunity for saturation despite a smaller number of participants and the possibility of low response rates among those that qualified to participate.

## Study Participant Recruitment

After viewing the list of engineering students who had enrolled in DEN 160 during their first year and had persisted to their second year as an engineering student, I then sent out inquiries to confirm their status as a first-generation college student. When I initially began contacting potential participants for the study via e-mail communication to inquire as to their willing participation in the study, I detailed expectations regarding the amount of time the study would require, the types of questions that would be asked during the two interview sessions, and the overarching methods to collect and understand the data (Appendix D). As each research subject confirmed their participation through an e-mail reply, I made consent forms (Appendix A) available for review prior to the initial interview, which were completed and signed before the start of the initial interview.

The initial IRB application submission to the Kansas State University's research compliance office was completed in February 2019, and included those individuals who had enrolled and completed the DEN 160 course in Fall 2017 (Appendix E). After a limited response rate, an amendment to the original IRB application was made and submitted in April 2019 to include those individuals that had completed DEN 160 in the Fall 2016 semester (Appendix F). A second and final amendment of the IRB application was submitted to the compliance office in August 2019 that allowed for incentives to be provided to those who participated in the study; $25 Amazon gift cards were provided to each research participant, and each participant was entered into a drawing for an additional $75 Amazon gift card (Appendix G). Research participants that had completed both of their interviews prior to the second and final amendment to the original IRB application submission were contacted and asked if they would like to also receive the same participant incentives. After both amendments to the original IRB application, a

total of 41 individuals that had enrolled and completed DEN 160 in either the Fall 2016 or Fall 2017 semester met the selection criteria.

## Interview Structure

Following the confirmation via e-mail correspondence of participation in the study and completion of the consent form, I conducted an initial one-on-one interview with each research participant, which contained open ended questions (Appendix B) regarding their individual experiences leading up to and during their first year on campus as an undergraduate student in the College of Engineering. In the second, follow-up interview, I asked more in-depth questions (Appendix C) that were built upon the content and information covered during the initial interview, where the existence of a rapport between researcher and participant lead to complex and insightful responses about the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students who participated in a first-year program. Through the utilization of existing research on first-generation students and engineering majors, I developed questions that explored and addressed factors that include but were certainly not limited to self-confidence (Atman et al, 2010; Eris et al, 2010; Matusovich et al, 2010; Navarro et al, 2014; Veenstra et al, 2009; Wang, 2013), pre-college academic preparation (Hall et al, 2015; Honken & Ralston, 2013; Veenstra et al, 2009; Wang, 2013), resources and programming (Honken & Ralston, 2013; Navarro et al, 2014), peer interaction (Atman et al, 2010; Honken & Ralston, 2013; Litzler & Young, 2012; Navarro et al, 2014), and interaction with faculty and advisors (Honken & Ralston, 2013; Litzler & Young, 2012; Navarro et al, 2014).

While I informed the students beforehand that they should plan for approximately 60 minutes for both interviews, I scheduled them in a manner that allowed for flexibility for

additional time to comprehensively address each question and any follow-up inquiries I saw fit. The overarching design of the grounded theory methodology allowed for adaptation on the part of myself and the participant to address the various inquiries that arose throughout the length of each session. In order to effectively and efficiently engage in transcription immediately following each session, I utilized the Voice Memos feature on my cellular phone to record each interview. Files associated with each interview were then securely stored and encrypted to ensure the anonymity of the study participants. By taking careful consideration of individual schedules, I conducted each step of the data collection process at points throughout the semester that were cognizant of the research participants' time and schedule. Each interview took place in a private setting within the College of Engineering's facilities that allowed for consideration of sensitive or compromising information disseminated by the participants. In addition to the two interviews that were conducted with each research participant, I participated in memo writing throughout the length of the data collection and analysis stages of the design, which entailed the drafting and writing of ideas and concepts related to the grounded theory during the open, axial, and selective coding processes inherent to the data analyzing stage of the research design (Creswell, 2007). By frequently visiting and revisiting the notes and memos I wrote during all three stages of the coding process, I was able to assist the overarching process of creating and developing a new theory that related directly to the unique group of individuals – first-generation students that began as engineering majors at the undergraduate level, enrolled in a general engineering introductory course during their first semester, and persisted in engineering into their second year of undergraduate work – at the epicenter of the study.

## Theoretical Sampling

Theoretical sampling, when properly incorporated within a grounded theory design, focuses on the collection of data in ways that are shaped by concepts established through the data (Strauss & Corbin, 2008). The researcher can employ theoretical sampling to lead to the development of concepts, establishment of relationships, and identification of unique variations without having to establish the parameters of collection ahead of time. After an initial collection of data, an open coding process can drive and shape further collection efforts (Breckenridge & Jones, 2009). Categories are then developed through a constant comparative analysis technique that allows for codes to be initially assigned and potentially re-assigned to a variety of classifications. When performed correctly, the incorporation of theoretical sampling within a grounded theory design can provide the researcher with the content necessary to begin formulating their theory (Creswell, 2007). The length of time a researcher spends in this part of the data collection process can depend upon whether or not saturation of the data has occurred and whether or not the theory at the core of the grounded theory design has been explored, examined, and addressed in its entirety.

When employing theoretical sampling within the confines of a qualitative methodology, the researcher should be cognizant of and take steps to combat inherent challenges that are associated with the utilization of this component. Challenges commonly associated with the incorporation of theoretical sampling within a grounded theory design include but are certainly not limited to the idea that rigid data collection procedures can lead to data manipulation, the risk that potentially unnecessary details are going to be included and described extensively, and that the credibility of a study, design, or research project will be disconnected from the process that led to its establishment (Breckenridge & Jones, 2009). By demonstrating patience throughout the

data collection process, a researcher can make strides towards the development of a comprehensive theory that provides a deeper understanding of the data and the study's participants. By showing caution regarding the inclusion of certain information within the parameters of the study, the researcher can work towards managing the risk of including excessive descriptions concerning unnecessary details. Through a concerted effort to demonstrate transparency throughout the entire data collection process, the researcher can strengthen the design's credibility by showing proof that the theory has gone through all of the necessary steps involved within a grounded theory design.

Several key components must be met and considered in regards to when the research design calls for the shift from a selective sampling process to a theoretical sampling process. Within the parameters of the data collection process in a grounded theory design, it is up to the researcher to determine when the shift from selective sampling to the process of theoretical sampling must occur (Draucker et al, 2007). The researcher must feel and believe that the transition from selective to theoretical sampling had to occur at just the right time; not too early in the process to exclude certain data from being collected, and not too late to alter the potential depth of understanding that could arise from the research design. Furthermore, within a grounded theory design in which interviews are being conducted as a part of the overarching data collection process, it is essential for the researcher to conduct each interview in a way that leads to new components, which would then lead to the development of new questions, which in turn leads the researcher to new discoveries.

In regards to this research design, I employed theoretical sampling within my methodology through several distinct and purposeful actions, including the addition of new questions after the first few interviews, expanding the population pool of prospective research

participants, and a comprehensive immersion into the data following the conclusion of each interview with the research participants. After the first two interviews had been conducted, I noticed a particular concept that organically arose from each conversation that had not been included in my original list of questions. The subject of this additional component focused on the balance of support and pressure to attend and succeed in college that an individual may or may not receive from their parents and family members. After the first two interviews, I added a question about that balance to the questions I asked each additional research participant. Additionally, I added an amendment to my original IRB application to include those individuals who completed DEN 160 in the Fall 2016 semester to further expand the pool of prospective research participants in the pursuit increasing the likelihood of obtaining rich data from the data collection process. Furthermore, after each interview had been recorded, transcribed, edited, and sent to the research participants for member checking, I would listen through the audio file an additional time in an effort to work towards additional questions and further discoveries.

## Member Checking

When properly employed, member checking can provide the researcher with a comprehensive assessment of the trustworthiness of the design's overarching structure. Designed with the intention of examining the credibility of conclusions drawn from the collection of data, member checking, also known as participant validation, occurs when the data is shared with the participants in order to confirm that the recorded responses accurately reflect their experiences (Birt et al, 2016). One of the most common practices associated with member checking involves the transcription and dissemination of interviews and conversations to the research participants, where they can then be asked to review, clarify, or expand upon the words found within the transcript (Birt et al, 2016; Carlson, 2012). While member checking can occur in various forms

throughout a qualitative research design, more often it is employed as a singular occurrence, the purpose of which is to verify the transcript of an interview or conversation (Birt et al, 2016). Depending upon their preferences, the research participants may wish to receive the transcripts in a specific form in order to provide a comprehensive review, which could include either physical or electronic copies upon successful transcription on the part of the researcher. Given the convenience related to both communication and scheduling, I sent electronic copies of the transcribed interviews to the research participants, which provided the necessary time and motivation to participate in member checking. In order to maximize the benefits of employing member checking, I digitally transcribed all interviews and sent the transcript verbatim to the research participant within two to three days of the completed transcription process (Appendix H). Furthermore, I provided a comprehensive set of details, instructions, and expectations, including a request that the research participant read the transcript in full in order to confirm the contents of the transcribed interview and offer, if they deemed it necessary, any additional context or clarity that would contribute additional depth to their responses.

## Theoretical Saturation

The process of simultaneously collecting and analyzing data continued to occur until the point at which I believed data saturation had occurred within the parameters of the study. The saturation of data is a point within the research design where all of the concepts involved throughout the data collection and analysis processes have become described and illustrated in a comprehensive manner (Strauss & Corbin, 2008). While the saturation of data in a particular research design does involve a point at which no new categories, themes, or concepts are materializing, the researcher should be more concerned with whether or not relationships exist within those concepts, themes, and categories, the depth of those connections and relationships,

and how those factors can shape the development of a grounded theory. While Strauss and Corbin argued that total saturation is unlikely to ever be accomplished, researchers designing a grounded theory study should be practical in terms of when they believe to have achieved data saturation within the parameters of their own design but should exercise caution when deciding to finish collecting data.

Out of the 41 total individuals that met the research criteria, 14 responded and indicated that they would be willing to participate in the study, which equates to a 34 percent response rate. Consistent with grounded theory designs, I continued to contact and interact with the research participants until data saturation had occurred (Creswell, 2007). For the purpose of my research, 26 total interviews, each 45 minutes to an hour in length, were conducted among 13 research participants. After the twelfth participant had completed their interview, I believed that a saturation of data had occurred and all concepts, themes, and elements derived from the data collection process had been comprehensively addressed and illustrated. An thirteenth research participant was confirmed, and the resulting data from their initial and follow-up interview did not contribute any new concepts, themes, or elements to the study, but instead reinforced what had already been determined through the simultaneous data collection and analysis processes through the constant comparative analysis technique at the core of this research design. The fourteenth and final individual that met the research criteria and expressed a willingness to participate was contacted and informed that their participation would not be necessary, as I believed that data saturation had been achieved.

## Data Analysis

Effective data analysis in a qualitative research design should focus not on outcomes or the establishment of causal relationships, but on a wide-ranging exploration process with the

intention of discovering patterns by sorting through rich and complex data that provides an underlying narrative or image of the participants' efforts and experiences (Suter, 2014). Through the incorporation of words, metaphors, visual representations, and other creative forms of expression, the qualitative researcher should invite the opportunity for flexibility and adaptability regarding the development and progress of their respective study. Furthermore, the data analysis portion of the study should incorporate various themes, ideas, and categories in which to connect the process or phenomena being examined in the first place. The data analysis portion of a qualitative study, arguably, would more appropriately be named an understanding of data, given the goal of discovering meaning among the complex and comprehensive information.

In order to effectively engage in the process of data analysis, I employed a constant comparative analysis technique, which is one of the most common and effective forms of data analysis and enables the researcher to simultaneously code and analyze the data collected from the research participants (Kolb, 2012). In qualitative research, the constant comparative technique is one that is most often utilized by researchers employing a grounded theory approach to the overarching design of their study (Parry, 2011). By incorporating the collecting, coding, and analyzing of data into one comprehensive process, researchers employing a constant comparative technique work towards the development of a new theory that adheres to the data collected through the research design and can be examined in future studies (Kolb, 2012). While the constant comparative technique for analyzing data is traditionally more demanding regarding time and consideration, the researcher is presented with the opportunity, under this particular methodology, to work from the start with rich data to the creation of a new theory that provides a unique insight into the individuals involved within the study. Through the incorporation of interviews into the overarching methodology, researchers can provide themselves with the

opportunity to collect rich data from the unique perspective of each research participant. With each additional interview that the researcher conducts, new opportunities arise to connect and compare categories among the responses from those who participate in the study (Parry, 2011).

When properly employed, comprehensive interview sessions with the research participants can not only collect a rich set of data in which to analyze, but an extensive volume in which to create and foster a new theory that helps provide context and insight into the experiences and perceptions of the research participants (Kolb, 2012). In order to enable the opportunity for the greatest exploration and analyzation of the data collected from the study participants, the researcher must strive to collect data until a point of saturation has occurred, which is when the incorporation of additional research participants and responses does not contribute any new information to the existing collection (Kolb, 2012). Furthermore, the constant comparative technique should be continuously employed by the researcher until it is believed that all of the categories and the relationships between those categories are concise and coherent (Perry, 2011). For this particular grounded theory design, I incorporated a three-step coding process outlined by Strauss and Corbin (2008), which included open coding, axial coding, and selective coding in order to examine all of the data collected from the research participants.

For the purpose of my study, I was able to adhere to this three-step coding process within a constant comparative data analysis technique in order to maximize the opportunity for a grounded theory that provided insight into the unique group of individuals involved in the study. Overall, I believe that the effective implementation of a constant comparative analysis technique was the best fit to addressing the overarching research question and exploring the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program.

## Organization of Transcripts

At the beginning of each interview, I would inform the research participant that I would be recording our conversation in two distinct ways, which allowed me the opportunity to focus my attention on the participant and pick up on specific verbal and non-verbal cues, to know when to ask follow-up questions, and how to frame my own verbal and non-verbal communication in ways that would establish trust and build rapport throughout the length of both interviews. Through the utilization of the Voice Memos application on my cellular phone and the Speech Recognition feature within Microsoft Word on my computer, the process of recording and transcribing 26 separate interviews, each 45 to 60 minutes in length, was made significantly more manageable throughout the data collection process. After each interview had been transcribed and assigned a pseudonym based upon the individual that had been interviewed, it was edited for content and grammar before being sent to the corresponding research participant for confirmation that the transcripts were correct to the best of their knowledge and accurately reflected that which took place in each conversation. Finally, after receiving confirmation through the member checking process that the content was accurate to the best of their knowledge, each transcript was uploaded to a secure folder on my laptop computer, which is equipped with a password protected login system for additional security support.

## Open Coding

The first step in the coding process, open coding, involves the initial comparison of data that are collected from the research participants with the intention of developing an understanding of the data (Strauss & Corbin, 2008). In order to begin the process of open coding, I first set out to establish nodes, which would form the foundation of the procedures of data collection. Through the utilization of the NVivo 12 software package made available by QSR

International, I was able to identify and organize nodes from the interview transcripts in an effective and efficient manner. NVivo 12 for Windows Help (2019) defines nodes as "themes or topics that you find in your files," where a comprehensive coding process supplies each individual node with appropriate references. Across all 26 interviews with 13 research participants, I identified 78 different and unique nodes, including the following examples: parents, studying, friends, tutoring, internships, and networks. In a manner consistent with a grounded theory design and a constant comparative analysis technique, I purposely selected nodes in ways that made them flexible and adaptable to maximize opportunities to "open the data to all potentials and possibilities contained within them" throughout the data collection and analysis processes (Strauss & Corbin, 2008).

## Axial Coding

Axial coding, the second step in the process, centers on establishing connections among the collected data with the intention of taking smaller subcategories and assigning them to a larger and more comprehensive category (Strauss & Corbin, 2008). Throughout the axial coding process, visual models can be employed that allow the researcher to determine categories and examine the conditions that influence those specific categories (Creswell, 2007). By carefully examining the nodes as I progressed through the data collection and analysis processes, I was able to engage in the axial coding procedures by relating the various categories and elements to one another in order to create theme node subcategories and theme node categories consistent with the purpose of the research. Similar to the open coding phase, the utilization of the NVivo 12 software allowed me to organize and manage the nodes, identify and establish relationships among them, and build those identified relationships into theme node subcategories and categories. The NVivo 12 software also enabled me to create and build node hierarchies, which

further enhanced the data analysis process through a strong visualization of the relationships between the themes, categories, and elements present in the interview transcripts, which can provide clarity in identifying connections and help maintain an efficient management of the data (NVivo 12 for Windows Help, 2009). Table 3-1 below shows several examples of node and theme node subcategories and category hierarchies that I was able to identify and establish throughout the collection and analysis of data from the initial and follow-up interviews.

**Table 3-1: Examples of Node and Theme Node Subcategories and Category Hierarchies**

| Theme Node Category | Theme Node Subcategories | Nodes |
|---|---|---|
| Support and Preparation Prior to University Enrollment | Involvement with Programs and Resources at the High School Level | Community College<br>Robotics<br>Teachers<br>Preparation<br>High School |
| | Encouragement from Parents and Family Members | Encouragement<br>Family<br>Support<br>Parents |
| | Exposure to Engineering and the Undergraduate Institution | Campus Visit<br>Engineering<br>Kansas State University |
| | Development of Motivating Factors and Expectations | Motivation<br>Expectations<br>Confidence<br>Balance |

## Memo Writing

Memo writing, according to Strauss and Corbin (2008), includes specific records kept by the researcher in written form that consist of efforts throughout the data analysis process. When properly employed, memo writing enables the researcher to encapsulate their thoughts in writing in ways that help their theory evolve and emerge within a grounded theory methodology (Creswell, 2007). Throughout the data collection and analysis procedures, I primarily engaged in memo writing as I was transcribing, reviewing, confirming, and coding the data, but also found notes taken during and immediately following individual interviews to be effective. For the purpose of my research, memo writing helped me to better understand themes, categories, and elements discovered throughout the data and assisted me in starting the process of assembling a comprehensive theory regarding the experiences of the research participants.

Table 3-2 below shows several examples of memos that I had written throughout the collection and analysis of data acquired from the research participant interview transcripts.

**Table 3-2: Examples of Memo Writing Throughout the Data Analysis**

| | |
|---|---|
| Memo Example #1 | **Balance of Pressure and Support: March 22, 2019**<br>After completing both sets of interviews with the first two research participants, I have noticed that each of them, when asked about their preparation prior to beginning their undergraduate career, have mentioned a feeling of genuine support from their parents regarding their decision-making process, despite the parents not having as much personal experience with college. I am curious to see if other research participants have similar feelings, and if they end up feeling more pressure than support from their parents in terms of attending and succeeding at the undergraduate level. |
| Memo Example #2 | **Changing Importance of GPA and Grades: April 11, 2019**<br>Several times now I can recall the research participants mentioning how important it was for them in high school to maintain a high grade point average (for scholarships, competitions among peers) and how they wanted to maintain those same figures in college, only to adjust those goals after the first couple of semesters or even months. While the motivations for changing their GPA goals for college are vastly different, one important item is remaining constant: an acceptance that they did not want to necessarily be defined by their grades or GPA in college, but what they were able to take away from their collegiate experience in and out of the classroom. |
| Memo Example #3 | **Recognition of Study Habits: April 16, 2019**<br>Knowing how and when to study is key to adapting and adjusting to the transition from high school to college in terms of the academic expectations. Several times now I have heard mentioned that there was a period of adjustment – usually within the first few weeks or months – where study habits that were successful in high school were insufficient at the collegiate level, and that adjustments had to be made in order to complete assignments and study for exams. Individuals that had mostly studied on their own embraced the idea of a group study environment, and individuals that had connected with teachers at the high school level but were initially hesitant and reluctant to reach out to professors were scheduling visits during faculty office hours. |

## Selective Coding

The third and final step, selective coding, involves the selection and exploration of an overarching category to which all of the other categories discovered during the previous coding

processes can be connected (Strauss & Corbin, 2008). Selective coding, when executed properly within the design of the study, provides validation for the identified relationships and allows the researcher to develop and foster a grounded theory from the data they have collected (Creswell, 2007). Once the theory has been developed, the researcher can then establish certain statements or proposals that interconnect all of the categories and elements within the coding structure. In grounded theory research designs, the selective coding process can also refer to the process by which a researcher wishes to achieve theoretical integration within the parameters of their design (Strauss & Corbin, 2008).

Several crucial steps must be taken on the part of the researcher in order to ensure that their theory will be constructed with a solid, transparent, and sustainable foundation. Initially, the researcher must make an effort to work towards the identification of a central category, which will serve as the study's primary theme. Strauss and Corbin (2008) suggested that the researcher should select the category that has the "greatest explanatory relevance and highest potential for linking all of the other categories together" for the central category of their research. However, the selection of a central category is not without its difficulties, whether the researcher feels as though each category has an equal share of relevance to the study's design or there are missing pieces that prevent the researcher from moving on in the analytical process. Considering the inherent difficulty in selecting a central category, memo writing plays an especially important role within the parameters of a grounded theory methodology, as the procedures behind the construction of a substantial theory rely heavily on the utilization, development, evaluation, and interpretation of raw data into various connections strung together with comprehensive and insightful memos.

As a starting point for engaging in the process of selective coding, I combed through all the memos I had written throughout the collection and analysis of data in an attempt to identify ways in which all of the various themes, elements, and categories could connect with one another. Following these initial efforts, I found that re-examining the memos, drawing both simple and elaborate diagrams, establishing a story line, and budgeting time to evaluate my progress were all beneficial in my overarching goal of working towards integration and the identification of a central category. After the central category had been identified and selected, steps were taken to begin refining the theory, which consisted of three crucial tasks: examining the central category for lapses in logic, reviewing categories to determine those that needed to be reinforced and those to be removed, and ensuring the validation of the overarching theory (Strauss & Corbin, 2008). It is the responsibility of the researcher, within the parameters of a grounded theory methodology, to ensure that their theory is comprehensive enough to be identifiable by those who participated in the study should the situation arise where specific elements related to the participants' individual cases are absent or incomplete.

## Positionality

When properly employed, qualitative research has the potential to serve as a means to establish a shared space that is occupied and molded into place by the researcher, the research participants, and the various identities that exist within and influence the overarching research design (Bourke, 2014). By making a concerted effort to understand identities, perceptions, and biases that could potentially influence and affect the research, I took steps to understand the questions and inquiries that formed the foundation of the study, the individuals I examined, and the means by which to engage and communicate with the research participants. Given my professional history and interest in the success of traditionally underrepresented and underserved

student populations at the higher education level, it was imperative that I took a proactive approach to discussing my positionality as it relates to the parameters of this study design. Within my professional career, I have served a variety of roles encompassing responsibilities that impact a wide array of populations and constituencies at the postsecondary educational level. In addition to recruiting prospective high school and transfer students, I have provided academic advising for individual students and have advised a number of different on-campus organizations. Additionally, I have served on several campus-wide committees, task forces, and working groups that adhere to the institutional mission of student success, academic development, and program implementation. Although the success and persistence of undergraduate students on the collegiate level is an integral part of my professional responsibilities and aspirations, I believe that better equips me to examine the phenomena at the center of this study from an invested yet impartial viewpoint.

Furthermore, I recognize that how I shaped meaning from the rich data I collected from the research participants may have been impacted by my tenure as a professional in higher education working with specific student populations. However, I am confident that my research design allows for a comprehensive exploration of the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program and properly addresses my positionality as it relates to the research and its participants.

## Trustworthiness

In qualitative research, efforts to establish forms of validity and reliability have led to the development of standards related to the trustworthiness of studies, and involves considerations ranging from the identification of the proper patterns and themes to the presence of certain

perspectives and biases on the part of the researcher (Nowell et al, 2017). Continued development in the field of qualitative research has established that the presence of four components – transferability, dependability, confirmability, and credibility – provides evidence and support for the existence of trustworthiness in the parameters of a specific design. Within this particular study, I took steps to address all four throughout the inherent structure of the qualitative research and grounded theory design with specific strategies and methods.

## Transferability

While the qualitative researcher traditionally does have advanced notice of where other researchers may wish to implement the findings of a particular study, the researcher must take strides to address transferability in their work, which focuses on whether or not the inferences made after data collection and analysis can be generalizable to other research sites. Grounded theory research designs traditionally strengthen transferability by offering exhaustive descriptions of every facet involved in their design. In order to properly address transferability within the parameters of my study, I provided extensive details regarding my methodology in order to proactively prepare for the instance where engineering programs at other institutions may wish to examine the efforts of similar populations.

## Dependability

In qualitative research, dependability refers to whether or not the researcher has clearly explained and disseminated information regarding the methodological process of the design. As the researcher is explaining the various parameters of their design, they should keep in mind the degree of effort a reader with no prior knowledge of the study or its target population would have to exhaust in order to properly understand every facet of the study. For the purpose of my

research, I addressed dependability by making a determined effort to ensure that each component of the design is clear and concise.

## Credibility

Just as the researcher should be concerned about finding the right methodological approach that fits the nature of that which they wish to study, so too should they concern themselves with whether or not the narrative drawn from the collected data fits with the perceived factors that positively influenced the persistence efforts of the research participants. For grounded theory research studies, it is recommended that a purposeful focus on the triangulation of data – through multiple data collection methods – can effectively address credibility within the inherent design. For the purpose of my research, I addressed credibility through the employment of three distinct methods that are consistent with grounded theory designs – interviews, memo writing, and member checking (Creswell, 2007).

## Confirmability

Within the confines of qualitative research designs, confirmability refers to whether or not the interpretations and inferences, on the part of the researcher, have been gathered from the data acquired through interaction with the research participants. Essentially, confirmability occurs once the researcher has addressed and established transferability, dependability, and credibility within their respective study in a consistent format. In order to properly address confirmability within the parameters of my study, I made a concerted effort to ensure that the three aforementioned components related to trustworthiness were properly identified, addressed, and reinforced throughout the length of the grounded theory research design.

## Ethical Considerations

As researchers develop study designs of a qualitative nature, certain efforts regarding ethics – research practices involving human subjects that are guided by moral standards – should be taken into consideration (Birks & Mills, 2015). In addition to efforts taken on by those conducting the study, specific organizations like institutional review boards, especially within the scope of educational research, oversee processes related to the conduction of ethical research. Within the parameters of this particular study, I focused on ethical considerations through the creation and dissemination of informed consent forms prior to the start of the data collection process. Furthermore, before the start of the interviews, I encouraged participants to share any questions or concerns they might have had about any subject or topic related to the nature of the research. After signing the informed consent forms but before the start of the initial interview, I instructed each participant that they had the opportunity to remove themselves from the study at any point, that they had no obligation to answer a question should they feel uncomfortable or unsure, and that any feeling of discomfort or hesitation towards any of the questions would be immediately acknowledged and addressed.

In order to protect the anonymity of the research participants, I kept all notes, documents, NVivo and other associated digital files, transcribed interviews, and information that could lead to someone outside the study to discover the names of those involved within the study in an encrypted folder on a laptop computer. Additionally, because I knew the identities of the research participants, I have changed the names of those involved within the study to pseudonyms to help maintain confidentiality. Furthermore, I have received full approval from the Kansas State University Institutional Review Board At its core, college student retention is an incredibly complex and multifaceted phenomenon that affects and challenges professionals

within higher education at every level and institution. Considering the nature of college student retention and the variety of theories, studies, and programs that have been developed at the postsecondary educational level, I recognize that the persistence (or departure) of first-generation engineering students who participated in a first-year program cannot be solved with a single resource or initiative.

## Summary

The objective throughout the length of this chapter was to provide a comprehensive overview of the research methodology, which involved a grounded theory design within an overarching qualitative design. When employing a grounded theory design, the researcher should be cognizant of the ways in which to strengthen the trustworthiness of the design. Through the incorporation of previous studies found in the body of research related to college student and engineering major persistence, first-year success programs, and the experiences of first-year students, this particular study was designed with the intention of adding to the existing literature focusing on the factors that positively influenced the first-to-second year institutional and major persistence efforts of engineering students who would greatly benefit from additional support during the crucial first two semesters of their collegiate tenure. Through the incorporation of a qualitative approach, a grounded theory design, and a constant comparative data analysis technique, I strongly believe that a greater understanding of how this unique first-generation student population persists in an engineering major, comprehensive programs, resources, and support systems can be developed and improved upon that are conscientious of their various precollege characteristics, interactions with their respective peer environments, and experiences that happen in and outside of the classroom.

# Chapter 4 - Results

Throughout this chapter, I will address the results of this research study. Within the parameters of this study, the overarching purpose was to explore the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation undergraduate students in a first-year program in the Kansas State University College of Engineering. In order to achieve the aforementioned purpose, the following research question was created and positioned at the center of the study: What were the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program?

As a part of the comprehensive processes of data collection and analysis, I employed a grounded theory design within the scope of a qualitative research methodology (Strauss & Corbin, 2008). The primary sources of data included two, one-on-one interviews with each individual that participated in the research, which is consistent with an overarching qualitative design and recent studies involving first-generation students, engineering majors, and a grounded theory methodology (Barry, 2015; Strauss & Corbin, 2008; Creswell, 2007; Knaggs, 2012; Simmons, 2012). Through the incorporation of a constant comparative analysis technique, the data collection and analysis processes enabled the materialization of several significant and fundamental themes and concepts (Strauss & Corbin, 2008). Throughout the processes of data collection and analysis, individual nodes helped to create clusters, which were broken up, reassembled, and reorganized multiple times over. When node clusters were organized in ways that were supported by the data, the clusters were then converted to subcategories, which then served as foundational components for each of the six primary elements that positively influenced first-generation engineering student first-year persistence. Each element was

comprised of two to four subcategories that were created from nodes that were coded from the interview transcripts, which were the primary sources of data for the research design. The content found within this chapter are organized into the following sections: (a) description of the research participants, (b) introduction and explanation of the six primary elements that positively influenced persistence among the research participants, (c) the theoretical model that developed as a result of the constant comparative analysis and extensive data collection and analysis procedures, and (d) a summary of the efforts related to the collection and analysis of data from the participants within the research design.

## Description of Research Participants

Given that all of the research participants would have completed the DEN 160 first-year orientation course in the Fall 2016 or Fall 2017 semester, each of the individuals involved within this study were in their sophomore, junior, or senior year of college, depending upon when the interviews occurred throughout the data collection process. In addition to those that started off in the General Engineering program, the research participants identified specific majors in which they were enrolled, including Architectural Engineering, Biological Systems Engineering, Computer Science, Electrical Engineering, Industrial Engineering, and Mechanical Engineering. Each of the research participants matriculated to Kansas State University as first-generation college students, which the institution defined as "students who will become the first members of their family (parents, grandparents) to graduate from a four-year college or university upon successful completion of the academic requirements of their major" (Kansas State University, 2018b). In order to protect their identity and preserve the confidentiality of the research participants, each was assigned a pseudonym at the start of the data collection process and include the following: Benjamin, Christopher, Damien, Edgar, Hannah, Jackson, Johanna, Kevin,

Mary Beth, Matthew, Penelope, Rebecca, and Walter. Each of the 13 individuals successfully attended and completed both the initial and follow-up interviews as a part of the data collection and analysis procedures. Demographic information collected from each of the research participants included their engineering major at the start of their first year, their engineering major at the start of their second year, gender, intended major, and ethnicity. Table 4.1 presents the pseudonyms and demographic data for each of the 13 research participants.

**Table 4-1: Research Participants' Demographic Information**

| Name for Study | Engineering Major at Start of First Year | Engineering Major at Start of Second Year | Gender | Ethnicity |
|---|---|---|---|---|
| Benjamin | General | Computer Science | Male | Unknown |
| Christopher | Mechanical | Mechanical | Male | White |
| Damien | Electrical | Chemical | Male | White |
| Edgar | Architectural | Architectural | Male | Hispanic |
| Hannah | General | Civil | Female | White |
| Jackson | General | Mechanical | Male | White |
| Johanna | Biological Systems | Biological Systems | Female | White |
| Kevin | Mechanical | Mechanical | Male | Unknown |
| Mary Beth | Mechanical | Mechanical | Female | Unknown |
| Matthew | General | Mechanical | Male | Unknown |
| Penelope | Mechanical | Mechanical | Female | Hispanic |
| Rebecca | Mechanical | Industrial | Female | Unknown |
| Walter | General | Electrical | Male | Hispanic |

## Six Primary Elements that Positively Influenced Persistence

Through the comprehensive processes of data collection and analysis within the parameters of this particular research design, I have identified and illustrated six primary elements that positively influenced persistence among the research participants, which were drawn from and based upon the responses they provided throughout the extensive interview process. The six primary elements include the following: support and preparation prior to university enrollment; an adjustment of their academic approach and expectations; strong connections with peers and relationships with friends; an incorporation of habits related to their

academic and social responsibilities; an understanding and comprehension of their educational investment; and the utilization of institutional support and programming. Within the confines of this section, I will provide further evidence and context that supports the establishment and identification of these six primary elements that positively influenced persistence, as well as highlighting how the subcategories within each element were unique to the individuals – first-generation students that participated in a first-year program – at the core of this study.

## Support and Preparation Prior to University Enrollment

The first of these six elements focuses on the various forms of support that were received and preparation that was made by the individuals prior to the beginning of their enrollment at the university. Within this particular element, subcategories include their involvement with certain programs and access to resources at the high school level, encouragement received from parents and family members, their exposure to the concept of engineering and the undergraduate institution, and the development of motivating factors and expectations before the start of their collegiate tenure. The experiences and connections that these individuals established before their very first day as an engineering student at the university set a solid foundation that greatly impacted how their first year on campus unfolded. Figure 4-1 demonstrates the corresponding node clusters associated with this particular element.

**Figure 4-1: Node Clusters for Support and Preparation Prior to University Enrollment**


### Involvement with Programs and Resources at the High School Level

As the research participants progressed throughout their respective high school experiences, specific programming and resources in which they were immersed established a

solid foundation that helped prepare them to endure the challenge of studying engineering at the collegiate level. Among all of those various experiences, several of the more noteworthy factors included college-level courses that exposed them to the academic rigor of college, teachers and coaches that encouraged and fostered their development, and research that the participants in the study conducted on their own. Additionally, involvement in academies, pathways, and other specifically-tailored programming available in high school had a profound impact on those that had the opportunity to participate in them, including Kevin, who expanded on his unique experience:

> I was fortunate enough, going to Blue Valley [High School], to have our CAPS [Center for Advanced Professional Studies] Program. I was able to do that for one semester and I thought that was a really great experience. Getting to work on these professional projects that are actually for the clientele of people who are working on projects to get out into the market. That was one of my best academic experiences in high school, being able to do that. I've always wished that there were more accessible hands-on classes in engineering, even in college actually, because so many times I feel like I've talked with people and they said, “I don't know how they expect us to go out in the real world just knowing all these theorems and these equations.” They kind of feel like they're being thrown in the deep end, just because they're doing all these hands-on things, all that knowledge you gained, they just take bits and pieces and then teach you everything else new. I think that if everybody was able to get more of that hands-on experience, then I think to me that would make it a lot easier to grasp new concepts and to be able to translate that into feeling more confident when you start those new things.

At the high school she attended prior to making the transition to the university as an engineering student, Penelope took full advantage of the opportunities available in one particular pathway:

> I was involved in a program in high school called aerospace engineering, engineering academy now, but it's a four year program where you take advanced science and math classes. Junior year, you have to take a projects class, and in that class, one semester you're doing robotics and FTC [FIRST Tech Challenge], and senior year it was my capstone, which I loved. We went the furthest in my school's history, so we did really good [sic] but it was fun. That's the program that got me into design. I also learned CAD [Computer-Aided Design] and worked with a 3D printer. I was the design lead [for the robotics team], so I did 3D printing in high school.

Although she grew up attending Catholic elementary and middle schools, Rebecca discovered that "the public schools in Olathe have 21st Century Programs," which are academies that build upon students' interest areas and provide foundational support for career-related aspirations. Looking at the options in front of her and the opportunities that the 21st Century Program would provide, Rebecca "applied for that and thought that 'if I get accepted, then I'll go there,' but if I don't, then I'll continue on with Catholic school." As it turned out, Rebecca was accepted to the academy in Olathe, and strongly believed that "having the program in high school definitely got me to the point where I felt that I was ready" for the transition from high school to the university setting as an engineering major. On the subject of specifically-dedicated programs and academies at the high school level, Rebecca reflected on what her involvement meant to her and other students with similar backgrounds:

> For first-generation students, having something in high school, I think that's super beneficial. I may not have been as interested in going to college or doing something like

> that if I hadn't had something to kind of give me a little bit of direction in high school to get here. I think that's pretty helpful.

In addition to the 21st Century Program, Rebecca "did robotics in high school," as did Penelope and Walter. Looking for ways to get involved at his high school, Walter "joined the robotics team" and discovered that he "really likes making that kind of stuff and how it works."

Enrolling in and completing upper-level courses through Advanced Placement programs, International Baccalaureate curricula, dual-credit agreements with local community colleges, or engineering-related electives were a significant source of preparation among the research participants. When I asked Kevin about the factors that most impacted his transition into the engineering coursework at the university, he responded that "AP classes helped with the transition, because they expect you to have no knowledge in drafting or 3D modeling. It did help me in our Graphics class for [my] Mechanical Engineering major, and it made for an easier jump into that, because I know a lot of people struggle with that" particular course. Edgar provided the following response when I asked about his academic preparation prior to making his way to the university to study engineering:

> I did very difficult classes in high school. Dual-credit and AP classes as well. I was taking challenging courses my senior year, a couple college prep courses, so I challenged myself academically on purpose to keep a high standard for myself. And then, you know, that's also instilled in me by my parents, and so in high school, I kept pretty good grades with challenging courses. I felt like my teachers told me that as well, you know, that they felt like I was very prepared as far as classes go.

As far as challenging prep courses and the path to an engineering major at the college level, Johanna "did the International Baccalaureate program in high school, and so that was a very

rigorous workload. So that, on top of already being good at math and science, you're just like, directed in that direction." When it came to the transition from high school to the university and her engineering coursework, Johanna believed that "the IB [International Baccalaureate] Program definitely prepared me really well for college." The logic that Christopher employed in regards to taking more challenging courses at the high school level centered on the idea that he believed that "if you wanted to be an engineer in college, you probably have to set a little bit higher standard for yourself in high school" given the notion that those high school classes "are going to be easier than what I'm going to be doing in college, so I need to set a higher standard" when it comes to preparation. While they were not a part of a formalized program like Advanced Placement or International Baccalaureate, Mary Beth found the dual-credit opportunities at her disposal to be beneficial:

> We did take college classes through our high school, so that was kind of helpful to see what they were like and how they were structured. We didn't really have like, necessarily an honors program, so the classes you took, everybody just kind of took. There wasn't really any emphasis on what you are going to do after high school, it was more like, these are the classes you need to take to finish high school.

For Damien, the opportunity to enroll in college courses as early as his "sophomore year of high school" enabled him to start "trying to figure out what I want to do in terms of what college I want to go to, or trade school" following high school graduation. Even though it was not an engineering-specific course, Walter recognized how important a college elective in high school was to his transition to the university to major in engineering:

> I did take college classes throughout high school, which I got the experience to kind of see that it was a little bit harder than high school because with high school, you really

> don’t have to study, honestly. Like, you can pass anything without studying, but with those college credits, especially one, which was History of the US from 1877 to the Present, that class, the professor was really rough on us. He really expected us to understand the material, so I actually had to study, and I think whenever I transitioned here, I saw that in all my classes.

While the college setting may take getting used to on the part of individuals making the transition from high school, Hannah noticed that the larger environment, “with that many people learning in a big setting, prepared me well” for her arrival on the university campus.

In addition to the challenging prep and college-level courses that comprised their daily schedules, the teachers at the front of those classrooms provided essential encouragement and fostered support among several of the research participants. As he was sorting through the all of the options available after graduating from high school, Jackson noted that “the discussion of engineering really came down to my physics teacher and my math teacher, and the discussion of Kansas State University came down to my Dad, Mom, and my Social Studies teacher, who was also my neighbor.” Given the involvement of these individuals, Jackson was grateful for the support system that he had in place:

> I definitely had the resources available to discuss what college was going to be like. I had them [teachers] here to kind of prepare me for this transition. I do know that there's a lot of students coming in that are looking [at college, engineering] and I know they don't have that kind of support.

The size of his high school and its proximity to a local community college provided Edgar with a pair of individuals that helped provide support and guidance at a crucial juncture in his academic career, including his architecture program instructor, who “didn’t know much about college, but

was still very supportive. He talked about some of his past students, [and] with him, it was definitely more encouragement" about pursuing aspirations. Additionally, Edgar mentioned "my advisor in high school. She works for Garden City Community College, she was also sort of dual-employed at the high school" and was "someone very important that was very helpful in the whole process" of preparing for transitioning to a four-year university to study engineering. Throughout high school, Edgar remembered the support that those two individuals provided:

> With my teacher and my advisor, that first thing for sure is when they introduce you to engineering, they say most curriculums [sic] are very tough, but it's a very rewarding career. So, after that first initial warning, it's just informing you of the real world, and everything after that is definitely encouragement. The teachers were definitely encouraging, saying that I would be fine going into engineering.

When I asked Penelope about individuals that inspired and supported her decision to attend a university for engineering, she made mention of an advisor from one of her extracurricular activities:

> My coach for the robotics team, that guy was amazing. He had way too much on his plate, he set a really good example, [and] he really took care of us, the students. He really cared. I really liked him, and he's the reason I did better in some of my classes in high school.

Finally, a number of the research participants indicated a certain level of preparation and research that they themselves conducted that helped contribute towards their transition from high school to college in order to pursue a degree in engineering. Before he got to college, Kevin performed "some research on what other people have suggested to succeed in college. I had talked with people who were in college, but I still didn't feel like I completely knew what to

expect" in terms of the environment and expectations. As Johanna progressed through her high school coursework, she discovered a unique approach to organizing all of her various opportunities for life after graduation:

> Towards the beginning of it, I tried to make a table of all the different schools that I would consider. I started making this table before I had visited anywhere, and you get like, piles and piles of mail. So, if one caught my eye and I read it and I looked into it and anything was interesting about it, I would put it on there. I wanted to be able to differentiate between the different schools.

Setting the right set of expectations from the prior research he had conducted is what enabled Benjamin to prepare for what it would take to navigate the jump from high school to college as an engineering major:

> I think me putting the pressure on myself thinking that college is going to be super hard helped, because when I started college, I realized it's much easier than I thought it was. It was a giant weight lifted off of me, and so that helped a lot, just like, psyching myself into thinking that it's going to be harder than it actually is.

**Encouragement from Parents and Family Members**

The support and encouragement that parents and members of their family provided to the first-generation engineering students comprises one of the most influential and prominent components across all six elements related to positive influences on first-year persistence. Each of the 13 research participants made mention of immediate and extended family members throughout the interview process. The means in which parents and family were mentioned strongly implied positive, encouraging, and supportive interaction prior to the students' arrival

on campus to pursue an engineering degree at the university. From the very beginning, Hannah knew that college would be in her future, thanks in part to her family members:

> My Dad, that was his huge thing, that he was going to send his kids to college. I had two older siblings, and they both attended universities. They were a lot smaller, and so I guess I always knew growing up that college was definitely in my future. It was something that I was going to work towards, as well as my family was going to work towards.

In terms of encouragement and feedback towards considering going to college and majoring in engineering, Hannah expressed that "it was a lot of my parents. I think that they were excited, you know, with all of my siblings they were really excited, but it was kind of the first time where they got to explore" a larger university setting. In addition to her parents being excited and offering support, Hannah's siblings provided encouragement from the perspective of a successful college graduate:

> My brother and sister in particular, their college experiences were a lot different. My sister was in public relations, and then my brother was human resources, so it was a lot different experiences for them. I think they were more the side of "make sure you're enjoying yourself, [and] make sure you know what you're doing."

Since the beginning, Mary Beth's family "has always been super supportive," and after she made her way to the university, her Mom "has told me several times that if I want to drop out of engineering, that she would completely support that decision. She says that 'I support what you want to do'" without reservation. Mary Beth first noticed this unique brand of support when one of her older siblings had to make a tough choice in terms of their educational pathway:

> I had a sister that started at Wichita State University, but didn't like college and went to cosmetology school, and my Mom was totally supportive of it. For everyone in my family, my parents have been super supportive of anything we do.

While she has always had the support of her parents and family, Mary Beth never felt compelled that attending college after graduating from high school was a requirement:

> I felt pretty good about going to college, it wasn't ever something that was like, you necessarily have to go, but it was like more like a "this is what's going to help you in the long run." It wasn't like, pressure to go to college, it was more of "this is probably what's going to help you most throughout the rest of your life." I've realized more that it's not necessary to go to college to have a good life, but I see where my parents were taking it, like it's going to help me a lot more in the long run.

Even though they did not pressure her towards college, Mary Beth admitted that it "was definitely my family that pushed me into going into engineering," and that the "support from my family helped reinforce that yeah, I can do this, and if I really push myself, I can do it." As she was first starting the process of figuring out whether or not she wanted to attend college after graduating from high school, Mary Beth admitted that "the only people I really involved and listened to were family. I knew [that] they knew what was going to be the best for me, like the best fit for me, they knew me better than anybody else." When I asked Mary Beth a follow-up question about how she involved her family in the college search process, she provided an example of a particularly memorable conversation with one of her older siblings:

> The one that sticks out the most is like, my brother. He is not very sociable, and we grew up together, but he is not the kind of person to have a serious conversation with me. So,

> when he sat me down and talked to me and was like, "hey, you can do this," that was kind of like "wow, look at this, and how much my family believes in me."

When she began the process of searching for colleges, Rebecca's interest areas were influenced by a number of factors, including "my Dad. He does construction, and so he's into the hands-on, kind of physics stuff of things," which helped introduce her to the concept of engineering. With the encouragement of her father and the idea of majoring in engineering in her mind, Rebecca "did robotics in high school, and seeing him and my Mom's excitement about that made me kind of realize that this is something I want to do" when it was time to head off to college. In addition to the positive influences of her immediately family members, Rebecca found inspiration and influence from those within her extended family:

> I definitely think my aunts and uncles did, because they all went to smaller, four-year colleges. So, just talking to them and listening to their college experiences, and what they did has taught me, especially looking for a place to rent. I remember them helping me figure out the little details that my parents don't quite see, and I'm like, I wouldn't have thought of that, so definitely them.

As Kevin shared details about his college search process with those around him, he became more confident in the likelihood that engineering was going to be the right fit:

> I wouldn't say anybody was too surprised, a lot of people were very supportive about it. My parents, for example, the main people that I talked to, they supported me in that decision, because they've always wanted me to pick something that challenged myself and kind of pushed me.

When the prospect of attending college was starting to become a reality, Kevin found inspiration to work hard and pursue a career that he would enjoy from an example that was set at home:

> I would say my father is a huge role model. He got his associate's degree, but he and my Mom married really soon after that, and he just wanted to find a job to keep their family afloat and move on to find a different job after that. He has stayed with this company ever since, he's been there 35 years, and just seeing his work ethic and seeing how he's been able to become successful in this job that he wasn't necessarily qualified for and seeing the end result of that, and that he is now living a happy life.

As a motivated and independent high school student, Benjamin "was the sole person that saved up for college, got the scholarships, and found the colleges I wanted to go to" after graduation. While this was going on, Benjamin recognized that "my Mom didn't really care if I went to college or not. She is very proud that I am going to college, but she never really pressured me to feel like I had to, and she's always made me feel smart" about the decisions that have been made. Although it was his own drive and ambition that led him to the university as an engineering student, the support that Benjamin had prior to leaving for college had a lasting impact:

> Growing up, it was just me and my Mom. My Mom, she wasn't married for a majority of the time that I was a kid, she got remarried eventually, but having that very close relationship with my Mom has helped a lot. She never put pressure on me to go to college. I've always been a self-motivator, but because of that close relationship that I've had with my Mom, it's important for me to have her validation.

Thinking back on the interactions he had with his parents regarding educational and professional options following high school, Walter recollected the following response:

> I don't think they really pressured me to go to college, because I knew that I wanted to go to college, so they didn't really pressure me. They were just really happy that I was going

> to college and just doing all these things by myself, so I think they more supported me then pressured me to go to college and choose a major.

As a result of that support, Walter developed the mentality that he wanted to succeed because of his parents, given that "they've always helped me through the process" of choosing to attend college as an engineering major. Christopher received a similar form of support as he was going through the college search process, noting that his mother especially "was going to be on board with whatever I tried to do, because she wanted to help me." While he was navigating all of his options, Christopher received help from his mother in the form of learning what "you do for FAFSA [Free Application for Federal Student Aid], looking for loans and all that stuff" as a part of the financial preparation for college. However, Christopher included his entire immediate family when discussing his educational and professional plans for the future:

> My parents, and my older brothers that had already gone through college, because they're the only ones in my family that had graduated college at that point. I would talk to them, especially my brother Carl, the one that graduated from here since he had been through it. He had an idea of what was good because he had just done it, so I listened to him.

Looking back on when he first started to seriously consider attending a university after high school, Jackson recollected that he "definitely had a lot of support for coming to college," including his father, who "encouraged me quite a bit. He was pretty indifferent about it, [but] he said he was very supportive" of Jackson's decisions. Even though he knew that the engineering coursework "was going to be tough and it would require a lot of hard work and studying," Matthew believed that he "could make it through it" with the help and encouragement of his parents, who "were just supportive, but wanted to make sure that I was committed coming in instead of going two years and switching my major and stuff like that. They were really

supportive" throughout the process. While primarily receiving support from her parents, Johanna also consulted with a sibling that had been through the college experience:

> My Mom and I were the main two, because my sister, since she's so much older, she had already moved out at the time. We would tell her about different visits I would go on, but it was mainly my Mom and I making the decisions and going to places. My Dad tagged along to some of them, but he wasn't as interested. He's like, "I don't care where you go, you're smart, you're going to get there," so that was kind of his mindset.

Furthermore, even though Johanna was an independent and self-driven student in high school, she recognized the value of having the occasional jolt of motivation:

> My Mom balanced it pretty well between giving me a kick in the pants when I needed it and "you need to be doing research, you need to be deciding where you want to visit, it's time to do another college visit," and things like that, but still letting me [do it]. She didn't just like, schedule [a visit] and say "okay, this is where we're going to go," it wasn't like that. I think that was really helpful, because I was really busy academically, especially during my last two years of high school with the IB [International Baccalaureate] program. She just did a good job of pushing me to keep looking into options and consider a wide variety of options.

From the very beginning, Damien understood what his pathway would look like after he graduated from high school:

> I think I always knew. My parents pretty much raised me that I would, no matter what was going to happen, that I was automatically going to go to college. That was very important to both my parents. They said it was pretty much their number one goal for me and my sister to go to college. So, I was kind of born and raised to have the mindset that

> no matter what, whether it is going to trade school, community college, or a university, I knew that I was going to go farther than just high school, for sure.

After one particular visit to the university as a prospective engineering student, Damien remembered how important it was in his mind to have the support of his parents regarding the decisions he was making:

> I think that's kind of when it started. I started to see how happy they were, and it wasn't about money anymore with them. It was more about me and what I wanted, and it was kind of the first time ever that it was like, I felt like I was doing [sic] the right decisions, making the right steps [sic] for what I wanted to do. I think stepping foot here, to be able to take that tour and really be able to show my parents, to get them on board with what I wanted to do was definitely that kind of last straw of "this is what I want to do."

Growing up, Edgar saw first-hand the sacrifices that his parents made to set him up for success, and it paved the way for how the trajectory of his educational and professional life would unfold:

> For me, that was a very early decision in my life, that I knew I was going to attend college. That came from, as you know, first-generation, first in my family to go to college, my parents are immigrants, [and] they came from Mexico. So you know, growing up I always had that attitude instilled in me, and I was raised that way, you know. My parents would say things, they would say it in Spanish of course, they are native Spanish speakers, and so that's always been something that's been stuck in my head. They would say we left our home country, and we left everything behind because here there's more opportunities, and so we're here for you guys, we're here [for] me and my sister to talk to, we're here for you guys. You guys [have] got to do the best you can, because everything that we are doing is for you. You know, my Dad worked a lot when I

was little, and I really didn't see him very much, so I made that decision very early on and I made that decision for my parents.

While the expectation was there for Edgar to attend college, his interest in majoring in engineering once he arrived on campus was supported by his parents through their belief in his abilities and academic performance:

> My parents didn't know what engineering was. They knew what an engineer was, but didn't know anything about how to get there. The general public, I feel like really doesn't know what engineers do, so I guess they knew to that extent, but they don't know much about it. They were a little reserved, but at the end of the day they still trust you. [They said] "You're doing well in school, you've never given us a reason to doubt you, and so we're going to trust you," and it's worked out.

Penelope's parents also immigrated to the United States, and she enlightened me on the unique influence that she received as a result of the journey her parents had made:

> See, there's this thing called the Immigrant Speech, which is what my parents tell me. They came to this country, didn't know any English, had like $5 or insert some amount of money here, and like, they make it lower every time. [They said] "I worked from the bottom to get to where I am to give you the opportunity, so like, you're going to college."

Even though her parents "didn't really care what I studied in college, as long as I studied something," Penelope remembered that her Mom was "the one that pushed me to apply to" the aerospace engineering academy that was offered through the high school. Despite not initially wanting to apply, studying engineering for Penelope "was more of an option, because of the program I was in in high school. It was more like, this makes sense" in her mind. As she was sorting through her options, Penelope received support for attending and majoring in engineering

at the university, given that her parents "wanted me to stay in Kansas because they love me and they want to see me more." Overall, Penelope wanted "to be successful in life, but that kind of came from my family. My family doesn't really care what I do, as long as I'm successful at what I do" regarding her education and career pathway. Immigrant Speech notwithstanding, Penelope understood that "I have all this great support behind me" from her family, and that with the support she received, "it's really easy to keep moving forward because you feel motivated. I know I can do anything I set my mind to. I know I can do it, and so I'm going to do it."

### Exposure to Engineering and the Undergraduate Institution

Prior to making their way to the university, each of the research participants identified the unique and purposeful ways in which they were introduced to the concept of engineering, which included conversations with friends and family, connections with high school teachers, enrollment in upper level and challenging courses, and participation in specific programs that their high schools had to offer. For Walter, it was a combination of the robotics team at his high school and focused prep classes that helped lead him to his major:

> I think those are two of the main ones, and I also was taking some engineering classes. It was kind of learning like CAD, I think it's called, you're like, designing interior houses and I like that a little bit. Also there was like lighting and stuff like that, and I think that had to do with my major. I think those two things were the biggest influencers in me being an engineer.

During his high school career, Matthew had several options at his disposal before shifting towards an engineering focus, thanks in part to a unique realization:

> Freshman, sophomore year of high school I really enjoyed math and stuff, and I took a couple of accounting courses in high school. I did a job shadow with a Certified Public

> Accountant and I kind of liked that, and then when I applied my friends were like, "you know, you took shop and all these other classes, you like to work with your hands, build stuff, [and work in] CAD." In high school, all my classes kind of leaned towards engineering rather than business and accounting and that stuff, and even though I enjoyed it, I figured I'd have a better experience in college doing something that my classes had showed in high school rather than business. So, that aspect played into it, and I just think I enjoy working with my hands more than working with a computer.

High school teachers also played a prominent role in exposing these individuals to engineering concepts, including Damien, who admitted that although "it's kind of tough for me to talk with my parents about going to college because they never really experienced that whole process," one of his teachers was "kind of the sole purpose of why I went into engineering…because she's been through that whole process of going for so long, that it was just nice to have someone I could talk to about the entire process" of transitioning successfully to a university setting. Jackson had multiple teachers assisting him, as he offered that "in high school, my physics teacher kind of suggested engineering, and I was really interested in how things worked. My math teacher kind of pushed me towards engineering because her son was here" at the university. Additionally, those teachers helped set up Jackson to complete "a career test thing on the computer, and it showed engineering was a good option for me." Several of the research participants credited immersive academic programming offered at the high school level with introducing them to the subject of engineering. At Rebecca's high school, she stated that "you can pick one of these programs that would get you interested in something, and figure out if that's what you like. So, I toured all of them, and the engineering one stuck out to me." As a part of that specific program, Rebecca recognized that "it was kind of expected that everyone would

go to college to study engineering" after graduation, and that that mentality was "normalized in the program" for those individuals that participated in that particular pathway. Among her colleagues in the engineering-specific program in high school, Rebecca discovered that "talking to them, and seeing where they wanted to apply, and what they want to do, and getting a feel for what everyone else was thinking" helped her to "figure out what I want to do, and what was a good path for me to do." Instead of feeling pressure from that mentality, Rebecca argued that her participation in the engineering program in high school "definitely helped [me] to realize that you can excel in different ways." Enrollment in these kinds of programs can also allow for participation in experiences that are impactful or meaningful. Penelope mentioned that she "did this SWE [Society of Women Engineers] thing where I followed this girl around [to her classes], I think she was an industrial engineering student, for the day as a part of a shadowing day."

Conversations with friends and interactions with family members about opportunities in engineering were impactful, as well. Mary Beth admitted that "I didn't really know what else to go into. I have a lot of passions and a lot of different interests" but that "my brother graduated from WSU [Wichita State University] with a mechanical engineering degree," which impacted her decision. Benjamin mentioned that it was his grandmother's decision to have a computer room at her home that helped steer him towards computer science:

> I'd really been into gaming and computer games like from the age of 4, so I started gaming for a while, and then when I was seven I started programming games in C++ and doing that. I've been programming for a really long time, and it just kind of happened that I grew up with the internet.

As a city administrator, Hannah's brother-in-law helped establish a drive to "work in cities and development and kind of use that mathematical side of things as well, so that's kind of where I

got on the engineering side." As high school progressed and he was considering engineering, Christopher mentioned his friend group as a source of influence, which told him that "if these guys can do it, I feel like I could do it because I was very similar to them, like how we approached class" and that "grade-wise, I felt confident in myself. Also, I just felt like engineering was one of the things that would fulfill me most job-wise."

Several of the research participants identified multiple sources of influence that helped introduce engineering concepts to them in unique and purposeful ways. Edgar was another individual that had the opportunity to participate in a specific academic pathway at his high school, which led to enrollment in challenging upper level coursework:

> They had different what are called Academies. They had Public Service, Arts Communication, and Trade and Health. I found myself in Trade and Health, and that was what interested me the most. That was usually for the kids that were more inclined to the math and sciences. As I took the ACT and as I went through college courses, I figured out that I don't really enjoy reading and writing as much as I enjoy math and science. Black and white answers, if you want to call it that, [it] just made more sense to me, in those processes. I was in an architecture program at my high school, it was a drafting program, using AutoCAD and stuff like that, and I built some models in a 3D printer, things like that in high school. I really enjoyed that stuff, so my teacher for that [class], he had some kids go on to engineering before, so he talked to me about it. Then, my advisor, who noticed that I was inclined to this kind of stuff, he started talking to me about this kind of stuff, and so I looked into it and I thought that it was something that I could do.

In addition to the Trade and Health Academy, upper level coursework, and advisor, Edgar also remembered a particularly influential conversation with his physics teacher:

> I do remember, I feel like he played a little piece in convincing my parents engineering was a real thing, very viable, [a] good solution. We were at parent-teacher conferences, and my parents [were] always adamant about going. I went one day and decided to sit down with him and discuss my grades. There wasn't a whole lot to discuss, I had been doing well in his class, and somehow it came out that I wanted to do engineering. This was my junior year, so I was still looking into it, and he told my Mom "he'll be perfectly fine going in to engineering." I saw the look on my Mom's face, and I think she was just happy to hear that. I remember that was a really small thing, and at the time it didn't really do much for me, but looking at it now, I really appreciate that.

A combination of coursework and family impacted Hannah, who stated that "I knew I wanted to do engineering because I am strong in STEM, it was something I felt I was good at. My Dad is [as well], he also works in machining," which was encouraging for her. Similarly, Kevin mentions conversations with friends in addition to high school coursework that helped introduce him to the concept of engineering:

> One of my friends suggested engineering, and so that always kind of stuck out in my head for no specific reason other than like, math and science. I never really thought of it as that interesting…it was a strength, but I didn't know if that was something I wanted to focus on for the rest of my life. So, throughout high school I kind of struggled with that question, whether I would be going into engineering. So, that was a pretty big deal for me throughout high school. I took a few engineering classes in high school, [like] a drafting class, computer modeling [class], and a problem-solving kind of class.

After addressing the factors that helped introduce him to engineering, Kevin mentioned additional components that helped solidify engineering as a potential pathway:

> Definitely parents, I talked to them a lot about it [and] they were probably my main point of contact, and then friends as well. I had some friends who weren't going into engineering that I was really close with that I talked about it with, and then some friends who both were going into engineering and who had already been in engineering in college, and a few that were even at Kansas State University. I kind of got to have an idea of what that was like.

For Johanna, it was a unique approach by her high school to create a program to identify "all of the girls who are good [at] math and science and had good grades in [those subjects]" and provide specific opportunities to teach them "about STEM fields. That was really helpful to be like 'okay, here's an engineering direction,' and I looked into that more" as a future career. The experience Johanna mentioned happened fairly early on in her high school tenure, and the timing of that experience allowed her the opportunity to process the pathways in front of her:

> I was able to think about it for a while and let it soak in, because if you tell someone their senior year [of high school], it could be hit-or-miss. They [may] have something else that they're looking at, but then my junior year I got to do a job shadow. It was like an assignment for a class, and so a relative helped me get a job shadowing [set up] at an engineering firm and shadow some female engineers for a day, and that was really cool.

Furthermore, Johanna mentioned the impact of conversations she had with friends that were pursuing similar interests, stating that "whenever I was talking about engineering specifically [with] a lot of my closest friends from high school, I guess that was pretty encouraging to hear the commonality" and discovering from those conversations that "so many of my closest friends, we were thinking in that way and wanted to learn more about that, so I think that'll be pretty cool as we all get jobs in our fields" after graduating from college.

In addition to being introduced to engineering through several unique elements, a number of the research participants indicated familiarity with the institution at the center of this study through a variety of individuals and factors. As his junior year of high school progressed and he was "looking at different colleges," Matthew had "always liked K-State [Kansas State University], liked Manhattan. I've just been excited to go to college and further my education." When Hannah was considering all of her educational and professional opportunities, she remembered that "I liked the program at K-State, and I felt like it was going to be a better suit for me" than some of her other options. Conversations with his teachers led Jackson to research programs that would be the best fit for his skill set and interest areas:

> I really wanted to go into something automotive. I really thought about going in to become an auto mechanic, or work in a body shop, and so that was kind of my main goal. I had some cool ideas and I was talking to my teachers about it. They said I should go into engineering, so I kind of looked into it and thought "K-State."

Similarly, Walter's relationship with an administrator at his high school enabled him to gain familiarity with the institution that he would eventually select to attend: "I was really close to my vice principal at the time, he also came to K-State. He studied something else, but he told me about engineering, [and] it was pretty good." For Johanna, it was a unique connection with a family member that shifted her trajectory towards the institution:

> My sister married somebody who went to K-State, and although he didn't do engineering, all of his friends that he lived with in the dorms were all engineers. They were all in the field and they are all professionals, and so they would talk about it all the time and try to say like, "we can help you out here" in getting more job shadows or different internships or something. It was always just kind of on the table.

Quite a few of the research participants identified the opportunity to, as prospective students in high school, attend a campus visit at the university as an impactful factor that acquainted them with the undergraduate institution. While many of the details are lost, Walter recalled visiting the university "sophomore year of high school. I don't remember specifically, but it was pretty early on, and I really liked the campus." The campus visit experience had a profound effect on Benjamin, who remembered from junior year of high school that he "felt pretty special, because the Assistant Dean, he was actually the one who helped tour me. I just kind of felt special, [and] there was a lot of stuff happening" in the engineering program. In addition to spending time with the Assistant Dean, Benjamin visited the computer science department specifically, where he discovered that "everybody here was super nice. All the people that I had ran into were super nice to me, so I think the atmosphere helped a lot" with the decision-making process. When Damien "took my first tour here my second semester junior year of high school," he knew almost instantaneously that "this is where I want to go, especially if you look at the numbers and statistics here for their engineering program," which made it "pretty easy to make that decision, especially after taking the tour, to be able to come here" after high school. For Mary Beth, the prospect of attending college after graduating from high school became more of a reality "once I started going on interviews to colleges and I realized how expensive it was, and like, what it's going to take to stay in college. That's when I kind of thought that this is real." Both Penelope and Christopher recollected attending a university event for prospective students called Junior Day while they were in high school; the former remarked that she "fell in love with this campus when I visited," while the latter noted that "I wanted to do engineering, so that's the field I went into," and visiting campus was "the next step for me" in

the college search process. After making his way to several campuses as a prospective engineering student, Edgar believed that he had found the right fit to continue his education:

> Out of all the schools that I visited, I feel like it is cliché because you hear it a lot, but I felt more comfortable. I got here and said "this feels good." I've been to other campuses, and I still get that feeling [at Kansas State University].

Through his involvement with the TRIO Program, Edgar spent several days throughout his high school career "taking trips to different colleges, and all of that was free, which is obviously a huge bonus. As far as my exposure to college and knowing how college works in and of itself, [it] was definitely TRIO."

### Development of Motivating Factors and Expectations

Across the entire timeline that encompasses the beginning of their college search process to the start of their first year as an engineering major at the university, the research participants offered responses that strongly suggested the possession of an authentic motivation to succeed in their efforts, as well as the ownership of confidence levels that can be described as cautiously, but substantially, optimistic. As Damien prepared to make the transition to the institution, he believed that his confidence levels were at "an all-time high right before I came to college. I think a lot of it had to do with me getting my Associate's at the same time as high school, so I kind of knew what a workload" would look like in a university setting. When the time came for Walter to head off to college to study engineering, he "was feeling pretty good about coming to my classes, especially my freshman year," which he knew ahead of time "was going to be hard. I knew that I would have to go through it, but I felt pretty confident" about being able to succeed. Although Jackson received support and encouragement at home, friends and peers from high school that doubted his chances gave him the confidence to "show them that I can do it,"

understanding that “it’s going to be hard, but I’ll take a challenge, because I have no idea what else I’m going to do with my life” outside of a career within the field of engineering.

When it came time for Benjamin to begin his college career, there were areas where he was certain of his ability, and others that gave him pause for concern:

> Coming in, I was confident in my programming. My confidence in my programming ability has always been there, so I've been confident about that. Not necessarily confident in areas outside of my program, because I didn't do well. I mean, I did average on the ACT, so that kind of took a chunk out of my confidence.

In order for Rebecca to feel prepared to enter the university setting as an engineering major, she had “to find my own confidence to overcome how difficult it was, and to accept that you have to work at something like that” to be successful. The mentality that Edgar adopted in terms of his confidence was drawn from the encouragement he received from those that taught his classes in high school:

> I knew that if I put my head to it, I can do it. I knew that because I got through high school with flying colors and my teachers, who knew more than me about college, told me “you'll be fine.” So, I didn’t question my ability to get a degree, and I still don’t question it.

The opportunities for meaningful and fulfilling employment after graduating in engineering gave Kevin the confidence he knew he would need in order to navigate such a challenging pathway:

> Deep down, I would say that I've always believed that I'll be able to do it. I've always believed that the difficulty of the coursework won’t really affect whether I'll be able to complete the degree. I think I've always believed that the most important thing is whether I believe it's worth it, [and] whether I believe I'll enjoy it afterwards, because it is a lot of

> work. I don't think that I would have continued on if I didn't think I could find self-worth in the work that I'm doing after I find that first job.

Although he did not possess an overwhelming amount of confidence coming into college, Christopher knew the approach that he was going to take in regards to his educational pursuits:

> I didn't come in with like, a super big head or anything. I was just thinking like, "I'm going to take this one semester or year at a time." So, I was thinking more along the lines of "let's get through what's happening now, and be successful at it." I think if that's what happened, then I would be able to be successful.

Prior to her arrival on campus, Penelope "had my plan out, and I knew I was just going to do it," which allowed her to feel "super confident going into my freshman year" as an engineering major. As college and the prospect of an engineering degree became a reality for Johanna, she reflected upon that which her parents had previously experienced at the collegiate level:

> I never doubted that I would make it all the way through. Both my parents didn't make it all the way through, but there were a lot of different reasons for those things. I think my mindset was more just being excited about uncertainty…you can either be scared of the uncertainty, or you can run into it. It depends on what you're trusting, what you're believing in, and what's your fuel for why you're getting up every day.

As the individuals involved within this study were preparing to navigate the transition from high school to the academic and personal challenges associated with pursuing an engineering degree at the collegiate level, the factors that would come to define their overarching motivation to succeed began to take shape. The primary foundations for their motivation, for each of the 13 research participants, can effectively be categorized into one of three classifications: parents and family members, the potential to have a significant impact on society

as a whole, and a desire to see their collegiate experience as an engineering student all the way through to the end goal. For Damien, the motivation to succeed and persist came from the sacrifices his family had made, and a desire to ensure a secure financial future:

> I think I know [that] whenever I'm done here, I'm going to look back and feel like it was worth every second of all the hard work I put in. Four years of hard work for the rest of my life to be able to do whatever I want, you know, not having to necessarily worry about money all the time like my family had to. I think that's probably my biggest motivation, is probably my family, especially my sister. She went to college, she went to a two-year college, but she still went farther than my parents. I see how happy she is, and how successful she is, and that definitely keeps me motivated.

Damien provided further context regarding his primary motivators, and how that relates to his family and his goals for the future:

> When I achieve stuff, that always keeps me motivated. I always try to look towards the future to stay motivated, because I kind of see what it was like for my parents to kind of struggle. They had to scrape by just to get a minivan to carry me and my sister around, and I don't want to have to do that. My parents told me for so long that they just want me to be successful, because life is so much easier.

Overall, Damien believed that his "biggest motivation is just to have that happier, better future," a mentality that his parents helped instill, knowing that planning for the future is important, "because it comes up a lot faster than you think, for sure." Similarly, the motivation that pushed Mary Beth to succeed stems from an aspiration "to be in a financially stable environment when I grow up. I want to be able to provide for a family" and to "provide a good situation for my family later in life." As Jackson prepared for the transition to the university to study engineering,

he admitted that his "real motivation is if I'm not doing what I'm supposed to be doing, then I just feel guilty," noting that it was "probably that way [that] I was raised" by his parents that would have led to that guilt. Motivation for Christopher came in the form of a presentation where he and several classmates "learned a lot about the different kind of demographics people would come from, and their [retention, success] rates, that it's kind of hard for them to get out of their social class." Given that his parents did not graduate from college and the statistics that had been presented to him, Christopher was motivated to work towards his engineering degree "just to be unique in that way. It wasn't like, I wanted to prove anybody wrong, but I feel like I can accomplish this," which made him feel as though "it was kind of a duty to myself, and everything that had happened to me was to keep me passing these classes" at the collegiate level. While Penelope admitted that, as a first-generation college student and the first of her siblings to head off to college, she received "a lot of pressure from my family," Penelope found that pressure to be motivating "to myself, because I wanted to do good [sic]. I wanted to take those opportunities" to set an example. Knowing what her family had done to put her in a position to attend college, Rebecca was driven by the need to recognize and honor those efforts:

> I want to do more than what they were able to do, because they are trying to provide for me the best that they can. So, it was just that kind of motivation of knowing that like, how I want to pay them back, for giving me what they gave me. If they hadn't have dropped out of college, maybe things would be different and I wouldn't be where I am.

The motivation that enabled Edgar to feel prepared for the pursuit of an engineering degree at the university level came from family and wanting to set an example for his siblings:

> My biggest motivation was my parents, to make them proud. To let them know that all of the long hours my Dad worked when I was little, and he wasn't around as much as he

> wanted to be, is worth something now, you know. I mean it, and I have a little sister now who's a senior in high school. I'm doing an engineering degree, which is what a lot of people consider you know, somewhat, I don't know if you want to say prestigious, but a lot of people say to me, “wow, you want to be an engineer,” and now my little sister wants to go to medical school or something. Now I feel like she's one-upped me, which I'm proud of her for doing. I feel that to a certain point, I hopefully set an example for her, you know. If she surpassed that example, that’s great. But most immediate, before myself, is making my family proud.

Several of the factors that the research participants mentioned throughout the course of the interview process fit into an overarching category that focuses on the potential for having a positive impact on other people, the engineering profession, and society as a whole. The opportunity to achieve his professional aspirations was important to Kevin, who believed that “the career is probably the biggest motivator for me, whether that means being able to find an internship, or just being able to find a career after college.” Additionally, Kevin was also cognizant of the kind of positive influence he could have as a graduate of an engineering program after his collegiate tenure had ended:

> I think that was a huge motivator for me, just to be able to see what pure hard work can do. Just knowing that that, combined with a degree, for example, the impact that I will be able to make. Whether that's on other people or my family down the road, that's always been huge for me. Other than that, I just say it comes down to me always wanting to be the best I can be at something. Not accept anything less than my best, and being able to look at myself in the mirror at the end of the day and say, “I gave it all I got.”

In addition to her parents and family members, the opportunities to participate in an engineering academy and robotics team in high school instilled in Penelope a sense of motivation that comes from “doing what I like,” and understanding that “you can’t just get into a career, something that you don’t want to do, because then you’re doing it for the rest of your life.” Similarly, involvement with a specifically-tailored program before coming to college helped establish a sense of motivation for continuing on with her academic pursuits:

> Before I came here, kind of in high school, I wasn't as motivated. I'm in this engineering program, like okay, that sounds cool, but by being in that [program], towards my senior year [of high school], I was kind of like, “this is interesting, this is kind of how I want to help impact the world, this is what I enjoy doing.” So, maybe there's something that I can do that can help someone, or change someone's life that way.

Although family was an essential part of the factors that helped shape Damien’s purpose, the opportunities available to leave home provided “another motivation to get the heck out of Kansas and go see the world,” because the ability to “come from a small town and have an opportunity to go to a college that literally had more people than my entire town” made him want to “go see the world even more now, because the world’s a little bigger than my home town in Kansas.”

The third and final category of motivational factors that the research participants identified throughout the interview process centers on the aspiration to see their experience as an engineering student to the end by finishing what they started in the first place. As Hannah prepared for the transition from high school to college, she had an idea of the mentality it would take to be successful as an engineering major:

> I think that I really excelled in high school, and I wanted the same [in college]. I know it wasn't going to be the same process, not even like the same level, and I wanted to

> continue that drive. I worked really hard in high school, and so I didn't want it to be for nothing. I wanted those same aspirations that I had as a senior to be as a continuation into college as well, and I think I did want to prove myself a little bit. I was kind of going into a hard major, out-of-state college, and I did want to set myself up. I didn't want to not [sic] reach those expectations that I had set up for myself.

Once she did arrive on campus, Hannah was successful with the mentality that she had developed as she was preparing for the transition from high school to the college environment:

> I think it was just that I was a first-generation college student, and it was that I was outnumbered. I think that I really put that pressure [on myself] because of those factors. I did want to succeed, and I think that I wanted to do well despite those things. It helped that I didn't just come in and know everything and expect everything. It was a good learning curve for me. It was really good. It was hard to adjust, and it was hard to learn all of these things at one time, but I did. It was a good experience, and it was something that I was proud of, too. I think that was a really big motivator and a push to succeed in the major that I chose and what I [had] started in, too.

While Benjamin had to resist the temptation of "quitting computer science and [the] university because I feel like I have the knowledge required to get a job already," he was motivated to complete his college degree "because I want to be the first in my family to have it." Benjamin was also aware of the inherent benefits of remaining in college and the experiences that would happen both in and outside of the classroom:

> I don't like the idea of going out and missing out on the opportunities that I would have [had] for the transitional period between becoming from a kid to an actual adult. I feel like this is a good transition period to prepare me for the real world, and I don't exactly

> want to lose out on my fun years. I've thought of leaving a lot but that's normal. You've just got to power through those thoughts.

Similarly, Walter determined that his primary motivators to succeed "were just like, sticking to it and finishing it. I always hate starting something I can't finish," especially something like his engineering coursework, which he "really liked doing" and was "what keeps me going" through the challenging academic program. Knowing full well the timeframe one needs to complete any engineering degree, Matthew understood that maintaining his focus would be the key to his continuation in the engineering program:

> I think the biggest motivating factor is like, I'm two years in, and I don't want to have to switch my major. I just want to get through it, pound through it, and graduate with a degree rather than having to start over and retake a class or something. I think the fear of not passing or not making it when I'm this far in has been the biggest motivator.

As Christopher was mentally preparing to make the jump from the expectations of a high school curriculum to those of an engineering major at the collegiate level, he recognized that his primary source of motivation was that "these are the goals I have set for myself. I want to meet them, and I want to get through this. I want to be successful," in addition to "that little bit of fear of being a failure" that served as "a little motivator" to find success in the engineering major. For Mary Beth, the opportunities that an engineering degree presented after graduation provided the foundational support for her motivation to press on:

> The biggest thing was that any other pathway I wanted to take, I didn't really know what I wanted to do. Every other major, not every other major, but a lot of the other majors are very competitive. It would be like I would have to take more schooling to be like, one of

> the top dogs. I'm not a top dog in engineering either, but it's more of like, wanting to get finished and start with my career rather than keep on with school.

Furthermore, Mary Beth was motivated by the prospect of a challenge, and refusing to back down from that challenge when other, possibly easier, pathways existed in college:

> I'm a very competitive person. Not necessarily competitive, but I like challenges, so I already told myself that if I dropped out of engineering, I would never forget myself. I knew that I could do it, and I knew that I can pull through if I could just get the mentality of like, finishing it, so that was the biggest thing. I just needed to push myself because I knew that if I went to a different major and got comfortable, I wouldn't be challenging myself. I would get bored, want out, and it would be wasting more time.

The steps Johanna took in high school to prepare herself for the challenges she would face at the collegiate level helped establish the motivating factors that would enable her to finish what she would be starting at the university:

> Knowing that I was in an academically rigorous program, I was like, “okay, I'm ready for college.” My classes in high school were really hard, and also I was always really busy. So, when people talked about [how] “there's so many things to do to get involved in college, you have to get involved,” I thought, “I'm already involved, that's not going to be a problem for me.” I think that was motivating, like what people were telling me to do. I was like “yeah, I can do that.” I think that mindset was really helpful.

### Adjustment of their Academic Approach and Expectations

The adjustment of their academic approach and expectations, the focal point of the second element, encompasses how the individuals reacted and changed their methodology to acclimate to the collegiate atmosphere. Subcategories within this particular element include a

significant shift in the importance of grade point average, the management of the transition of going directly to college after high school, the adaptation of study skills and techniques, and the identification of and successful response to challenges and concerns they faced. Although each of these individuals found success at the high school level, adjustments had to be made in order to fully acclimate and adapt to the collegiate atmosphere and its various attributes. Figure 4-2 demonstrates the corresponding node clusters associated with this specific element.

**Figure 4-2: Node Clusters for Adjustment of their Academic Approach and Expectations**


### Significant Shift in the Importance of Grade Point Average

One of the most intriguing findings that arose from the analysis of data focuses on the shifting importance of undergraduate grade point average that the engineering majors reported, and how it related to their feelings of self-worth and accomplishment as they progressed through

their academic tenure. Key points from conversations centered on grade point average include their mentality coming into college from high school, specific goals and benchmarks they had in mind, the adjustments that they made as they progressed through their first two semesters, and the shift in importance as it relates to their professional or career aspirations. Additionally, the research participants shared their own individual definitions of academic success and how those definitions may have deviated from their initial ideas upon entering the collegiate experience.

As they made the transition from high school to the undergraduate institution to major in engineering, a certain number of the research participants at the center of this study indicated that they entered the collegiate experience with a certain mentality regarding their grade point average. Penelope, for example, expressed that as she was starting her college tenure, she "wanted to have a 3.5 GPA at least. A 4.0 would be awesome, but probably not [in] engineering…3.5 was my goal freshman year, and that's going to be my GPA." Penelope followed up by stating that her "time management skills have progressed a lot, but they are not the best…I didn't do as well as I hoped to do, so now I put in the work to do a lot better." Damien harbored a similar mentality, explaining that "in high school, I was proud of myself to try to get a 4.0 [GPA], where here [in college], that might not be the case for me to be in engineering classes. I definitely thought that I should shoot for a 3.25 GPA." However, Damien recognized that he wanted to "think outside the box a little more and see the bigger picture," in addition to a desire to "be a little more realistic [about those expectations]." Looking back on when he first started, Walter shared insight into what may have influenced his mentality coming into college:

> Back in high school, I was valedictorian. I was getting all A's, but it wasn't as hard because I was taking community college classes, so they weren't as hard. It was easier to get an A, but I still pushed myself to get an A in every class.

On the other side of that spectrum, Jackson admitted when he arrived on campus that "I did the bare minimum in high school, and I'm starting to realize that you've got to do more than the bare minimum in college." Christopher, as he was about to begin his college career, was "thinking more of at least a 3.0 to a 3.2 [GPA] range was feasible for me, but also a goal at that time…probably a benchmark GPA for me rather than just the overall understanding." For Penelope, who "was never the student who had to get straight A's," her GPA goal was in place in order to meet certain requirements for a scholarship that was the primary reason behind her institutional attendance.

Throughout their first two semesters on campus, the research participants described several moments that influenced adjustments made to their notion of grade point average at the undergraduate level, starting from the very beginning of the transition from high school to college. Kevin identified that his particular high school "was really competitive. I was always comparing myself to these other students…I never really considered not getting a 4.0 in high school." When asked if those grade point average expectations continued into college, Kevin offered the following response:

> I would say that it's changed a lot. I don't know if it's the atmosphere or if it's just my outlook, because I feel like in high school it was really competitive, but in college, it's kind of more of a collaborative atmosphere. Everybody's kind of having the train of thought of "we are going to get through this together."

Similarly, Edgar believed that when he first began his college career "GPA was one of the bigger things I had on my mind. As I progressed through college…I realized GPA doesn't have as big effect as you might suppose." As a result, Edgar was "a little less worried about my grades" but still made an effort to "do my best in all my different classes, but I didn't stress about it as much."

For several of the research participants, it was a particular grade on an exam or an entire class that provided the opportunity for the reassessment of their academic expectations. Hannah, who had been very successful academically in high school, stated that "I got my first B, and I've never done that before, and so I thought that was the worst thing in the world. Now looking at it, I really hope a get a B [on future exams and classes]." Early on, Edgar explained that he "got a D in a class, which [for me] is failing," and that his biggest fear was having "to tell my parents I failed in a class. They took it well, and I re-took that class over the summer" and earned a better grade. Along that same line, Matthew explained a similar experience upon receiving an unexpected exam grade:

> I got my first D on a test ever and I was like, "Oh my gosh," and then I learned about curves and stuff like that. I saw test averages and now a D is more like a C for some people, and I just think with curves and stuff, it's not as bad to get say, a B, which could be curved to an A. It's definitely different than high school with the grade scale and stuff like that, but I think it's just [that] you [have] got to put in your best effort. If you're above average, then you're going to get a better grade. And rather than thinking like, "Oh, I'm going to get an A on this test," it's like, "I'm going up to try to do 3% above average" or something. So, you would kind of compare yourself to what other people are doing and then try to do better, rather than "I'm going to get an A or a 90 [percent]."

As the research participants progressed through their first year as an engineering major, the pursuit of their degree and the role that grade point averages played in those efforts became clearer. Johanna, in addressing other engineering majors, argued that they should be "learning what you want to learn about, what interests you, and pursuing learning more about those things" and not necessarily chasing a particular grade. Furthermore, Johanna expressed concern for her institutional peers, contending that "for some people, it's just about getting A's. But, if you fail at that and you [only] care about that, then there's a problem. There's a disconnect." For Edgar, it was "definitely staying on top of classes. When you talk to upperclassmen and you learn more about other people's experiences, then you realize [that] maybe coursework isn't as important as you might have thought it was" when college began. Similarly, Benjamin explained that "a lot of social aspects became more important to me as opposed to GPA. Getting the knowledge is still important, but I've noticed that being become increasingly more important to me" in regards to his collegiate experience. As a part of that adjustment period across his first year as an engineering major, Matthew offered the following overview:

> I think that it had been tough, and there was lots of work that needed to be put in. I think that I did just enough to get by instead of doing everything I can and getting straight A's. I've been kind of like, "Oh, I have this grade, I can do this [on an exam] and get this average" is what I've been doing, and at this point, it's not a discouragement.

When reviewing the moments that have made them adjust their academic expectations in regards to their undergraduate grade point average, Rebecca stated that her experiences throughout that first year "made me realize that it's not just about the grades. It's about the skills you take from taking the classes," and Matthew affirmed that "grades do matter, but not as much as I thought. Just getting through is what matters now."

In addition to making adjustments to their expectations regarding grade point average throughout their first year as an engineering major, several of the research participants expressed a shift in their overarching GPA outlook because of factors related to available career and professional opportunities during and after their undergraduate tenure. Edgar provided insight on this subject as it relates to his thought process during his first two semesters in engineering:

> I did enough to position myself where I want to be. A little of that might be "yes, I don't want to fall below a certain GPA percentage," but it's not so much about the A's and B's anymore. Now it's about the whole picture. Definitely the grade that you get is important, but like I said, when I'm looking at the future, [I ask] "am I getting the grades now that will put me in the position I want to be when I get out of school?"

Through communication with employers, recruiters, and company representatives, Jackson was "told many times that they want to see that you've been active and social in college, because a 4.0 GPA means nothing if you weren't out doing stuff" like being involved with on-campus and community organizations. Kevin weighed in with his experiences connecting with employers and company representatives and the grade point average requirements for internships and post-graduate careers, stating that it "is literally just a cut-off [point]. If you make it past that, then they really don't care about the difference," which made him consider whether "letting that GPA drop and getting a better college experience will make the rest of my studying worth it" through additional time to enhance other components on his resume that would stand out to a company or an employer. Additionally, Kevin shared this anecdote from his experiences building contacts and networking at career fairs and interviews being held on campus:

> I pretty quickly realized that in these interviews, they're not asking anything about your coursework, they are not asking anything about your GPA. That's when I realized that

> once you get that interview, then it's about everything else on your resume. I've heard people say that before and I'd always just kind of told myself that it would make me stand out, having like a 4.0 [GPA]. I realized that even if you have a 4.0 and the other guy has a 3.5, for example, then they're going to go with the person that interviews better and that they feel is going to be a better fit.

Similarly, Mary Beth found these conversations with future and prospective employers to be "really eye-opening…to see how they're not going to look at anybody else, they are not going to compare your grades or anything. They are going to look at who you are and what you're doing to advance yourself."

When asked about how they would individually define academic success, the research participants resoundingly responded with factors that went beyond a high-achieving grade point average, including Rebecca, who believed that academic success for an individual focuses on their ability "to complete the curriculum that the college provided for you, but [to] do it in a way that you gained skills rather than just gaining a grade." Mary Beth argued that while other college students may value A's and a 4.0 GPA as determinants of their success, she believed that academic success means "giving it your all, and no matter how that ends up, that's how you succeed" because those individuals that are "just going to class and not putting extra effort…or not doing those extra things, you're not technically succeeding. You're just going through the motions." Furthermore, Mary Beth stated that even students earning C's could consider themselves successful if they are "putting in all the effort and learning all the material," and that she did not feel as though "grades accurately define your intelligence" as an engineering student. Johanna shared a specific example of how her academic approach had to shift and the impact it had on her definition of academic success:

> I got my first and second C in the same semester, so that was kind of like a wake-up call about like, what do I need to care about. It's kind of like necessity-based at first, but once you get not as good of grades, then you start expanding your view of success. You have to adapt that to be flexible, because everybody wants to be successful in some capacity. You have to adjust it so that you can be successful because it's like a mind over matter thing. Someone can get a 2.0 GPA and come out with a job they love if they sell themselves the right way [and] if they followed what they actually want to do.

Regarding her thoughts on academic success, Hannah "used to think of it as a really good GPA, A's in your classes and stuff," but her idea of academic success has shifted to whether or not she can answer certain questions: "Did I understand the content enough to use it later on? Did I go into my professor's office hours? Did I work hard outside of class?" In regards to academic outcomes despite these efforts, Hannah argued that "even if I got a B instead, I still would say that was a successful semester, so my standards definitely changed in that sense. [It's] definitely more of an involved personable academic journey" for her as an engineering student. Matthew responded in a similar fashion to Hannah regarding academic success:

> Being academically successful for me means number one, passing your classes and number two, putting your best foot forward and trying with all you've got. You're not going to pass every test with an A, you're not going to do the best you can all the time. But, I think learning from those mistakes and talking to a professor, talking to a friend, and learning what you do better next time, I think that's what's going to make you successful.

The prospect of job and career opportunities beyond graduation also affected their definitions of academic success. Johanna stated that for her, "it's a lot more sustainable to think

I'm going to pursue learning" in a variety of subjects, that if expecting high grades in all of your engineering classes is "your standard of success, then you are going to fail," and that "if what you're learning is preparing you for your future career, [then] I feel like that defines your academic success." Benjamin felt that academic success "shouldn't just be defined by your GPA. Really, it should be if you get a job and you worked hard, then you should consider yourself successful." Alternatively, Edgar did have a specific goal in mind concerning his grade point average, stating that "[I] definitely don't want to drop below a 3.0 GPA. I'm not close to that [and] I don't particularly care if I'm close or above [a] 3.7 [GPA]." Edgar was not concerned about falling short of his original goal, but wanted to maintain at least a 3.0 GPA because "I've realized that from talking to recruiters and employers that the academics are just a piece of the overall person." Regarding his own approach to academic success, Kevin shared that "it's the end result" that he cares about, and that "I wouldn't say that it's necessarily my GPA. I'd say that it is succeeding [in] classes and having a good enough course record and resume to impress employers…I wouldn't say it's necessarily excelling in coursework." Kevin then further expanded his initial remarks:

> I've always felt like succeeding in my classes is what will allow me to have that freedom. I've heard a lot of people say that after college then your GPA only matters for your first two or three years, and your activities in college only matter for those first couple of years, and then it's just about your performance in your jobs after that.

Penelope recognized an important first step towards gaining professional experience as an engineering student, as she articulated that "the end goal is to get a job, and so grades are important from that aspect. You need [certain grades] to get looked at by companies and to get

an internship," but that engineering students "have to go out and do things to succeed and get farther" to become more of a well-rounded individual that companies will want to hire.

### Management of the Transition from High School to College

The transition from high school to a four-year university can prove challenging for students of any major or background, and first-generation engineering students are no exception. The research participants involved within this study shared a common thread in the early discovery of how to manage their transition to the university as an engineering student. As she began her college career, Penelope identified that her experience was "completely different from high school. You are going from taking eight hours of class [a day] and doing some homework after class" to the university, where she was "taking way less hours of actual class, but you have a lot of independence that just wasn't there in high school." As a result, Penelope admitted that she needed to stay busy in order "to actually manage my time wisely. If I have too much time on my hands, I tend to procrastinate."

Coming from a high school that had significantly different demographics than those found at the university, Walter believed that "coming out of my comfort zone, talking to more people, and just trying to live that college experience made me transition better" to the collegiate atmosphere. Walter further addressed the differences between the environment at his high school and the one that was waiting on him at the university:

> I felt really comfortable in my high school and everybody looked like me. We all look similar, we all had similar backgrounds, but coming here it was a completely different transition. I feel like obviously demographics are the opposite, you know, there's not that many Hispanics. Well, there's a lot of Hispanics coming to college, but not that many compared to Caucasian demographics.

However, the campus environment empowered him to quickly realize that “it’s not really about color. It’s more like, you are here for yourself, who cares if you're different than everybody else, you know, you're here for yourself and your future”. In addition to that adjustment, Walter also stated that, in order to be successful, he had to manage his responsibilities in a way that allowed him to know “what I am doing the entire time, what I need to get done, [what] I need to set up, [and] stretching my time to get things done.” Similarly, Kevin was initially concerned about the adjustment to college before speaking to a friend who was already enrolled as an engineering major at the university:

> He told me that it's difficult, but he was getting by and he was doing well while being a division one student-athlete. So, that really told me that I would be able to do it. I would be able to transition, so that was encouraging to me that I'd be able to do it.

Participation in a variety of events and activities was another factor that several of the research participants identified as a key to their transition to college. For Johanna, involvement outside of the classroom “helped me be able to put myself out there in college and join marching band, join a scholarship house, [and] not just hide in the corner.” Mary Beth noted that “it was hard realizing that you had to make the effort to go out and do stuff, like go out and make friends and go out. It was all on you,” and that “it was definitely eye-opening on how much more social I needed to be” in order to establish connections that would encourage her transition. Along those same lines, Kevin identified that he wanted to “branch myself out, and use that to meet new people and get a view of different aspects of college” that could help him manage the transition. Edgar took a similar approach, which was motivated by a unique factor:

> I got to college and I saw other people doing different things, and then I realized what I was missing out on. I set expectations for myself to get involved in more extracurricular

> activities, so once I got here I took very naturally to it, and it was a good transition for me. I had that mentality of "I'm missing out, so I'm going to dive in," and then I did, and it worked out pretty well.

Initially, Christopher was "kind of afraid to put myself out there in those kind of situations," but eventually overcame that fear and found that "staying after [class, meetings] and things like that, and trying to learn as much as possible" had a positive impact on his transition to college. Benjamin experienced a similar initial apprehension, and expressed that in college "you have to force yourself to talk to people, and that can be difficult" as a part of the learning experience, but overall, putting yourself "in those situations that you're not exactly comfortable with was difficult at first, but as I went on it became much easier."

Several of the research participants, on the subject of managing the transition from high school to college, mentioned concepts related to a feeling of accountability and being responsible for their actions in and out of the classroom. Early on, Mary Beth discovered that "the biggest thing going from high school to college was it was more of, it's your choice to do the work and to go to class," and that she learned "it's more of, you have to hold yourself to that expectation of doing well, rather than someone else," like a teacher or counselor at the high school level. Mary Beth continued that point by suggesting that her responsibilities were "all on me now. It wasn't anybody else's. I was the one who had to seek out those resources" to be successful. As an engineering student, Kevin described his mentality during the first year on campus:

> Freshman year, I didn't feel as if the coursework was all that much harder, all that much more difficult compared to a course load of AP courses. I think the responsibility was a lot different with the time management, and being on your own, and having the freedom to be able to explore all these different avenues, whether that was clubs, intramurals,

> activities, [or] meeting new people. I think that was the most difficult part for me. I really tried to start off on a good foot, tried to ease myself into those extracurricular activities, so that I would be able to kind of gauge how much effort it was going to take to complete that coursework, and how much time I would have left over to be able to distribute that between things that were going to be my free time.

While he eventually established a balance among his responsibilities, Walter argued that the most challenging part of the transition from high school to college "was being responsible in the sense of getting everything done and studying. I think that was really difficult, because I never really had to do that to [that kind of] an extent," and that with his college courses it "was really difficult, just setting the time for that and going to class, being responsible, just like an adult." On the subject of being responsible with time, Johanna shared an anecdote about a very specific challenge she faced early on in her tenure as a college student:

> I remember my first few weeks of my freshman year, I would think "I [have] got this two or three hour gap in my schedule, I'm going to call all my friends from home." That resulted in me being like "I actually need to do homework during this time," so I think that was probably the hardest thing, and that was pretty easy to fix for me.

Successfully transitioning from high school to college may also involve a willingness to admit when to ask for help, as Benjamin detailed when I inquired about the adjustment:

> Originally, I was the person to be like "I can do it all on my own and I can figure it out," and yeah, you can figure it out on your own, but getting it figured out in time is what's important. You shouldn't be afraid to ask for help, and that has changed a lot for me, like consulting with other people and working on team projects, because you just learn a lot when you expose yourself to other people.

Walter came to a similar realization, as he addressed in regards to his first few weeks on campus as an engineering student:

> I didn't know how to adapt at that point, and I feel like that kind of set me back in asking for help. I was like, "it's going to make me look dumb if I ask for help or something in class," but then I realized that it's not dumb to ask for help. I feel like other people have the same questions as I did. Sometimes, I would wait for people to ask for help with questions and I would have the same question, so it was more pride to it. I feel like that was really difficult for me to get over with. I needed to ask for help in order to be successful, and obviously that's getting out of my comfort zone.

**Adaptation of Study Skills and Techniques**

In addition to making concerted efforts to successfully navigate the transition from high school to college, the research participants shared qualities and experiences that demonstrated an ability to adapt their study skills and techniques to the college environment, including purposeful choices regarding the classes in which they enrolled, the homework and assignments they received, and how they studied and prepared for the content associated with their coursework. During his first semester on campus, Kevin remembered that he "was in 13 credit hours, so a little less than the average. I really tried to invest a lot of time into all my classes to really understand the material," which be believed "really kind of set me off on the right foot [and] kind of taught me what it takes to be doing well" from the beginning of his college career. Starting off with a lighter course load during the first semester was a strategy also employed by Mary Beth, who stated that "I took 13 or 14 credit hours. I knew that was going to be about my average for the rest of my career, so that's what I started out with," while Walter admitted that "I was only taking 12 credit hours because I didn't know what I was getting into" in regards to the

demands of college coursework. Due to his own research and the proximity of a community college in relation to his high school, Damien was able to have a manageable first semester:

> I came in [to the university] with 36 [credit] hours, so I'm able to take a little bit less [and] put in five, six hours on average a day of outside class, whether that's preparing for classes or studying for tests, or whatever it is and try to stay involved.

Similarly, opportunities offered at the high school level enabled Kevin "to not have to take as many credit hours per semester as others have. I think that might have been part of how the academic volume of work was more manageable in the transition" to the demands of a collegiate atmosphere. Jackson had a different approach, but came to a similar conclusion: "First semester, I was taking 16 credit hours. I didn't have too much of a work load…they were pretty much a review of what I took senior year of high school." However, Jackson admitted with significant candor that "second semester, I took 18 credit hours, and some of those classes I took were like a slap to the face." When I inquired as to why Jackson was enrolling in higher-than-average course loads during his first couple of semesters, he offered that younger family members with college aspirations and the associated cost to his parents spurned a desire "to get in and get out fast," before he arrived at the conclusion that "18 to 20 credit hours every semester is not a good idea. I decided that after my second semester" as an engineering student. Jackson then concluded that he "didn't meet my expectations for those classes, so I'm retaking those now" to improve his overall grade point average.

Opportunities available at the high school level to receive college credit can also lead to unintended consequences for first-year, first-generation engineering students. Hannah noted that "one thing that made it harder [about the transition] was [that] I took a lot of Advanced Placement and college courses, so I was starting with a majority of sophomore-level students,"

which made it difficult for her, because among the other students she "felt like the only new one. Everyone else had at least been there for a semester." While Damien excelled at the college-level courses he completed in high school, he conceded that the university coursework "was a whole different ball game," and, following the first round of exams, discovered that he was "not doing as hot as I thought I was, and I had to make some changes to do better in my classes."

The structure of the university courses themselves, in addition to the rigor of the material, were among the factors that the research participants recognized and reacted to within their first few weeks and months on campus. On this subject, Matthew remarked that his study habits were heavily influenced by "getting into my first real class, which was Engineering Physics," and that the tests and exams in these college courses "can throw a lot more curveballs at you, so you have to know everything about something" to be properly prepared to succeed. Sharing a similar outlook, Christopher indicated that "from an academic standpoint, everything is just magnified times ten" in regards to the college coursework, when compared to his high school tenure. Additionally, Christopher shared the following in relation to the structure of his college courses:

> As the classes kept going on, you just had to keep learning at the beginning of the semester like, this is how this teacher is going to be, [and] this is how this class is set up. You have to find ways to study. For me, it's kind of the same process each semester. It's learning how to be successful in that class.

Although the amount of time spent inside of a physical classroom decreased from what he was used to in high school, Damien offered that "calculus classes, Engineering Physics, and classes like that take up more than an hour or two of homework. It's [more like] seven to eight hours a week of homework," but that the upside was that there was "a lot more time and stuff that you

have to put in those classes" to complete the homework and study for the exams. Similarly, Rebecca noted how the design of college-level courses enabled her to adapt and succeed:

> The way that they structure the classes to where it is like a lecture corresponds with the homework. I think that's really helpful, because then you're forced to at least view the material or look at the material. I found the homework was reasonable to do. I didn't think it was unreasonable to have multiple homework assignments due each week, it was just me putting in that last step of effort to really comprehend. It was kind of like what they had set up was very manageable, it was just me understanding what I needed to do to really make what they set up beneficial to me.

Rebecca also commented on how the structure of the class made it feasible to adapt study skills, techniques, and expectations in terms of the necessary time and effort:

> It's kind of like the first few weeks of class, coming in as a freshman, you kind of started to get a feel for it. The professors are really good about making it clear what their expectations were, so in doing that you're able to kind of understand [that] this is the level that I need to get to. That's kind of what I need for me to do well in this class.

Making note of the freedom that college students have at their disposal, Mary Beth remarked that she could "feel within the first couple of weeks, I kind of realized…that you could sleep through class if you wanted to, but you miss the material," and would have to find ways to catch up with the rest of the class. From an accountability standpoint, Mary Beth followed up by stating that "I knew that I was going to have to do it myself, but I didn't realize what that meant until I started going to class" that first semester.

Another common thread among the research participants focused on the concept of studying for the courses within their respective engineering major, as well as the adjustments that

had to be made to the amount of time spent studying, the individuals with whom they studied, and the different strategies employed in order to adapt to a challenging set of classes. When asked about his study habits, Matthew made the following admission:

> I didn't really have to study much. [I] did my homework in class or whenever, and then coming to college, [I] had to study a lot harder to get an A or a B as opposed to not studying at all for a test and then going and taking it. I think it was a big change coming to college, the amount of studying and time you had to put in to actually learn the material and succeed, rather than in high school, [where] I could just blow it off and pass. I think the classes and material wasn't like, it's harder, obviously, but it wasn't anything that was just out of this world. The material was more, you had to know a lot, [and] you had to know it better than you did in high school.

Edgar offered a similar response in regards to the adjustment that needed to be made to the amount of time required to study as an engineering major:

> The fact that you have to study so much more outside [of] class. You know, I didn't have to study this much in high school, whether that be the classes weren't that tough or pacing, whatever you want to call it, but I had to study a lot more for sure in college. You get a lot more workload in college, and so that was the toughest piece. It took me a long time to make that transition and force myself to study more.

Penelope remembered not having to study very much in high school, but in college, "you definitely need to set aside time to get everything that you need to get done for each class." Both Penelope and Rebecca recalled suggestions that they received regarding a studying formula; the former gathered from first year "that you had to study for two to three hours for every hour class that you met for class," while the latter recollected that "everybody says like three hours of

studying for every hour you are in class." However, Rebecca added that it was difficult to comprehend just how much time that was, so she would spend "a lot of time doing the homework, and then I'd realize, 'oh, I don't really understand it', so I slowly would add more time to spend actually studying the material." For Walter, it was a realization about his future that led to a change in his mentality regarding studying:

> I've never studied so hard, but then I realized after that [that] hard work pays off and that I need to study whenever I'm going to be an engineer. Those [upper-level] classes are going to be equal to or greater than chemistry, you know, so I realized at that point that I needed to really study.

Early on, Johanna figured out "when I had a study guide to do, or paper to write, or a speech to give, I knew how to manage my time to make it come together" in time to have other interests and pursuits at the collegiate level.

In addition to discovering the changes that needed to be made concerning the amount of time that had to be dedicated to studying, the majority of the research participants also indicated a process of determining whether individual studying, group studying, or a combination of both should be employed as they acclimated to the collegiate atmosphere as an engineering major. As one of the few advocates for individual studying, Rebecca remarked that "I tried group studying, and then I realized that wasn't quite my thing…I found that it was really helpful to just go to the library, find a quiet corner, and stay there for the afternoon." For Rebecca, individual studying helped keep her accountable: "I knew that I had my stuff in front of me that I could work on and work at my own pace, so definitely individual studying was kind of what I preferred to do." Similarly, Hannah remarked that "I like to collaborate with people, but when it's time for studying, I realized I need to be by myself and focus on my thing," but also recognized that she

"had to adjust to the way that I study and prepared for my academics more than in high school, [where] I used to be able to look at my old notes an hour before [an exam] and be fine." Matthew started off college primarily studying on his own, until upper-class students in engineering helped bring about a revelation in his approach to studying: "I think it's a learning curve to form study habits that work for you…I think the more you're with the people you want to be with, [the more] you can work better and work harder" than you would on your own. When I asked Matthew about specific study habits he developed through group studying, he replied that "I know friends and people, we go to Fiedler [Hall]. We work together or we can go find a study room and we can talk through stuff rather than trying to figure it out on our own," and as a result, he believed that "my study habits have gotten better" since the start of his college tenure. While others may have had difficulty connecting with others to form study groups, Walter overcame that hurdle by "talking to people, and just getting out of my comfort zone. I met people that we first started studying, and getting study groups [together]…and I think that helped me be pretty successful in my classes." Penelope went a step further in discussing how she found success when she studied for classes during her first year on campus:

> I think every day from at least 5:00pm to 8:00pm, I would study with [other] First Scholars or my roommate. She was also in MAPS [Multicultural Academic Program Success] with me and First Scholars, and it was a lot of studying with the people I knew. I couldn't really study by myself. It's hard to motivate, like self-motivate, but if you're in classes with people that you like, it's a lot easier. I definitely did better in the classes I had friends in, [because] it's easier to study that way.

Other research participants found that a combination of individual and group studying was a necessary adjustment to the rigor of the engineering curriculum, including Damien, who incorporated a unique study space within the engineering building into his academic regimen:

> I spent hours and hours in the "Chamber of Understanding" up on third floor. It's just kind of nice like, I really have to be able to find myself a little quiet spot to be able to get away if I really want to get it, you know, that many hours of consistent studying. I have to be alone, [but] there are some classes that I do prefer to study [with] groups. It's a little easier to work out a problem that takes me three or four hours with someone rather than doing that on my own.

Kevin also made note of the importance of finding a comfortable study space in the engineering building, arguing that it "was a lot more helpful than studying in my dorm room, because [of] so many distractions." Additionally, Kevin discovered that he had "spent a lot of that time studying by myself," but that after his first semester he "realized the importance of studying with others" to help navigate those more challenging classes. At the start of his college career, Jackson admitted that "I didn't study a lot. I just got to the homework and thought, 'oh, that's good enough' for studying" before the more challenging, upper-level courses encouraged the following admission regarding his study habits: "I'm definitely like, working harder and studying. I work with groups, and sometimes I just kind of worked alone because it's easier and quiet." In a manner similar to Penelope's response regarding studying and the presence of friends, Mary Beth offered this insight into how she maintained balance in the adjustment of her habits:

> I would start off studying by myself because I feel like sometimes I might stay more focused if I studied by myself. But then, if I got [sic] questions, or if we were all

> struggling with something, I have a group of friends I kind of bonded over that time with in engineering. So, if we were all kind of struggling with something, we would be like, "hey, do you want to meet up and study sometime," so it was kind of a combination of both.

New studying strategies that developed as a result of the adjustment to the rigor of engineering-related coursework were also indicated by several of the research participants, including Damien, who shared the following anecdote regarding his academic adaptation:

> You learn over time, especially like, I prepare way more before I go into classes than a lot of people do. I figured out that's what helps me best, because then I can actually go into my classes and I'm not just learning new material. I'm going in and kind of revising what I went in with and before I went into that class. I'll just make sure to read my chapters before I go into Engineering Physics so it's not just [that] I'm learning new material when I go to lecture, I'm actually revising and reviewing what I went over the night before, and that's what helps me best. I know some people that, you know, they don't need the EP2 [Engineering Physics 2] textbook or anything like that, they [are] just going to lecture and they're fine, but personally, that's what I have to do.

For Christopher, it was an unexpected grade from his first Calculus 2 exam that first made him realize that "I need to do more than just study guides. I need to be getting into different habits for staying on top of things ahead of time. It's a big thing for me" to manage the academic workload. However, not everyone who makes these types of realizations has a smooth transition in terms of adjusting their study methods and strategies, as Hannah details regarding her own experience:

> I had to practice. I had blank study sheets where I would just practice problems over and over until I just couldn't look at it anymore, because I'd say "oh, yeah I got it," and get to

> the test and not understand it. So, that was a huge adjustment that I had to make. It was a huge adjustment, and it frustrated me a lot because it was a huge time difference in effort, [and a] difference that I wasn't prepared to do.

**Identification of and Successful Response to Challenges and Concerns**

The ability on the part of the first-year, first-generation engineering students at the epicenter of this research to adjust their actions and approach to the demands of their coursework was significantly reinforced by their capacity to not only identify certain challenges and concerns throughout their first two semesters, but to take purposeful steps to address them through a wide array of methods. Comprehension of the content being taught in the classroom was a common thread among the research participants, as Kevin demonstrates in the following admission:

> One of my most significant concerns was that the coursework was going to be way harder than what I was used to in high school. I kept up with AP [Advanced Placement] courses throughout high school, but I had heard from so many people that college in general [was] so much harder than high school, and that engineering is so much harder than like, the typical college student experience. I was concerned that starting off in Calculus 2 for example, rather than retaking Calculus 1, was going to give me a tough time throughout that semester and that I would start off on the wrong foot, and that would be really discouraging for the semesters to come.

Even through Calculus 2 was indeed challenging for Kevin, he credited a balanced outlook on his college career with giving him the necessary approach to weather the academic storm:

> I've always been really goal-driven, future-oriented, and I always told myself that I need to remember why I'm at college, which is to go to class, get a degree, and to excel in my classes. At the same time, I've always had to remind myself that it’s worth it to take

> breaks, it's worth it to go into the social scene and meet new people, have new experiences, and ultimately end college with a positive view of it. It wasn't all just grinding away in classes. It's not all just about the grades you make. I wouldn't say it's that I was necessarily like, opposed to going and meeting new people, it's more just letting myself not spend all the time in classes.

Conversations and experiences prior to coming to college helped Damien to anticipate that "engineering can sometimes be on a different level than a lot of other majors" at the university, and upper-level prep courses in high school put him in a position to know how to properly "prepare for my classes a lot more, especially because I knew they're harder. So, I put in more time before, during, and after class" once he arrived at the university. For Benjamin, his "biggest concern was just wanting to do well, but being worried that I wasn't going to excel" because of how he viewed his composite ACT score and how that score might reflect on his academic abilities. When I asked about whether or not that concern remained throughout his first year, Benjamin responded that "it's gone away completely now. The 21 on the ACT, it actually means nothing after your first year" in the engineering curriculum. At the start of her college career, Penelope was initially "worried about how the classes were going to be, and like, how I was going to get into my schedule," but her participation in MAPS (Multicultural Academic Program Success), a summer bridge program offered for individuals entering their first semester at the university, helped her to feel "pretty well prepared for what it was going to be. It was way less [sic] hours than in high school, and you make up for it with the studying that you do" outside of actually being in a college classroom. Jackson also had reservations about the shift in his schedule going from high school to college, and acknowledged after arriving on campus that "one of the biggest challenges is [sic] the breaks between classes, because you are not motivated

to do stuff." In order to combat this unique challenge, Jackson would "try and pack my classes in as close as possible. That way, I don't have those time gaps," where it would be easy to get distracted.

While Edgar conceded that going into his college career his most significant challenge was having "no idea what I was getting myself into" in regards to what it would take to be successful academically, he also noted that "I never once thought that I couldn't do the degree," and that "I never once doubted myself" to do what was necessary to persist in an engineering major. In order to do that, however, Edgar had to solidify a certain mindset, which meant "staying motivated on coursework" and "definitely staying on top of classes," but also realizing that "coursework will only take you so far" in regards to having a rewarding and fulfilling collegiate experience. From a confidence standpoint, Mary Beth entered her college career with a mentality similar to Edgar's, but soon found that "getting into [the] engineering material, it was kind of a setback. It was like, 'wow, I really have to try' if I want this" engineering degree. Recognizing the challenge of these more rigorous classes, Mary Beth made connections with her classmates, and believed that "the biggest thing that helped me were my friends. They were in the same place as me, they all felt the same way, so that we all can push each other" to stay with and finish the engineering major. While her initial levels may have taken a hit, Mary Beth knew by the end of her first year that with her support system, "I'm confident enough in myself to finish" the degree. Workload was a concern for Matthew, who believed that his "most significant challenge would be just really buckling down and getting everything done" in relation to his engineering classes. As he made his way to the university, he believed that he had "something to prove now…it's not just going to be a breeze. They're saying it's going to be tough, and I just want to show them that I can get through" the engineering curriculum and graduate with the

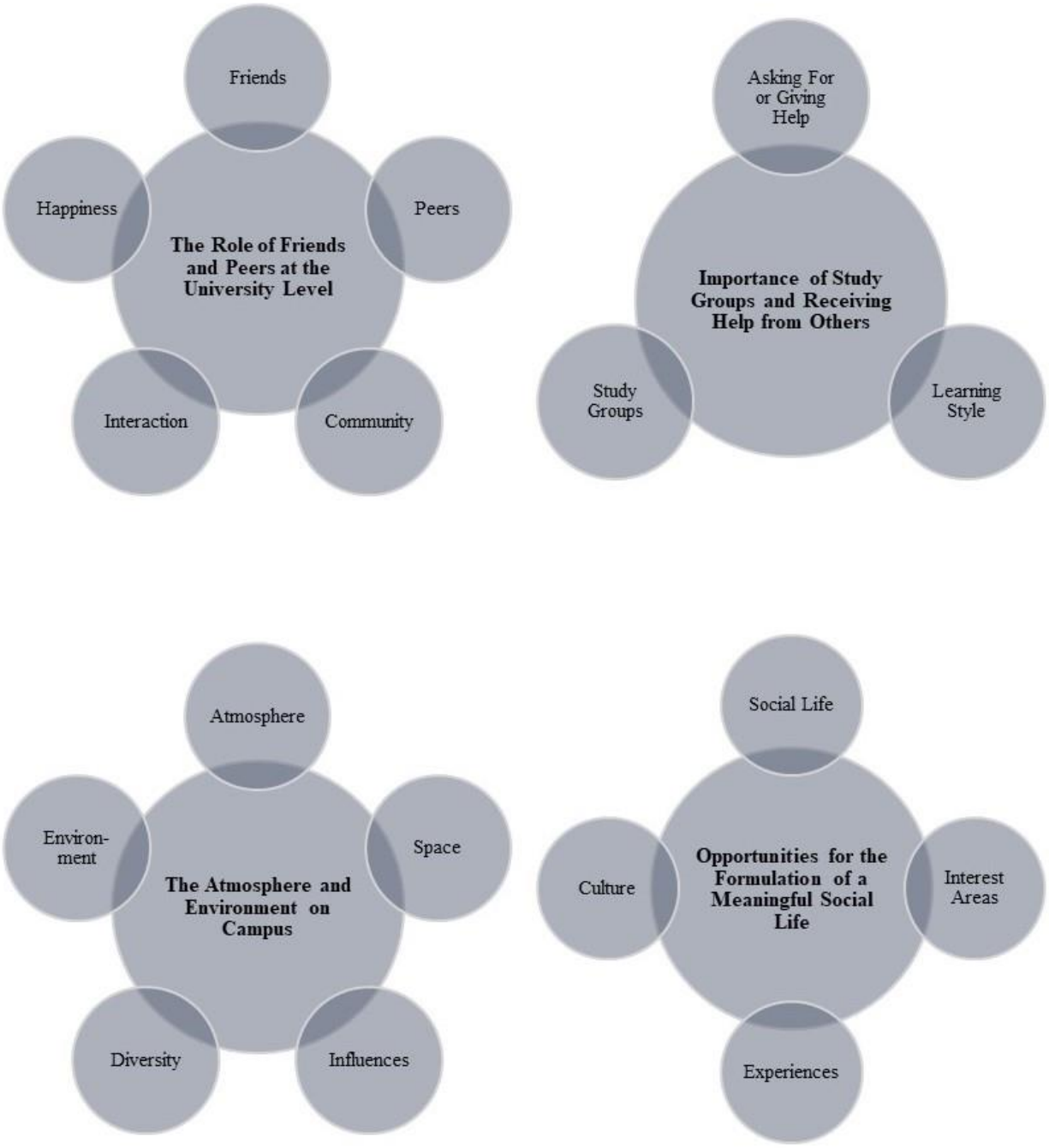
degree. Christopher's biggest concern in first year was managing all of his responsibilities in a brand new environment, which he detailed adjusting to throughout the following response:

> You're living on your own, which is a lot different. You have to learn how to manage your life on your own, which kind of affects your academic life. Everything else takes time that you don't have to do at home, but now you're living on your own, so learning how to plan, when to study, and when to carve out time to do so.

### Strong Connections with Peers and Relationships with Friends

The third element centers on the strong connections with peers and meaningful relationships that the individuals established and fostered throughout their first year in the engineering curriculum. Within this particular element, subcategories include the role of friends and peers at the university level, the importance of study groups and receiving help from others, the atmosphere and environment on campus, and the opportunities for the formulation of a meaningful social life during their first year at the university. Given the challenging nature of the courses associated with any undergraduate engineering program, having support from those around them had a significant and positive impact on those that participated in the study. Figure 4-3 demonstrates the corresponding node clusters associated with this particular element.

**Figure 4-3: Node Clusters for Strong Connections with Friends and Relationships with Peers**




### The Role of Friends and Peers at the University Level

Throughout their first year on campus as engineering students, the research participants, based upon the responses they provided during the interviews, were significantly and positively

impacted by the bonds that were forged among friends and peers as they navigated the college curriculum and adjusted to the university environment. Involvement in specifically-tailored programs, the need for developing a support system, and the efforts taken to branch out and connect with fellow classmates were some of the most important factors that led the study participants to rely heavily on the experience, guidance, and encouragement of their friends and peers at the university. Coming into college, Kevin set out to "meet new people and learn where they are from [and] what they want to do. That's always been a big interest to me, whether that was through like, residence halls, organizations, or just class." On the subject of initiating contact with individuals in classes and on campus, Kevin found that a willingness to step outside of one's comfort zone had a significant impact:

> I'd say that played a big role in the amount of people you got to meet. Any amount of time you get to spend with them, and also just the difficulty of reaching out to new people and just kind of taking that first step towards creating a friendship with somebody. I found a lot of people don't exactly want to make the first move to initiate a conversation in classes, but once you kind of bridge that gap, it was really easy to go from that point to taking time to study together [and] taking time to hang out with people.

As Rebecca was connecting with individuals on campus during her first year in the engineering program, she quickly picked up on a significant difference between the college environment and the one she left behind back home:

> The most difficult part was probably, since it's such a large atmosphere, you're not always going to get along with every single person. So, understanding that if you don't mesh well with somebody, you don't have to be their best friend. You don't have to do everything with them, [and] it's okay to find other people. Realizing that the people you meet, you

> aren't stuck with them, and to understand that you can make new friends and you're not stuck in a specific group…so definitely that was the most difficult part to understand. You didn't want to hurt people's feelings, but if it wasn't beneficial to you, if it wasn't something that was helpful or a good relationship, then you could easily find other friends. Just branching out more once you met people was kind of the hardest part.

During those first few crucial weeks of that very first semester, Rebecca recalled that "there were so many people to meet. It was kind of like you were expected to at least mingle with some people or get to know people," and noticed that "it's kind of expected of you in college to be able to make connections with people, what you have in common, especially in engineering." With first-year courses that included subject material ranging from calculus to physics and chemistry to biology with classmates from all different majors at the university, Rebecca appreciated the opportunity to "bond with those people. You feel like 'this is where I'm supposed to be, I kind of fit in here." Like, these people have the same mentality as me." By taking the initiative to connect with other individuals in and out of the classroom, Rebecca believed that "having older students kind of mix in with younger students is really useful," especially because it provided the opportunity to see the persistence of upperclassmen that had "made it through, and they're totally fine. They were able to do it, so I should be able to do it." In regards to establishing and fostering connections once her college career began, Hannah confirmed that "coming here, that's exactly what I wanted to do, was to have friends. I wanted friends outside of the engineering college." As a part of her strategy that initial semester, Hannah, "sat next to someone and asked them" about expectations for the course, "and that was my first friend, and it was in my first class" at the university. After those first few classes, Hannah observed that "that aspect of 'who do I

spend my days with? Who do I have classes with? Who am I going to work well with?' It's a lot more oriented towards academics, even in my social circle, as well."

As a part of their involvement with and participation in the MAPS (Multicultural Academic Program Success) summer bridge program that was offered prior to the start of their first full-time semester at the university, both Penelope and Walter were able to establish meaningful connections with friends and peers across the institution. Thanks in part to MAPS, Walter "had a little group established with friends that I knew that were here, so I think that was really cool" to have that starting out first semester. As the fall semester began, Penelope "already knew the campus, already knew a bunch of people because I had all my friends from MAPS, and I had my friends in high school. So, I was already established socially" at the university. In addition to those with whom she connected through MAPS, Penelope also had "my friends that were First Scholars. I meet my friends from First Scholars because we had a mandatory class every two weeks, and we were staying in the same dorm freshman year." The opportunities available from her participation in MAPS and First Scholars gave Penelope a network during her first year as an engineering student that made her feel quite fortunate:

> Freshman year is when you kind of solidified that bond, because we were all staying together. Not a lot of people have those opportunities, so I was definitely very lucky that I already had so many people that I already knew. Maybe I wasn't like, close friends with all of them, but if I needed someone to sit with at lunch, I had someone at all times, [and] that was really nice.

One of the most important reasons to develop a network of friends and peers as a first-year engineering student, a number of the research participants indicated, was to establish a strong, encouraging, and purposeful support system that would enable them to succeed through

the transition to the collegiate environment. Looking back on a conversation that had happened prior to his arrival on campus, Damien remembered that "some of the best advice I ever got from my Dad was, 'you are the average of the three most people you hang out with,' and that really stood out with me," which made him reflect on "who I was picking to be my friends, and who I was studying with all the time. That was what made it even more empowering, was to know that I was making myself better" through these purposeful choices. Additionally, this mentality and approach encouraged Damien to be "much more open and willing to go out and meet people," which he believed "was probably the most difficult, but also the most exciting, to be able to meet all of these interesting people" at the university. Furthermore, Damien knew what having a strong support system would mean in terms of his success throughout his first year in the engineering curriculum:

> One of the things that I was most excited for to come to college was to be around people that wanted to be successful. It made me want to be more successful. You usually are who you tend to surround yourself with, and it was much more manageable to be able to take the classes that I have had with the people I surrounded myself with, rather than the people I was surrounded by back in high school.

As she reflected back on the individuals with whom she interacted throughout her first year as an engineering major, Mary Beth found crucial support from her friends "because we are all in the same place," and "we all supported each other and told each other we are not going to let each other switch" out of their engineering major. When I asked Christopher about his interactions with peers and friends, he noted that the support system around him helped him "find my way through anything here, because I know what is here. I know where to go, what to do, and who to find." Although his college roommate was also his best friend from high school, the inherent

nature of their relationship allowed Edgar to build a unique support system of friends and peers within the university setting:

> I think it's really interesting to push each other outside of our comfort zone outside of the classroom. I would push him, and he would push me, and I think it was a really good balance. We're still roommates now, and so it's been really great. I spent almost all my time with him. Once I got involved in extracurricular activities and started making other friends, the president of the Society of Hispanic Professional Engineers at the time, he was a really awesome guy right upon my entrance into college, he really made me feel at home, and just became friends with me automatically. I remember I appreciated that, and then I was like "you know, I'm looking around, and I'm having a really good time." I didn't do a lot of this stuff in high school, and there's some really cool people here, so once I started to get exposed to different kinds of people, it opened up new opportunities and told me that I need to do more of this.

While the larger classroom settings may have been off-putting to other engineering students during their first year on campus, Matthew discovered that "just being in a class with 150, 250, 350 people, you just realize that there's so many other people in there. Even if you don't understand something and you think everyone's lost," it is easy to have the courage to "ask a peer, or ask someone else, rather than just being like 'we're all lost.' I just think having a lot of people helps you learn, too." At times, Hannah felt "like the engineering major can be extremely competitive, and that was hard for me," so she made it a priority to find "the people that kind of went through it in the same way that I do it" in order to break from that particular environment. With such a demanding course load and the pressure of adjusting to the college atmosphere, Jackson believed that, in the engineering curriculum, "we're all kind of struggling together.

There’s always somebody there to help you, whether it is someone in your class or has taken the class before you. They’re always there at the snap of a finger to help out” their peers and classmates. Early on in his tenure as a college student, Benjamin understood what he would need from his friends and peers in terms of a support system at the university:

> I'd say it's important to surround yourself with good people. The people that you surround yourself with have a significant impact on you as a person, so I like to surround myself with people who are intelligent and humble. They'll tell you, kind of put you in your place, but they're not mean about it. Again, that comes with the social aspects, because if you're alone, you're going to be stuck in that mindset. If you're not cognizant of the fact that you are in that mindset, you're never going to grow as a person. Being surrounded by people and kind of stepping out of yourself and objectively looking at yourself is important to building – this is going to sound cliché – the best you that you can be.

While the best part of the first year for Johanna “was being in the band and getting to meet all those people,” she also gathered that “meeting a lot of people is really beneficial, whether you become best friends with them or you just know them and know a more diverse set of people,” within the college environment, which she learned “on my own, and I think that was really impactful.”

### Importance of Study Groups and Receiving Help from Others

In addition to the establishment and management of friend groups and peer networks, those involved within the parameters of this study suggested, through their responses, how essential it was to their success as engineering majors to have the opportunity to form study groups and either provide help to or receive help from their fellow students. Early on in his first-year coursework, Kevin was motivated to work with others after he “realized just how long the

assignments would take, and how much quicker you can get it done with study groups," as opposed to independent studying. During those first few crucial classes in the engineering curriculum, Hannah would "make some friends in classes and do group studying after classes in the afternoons," knowing that she and her friends would "do a lot more group studying, a lot more collaboration as the classes got a little more intense". The time in between classes was especially important for Hannah, given that "a lot of my friends would have the same set schedule because it's pretty well set in stone. We'd have a gap between classes where we'd sit and kind of hash some stuff out and have that collaboration."

For the most part, students enrolled in majors across the engineering spectrum would take fairly similar classes throughout their first two semesters, depending on where they would place in terms of mathematics and the college-level courses they brought in from high school, among other factors. The shared experience among students in his and other engineering majors played an integral role in Christopher's academic progression during his first year on campus:

> I had a couple of people that I knew that were engineers at that time. At that time we were all taking the same kind of math classes. Even if they were computer engineers or something like that, we'd all be taking the same ones freshman year. So, if I wouldn't understand it quite as well, they did, and so that was good for me to be around them because they explained it to me, which has helped me a lot. In college, it's [about] being around the right people.

Christopher further addressed his academic approach and how it had been positively impacted by the presence of group studying with peers and friends:

> The opportunity has been great in terms of having reviews and things, but also study groups. You will see people out here all the time, you'll see people doing the classes that

> you're in all over the engineering building or wherever you're at, they are working on the same things you are. People have been really open about, “let’s work on this together, the whole class can’t understand this one problem, so let’s try and help each other out.” There's been a lot of set-ups like that. One thing I wish I would have done a little bit more of is opening myself to that, because if you just want to grind it out on your own and you're working on it at the wrong time, it's due in a couple hours or something like that, well, that’s probably not the best time to do it. You want to work on it when you can have a group, and you just want to work on it when everybody else is. It just makes you feel a lot better, but also it will help you understand it.

Similarly, Penelope gathered from her experiences early on in her first year that “it’s really easy to just study together, especially when you’re in a shared class. With the First Scholars, there’s like 20 people that are all in the same class, and we studied together frequently.” In order to navigate some of those more challenging courses, Matthew and his colleagues would meet in the engineering building and “work together, or we can go find a study room and we can talk through stuff, rather than trying to figure it out on your own,” which would require additional time and effort to complete. One class in particular during that first year encouraged Matthew to embrace the effects and benefits of group studying:

> Once I got to engineering physics, I was like “I need to talk through this, learn the equations, and stuff.” I started to have a buddy that would come to the dorms, and we talked through it and worked together.

When it came to effective methods of communication among members of a particular study group, Matthew recalled that “we did create GroupMe study groups for each class, and we can text each other questions. That was another way to learn” the material within a specific course.

As a part of the process of creating and fostering those crucial study groups, a number of the research participants had to adopt a proactive approach to their academic endeavors, which entailed efforts to reach out of their comfort zone and develop meaningful connections with their peers and classmates. As her first semester progressed, Rebecca noticed that "it's kind of up to you to understand that you have to go and reach out to get the help that you need," because "people aren't going to come to you to help you, and people won't necessarily notice that you're falling behind. It's more on you to understand that you're falling behind." When I asked Walter about one of most significant challenges that he faced throughout his first year as an engineering major on campus, he admitted that "getting out of my comfort zone, and really like, asking for help. I think asking for help was my biggest thing to get over with, and it was more like pride to it than anything." For the most part, Edgar enjoyed the opportunity to connect with his classmates and peers for group studying, noting that "they're pretty welcoming. Sometimes it just comes down to 'these are the people you're working with,' and that's all you do, is talk to each other when you're working on the assignment." Although he initially started college with more of an intrinsic approach to his academics, Benjamin eventually realized that "just connecting with other people, taking classes with other people, and knowing that you're not alone in that, and knowing that other people have shared the same experience just makes you feel a lot better." While the atmosphere may have initially been overwhelming, Damien eventually found solace among several hundred other students in the larger classes that are traditionally associated with the first couple of semesters in an engineering major:

> It can be kind of intimidating, like if you're in an Engineering Physics 2 lecture, and you raise your hand and ask a question and there's two hundred kids. You don't want to feel stupid sometimes, but I also know that like, everyone's here to learn, and out of the two

> hundred kids that are there, I cannot be the only one thinking that same question. That's how I look at it. The whole sense of unity thing, I really started to notice as the semester went on is that classes get smaller. You tend to have the same people and same classes, you tend to start making connections with people, so it's really nice to be able to have that unity with the same people taking those same classes as we move on. I know people in my chemical processing analysis classes are going to be in the same classes with me next year, so to be able to have that community where we are all going through the pain and suffering, it makes you feel like you aren't the only one going through that.

**The Atmosphere and Environment on Campus**

As the research participants were detailing the experiences that occurred throughout their first year as engineering majors, a common thread started to emerge regarding the atmosphere and environment on campus. By carefully reviewing all of the recordings and transcribed interviews, I made note of the fact that the terms atmosphere and environment, for the purpose of my research design, were and will continue to be used interchangeably. Through their responses, the research participants described the institutional environment in terms of the energy on campus, the opportunities for collaboration and community, and how welcoming and inviting it was from the moment they collectively arrived at the university. Within the engineering-specific facilities on campus, Damien noticed that there were "a select few rooms where I can just go and feel so relaxed. I could study a hundred times better," and that the people in the building were "just friendly. I know if I ever need help anywhere, it's here on campus. I can go anywhere to be able to find help." Given his opportunity to travel and build experience, Edgar was convinced that the environment at the university was inherently unique:

> The best part about K-State [Kansas State University], I feel like it's the people you talk to. Everybody is so welcoming here, so willing to help out. I don't know, it's cliché, but it really is just one big family. There's a thing called Midwest hospitality, and that's true.

From Jackson's perspective, the environment on campus was "part of the reason why Manhattan has been ranked several times as one of the nicest college towns in the country. I think that the community gives tons of support for the college students." As she progressed through her first year in the engineering program, Rebecca believed that the university was "really welcoming, and there's so many resources," in addition to being "really good at making sure that everybody feels like they have the resources they need to go get the help. I think it's also the whole family kind of thing" that others have previously described.

In addition to the welcoming and inviting feeling they received on campus, a handful of the research participants indicated an appreciation for the energy they felt on campus from the very beginning. Considering that Benjamin was "heavily influenced by the people I surrounded myself with" and liked "to keep my environment healthy, because otherwise that can kind of drag you down," he was grateful that "everybody on campus is pretty nice, and they all like to help." As he went from class to class throughout the semester, Matthew was grateful for the physical portion of campus:

> I think the environment is overall pretty good. I like walking through campus and seeing all these people. We have the Quad, and that's just kind of a big meeting space for a lot of people. I just like walking through campus and seeing people that you might not see that might be in another major but they might have a class in another building. I just think it's a good environment to be in. I think the way it's set up, everything about campus I like.

Thanks in part to her participation in the marching band and their week of orientation prior to the start of classes, Johanna discovered that it "lets you notice a lot more things and be more excited about things," which enhanced her ability to "get excited about K-State [Kansas State University] stuff…and have a great time, because I am a K-State student. I think that kind of culture is really cool to explore and learn about." When thinking about the elements that positively impacted her first year in the engineering program, Mary Beth concluded that "one key factor was that I really liked the campus. I liked the energy, and liked the hospitality of the people here and how they treated me" from the start.

Within such a demanding and rigorous academic program, opportunities for collaboration among various campus constituents and the construction of a meaningful community were influential to the experiences of the research participants as they navigated their first year as engineering students. As he made his transition to the university, Kevin ascertained that the inherent atmosphere and feel of campus would encourage and promote his success:

> I gravitated towards others who prioritized their school work. I was kind of nervous coming in engineering and some of the stories I've heard, that I wasn't going to be able to find other people who were sociable, and also care about their coursework, because I just heard so many stories about extremely introverted engineers. I've really been able to find a lot of people who have motivated me throughout my classes who have pushed me to succeed past what I even thought at the time was possible. They have really been the reason that I've been able to do so well in classes, the difference between letter grades, for example. I really feel that in engineering, collaboration is really encouraged, which I really appreciate because the course work is difficult and it's a great way to meet people.

When referring to the university as a "giant family," Jackson touched on a challenge experienced by other involved and connected individuals, noting that "now if I leave for class late, I will get to class on time. But, if I leave early, I'll walk into class late because I run into people I know constantly." Similarly, Mary Beth noticed a family-related feeling that she experienced throughout the course of her first year on campus:

> I've grown up around other engineering students, and just seeing them in the hallways gives me comfort. I know that they're like, sticking it out too, and we are all in this together. I feel like in the engineering department specifically it feels like a family. Like, you might not know everybody's name, but you can recognize people from your classes and you can give them like, a slight nod or something. That's just how I feel, and even walking around campus, I never feel shut out or anything. It's always, not even walking at night, I never feel like I'm under threat or like people don't want me there. It's always really friendly, which is what I felt when I first came and visited.

Coming from a high school with a significantly different racial and ethnic population than the one found at the university, Walter was cognizant of the atmosphere on campus and grateful for a new perspective:

> I definitely feel like it's literally the opposite back in my high school. I feel like it was like, you would see five, 10 Caucasian people, and honestly…I kind of realized how they feel. I feel like that now that I'm here, I understand how they feel now. So, it's not like it's a bad thing. I realized that if they can get through it, then I can, too.

### Opportunities for the Formulation of a Meaningful Social Life

Another foundational piece of the research participants' ability to develop strong connections with peers and establish valuable relationships with friends was the opportunity to experience a

meaningful social life as an engineering student within the university environment. Given the smaller size of her hometown and high school, Mary Beth understood that "it helped coming to college having someone from high school to get me to be more social" once their collegiate careers began. Alternatively, Kevin found that breaking away from the regimen of high school enabled him to have a more fulfilling social life experience at the university:

> I felt like it was a lot more enjoyable to the social scene in college, because in high school, even if you have a big high school, you're surrounded by all the same people. Sometimes those relationships, you're friends with some people, there's some people you may not get along with, but you just have to make an effort to interact with them because you often share the same classes with a lot of other people. In college, I really feel like I've been able to find those people that I really enjoy being around, and don't have to spend as much effort into interacting with those people that I don't get along as well. Things like residence halls and activities, those have probably been the main two ways that I've met people.

When I asked Rebecca to reflect back on her first year as an engineering student and what she felt had gone according to plan, she replied that "meeting new people, being social, and getting things done with classes" were among the more prominent items.

Two of the research participants, Damien and Hannah, made mention of the impact that being a part of an off-campus living community had on their ability to develop and foster a meaningful social life. Looking back on his first year as an engineering student, Damien was grateful for the experiences he had as a member of a fraternity on campus:

> You tend to have a little less time sometimes in college because you're so busy with everything else. It can be kind of hard to have that social aspect all the time, but coming

> here and joining a fraternity kind of helped me with the whole social aspect. You move in and you are moving in with like, 60 guys, and you're around them all the time. It makes it a lot easier to be able to meet those friends, meet those people, and make those connections, rather than having to go out and stuff.

As Hannah was navigating her first year on campus, she found that "the sorority would offer kind of a more, 'hey, we're in this together, here are some resources that I found beneficial,'" in addition to being "a source of friendship" where "you would see someone you knew in class, and that was very helpful." During that first year, Hannah employed a unique approach to her responsibilities that she knew would be the right fit for her academic and social aspirations:

> I did a variety of things, and so that's what I kind of had to do here, kind of take what they say with a grain of salt and enjoy things that I want to do. Especially freshman year, [I thought] "I don't need to focus on that right now." I think if I do well in academics but am also involved in some organizations and social groups outside of the college, I think that will be best for me. So, that was kind of hard to not fall into that expectation as much, but it's helped me.

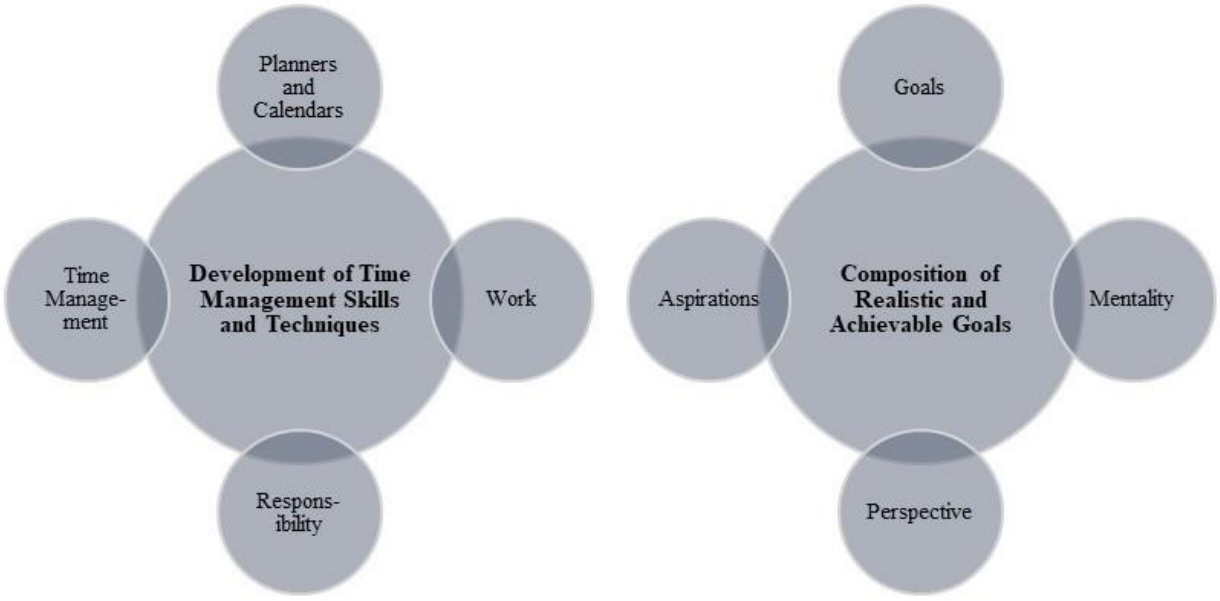
Finally, a handful of research participants offered responses throughout the interview process that suggested their opportunity for a meaningful social life was supported through the establishment of balance between academics and involvement, as well as a need to move out from under the confines of one's comfort zone. Reflecting back on an eventful first year in the engineering curriculum, Johanna recalled that she "had a pretty good balance between having a social life and keeping up with my academics, balancing a long-distance relationship from home, and all that." Starting out, Benjamin had the opportunity to develop a social life, "but it involved just the people that I lived with, and I didn't really socialize with a lot of people until I got a firm

grasp of how everything worked on campus." Realizing the importance of having experiences outside of the classroom, Benjamin, during that first year, tried to "put all of my effort into studying," but understood that "it's important to have a social life, and you shouldn't feel like you're failing if you're going out and doing something." As far as her opportunities to develop a meaningful social life, Penelope remembered that "right before Finals, the First Scholars and I, we went bowling. We were so stressed, and so we needed to go bowling," which provided the ability to step away from the academics and approach it later with a fresh mind. Despite knowing that "a lot of engineering students will not take the advice," Penelope, in terms of having a social life, simply recommended that her colleagues just need to "get out of your room and go outside" from time to time.

### Incorporation of Habits related to their Academic and Social Responsibilities

The incorporation of habits related to their academic and social responsibilities served as the foundation for the fourth primary element. Subcategories within this particular element include the development of time management skills and techniques and the composition of realistic and achievable goals. Through the establishment of balance between their academic and social responsibilities and the presence of attainable aspirations, the individuals at the core of this research design initiated a sustainable approach to college within their first year on campus. Figure 4-4 demonstrates the corresponding node clusters associated with this specific element.

**Figure 4-4: Node Clusters for Incorporation of Habits related to their Academic and Social Responsibilities**




### Development of Time Management Skills and Techniques

Throughout the course of the interviews, all but one of the research participants shared examples and anecdotes suggesting that the overarching skill of time management, as well as its associated techniques, was a significantly influential factor in enabling them to succeed in their first year as an engineering major. While some had to adopt entirely different strategies, others had to make adjustments to what they had learned or developed throughout their high school tenure. Several of the participants indicated the utilization of planners and calendars to manage all of their appointments, assignments, responsibilities. Challenges, in addition to their recognition and identification, were not uncommon for these individuals in regards to time management, as Damien explained when I asked about his arrival on the university campus:

> I would say time management was one of the hardest things to learn. That's definitely one of the hardest. I think I was pretty good with my time until I came here. I really had to

> pretty much write down my full schedule before I started my day, just so I know everything that's going on and make sure I don't forget anything, because there's just so much going on here. I can be so scatter-brained sometimes.

Concerning the start of her college career, Rebecca remarked that "usually I could get stuff done, but it was me trying to get it done to where I wasn't always rushing to get to the next thing," or where she had "enough time to make sure that it's turned in and done correctly and not like, quickly put together and turned in," where she would receive less credit for hurried work. In order to manage these items, Rebecca recognized that "the time management part was something that was new" for her to have to overcome during her first year of college. To help her overcome that challenge, Rebecca turned to her colleagues and supervisors at her on-campus job:

> Definitely a lot of the people like faculty members, like the full-time ones that I work with over at the Dining Center. They are really helpful and are more than willing to answer any questions and help you if you feel overwhelmed, or if it's too much with your schedule when you can't figure it out. They're always trying to help and make sure that your needs are met before theirs.

Connecting with these individuals during first year helped guide Rebecca to a point of understanding that managing her time and college life in general "is not as difficult as it seems, but you have more people to bond with over that" shared experience. Edgar shared a similar comprehension on the subject of the challenges posed by the collegiate schedule:

> It was definitely more difficult managing so many different things. When I was in high school, I was used to managing school, [would] go home, or I go to work, so it's really two things every day. My day was split in two halves or so. When I came to college that was different, of course. You're not in class all day, you have time in between classes

> that you don't know what to do with, and so you have got to figure that out. I started joining more clubs and organizations, and [would] go out more, and suddenly you have all of these choices. “Do I go out on a Thursday night when I got [sic] something to do tomorrow morning?” Difficult choices, and I guess balancing your time and how much you want to dedicate to everything.

Kevin found that focusing on the reason he was at college in the first place enabled him to master the challenges associated with his new schedule and responsibilities:

> Time management was the most difficult part. Learning how to really function as an adult because you really are functioning as an independent person, for a lot of people, for the first time in their lives. You're also interacting with a bunch of other people who are doing that for the first time in their lives. I think that freedom can either be good for some people or bad for others, and so just being able to understand kind of why you're here and the end result.

Alternatively, Mary Beth was “concerned about time management because I have so many different passions and interests. I get really distracted and I like to be creative, so instead of studying I might go like paint, or something.”

However, these individuals also noted ways in which they modified or altered their approach regarding time management as they progressed through their first year as an engineering student. While Kevin initially went back and forth “either feeling like I had to study all the time and couldn’t actually enjoy my college experience, or having so many distractions and so much freedom it that would be hard to keep up good study habits,” he found that eventually “it was more manageable than I expected it to be. With time management, I felt like I was more prepared than I had given myself credit for” at the start of his college career. Similarly,

Mary Beth got "better with knowing what I need to get done and getting it done, and then giving myself time to do other things" that allowed her to express her creativity and artistic side. Walter discovered that he needed "to learn how to set up a structure of how to live, study, and manage my time," and saw first-hand that "managing my time is what really changed, because obviously every semester is different. I had to get accustomed to how to study for them." As that first semester progressed, Walter "realized that I really need to study. That's one thing I really noticed, just time management" and the impact it had on his experience. Christopher had the following to share about his first few months on campus:

> For the most part, I got more comfortable as it went on. I just kind of got into the flow. I got the first week jitters out, and I just got into a little bit of a routine and nothing new came up that I can think of really, class-wise.

In terms of the freedom associated with being in college and the struggle of finding productive uses of one's time, Johanna commented that "you have to manage your time well, study for your exams on your own, and be independent," which provided her with "a lot of good skills to be able to keep up with my classes" throughout her first year. While engineering students can have busy schedules and challenging courses, Penelope realized that in her first year, she did "have free time, but I chose to fill that time with productive activities," and that the key to navigating those first two semesters was "the time management, and the going out – not like going out [and] having fun – but, like going out and doing something productive," in addition to "just time management, doing your homework, [and] getting everything turned in on time." On a similar note, Matthew found the most challenging part of his time management strategy was finding "what you want to do with your time in college, and how you want to go about your time, whether it be studying all the time, or being involved in stuff." As a part of her

approach to managing her time within the collegiate experience, Hannah shared the following anecdote about her day-to-day schedule:

> I thought I kept it pretty well-balanced. I had a lot of time, [and] I would go to the library in the morning and get all my homework and stuff done. Then my classes usually started around 11:30am, and I'd be done in the mid-afternoon and I'd have all my homework done because I did it in the morning, and so I really did try.

Among a variety of other noteworthy techniques, a number of the research participants identified the integration of planners and calendars, in both digital and print form, to tackle the challenges associated with the management of time and responsibilities at the college level. On her personal calendar, Penelope adopted a unique approach that helped keep her accountable:

> I started putting soft deadlines, not like a hard deadline that it actually was, but like, the day before it should be due. Then, I could have a friend look it over so that I can make sure that all my answers are correct, so that kind of stuff. You might have to do something like soft deadlines for when like, a rough draft is due.

Google Calendar worked best for Jackson, which allowed him to put "all my classes on there so [that] I know when my breaks are," which also gave him the ability to know "how long it's going to take me to do a homework assignment depending on how well I understand it. So, I kind of fill it in when I can" on any given week. Digital was also the way to go for Walter, who found that "for my time management, I started to set up my schedule, like 'what to do' [and] 'when I have homework due,' so I set up a schedule online, like on Outlook, and I set it up on my phone." Accountability and independence in the college setting helped drive Rebecca to employ the following strategy as a way to manage her time and responsibilities:

> I made sure to be more organized and write everything down. I keep a planner that is super detailed, it's all like highlighted and color-coded by day and everything, and I think by writing it out I realized, “okay, this is what I have to get done.” Then, if I don't get it done, then I'm going to face the consequences of my grade. So, it's not as much, “if I don't get this done, I'm going to get an email from my professor about it.” You're not going to get that [email], so by having it written down somewhere and having something that you can keep track of all that, I found it really easy to make sure to get it done. I'm like, “I can cross that off now. I want to get that done, for sure.”

Furthermore, Rebecca followed up by making sure she had time “to go back through and at least have all of what I need to have done [or] needs to be done by the end of the week written down somewhere,” which gave her the ability to “kind of visualize where we are going into the future with that” particular assignment, examination, or course. While his approach was along a similar line, Damien widened his scope in regards to managing his time and responsibilities during that first year on campus:

> To-do lists. That was one of the things I had to learn how to do in college, if you're going to do well in college. Every single day, I [would] write down three things that are school-related and non-school related [that] I wanted to get done, whether it's anything from three homework assignments I wanted to get done, to cleaning my car, or just taking an hour out of the day [to] just relax and get outside. I try to write at least six different goals. Three of each to get done every single day, and that's what's really kept me to be not be so stressed out all the time, but also to be able to make time for things outside of school.

In addition to his to-do lists, Damien also incorporated a digital tool into his schedule that allowed him the opportunity to make the most out of his experience:

> Google Calendar has saved my life, because that helps me plan not just days, but weeks [and] months. I have everything that I ever need all in one area, and I think that's been by far the most beneficial thing for me to keep in line, stay on track, and also just look into the future and make sure my load is consistent throughout, if that makes sense, school-wise. If I have three tests coming up, I can prepare for those three tests weeks in advance. I try to plan for the future, rather than everything coming up all at once.

**Composition of Realistic and Achievable Goals**

In addition to employing a number of unique strategies and techniques to manage their time and responsibilities as engineering majors at the university level, the research participants, through their interview responses, demonstrated the possession of goals and aspirations that were both realistic and achievable. The goals that the participants identified encompassed an extensive spectrum, including specific academic thresholds, a central purpose to their scholarly pursuits, the accumulation and inclusion of close friends and colleagues, the development of career-related qualities and attributes, and a desire to become a well-rounded individual. For Christopher, achieving his goals meant having a pragmatic conversation with himself about his academic journey:

> I knew I wasn't going to be a top student, but I wanted to be a little bit above average grade-wise, and just to understand the material and feel comfortable with it, instead of feeling very frantic about the information and hanging on by a thread. I didn't want to be doing that, I wanted to excel in what I was learning.

As he progressed through that first year, Christopher realized that “I’m just going to have to try my hardest and kind of see what happens. It was just a struggle sometimes to meet those goals as well as I wanted to,” and that in the end, “it’s about trying my best” to accomplish those

aspirations. Similarly, Walter wanted to "get good grades, come out of my comfort zone, meet new people, get involved as much as I could, and have fun. That was it."

Engagement with individuals across campus was important to Johanna's first year, as she explains in the following response regarding her goals and aspirations:

> I wanted to accomplish being invested in a lot of communities. In college especially, because I went somewhere out of state, I only knew two people from my high school who came here, and so I really knew relatively nobody. So, getting plugged into communities was a really big thing. I can definitely see, if there was a first generation college student, or any college student for that matter, who came to college, it would be way more overwhelming if you're doing it by yourself and you had nobody to complain to, or nobody to bounce ideas off of, or to encourage you to go for that leadership position, or things like that.

When I asked Johanna about the approach to her goals and aspirations, she provided the following insight into her collegiate experience as an engineering major:

> I think it probably started right away freshman year. Just seeing that difficult things happen, and you [have] just got to take them. You've got to learn a sustainable way to deal with them, and you can't just get torn down.

Being intentional with her time in college helped shape the development of Mary Beth's goals and aspirations, as she outlined with this response:

> To figure out where I wanted to go with engineering. I started looking into that a lot more, because I didn't want to just still be in it just to be in it. I wanted to find a purpose in it, so that was kind of hard to find, but I think I'm in a good place of where I want to go

with it. As far as other goals it was just, you know, I'm at a four-year college, this is going to be my college time, so just enjoy it and find friends that you will have for life.

Influenced by his experiences at home, Edgar's goals entering college as an engineering student were "to prove to myself and my family that 'hey, I can do this, I'm fine,'" and to "do things different than I've done in high school. Not totally reinvent myself, but do things I've never done before," both in the classroom and across campus.

Several of the research participants I interviewed came to the university with realistic and achievable goals that centered on the end result of a college experience: graduating with a degree and entering the workforce with promising employment. When asked about his goals as an engineering major, Jackson very simply stated that "I wanted to make it through, prove that I could do it, [and] make it through" to graduation with an engineering diploma. For Benjamin, his focus entering college "was more geared towards feeling better about that 21 [ACT score] that I had gotten," but throughout first year shifted towards professional aspirations, including a drive to "get a good job" and work towards multiple internships, which he argued had "become increasingly more important to me" as his navigated through his first two semesters on campus. Upon entering college, Kevin held one particular goal in his mind, which he described in the following response:

> My biggest goal was to be able to succeed enough in my coursework that I would set myself apart from others. I didn't realize it at the time, but that kind of translated into being successful enough in my coursework that I would be able to find an internship after my sophomore year. I've always felt like that is going to set you apart, because you're going to have that experience to talk about the following year. So, I would say that was

> probably my main goal, to be able to do well enough in college that I would be able to graduate and be able to choose a job that I would really enjoy.

Alternatively, Penelope arrived on campus with one set of realistic goals, only to adjust her priorities and switch them out for an equally-feasible pair of aspirations:

> I really wanted to do well in school, which freshman year I did a lot better, and I really wanted to make new friends in college. I still want to do well in school, but now my goal is to graduate and find a good job. Freshman year, it was all about "I want to do well in college," [and] now it's like, I want to do well outside of college.

When I asked Penelope a follow-up question about her goals and what may have motivated their development, she replied with the following response, which may resonate with first-generation college students who are also the first generation of their family to be born in the United States:

> Basically, I'm very stubborn and I don't know when to quit. So, like if I said that I'm going to succeed in something, then I'm going to try and I'm going to fight tooth and nail to do that, and it has a lot to do with my upbringing. We're Hispanic, and we've always fought for everything that we have. My parents were always super proud that they came to this country and never needed help from anyone, so I kind of grew up with that mentality to always persist, no matter what the odds.

Several engineering disciplines require additional licenses or certifications after graduating with a degree, which helps explain why Edgar's goal was "to have my FE [Fundamentals of Engineering exam completed] with a purpose of becoming a licensed PE [Professional Engineer] after school, so I definitely want to do that before I graduate college" and enter the workforce.

Finally, a number of the research participants indicated that an ambition to become a well-rounded individual was a priority in terms of their goals and aspirations entering college as

an engineering major. Hannah responded with the following when I asked her about those goals that she had in mind as she progressed through her first year on campus:

> I wanted to make sure that I'm not just here for school. I do want to have that community, and I felt like in order to be successful, I needed that. My brain doesn't just go math, science, math, science. That's why I got involved with leadership studies, as well. It kind of balanced it out and had that sense of community, and made me want to succeed and study and do well here. I guess that was my goal, to make sure I felt connected to my studies here.

Rebecca shared a similar sentiment in regards to her goals and aspirations entering college:

> I knew that I wanted to get good grades, but I understood, it is difficult. I just wanted to make sure that I put all my effort into it, so it was me making sure that I didn't slack off or have too much free time to where I screwed around, or didn't do anything that would better my education or better my classes for me. It was definitely that. I still wanted to be well-rounded, because I didn't want to be someone that just had their head in the books. I wanted to be able to have a conversation with people, do other things, and kind of build myself with different skill sets that weren't just engineering. So, even though engineering was the thing I was coming here for, I was kind of looking to college as something else to build my personality. Like who I am, and who I want to be.

As a follow-up to that response, I asked Rebecca how those goals may have shifted or adapted throughout her first year, to which she provided the following reply:

> I definitely think that building a well-rounded person in myself is still a really important goal that keeps continuing, and same with the grades. Sometimes I'm like, "okay, I saw

what I did there, and maybe that didn't work so well, so let's try something new" so that next time, I can do better in that.

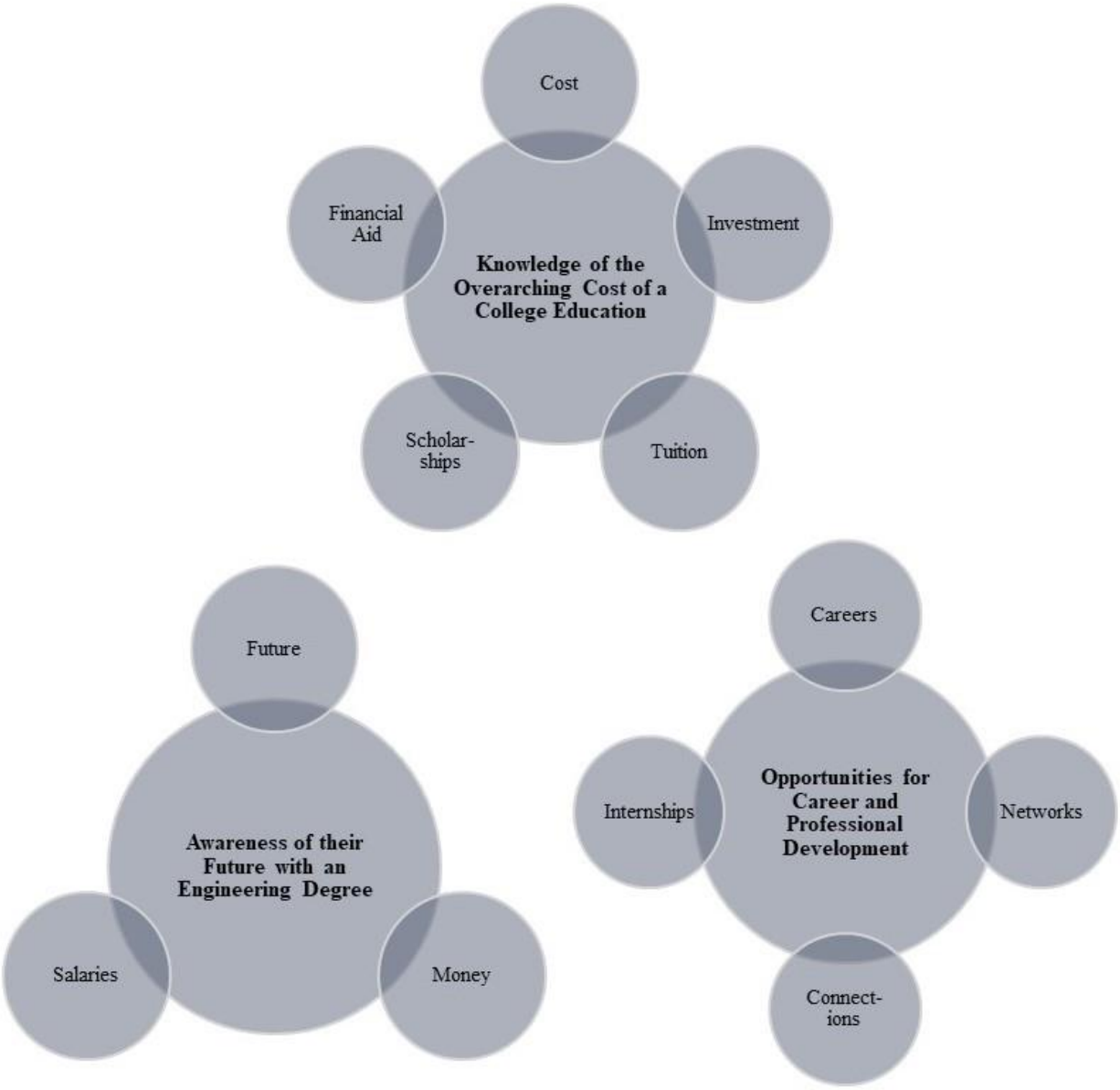
For Matthew, his "number one goal coming in was just to graduate," and as he progressed through his first year on campus, he felt that, in addition to graduating with an engineering degree, "I've got to build a resume, I've got to do this, and I think my goals were to get higher grades so [that] your resume looks better" to prospective employers for internships and professional positions. Similarly, Damien wanted his goals as an engineering major to include, but also go beyond, the grades he was receiving in the classroom:

> The 3.25 has always been my GPA goal. I've been able to keep it every semester, and I've been very proud of that. I'm trying to keep that throughout the next four years. That's been my biggest goal here. Not only that, but really trying to enjoy going to my classes.

### Understanding and Comprehension of their Educational Investment

The fifth primary element involves the understanding and comprehension of their educational investment as it relates to their short- and long-term future prospects. Within this specific element, subcategories include their knowledge of the overarching cost of a college education, the awareness of their future with an engineering degree, and the pursuit of opportunities for career and professional development throughout their first year on campus. The individuals involved within this study possessed an encompassing knowledge of the benefits of starting and completing their undergraduate tenure with an engineering degree. Figure 4-5 demonstrates the corresponding node clusters associated with this particular element.

**Figure 4-5: Node Clusters for Understanding and Comprehension of their Educational Investment**




### Knowledge of the Overarching Cost of a College Education

Through their responses over the course of both interview sessions, the research participants demonstrated a comprehensive understanding and knowledge in regards to the overarching cost of their educational pursuits at the collegiate level, including the impact of tuition expenses, scholarships and financial aid, their time and effort as an equivalent to credit

hour expenditures, and how their work towards graduation could and should be seen as an investment. On the subject of the university experience, Damien felt the weight of the responsibility concerning tuition, fees, housing, books, and other associated costs:

> I think that's really big for me, [and] not just me, but for a lot of first-time college kids. I deal with all my bills, I do all of my FAFSA, I deal with everything. My parents do nothing, and they're kind of just there for moral support at this point, and so it's a learning curve. Not just on the educational side, but life lessons just in general.

Building on that sentiment, Damien knew all too well prior to entering college just how costly it could be if a lack of academic focus negatively affected his performance in the classroom:

> I know I'm the one paying for it in the long run. My parents are not paying for it, I know it's on me, not them. It's a lot more emotional and personal failing a test now, because you're like, "dang, I could have just potentially spent a couple thousand dollars just to fail a class, and now I have to redo it all over again for the same amount of money." That's scary, it's really scary for a lot of people. Thank goodness I've not had to retake a class yet here, and hopefully that's going to continue.

Even when first-generation students are able extensively research and understand the cost of their educational pursuit, it can still prove intimidating for individuals like Rebecca, who remembered "hearing about the cost of college" and immediately thought "it's so much. I can't even comprehend how much that actually is, so I think definitely the cost" was one of the very first challenges that had to be addressed in order to make attending the university a possibility.

When specifically looking at the expenses directly related to tuition and the research that was conducted ahead of time, Kevin admitted that, in all likelihood, "the biggest deciding factor was the financial reason, and this being in-state [tuition] for me, that made a big difference, as

well as the scholarships that were offered" to come directly to the university. Similarly, Penelope was cognizant of the "cheaper in-state tuition, because my parents don't have a lot of money." Within her first few weeks on campus, Penelope recollected an analogy that left a lasting impression and helped further reinforce the comprehensive cost of attending college:

> I remember I had a professor, and what she said was that like, every single time you missed class, you are throwing like $100 in the trash can. No one ever does that because that's such a waste of money. So like, if you think about it like that, then that's a pretty motivating factor, because that's a lot of money.

However, the opportunity for an engineering degree and college experience from the undergraduate institution was enough for several of research participants to see the cost of their education as an investment in their personal and professional future. As an independent first-generation student, Johanna had the freedom "to make my own decision, like going to an out-of-state school" beyond her home in Nebraska. Knowing that she had the support of her family behind her, Johanna had the ability to research her options, understanding that "you're going to have some student loans afterwards" attending an institution that is almost certainly "more expensive than going to somewhere in Nebraska," but at the end of the day, being able to "do what you want to do because it's your future." In a mentality that combines the responses of both Penelope and Johanna, Jackson remarked that "an education is just an investment in your future," while reiterating that "I'm not throwing away $100,000 to come to Kansas State University for nothing," which aligns with his primary goal of remaining in engineering until he graduates with his degree. From Jackson's perspective, he argued that "if I'm not going to these classes, I'm not learning this stuff, and I'm literally spending $600 per credit hour to be here," and followed that up by admitting that "I kind of think my future self is going to be pretty mad if I don't go to class

and don't take this seriously, because the future self is paying a lot of money to be here" at the university as an engineering student. However, despite the costs that he has associated with attending the university, Jackson acknowledged that his choice to go to college "is going to get me further in the future," and "I find that coming here was a good choice. I also find that by investing my time and money in college, it's preparing me for the future."

After being exposed to the institution through watching and attending various sporting events, Christopher discovered through his research that attending the university "would be best cost-wise for me. I was thinking about playing football at a junior college for two years and then coming here," but eventually came to the conclusion that "in the long run, it would be best for me to just come straight here out of high school" to pursue an engineering degree. Upon arriving on campus, Christopher adopted the mentality that "I've done all this work, put in all this time, effort, and money…I would really like to see it pay off and finish" as an engineering graduate. While Mary Beth "looked at a lot of different options other than college" as she was preparing to make the academic and financial transition from high school to the university, she "ultimately decided to stay with it," with the understanding that she "always knew that an engineering degree was going to be a 'pay now, play later' kind of mentality."

In addition to an extensive comprehension of the various costs of attending a four-year university, the research participants also expressed a substantial understanding of the role that scholarships and financial aid provided in their journey towards achieving a degree in engineering. As a non-Kansas resident, Hannah knew that her financial aid package would be a significant factor in her transition to college following her high school graduation:

> In order to come to K-State [Kansas State University], it was out-of-state tuition, so I really had to work hard on the scholarships. I think that was the one thing where, I got the

> scholarship [and] my Dad was like, “you've made this possible,” and so I think that stood out a lot. He actually runs his own business, and so our income is always like, it's family-owned, so it's up and down all the time, and at the time it wasn't doing as well as it had in the past. So, that was like, huge for him to say that “this is going to be something that we can do,” and “you've worked hard to get that scholarship.” I think that was the one turning moment that really stands out to me.

Given the financial situation of her family, Hannah knew that as an engineering student she wanted “to succeed and do well for myself, and for my parents, as well.” As a high school senior, Walter connected with advisors and administrators at the university to apply for and receive a considerable financial aid package: “I think I managed to have those [first] couple of semesters paid for, so I wasn’t really stressing about that. I managed to do it through scholarships and like, private scholarships that I acquired to get here” to the university. Through her involvement in a summer bridge program that she attended prior to starting her college career, Penelope was able to take “three to five credit hours for free,” which set her first year up for taking “classes like sociology [and] leadership, because those were required for the scholarship” that she was receiving from a program housed within the university’s first-generation student resource office. Between her involvement with both the summer bridge program and the first-generation student program, Penelope “started with a few scholarships for class, and I already had my plan laid out and I knew I was going to do it.” Financial aid in the form of scholarships made a big difference for Mary Beth, as she detailed with the following response:

> I think the final decision came down to, I got the Putnam Scholarship. So, it was about money, like, where I was going to go. All the scholarships were a big deciding factor, [and] I didn’t really want to go to a community college. I knew that it probably would

have been the smarter thing, but I also knew that if I didn't go to a four-year institution right away, I wouldn't get those four-year scholarships.

While Mary Beth was grateful for her financial assistance from the institution, she lamented about the factors that determined how and to whom those scholarships were distributed:

> It made me realize how much college is dependent on the ACT. I felt like college and scholarships shouldn't be decided for you based on a simple test you took for 4 hours. I mean, I did do well on it, so it wasn't because I was angry about it, but I felt like there's a lot of smarter people, not smarter, but other people who are intelligent in other ways that can't take tests that didn't get like as much money, or didn't get in to the college they wanted just because of a test.

**Awareness of their Future with an Engineering Degree**

The educational exploration conducted on the part of the research participants prior to their arrival on the institutional campus extended beyond the overarching cost of a college education and into a space where they were able to establish a comprehensive awareness of the future they could have with the possession of a degree in engineering. The information they acquired and the knowledge they gained empowered them to understand a higher volume of material regarding their future prospects, financial incentives, and careers that an engineering degree could provide for them beyond their collegiate experience. Damien, despite the indifference from his friends and peers in high school, knew what the future had in store for him:

> At home, it was really tough. My friends never really thought about their future and what they wanted to do with their lives. They were just okay with working [for the hometown manufacturing plant] for $17 or $18 an hour, rather than going to college or pursuing their goals and dreams. I felt like I was the only one from back home that prepared for

> my future, thinking of my future while my friends were just doing high school because they have to, not because they really want to. I think that was the biggest culture shock for me, was just to be around successful people all the time.

On the subject of her outlook and the choices that had to be made, Mary Beth very simply stated that "I had to make smart decisions for where I wanted to go in the future, not what I wanted to do right now." Walter understood as early as middle school that, in regards to his future, "if I want to be able to sustain myself and maybe my family, help them out, I realized that education is the way to go," and that "if I want to be able to be financially good, my future education" was essential in order to bring that to fruition. Additionally, Walter was driven by the opportunity to assist others in an exponentially-growing field within engineering:

> I feel like, especially solar energy, I feel like it's the future. I feel like I want to do something with that in my future, and I just want to finish that so I can like, start doing, you know, helping people. I don't want to get out of it, because even if though it's going to get harder, I know that's part of it.

The promise of fulfilling employment in the future was important to Kevin, who expressed that "I've always wanted to be able to finish college and go into a career that I really enjoy and really feel rewarded in doing," and was drawn to try his best in his engineering coursework because "I've always felt like succeeding in my classes is what will allow me to have that freedom" of pursuing a rewarding professional career. However, Kevin had a different idea in his mind than that of the traditional climb up the corporate ladder:

> I know a lot of people [that] have talked about it have said "yeah, you can just go and start out at this company and then work your way up to this prestigious company that you

want to work for," but I've always hoped to be able to come out of college and just love my job. I've always wanted to be the best I can at what I do.

Along those same lines, Benjamin's focus in regards to his future made a significant shift towards sustainability and fulfillment:

> Originally, it was "I want to make the most money that I could for being a computer scientist." I'd say now with my girlfriend, I've been with her for like, four years, and so that has grown into me wanting to make a good life for both of us. Spending time with her, having a nice house, and kids has probably been the motivator now as opposed to the money. The money is nice, but like, I want to enjoy what I do, and I want to come home and enjoy my time at home.

One of the primary influences behind the financial future that Jackson had envisioned for himself with respect to a degree and career in engineering was found right at home:

> My Dad attempted to go to college for nuclear engineering, and then he went to the Navy and was able to get almost a nuclear technology degree. That kind of helped him out with getting his career, and I see that it's been able to support our family just fine, so I decided maybe I should go to college and get a degree.

With further examination, Jackson discovered that "if I go into engineering and I learn this stuff, maybe I'll be able to create this product and maybe have a prosperous financial future." A career exploration program at his high school helped Jackson understand "that I could go to a tech school and get good pay, but with a college degree I may start [at a salary] lower than a tech school degree, but eventually, I can make more. A lot of it was a potential outcome of finances." In addition to his father and the career statistics he received in high school, another member of his family provided Jackson with information to consider:

> A lot of it comes down to that career program thing I was talking about earlier, because it gave your average starting salary straight out of school. My uncle is an engineer, and he makes considerably more than that average starting salary. I know a lot of engineers, they have a higher starting salary than what the starting salaries are [for other professions].

**Opportunities for Career and Professional Development**

Although the field of engineering continues to grow in terms of the number of available positions and careers for those with undergraduate degrees, the acquisition and completion of an internship on the part of an individual student has the potential to set a candidate apart from their institutional peers. The participants I interviewed for this research project that mentioned them were unanimous in their belief that internships were an instrumental addition to their education experience as engineering majors at the collegiate level; those that had not yet obtained one were clear in their focus, and those that did lauded the experience and value it provided. As she progressed through her first year as an engineering major, Mary Beth knew that she "wanted to get an internship by my junior summer, because that would give me job experience and would get me started in the field. That's what everyone was aiming for, too." Similarly, Penelope discovered early on the "need to start thinking about internships," and that upon completing her first internship, believed that it "was definitely a step towards the right direction" in terms of her career development. In addition to a career after graduating with his degree, Kevin affirmed that his most significant motivating factor was "being able to find an internship" in his field of study. After getting that first internship, Benjamin realized that his professional experience has "definitely helped me with interviews. I've had multiple internship interviews, and I think I've only been denied one internship." In terms of internship experience, Edgar hit the ground running from the moment he arrived on campus: "I was very fortunate at the first career fair, all

of three or four weeks into freshman year. I did get an internship, and that was just reinforcing to me that I was doing something right." After securing an internship after his first year, Edgar quickly discovered that "it wasn't a very common thing for a freshman to get an internship, so I told myself I can have three or four internships by the time I graduate, if I play my cards right." For Edgar, these internships provided an unexpected source of pride and validation:

> I've done internships with construction companies, and a lot of those guys in the field, those construction laborers, they are Hispanics. This past summer, I was working with one of the managers, and all of the managers in this company are Caucasian. All the laborers are Hispanic, and [they] would tell me, "you make us all really proud, now that you're up there with the managers." It's things like that that are really motivating.

Along that same line, Johanna was provided with an internship opportunity that served as a culmination of her vast skill set and presented her with a unique perspective going forward:

> I went to Namibia, right next to South Africa, and I did a feasibility study there for a farmer. So, it's like an internship, and it was a weird connection that led me to be able to do that. I knew a University of Nebraska professor, and he had been to Namibia before. He knew that the farmer wanted somebody to come intern at his farm who is maybe a biological systems engineering major, and maybe would be helpful if they spoke German. I took four years of German in high school, so all the stars kind of aligned. So then I pursued this opportunity, and it was not through any kind of organization. Just traveling by myself there gave me a lot of really good independence. It set you up for some adverse culture shock, but it also sets you up for some more independence and confidence in yourself. I came back and some of my friends were like, "we can tell you're a stronger person and you're more confident in yourself," and things like that. I think that doing

> things like that or finding unconventional routes to pursue your own leadership or explore your own leadership or your own independence is really important.

Even if they are not in one's specific field of interest, Jackson argued in favor of acquiring any kind of internship experience available, given the nature of the field:

> I applied to several places, and when I didn't hear back from them, I applied with several automotive people, and I never heard back from them [either]. I tried getting my foot in the door working with some companies out of Kansas City that are automotive-based, and I never heard back from them…so, I decided that this summer I did apply for several companies but they weren't in my field of interest because my initial field of interest was automotive and aerospace. And so, I've kind of looked at those companies, and if I get in with them, it's a foot in the door, it may become like a future career. However, the companies I've applied to for an internship could be a potential career, but they're not exactly where I'm wanting to go for my degree. But then again, if I don't get an internship or job in the automotive industry, I'll still have that information in my head that I can do what I want with, and can potentially start my own company in the future.

One of the most significant findings in relation to the understanding and comprehension of the educational investment of an engineering degree on the part of the research participants converges on their awareness of and efforts towards careers in the engineering profession. Looking beyond the grades they received in their classes, interactions with recruiters and representatives at career fairs and other associated events, and the pursuit of a career that they would truly enjoy were the focal points for their discussion on career opportunities. For Hannah, the experiences in which she engaged throughout her first year on campus generated several crucial questions about the purpose of her collegiate journey:

> How am I going to be successful in this career? How do I start looking at internships? How do I start getting more career-driven? And so now, it's not as much "how do I engage in all these different activities?" as "what activities are going to help me launch me towards that career side of things?"

Knowing that college would be more than the classes in which he enrolled, Matthew arrived on campus and adopted a mentality that "more of my time was going to be focused towards building my resume and building my experience for my future, rather than just coming in, studying, and graduating," which assisted in his efforts "to really try to build yourself and how you present yourself" to employers, recruiters, and engineering firms. Initially leaning towards a more introverted approach to his collegiate experience, Benjamin discovered that an adjustment had to be made in order to fulfill his professional aspirations:

> I've connected with people. I force myself to say hi to people, become friends, and I've expanded my network significantly so that I have ins [sic] in different companies. That's definitely helped me out, so I feel like my expectation went from "I'm just going to focus on myself and only myself" to "having friends is absolutely crucial to expanding your network and getting the opportunities that you need."

When I asked Benjamin about a specific factor that helped lead to the aforementioned adjustment in terms of building connections and making friends, he offered the following response as an insight into his awareness regarding career development:

> Realizing that it's more than just a degree. College is important because you have all of these things that are open to you. You get to connect with businesses, you can connect with hiring managers, you get to expand your network, and that to me is the biggest thing

> of going to a university. If you're not taking advantage of that, then I feel like you're not getting the fullest [sic] out of your education.

Benjamin expanded further upon the importance of networking, stating that "a lot of social aspects became more important to me as opposed to GPA. Getting the knowledge is still important, but I have noticed that becoming increasingly more important to me" in regards to career aspirations.

A number of the research participants mentioned the impact that attending one of multiple career fairs offered to engineering students had on their understanding of professional opportunities. One specific interaction that Penelope remembered and shared details her knowledge concerning career development:

> It was freshman year, and I was talking to somebody at the career fair. She's like, "I won't even look at your resume if it's [a GPA] below a 3.0." Some companies, before they even look at your resume, they'll just look at the line that says your academic grades and they'll judge you based on that. A lot of engineering students do get a lot of good grades, and yes, it's important to stay well-rounded, but it's also important to have the passing grade, so then you're even looked at. The end goal is to get a job, and so grades are important for that aspect. You need to get looked at by companies to get an internship, and to apply to those you need pretty good grades. I don't think a lot of companies will look at you if you struggling. You have to go out and do things to succeed and to get farther.

Rebecca recalled a similar experience after attending the career fair during her first semester:

> Both the General Engineering and then the Introduction to Industrial Engineering [introductory courses] made us go to the career fair and just like, talk to people. You don't have to take a resume, if you just want to go up and ask them what are they looking

> for in someone, if they are going to hire someone, what do they want them to be. Just hearing different companies' perspectives on what kind of a person they want. Rarely was it a "we want this person who had all A's," or somebody who has this GPA. The GPA rarely came up. They said it has to be decent, as long as you passed your classes. Most of them were more interested in outside knowledge [and] that you can apply yourself to things, because the world isn't going to be like, the straight questions. So, hearing them kind of tell you "well, we need somebody who's going to attack problems that don't have an answer" kind of made me realize that it's not just about the grades. It's about the skills you take from taking the classes.

Furthermore, Rebecca recommended, in addition to participating in the career fairs, "attending events similar to that, talking to the companies, or listening to the company presentations that they do once a month" can help lead to an understanding "that college isn't just the studies. It's kind of everything else" that engineering students can get involved with on campus. In terms of Johanna's experience, the career fairs provided an early opportunity to shape and define the skills she saw as necessary to achieve her professional aspirations:

> If I practice at each career fair talking to employers, I would get better each year. Seeing progress there, even if it's not like 100% what you want in terms of progress every time, I think seeing progress probably helped with me being persistent. Okay, it's not like I get rejected by everybody at a career fair because that would be very discouraging, but seeing things come out of it, or being able to have a mindset of when things go wrong, understanding that I can use that.

An education and a degree in engineering, for several of the research participants, meant the ability to secure a solid financial future, but more importantly, it meant an opportunity to

pursue a fulfilling career and professional life that they would enjoy after their collegiate tenure had ended. Despite the challenging coursework associated with the program, Walter wanted to "be able to do something with my major to help people. Engineers literally help people, and I feel like electrical engineering is nice." Walter very clearly described his intent in terms of how he was going to help others: "I'm going to be doing power systems, and I'm going to learn more about energy and how it works." For Jackson, a career in engineering meant financial security, but it also meant a more unique benefit:

> I'm sure you can ask about any and every student in here, [and] they have all kind of got the same point of view. Their goal is to get out of here and have a good career, but a lot of the reason that they're here is because their interest and hobbies and stuff, and that's probably similar across the whole campus.

Counting himself among the students he mentioned in the aforementioned response, Jackson believed that "one of the biggest factors for me was the hope of a good career. I would even say that some of my hobbies fuel me to continue through college" as an engineering major. Even though she was originally drawn towards engineering as a college major because of "money and family," Penelope ultimately chose that pathway because "that's more where my mind is at, the things I enjoy." Since the beginning of his time at the university, Kevin has "always wanted to be able to finish college and go into a career that I really enjoy and really feel rewarded in doing." In a manner similar to Damien's mentality, Kevin knew that the complexity of the classes that engineering majors had to complete would not serve as a barrier to his pursuit:

> I've always had the train of thought that the difficulty of the coursework shouldn't change your decision at all, because to me the end result is always what motivated me. It doesn't really matter what it takes to get there, because I wouldn't be satisfied having an easy four

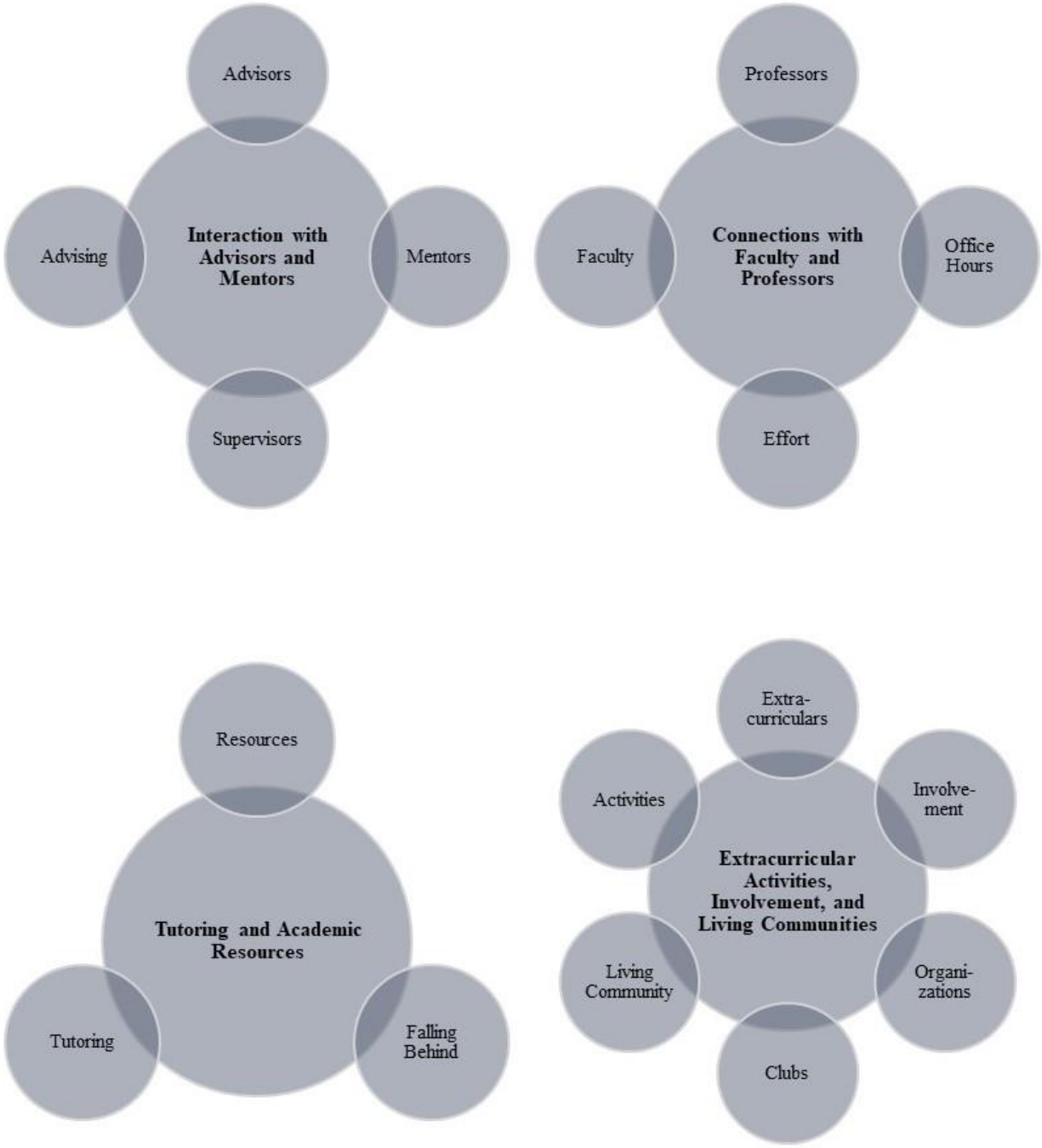
> years in college, maybe doing a different major, and then having a job that I wasn't satisfied with or wasn't happy at. And what being happy at my job means for me is something that's rewarding and something that makes me feel like I'm making the world a better place for other people. I've always felt like being able to be challenged throughout college in my coursework will really help me to be the best I can be in the professional workplace.

As he progressed through his first year as an engineering major, Kevin understood that "the hard work in college put me where I am now, rather than just saying the degree I got in college allowed me to get this job," and that his determination empowered him to "start at this higher position because I put that much effort in during college."

### Utilization of Institutional Support and Programming

Lastly, the utilization of institutional support and programming functioned as the sixth and final element that positively influenced first-year persistence in engineering among those involved within the research design. Subcategories within this distinct element include their interaction with advisors and mentors, their connections with faculty and professors, the incorporation of tutoring and other academic resources, and the ability to pursue extracurricular activities, involvement, and living communities throughout their first year. Through their exposure to and utilization of programming offered at the university level, these first-year, first-generation engineering students were able to find purposeful and engaging experiences that enhanced the first two semesters of their collegiate tenure. Figure 4-6 demonstrates the corresponding node clusters associated with this specific element.

**Figure 4-6: Node Clusters for Utilization of Institutional Support and Programming**




### Interaction with Advisors and Mentors

As each of the research participants were navigating through the courses and responsibilities necessary to work towards and achieve an engineering degree, several of them

made mention of the guidance, support, and encouragement they received from advisors employed by the university, including those within each department in the engineering program, as well as advisors for various clubs, organizations, and programs. While Damien was certainly better prepared than some of his colleagues for the transition from high school to college, he found an advisor with whom he connected, "not necessarily when I was down, but just all the time. She's always giving me advice about how to make the little things better, and I think that's for sure made the biggest difference for me" to be successful. When the time came to move on from the General Engineering program and into a specific major, Damien found his primary academic advisor to be quite accommodating:

> I got to talk with her for two hours when I was making the decision to switch to Chemical Engineering, and the fact that I could go and do that meant everything to me. I didn't feel so alone anymore. You know, you go to school with 20,000 kids, and you can kind of feel alone really quickly, and kind of feel like you're thrown to the wolves sometimes. But that's what makes me really feel safe and secure, to be able to go talk to anybody when I do have a problem, and they can lead me in the right direction.

Similarly, Mary Beth's advisor provided her with support and encouragement that meant a great deal to her at the time:

> I would say that definitely my college advisor pushed me a lot. There was one point where I was like, "I don't know if this is what I want to do," and he pointed me in directions I could go, but he looked at me and he was like, "I know you can do this, I know you can push through." That was really impactful to me.

Since Matthew was involved with a design team and started off in the General Engineering program, he had access to a number of different individuals that all served in advising roles:

> I've had really good interactions with all of the advisors for the tractor team and my academic advisors. I've had three so far, because I came in General Engineering, I took the DEN 160 class, then second semester freshman year I had a different one, and now I have a mechanical engineering advisor. I really like my advisors and everything.

At both the high school and college level, involvement in various programs gave Walter access to a number of individual advisors that significantly impacted his transition to the university:

> My [high school] counselor, she also helped me with part of the process of getting scholarships. There was this other group called KU [University of Kansas] Gear Up. They also helped me through the process of transferring here. Not really deciding what I was going to be because I already knew it then, but it was more like, they were helping me through the process of how to get here, what to do, where to go apply for scholarships, who to talk to. Then I got connected with people like Laverne [Bitse-Baldwin, Director of the Multicultural Engineering Program], Pat Bosco [Dean of Students], and Larry Moeder [Director of the Student Financial Assistance Office], so they helped me through the process.

After his first few weeks in the engineering program, Walter continued to interact with Ms. Baldwin, who as an advisor "helped me and kept up with me, and made sure that I'm still doing good [sic], like how I'm doing in classes, and just personally how I'm doing. I think that that motivates me to keep going" as an engineering major at the university. As he was gearing up for the second half of his first year on campus, Ms. Baldwin helped encourage Walter to make several sustainable choices regarding his course schedule:

> Freshman year, I was going to take a bunch of classes. It was my second semester, I was going to take like 17 credits, and I didn't know that I was not going to be able to do that. I

> just put a heavy course on myself and I was involved in all these things…I talked to Laverne before all that happened, and she was like, "I don't know if you're going to have time for all that if you're going to be successful, you know, get good grades." She said that I should consider dropping some of these and you're still going to be on track [to graduate], so it's not like you'll have to rush things. I think that helped me realize how a course load was going to be, how it's going to look like, and how to be successful in it, so I think I've understood how it works.

When working with her academic advisor, Hannah found that they were able to help her "adjust to the swap between one year being comfortable and understanding how things work," because "that's their job, that's what they're here for" at the end of the day. Within the engineering program specifically, Rebecca felt that the advisors were "incredibly helpful people," and "are a resource" to anyone majoring in or thinking of switching to engineering. Throughout her first year, Rebecca utilized the services of two advisors that helped her establish a solid foundation:

> My academic advisor was the same as the Industrial Engineering 101 class, so I think having him for the class and as my advisor when I was kind of figuring out that I wanted to do Industrial was really helpful. He knew the program really well and he knew everything about it. Even the General Engineering advisor that I had, she was really helpful. She wouldn't try and pretend that she knew a hundred percent all about it, but she tried to give you as much information as she can, figure out your interests, and try and help find the right one for you. I found it really helpful because they're so knowledgeable. They're willing to put in a little bit of effort if you have questions, or if you're confused, you don't really know what the next step is, they are always willing to help you figure that out.

Within the Computer Science major, Benjamin worked with an advisor that "helped me significantly in proving my worth to employers and critiquing my resume and my cover letters," in addition to "just walking me through a lot of the processes. She has helped significantly. In fact, whenever I walk by her office and I see her, I like to just talk to her." When I asked Penelope about individuals that have positively impacted her college experience, she proclaimed "my advisor. I love her, she's amazing. She is so nice. She will get stuff done and will make sure that you're on the right track. She definitely helped me through some tough times personally, too." Once he arrived on campus, Kevin "interacted with the freshman advisors for mechanical engineering," and found that "one was super helpful. He was really nice. His main goal was [for you] to succeed in your classes." Through these interactions with his advisor, Kevin found the connection to be "really encouraging, just to see that he really did want the best for me."

Outside of the classroom experience, a handful of the research participants made mention of the presence of mentors that provided stability, guidance, and reassurance throughout their first year as engineering majors at the university. By choosing to living on campus during his first year, Kevin saw great opportunity in developing connections to those in proximity to him:

> Just being able to interact with the Resident Assistants in the residence halls. I thought that was awesome because you kind of automatically had an upperclassman that you can talk to about anything. It was really nice to hear their tips, hear their advice about how to get through college, what the best way through it is, and learning from their mistakes.

Similarly, Rebecca connected with the Resident Assistant on the floor of her residence hall, and would "ask him questions, like 'how did you do this?' or even like a question about advising before I went to my advising appointment. He helped me prepare for that." Overall, Rebecca found her connection with that individual and other Resident Assistants to be "really helpful,

because as older students, it's kind of like, 'been there, done that,' so they kind of have a larger bank of knowledge for that. It's really easy to pick their brain" on a variety of subjects. For Johanna, the inherent nature of the environment on campus provided ample opportunities to establish relationships with mentors:

> Just seeing students like that and having a lot of leaders that I can follow in terms of their example. A lot of those are engineering students or students that are in really rigorous classes. That's been really encouraging, and that's been a good community to have people around. We all check in on each other, and having accountability like that in a really radically loving way has been really impactful, and the mentorship that goes along with that. There's an older woman that mentors a lot of the girls [in engineering], and so that's been really cool to have check-in points on that for the stuff that matters more than academics. That helps you be more academically motivated indirectly too, because you want to do well so that you can go to cool places, do cool things, and love people more.

No matter the subject material, Damien took strides to connect with "my mentor all the time about stuff I need to do with my life, whether it's financial, whether it's just life problems, or if it's here on campus." Through his on-campus job, Benjamin grew "really close to my boss here, as well. He's the senior web developer…becoming close with him has helped." On the other side of that equation, Edgar was impacted by so many of his peers and upperclassmen that he has "served many upper-class mentorship roles now that I've gotten older."

**Connections with Faculty and Professors**

As an engineering major, first-year students enroll in and complete high-level courses in calculus, physics, and chemistry, as well as introductory-level classes in their specific engineering department or program. Despite historically-larger class sizes throughout the first-

year curriculum, the research participants provided responses and addressed questions that strongly suggest that the faculty and professors at the university were accessible, approachable, understanding, saw them as more than an ID number, and cared about them outside of the grade that they were receiving in a specific course. During his first year in the program, Matthew noted that "almost every professor has office hours. I think they all do, and they're there for you. You can e-mail them, [and] there's so many ways to contact them" about anything. Although this certainly does not happen in every single case, Matthew discovered a particularly unique benefit of visiting the faculty members outside of the class period:

> One of my biggest things was, I would go talk to professors and go to office hours and just try to really understand what I'm doing wrong or how I can improve. I think that helped me in Calculus 2 and Calculus 3, just getting to know my professors. Even at the end of the year they'd be like, "okay, you're at an 89 percent, I can round your grade up to an A, or a 79 percent, I can round that up to a B." Just getting personable with your professors, advisors, everything just really helps you.

In some cases, Christopher noticed, "all of my professors have been very open to office hours," and will even "have you meet them, like as an assignment. I thought that was actually pretty nice." While she was initially hesitant about reaching out to the faculty at the university, Hannah quickly learned just how much she could benefit from their interaction:

> My freshman year, I was intimidated for sure about going to talk with professors, going in their office hours…I think that was just, when I started [college], I saw them way up there, and I was super intimidated. Here they are in front of 200 people, and they have to be extremely important or extremely intelligent. Not that they aren't, but I didn't think

> that I had a connection to really go and talk to them in that sense. Now I realize that they're just there to help, and I guess that environment really changed.

In one particular instance, Hannah remembered, an issue with an assignment led to the development of a meaningful relationship with the faculty member for that particular class:

> One of my office hours, I had a technical difficulty with the attendance. It wasn't syncing, and it was something super small, but it made it a lot more comfortable. I think what I realized after attending office hours was that since I made that connection with the professor, I wanted to do better in their class because when I had my test, they're going to see my name, and now they have a face to it. So now I think "gosh, I really have to do well," and I think that was a big motivator for me, especially.

As Mary Beth progressed through the engineering curriculum, the professors and faculty members she had for her coursework were important as advisors and mentors:

> They're always focused on getting me to where I want to be. It's always "what can we do to help you?" It's never been judgmental or anything like that, so it's really helpful to be like, they're all here supporting me and they have my back. If I ever need to, I can go to a random professor and they could help me. I've always felt like that.

From the interactions that Penelope has experienced, the professors and faculty at the university were "so helpful, and they always want to do what they can to help you succeed, and honestly, it's like one big family. It's weird saying that, and I hear it a lot, but it's kind of true." Furthermore, Penelope believed that the accessibility of the individuals at the front of the classroom was an essential part of the university structure:

> The faculty and professors are super easy to connect with, and it's easy to make an appointment online. They can meet, or you could just stop by their office during their

> office hours. Sometimes they're free, most of the time they're free, but it's just nice and honestly, finding a faculty [member] that you trust on campus is super easy. I think it's important because then if you're ever having problems in your classes, if you're having problems with navigating campus, or if you're just having an emotional problem and you need someone to talk to, they're there, and it's amazing.

Along those same lines, Rebecca noticed that her professors and faculty "genuinely do want to help you," and the atmosphere they build on campus is "definitely welcoming. You feel like you have a place where you belong" at the university. Through the connections she has built with various faculty members, Rebecca recognized that it was "kind of neat to see professors that you went in and got help, and they kind of watched you progress through the year," and recalled that she "never had any issues contacting [them]. Professors are always more than willing to be with you, or if you can't make their office hours, are more than willing to try to find a time that will work with you."

Throughout the first two semesters of his college tenure, Edgar recalled that he "had 95 percent good experiences with faculty [and] professors…especially within my department. They have been very helpful." As Kevin was navigating a particularly challenging course that most engineering students take within the first year of the curriculum, he developed an unexpected connection with the faculty member that was responsible for teaching the class:

> My recitation professor for Calculus 2, he was extremely helpful. He really helped me get through the class and made me enjoy it, which I was really surprised about. He surprised me in my first year because he was the first one to know everybody in the class's name, and coming into college, that was not something I expected. I just heard that professors would be there to teach, and whatever grade you got, however well you did in the class,

> that wasn't necessarily their concern. So, that was really a good thing to see my first semester. Then other professors, it was really nice to see that they had their available office hours, and just hearing them talk, saying "if you don't understand it in class, then come to my office hours, we'll try to explain it in a different way." I thought that was great, because I had imagined that so many professors would just be stuck in their ways and would think that there's one best way to do it. So, that was a really good thing to learn about.

Given her extrinsic personality, Johanna proactively attended office hours to "ask questions about class content, and that worked out pretty well for me. I really like talking to strangers, and I'm really energized by it, so reaching out to professors is kind of fun for me." During those first two semesters, Walter made a concerted effort in his classes to "get really close to the professor. That's the one thing I learned. It just puts you ahead in really understanding the course, and what's going to be on the test they make. So, [I] might as well get close" to the faculty members.

On the whole, Jackson believed that all of the interactions he had with faculty, professors, and advisors throughout his time in the engineering program had been overwhelmingly positive:

> I would say that the employees of the university, they are really helpful and really friendly. They're here to help you out. I found that teachers in the mechanical engineering department were very helpful, and I find that the faculty here are very supportive, very friendly, very helpful, and they're here for your success. I'll walk by, and if their office is open, I drop by, and that's pretty much it. Before class, not really, but after class, definitely. I don't have a problem with stopping and talking with the teachers. In fact, I've had conversations with teachers after class about everything from class subjects to life,

> and about extra hobbies and stuff. Just about any teacher here I find that it's easy to make a connection.

As he was developing those connections, Jackson remembered “last spring, I was taking Engineering Physics 1 with Dr. Bolton. When he could actually call me out in the lecture hall with the hall full of people and call me out by name, I was pretty impressed.” When he made his way to college to study computer science within the engineering program, Benjamin noticed a difference between the connections he developed with his teachers in high school and those among the professors at the university:

> Definitely connecting with people and professors. The relationship with professors and my teachers in high school was kind of different. A teacher in high school, you can get close to a teacher, but I never really connected with a teacher as much as I do professors, who were teaching me something that I’m interested in and pursuing as a career.

In order to establish those relationships, Benjamin recommended that “as long as you take the time to speak to your professor for your classes, a lot of the time you end up connecting with them,” which is helpful “if you ever have any issues or if you’re teetering between a B or an A, it’s important” to take those strides. To his surprise, Damien connected with his professors quite a bit “more than I ever thought I would, and I used to be close with my high school chemistry teacher. I still talk with her every day, and I didn’t think I would really be able to make those connections” at the collegiate level. Through those connections, Damien experienced a significant revelation on the subject of professors and faculty within the university and the engineering program:

> I noticed with a lot of these people that if you're going to put in the effort, they're going to put in the effort to help you if they see how much you care. They're willing to help you,

> and they care about you enough to help you be the best person you can be as long as you're willing to put in the work. I think that's the biggest thing about college. If you're willing to put in the work, you can get whatever you put into it.

**Tutoring and Academic Resources**

As the research participants were navigating the challenging curriculum associated with the first two semesters within an engineering major, the availability of and access to certain resources, including tutoring, summer bridge programs, and engineering-specific accommodations played an essential role in their persistence efforts. One of the most important resources available to students at the university, Damien argued, was "just being able to go and ask for help" at any time, and noted that "the best advice I could give anyone that was coming to college [is that] the help was there. You just have to go and look for it." At the very beginning of her college tenure, Hannah was concerned that she "would walk to class and not recognize a face, and that made me really nervous," but then she "met my roommate the first day of classes," which helped get her connected to a variety of resources available on campus. In order to help her with both the academic and social transition, Rebecca utilized the extracurricular activities available at the university:

> I definitely think having programs that get you involved…things like that, because those are really helpful resources for people that want to get involved but they really don't know how. There's always a way, and I think definitely on campus there's so many resources that it's just a click of a button on a webpage.

For a pair of the research participants, the opportunity to enroll in and complete a summer bridge program on campus between their graduation from high school and their first semester at the university enabled them to get familiarized with available resources. Walter recalled that "as

a part of MAPS [Multicultural Academic Program Success], we took classes," which included chemistry, and the one-credit hour general orientation course called "University Experience, and I think those two things really helped me find resources and stuff" on campus. While Walter was grateful for his experience with the summer bridge program, he also recognized the need for specific programs directed towards first-generation students at the university:

> I feel like as a first-generation student, you really don't know anything, or where to ask for help. I feel like there should be some sort of a resource. I was in MAPS, so I have resources for me like that, so I don't know if other people have that. I feel like that should probably be a thing for first-generation students, like with advisors that check on them and see how they can be improving. I don't know if that's a thing already, but I feel like that can be a good thing for people. I was lucky enough to put myself out there to help understand where resources are and just asking for help, and I feel like a lot of people that come here, they don't really understand how that works and they're kind of lost. I don't want that to happen to anybody. I feel like maybe having a resource like that for first-generation students would be pretty nice.

Upon her arrival to campus, Penelope "really wanted to get to know more about the resources on campus," and utilized her participation in the MAPS summer bridge program to connect with those that would support her professional aspirations, like the "Career Closet and stuff, which is really cool, and the resume stuff." When it came to academic resources, Penelope found that making appointments with the staff at the Writing Center was quite valuable, especially "when your polished rough draft is due," because "you can't show up to the Writing Center without a paper, so then you have to do it."

Although they had rarely, if ever, needed academic assistance with their classes in high school, several of the research participants made note of the benefits inherent to campus-wide and engineering-specific tutoring as they made the transition to the more difficult collegiate curriculum. Right out of the gate, Hannah "got a tutor my first semester, and that was something big. I never used to ask for help, so that was a big step for me." When I asked her about that experience, Hannah provided the following response:

> I got the tutor for my first semester starting in Calculus 2, and so that was a good time for me to sit there. There were other people in the class that we could ask "hey, how did you go about this problem?" or "how did your recitation teacher go about this problem?" It was a good source of communication, and it was a set time where I would be able to do that. I think that's what I had been wanting to utilize for the rest of my studies.

Similarly, it was the crucial role that mathematics played in the engineering curriculum that encouraged Christopher to incorporate tutoring and other resources into his academic regimen:

> I went to tutoring in Holtz Hall for a lot of the calculus classes, and then I went to the tutoring here [in the engineering building] a little bit freshman year. I like the tutoring over in Holtz Hall, honestly, so I did interact quite a bit with the resources. Also, I would attend any reviews or anything like that.

Within the confines of the engineering facilities, Matthew suggested that "it's up to the student to want to get help and everything, including SAS [Scholars Assisting Scholars] tutoring," where upper-class engineering majors provide complementary group tutoring and review sessions for core classes in mathematics, physics, chemistry that are primarily taken within the first four semesters of an engineering curriculum. In addition to utilizing the "physics tutoring quite a bit in Cardwell" Hall, Damien sought out SAS tutoring for "calculus and physics," which he

believed were “definitely my toughest classes for me” during that first year on campus. Rebecca also found success in first year through “getting help by going to SAS tutoring,” noting that, in the engineering curriculum, “it’s okay to go and ask. It’s okay if you don’t understand. It definitely helps you get over that and realize that yes, it’s going to be difficult, but it’s not impossible.” Overall, Matthew argued that the university had the resources available, but that the individual student needs to have the initiative to go and incorporate them into their schedule:

> I think a big one would be taking advantage of the opportunities given to you on campus, whether it’s tutoring or whatever you have. If there's anything, take advantage of it, or try it out. I think another big one is you have to have that will or the want to get it done and succeed. I just think it relies on how you want to do. So, if you want to be successful, you [have] got to put in the work and the time, and take advantage of everything you can.

**Extracurricular Activities, Involvement, and Living Communities**

The opportunity to become involved with a variety of extracurricular activities, clubs, organizations, and living communities within the overarching university setting gave a number of the research participants the ability to connect with crucial support and programming, to ensure a seamless transition from high school to the collegiate environment, to help establish a balance between academic and social responsibilities, to further hone their skill set in regards to career development, and to expend their knowledge on the importance of accountability. One of the most prominent and common threads among the research participants centers on the length, breadth, and meaningful purpose of their involvement. Quite a few of those involved within the parameters of the study, including Johanna, connected with opportunities on campus that enabled them to grow and develop within their faith:

> I would say one of the biggest things…has been my involvement in a discipleship group. I would have Sunday night dinners and Saturday seminars just to learn the Word more, and know the Bible more, and be more discerning. That's been really motivating, to be encouraged to know the Word and have more of a purpose.

During her first year on campus, Mary Beth "had a lot of free time, and it was mainly spent with my roommate, trying to do fun things. I started to get involved with Saint Isadore's and trying to get involved in clubs" offered at the university. Additionally, Mary Beth "was really into sports all throughout high school, so I did a lot of going to the Rec [Recreational Center] and playing intramurals, [and that] was more my thing freshman year." Rebecca attempted to stay busy throughout her first year, finding time to be "pretty active with the Catholic Student Center," in addition to having the opportunity "to work at the Derby Dining Center" approximately "12 to 20 hours a week," depending on her workload throughout a particular semester. Now in his sophomore year, Damien reflected on his involvement with a variety of leadership and hands-on experiences within the College of Engineering, including how he "did the CLUE [College Leadership, Understanding, and Education] Program last year," spending "some of my time at St. Isadore's outside of campus, and also was a part of the Rocketry Team." Matthew also "ended up joining the CLUE Program for freshman year," which he got connected with by going "to the Club Fair" that the university hosts at the beginning of each semester. In addition to his involvement with the Engineering CLUE Program, Matthew connected with the "Quarter-Scale Tractor Team," working towards involvement that would enable him to look "more towards what I can use to further my experience and stuff for the real world." Hands-on experiences were also important to Jackson, who in freshman year "moved towards [the] Baja [Car Team]," where being a member of the team "involves a lot more mental processing," and "you have to think

more" in order to be successful at competitions. Similarly to Matthew, Kevin "went to the Activities Fair and joined a few organizations, like Engineering Ambassadors and Engineers without Borders" during his first semester at the university. Through a combination of opportunities in and out of the classroom, Hannah attempted to make the most out her first year on campus:

> Freshman year, I did the fun stuff. I did the Swing and Salsa Club and that was fun, [and] I went to a couple Young Democrats meetings. I took LEAD 212, and within that class we did a lot of community stuff in there. Then, once I started getting to know more people, I started getting involved in different things. I joined an engineering sorority too, which was nice because I didn't know a lot of girls in engineering.

From the very beginning, Walter connected with organizations in the engineering program, as well as a campus-wide opportunity that provided him the ability to positively contribute to the rest of the student body at the university:

> I was involved with HALO [Hispanic American Leadership Organization], SHPE [Society of Hispanic Professional Engineers], and LULAC [League of United Latin American Citizens]. Then, I don't remember if it was my first semester or my second semester, I became an intern in SGA [Student Governing Association]…at the time I applied, I got it, the position for Intern with the College of Engineering. Then I ran for Senator, and was elected as a Senator for the College of Engineering.

In a similar approach to her first year, Penelope "joined SHPE and HALO," and participated in a number of events as a part of her responsibilities "in the First Scholars scholarship program."

Several of the research participants, through their responses, indicated the adoption of a mentality that easing into the involvement and extracurricular activities while adjusting to the

collegiate environment was necessary for achieving success during their first year. While it may have taken Edgar a few weeks to get fully acclimated to the university environment, once he did, the opportunity to build a community and support system from the available clubs, organizations, and activities significantly impacted his collegiate experience:

> When I came to college, I realized there was a lot I was missing out on, so I did everything I could as far as extracurriculars. I went to every meeting I could, I stretched myself way too thin, and I don't regret it. I got exposed to a lot of different things, I got involved with lots of different organizations in college, and eventually I zeroed in on two or three. My first year, I got most involved with the Society of Hispanic Professional Engineers here in the college, and so that was a really powerful place for me that made me feel like home, especially here in the College of Engineering at K-State [Kansas State University]. In Kansas, the minorities in college are even more of a minority, so being close to people who have very similar experiences to me growing up, and my high school was largely Hispanic, and so that group was familiar to me. So, extracurricular-wise I really got involved with that, and that group really made me feel at home with my friend group. They do a lot of professional development for students, especially first-generation students, because we lacked a lot. We lack a lot of that prior support [and] knowledge from our parents, not because they didn't want to, but because they didn't know how things [worked]. That's probably the way I got involved the most.

Although the environment, expectations, and workload was different, Christopher took a unique approach to his extracurricular activities, where he "kind of modeled it like I did in high school: freshman year, just kind of learn the ropes," and wait until sophomore or junior year to see if "being in a larger part of groups and taking on bigger roles in those organizations" was

something that his schedule would allow. As he progressed throughout that first year, Jackson discovered that “there’s clubs that meet everyone’s personality, and there’s things for everyone on campus. That's what's great about it, you find something that you're really interested and really into, [and] it’s really easy for you to get involved.” The development of connections on campus was especially important to Matthew, who believed that during first year “getting in clubs and doing stuff outside the classroom really helps your ability to make friends and communicate,” which was important, because “you can really get to know them and understand how they learn, and what works for them. You can help yourself by talking to other people” at the university. Involvement within a specific organization on campus empowered Walter to “just feel at home and just feel like I was in a safe environment where I have people like me. We know each other, [and] I feel like my community, I feel like everybody knows each other.” Similarly, the clubs and organizations that Mary Beth got involved with during her first year were “more like a home away from home, but then it was more of a place I could go for like, security and people who would support me” in any way. By taking his time in terms of getting involved with various clubs and organizations, Kevin learned a valuable lesson about how to spend one’s time while in college:

> I was kind of scared that getting involved would just kind of make me busier, but being able to make those connections with upperclassmen, for example, really helped. They would give advice on study habits, or time management, or even the classes that I was in. It taught me the importance of being involved with something, as opposed to just joining 10 organizations and having all those to put on your resume. I definitely did want to branch myself out and use that to meet new people and to get a view of different aspects of college, rather than just the engineering building and my department.

The ability to get involved in a variety of extracurricular activities, for a pair of the research participants, meant an opportunity to develop a strong sense of accountability towards all of the roles, responsibilities, and expectations associated with being an engineering major. As Matthew made the transition from high school to the collegiate environment, he noticed that taking more of an initiative with one's responsibilities was not just reserved for the classroom:

> In high school, we had clubs and stuff, but I think the clubs were more teacher-oriented. They'd make sure that you were there, take attendance and stuff, where clubs now in college, it's like you're part of it, but you either show up or you don't. You participate or you don't, no one's going to be there to check in on you. It's a lot more "if you want to do something, it's on you to do it," rather than someone holding you accountable. So, you have to hold yourself accountable. You're getting pulled every which way in college, trying to join this, do this, come to this, and so you really [have] got to focus on using your time wisely and choosing where you want to put your attention.

Through her involvement in the university marching band, Johanna learned in her first semester that "when you have such a full schedule with band and everything, you don't have time to slack off and you don't have time to procrastinate as much." On the subject of distractions that take time away from involvement, Johanna argued that "it's not productive to spend time worrying about that, so you just do the college thing like everybody else is doing. It's a lot more productive or efficient to have fun about it instead of being worried."

Finally, a handful of the research participants remarked that their efforts towards involvement with extracurricular activities stemmed from an inclination to focus on the development of skills and attributes that would benefit their career aspirations during and after their collegiate tenure. As she was navigating her first year on campus, Rebecca figured out that

"as long as I get involved and do the fun things like clubs, and volunteer and stuff like that, then I'll still be more interesting to a company than somebody who just spent their whole time studying" and not getting involved on campus. One piece of professional advice that helped Walter shape his involvement at the collegiate level informed him that balance in several key areas would be beneficial in the long run:

> You have to have three different groups. So, one's like, related to like your roots, so HALO [Hispanic American Leadership Organization] and SHPE [Society of Hispanic Professional Engineers], and then something related to your major, which SHPE is kind of related to my major. Then the third was something that wasn't related to your major, so I think that's what influenced my decision to choose SGA [Student Governing Association]. It was not related to my major at all, but I thought it was going to be a really good experience.

As Kevin vetted a variety of organizations and activities throughout his first year on campus, he committed to seeking "out the experiences that employers will value a little bit more, and luckily those have been some that I have enjoyed." Furthermore, in regards to his efforts towards professional and career development, his involvement with one of the hands-on design teams in first year "really made me feel more accomplished than I thought it would about this remote control car that we're making" within one of the machine shops in the engineering building.

In addition to their involvement with an assortment of programs, organizations, and extracurricular activities, a majority of the research participants made mention of the impact that being a part of an organized living community had on their collegiate experience as their first year on campus unfolded. For Kevin, making the purposeful choice to spend his first year living on campus helped set the foundation for a successful and fulfilling collegiate experience:

> I really felt like with residence halls, that kind of let me get out of my shell. I was able to reach out and build relationships with a lot of other people and get to know a lot of people with different backgrounds than me. I'm from the more urban part of Kansas, and there's so many people from the rural parts and even that are out-of-state, and so that kind of made me realize that everybody comes to college feeling a little uncomfortable. Everybody has those high expectations of making these great friends that they're going to keep for the rest of their lives, but not everyone really knows exactly how they're going to go about that, so I think that was a really great experience for me.

Through the connections he made with those in his residence hall, Matthew "started hanging out more and became really good friends" with several of the upperclassmen on his floor, which was beneficial because those new acquaintances "had more of the college lifestyle figured out," the details of which they would share with the first-year students. Coming from a smaller population back home and in high school, Jackson was pleasantly surprised to find that quite a bit of the "interaction and support comes from the students around you. When you live in the residence communities, you hang out in the lobby and those kids that are in the lobby, they're practically your family." As one of the engineering students living on campus in the residence halls, Jackson believed that "the support and constant pushing on each other to do your best is very beneficial" in terms of succeeding as an engineering student. By choosing to live in the residence halls during her first year as an engineering student, Rebecca was able to surround herself with individuals that would help keep her accountable in every facet of the collegiate experience:

> I think living in the dorms was the best thing to have a social life, because I was able to meet my roommate and other girls on the floor. So, that was helpful to build friendships, because from there we would go to football games, basketball games, and that kind of

> stuff together. That was kind of like my social life, and then the rest of the time was kind of spent primarily studying and doing the homework, and making sure I was where I needed to be for my classes.

Given the sheer volume of engineering students on the university campus, Hannah gathered that "even living in the dorms, you found people in your major who were there to work on homework with you. Those are still the same people that I get together with" to this day. Similarly, Penelope recognized that living in the residence halls meant opportunities to "meet people, [and] hang out in the lobby. They are doing homework, like people are helping each other with calculus and stuff like that. It was just awesome." Even though his roommate in the residence halls was a friend from high school, the opportunity to live with someone in that kind of setting during his first year on campus provided Edgar with what he needed to make the necessary adjustments to the collegiate environment:

> I chose to live in the dorms because I believed that to be the best way to immerse myself in the college and K-State [Kansas State University] experience. That is true, because now I live off-campus, and I do notice a difference. And so I lived on campus, and it worked out for me because my roommate I came with, we had known each other since seventh grade. That was a very conscious decision, because we both knew that we were going to major in engineering, and we were both competitive as far as academics go. We knew we were going to keep each other in check as far as being faithful to our studies and not losing ourselves in the college experience, and so that was huge.

While their physical addresses were outside of the university's boundaries, the fraternity that Damien was involved with and the scholarship house where Johanna spent her first year provided a strong living community that positively impacted their transition to the college

atmosphere. For Damien, “joining a fraternity was a great way to be able to meet new people and make all different kinds of connections,” which was especially beneficial because “you don’t always have the time with school to be able to make those connections” with other individuals on campus. When he was examining all of his options for available living communities in college as a high school senior, Damien knew what kind of environment would be best adapted to his unique approach and aspirations:

> When I was looking at fraternities, I wanted to pick a fraternity that was diverse, but also have people that I could connect with, as well. I’m the kind of the person, I usually gravitate towards people that are like me, but I also didn't want to live with 60 guys that are just like me, either. So, my fraternity was a great diversity of both, to be able to give me the experience to connect with engineers, but also with the outside world, as well. We have a really good diversity of both, and I think that's been really great to be able to see other people’s experiences throughout engineering, and to be able to learn from that to make my life a little easier.

As a first year college student, Johanna “got involved with Smurthwaite Leadership and Scholarship House, and that was a nice community to get involved with on campus.” By establishing that solid foundation with the scholarship house living community, Johanna helped steer her tenure as an engineering undergraduate student in a positive direction:

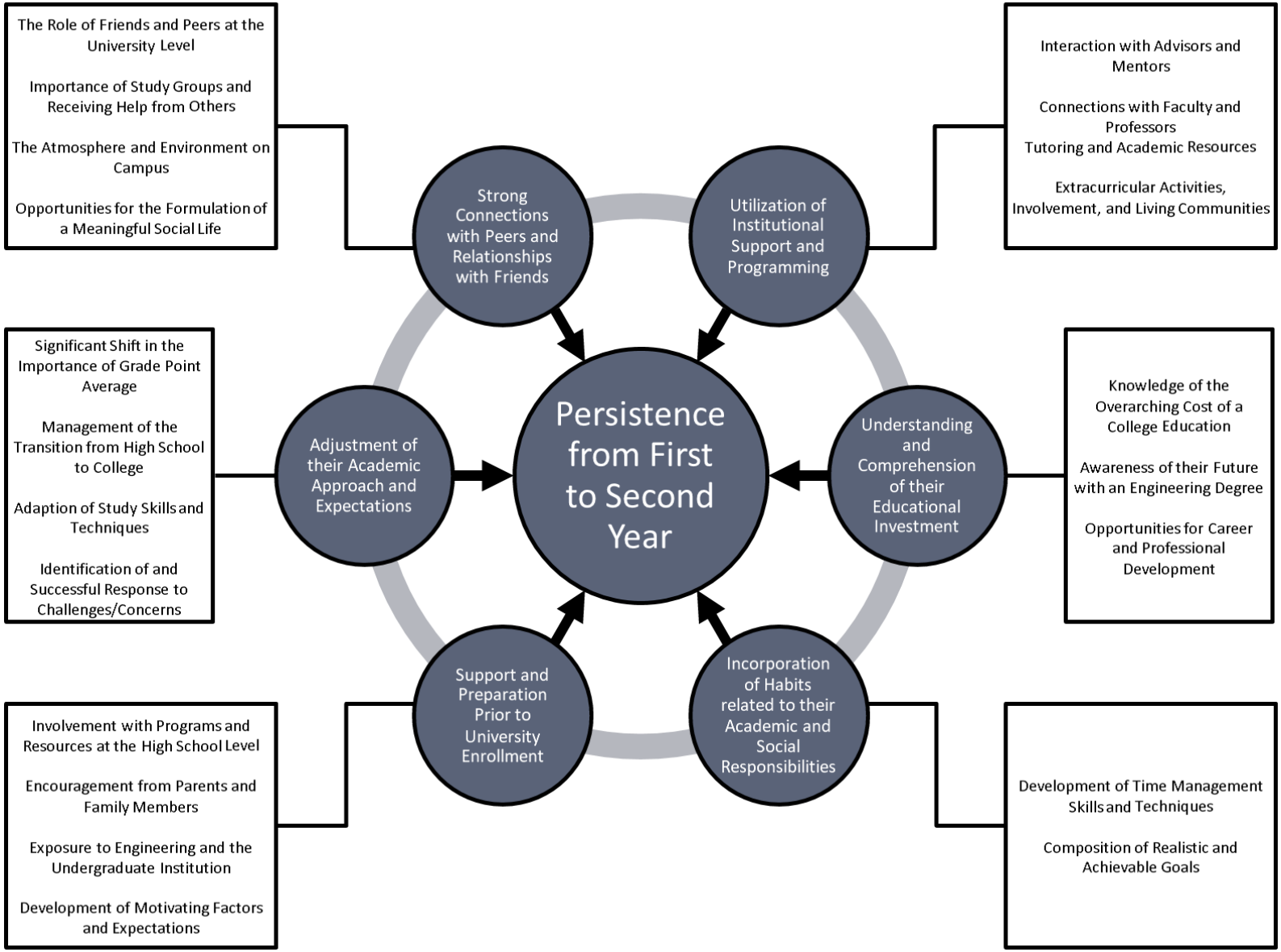
> I was in Smurthwaite right away at the beginning of my freshman year…I was pretty involved and engaged with all the house meetings. I started my own event that we've had every year since my freshman year, and I worked my way up to the executive board. I've been president this year, and will be president next year, so being able to invest time and serving people there with leadership skills has been really cool. I think that involvement

has really kept me grounded, because it's been a very consistent factor during the time I've been at K-State [Kansas State University].

## The First-Generation Engineering Student First-Year Persistence Model

The six primary elements that positively influenced the first-year retention of first-generation engineering students, which emerged through findings that were generated as a part of the comprehensive processes of data collection and analysis, established the groundwork for the creation of a theoretical model that describes the comprehensive array of factors that impact the first-to-second year persistence of first-generation engineering students enrolled in the College of Engineering at Kansas State University. Fundamental aspects of this particular model include each of the six aforementioned primary elements: support and preparation prior to university enrollment; adjustment of their academic approach and expectations; strong connections with peers and relationships with friends; incorporation of habits related to their academic and social responsibilities; understanding and comprehension of their educational investment; and utilization of institutional support and programming. The model, known as the First-Generation Engineering Student First-Year Persistence Model, is detailed and demonstrated in Figure 4-7 below.

**Figure 4-7: The First-Generation Engineering Student First-Year Persistence Model**



Each of the six elements are connected with one another and reinforced by their respective subcategories. The circles are connected because the theoretical model suggests that a combination of the primary elements is necessary, given the unique background, challenges, and opportunities that first-year, first-generation engineering students possess from the moment they begin their undergraduate tenure at the university. Each of the arrows moving from the primary element to the overarching objective of first-to-second year persistence indicates that the element helps to provide the structure and support for that fundamental outcome. The predominant goal of this particular model is to describe the experiences of first-generation students, and how a combination of factors through those experiences – which come together to create the six primary elements – support the overarching objective, which is the first-to-second year institutional and major persistence of first-generation engineering undergraduate students.

## Summary

Throughout the length of this chapter, I discussed the results and findings that arose from the comprehensive processes of data collection and analysis. Additionally, I provided a brief description of the 13 research participants who were interviewed as a part of their involvement with the research design. As a result of the data collection and analysis processes, I identified six primary elements of persistence for first-year, first-generation engineering students that participated in a first-year program and described their corresponding subcategories, which are reinforced through responses collected during in-depth interviews with each of the research participants. Finally, I introduced and described a theoretical model, known as the First-Generation Engineering Student First-Year Persistence Model, which was supported by the findings that were a result of the collection and analysis of data.

# Chapter 5 - Summary, Implications, and Recommendations

The overarching purpose of this chapter is to offer an overview of the study, to provide a summary of the primary findings, and to address the implications the study can have on specific constituents. Furthermore, a discussion of the primary findings is provided to review the contributions the study has made to the existing body of literature. In regards to future studies, I developed several recommendations regarding the pursuit of further knowledge concerning first-generation college students, college student persistence, and first-year university program participation.

## Summary of the Study

Through the employment of a grounded theory design, the principal purpose of this study was to explore the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation undergraduate students in a first-year program in the College of Engineering. Within the confines of a qualitative methodology, the primary research question was the following: What were the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program?

The foundation for the research study, a grounded theory design within a qualitative methodology, was the best fit in terms of studying the unique population and the opportunity to develop a new theory concerning the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering undergraduate students that participated in a first-year program (Creswell, 2007; Strauss & Corbin, 2008). Responses recorded and collected throughout two in-depth, one-on-one interviews conducted with each research participant served as the primary source of rich and meaningful data. Over the course of

the data collection and analysis procedures, 13 individuals participated in the research study by attending and completing both the initial and the follow-up interviews. The research participants were all individuals that had completed the DEN 160 first-year orientation course in the Fall 2016 or Fall 2017 semester, were first-generation students as defined by the undergraduate institution, and persisted in an engineering major from their first to their second year at the university. The collection and analysis of data from the transcription of the one-on-one interviews with the research participants generated a wide array of initial nodes, which assisted in the creation of node clusters. The node clusters were then reorganized and reassembled multiple times in order to reclassify them as subcategories that were supported by the data. The subcategories that emerged from the distribution of node clusters then served as the foundational components for each of the six primary elements that positively influenced first-generation engineering student first-year persistence. As a result of these comprehensive findings, I established a theoretical model within the parameters of a grounded theory design that incorporated the six primary factors that positively influenced persistence that were addressed in the previous chapter. The theoretical model, the First-Generation Engineering Student First-Year Persistence Model, examines and illustrates the primary elements that positively influenced the first-to-second year institutional and major persistence of first-generation engineering undergraduate students that participated in a first-year program at the university.

## Summary of Primary Findings

As a result of the grounded theory design, the findings of this particular study suggest that the first-to-second year persistence of first-generation engineering students that participated in a first-year program is positively influenced by a variety of academic, social, and institutional factors. The research participants, through their responses, indicated components leading up to

and throughout their first year as engineering students that were influential in their first-to-second year persistence as engineering majors. Support, reinforcement, motivation, and encouragement from a number of different elements established a strong educational foundation that enabled them to persist in a traditionally difficult academic program at the collegiate level.

Before each of the research participants arrived on campus, the support that they received from a variety of sources and the ways in which they prepared for the transition from high school to college helped shape their persistence efforts. As high school students, the opportunity to enroll in and complete dual-credit courses at local community colleges, as well as nationally-accredited programs like Advanced Placement and International Baccalaureate, helped introduce them to content similar to what they would see at the college level. Furthermore, specific interaction with high school teachers, advisors, and coaches led to conversations that encouraged the research participants to consider college and engineering as options following high school graduation. Additionally, those involved within this study indicated that research they conducted on their own in regards to available pathways after high school shaped their trajectory towards the pursuit of a college diploma and an engineering degree.

Despite not having a four-year college degree themselves, the responses during the interviews indicated that the parents of the research participants provided encouragement and feedback in such a way that those involved within the study felt more support and less pressure to attend a university after high school graduation. When focused specifically on the pursuit of an engineering major and degree from a four-year university, interactions with parents and family members were both positive and encouraging. For the most part, the parents and family members of the research participants trusted the academic successes of the students within their high school curriculum, and believed that success would translate to the collegiate level. In turn,

several of those that participated in the research recognized the sacrifices that their parents had made in order to provide them the opportunity to even consider college as an option following the completion of high school. Overall, the parents and family members of the research participants established and maintained a balance between enabling the individual student to be independent in their research and pursuits while only occasionally intervening on their behalf.

As a part of their exposure to engineering and the undergraduate institution at the center of this study, the research participants indicated that enrollment in upper-level mathematics and sciences courses were instrumental in their academic development prior to arriving on campus. Additionally, several of those involved within the study mentioned the opportunities to participate in engineering- and science-specific academies or programs that were offered anywhere from a single semester to the entirety of the four-year high school experience. Even if they did not have access to an engineering- or science-specific program at their high school, several of the research participants mentioned the opportunity to take elective courses that helped steer them towards engineering, including those that focused on design, graphics, and modeling. Participating in specific academics and enrollment in elective courses enabled those involved within the study to make connections with teachers and instructors that either introduced or helped lead the students to consider enrolling in college as an engineering major in lieu of parents or family members that may not have known as much about engineering. Furthermore, several of the research participants conveyed that conversations with friends, siblings, and other family members that were going into or already studying engineering and had been successful were impactful in their overarching preparation for attending college after high school.

When examining other factors that were impactful in terms of preparation prior to arriving on the institution's campus, the research participants, through their responses,

demonstrated a genuine motivation to pursue and complete an engineering degree at the university level. The motivating factors that the research participants reported can, for all intents and purposes, be classified into three distinct categories: parents and family, the ability to have a substantial impact as a graduate and professional in the field of engineering, and a drive to remain as an engineering major from their first semester on campus to graduation. In addition to an authentic sense of motivation to achieve a degree in engineering, those involved within the study exercised cautious, yet substantial optimism related to their self-confidence, self-efficacy, and ability to succeed when they made the transition from high school to college. The students, prior to their arrival on campus, were keenly aware of the inherent challenges associated with making the transition from high school to college and took ownership of the confidence they knew would be necessary to persist within the engineering major. Since they felt more support than pressure from parents and family members in regards to their post-high school plans, the individuals involved within the study had a firm grasp on their expectations for what college would entail, and had organically gravitated towards attending college and majoring in engineering once they arrived on campus.

Once the research participants arrived on campus for the beginning of their first year as engineering majors, their responses throughout the interview process suggest that adjustments had to be made in regards to their academic approach and expectations in order to succeed at the collegiate level. One of the most noteworthy adjustments that was reported by the research participants centered on a significant shift in the importance of college grade point average in the collective minds of a number of the research participants. As a result of a mentality that developed through their experiences in high school, many of the research participants expressed the idea that their grade point average was a direct reflection of their academic success. When

these individuals collectively arrived on campus, the aforementioned mentality involved specific goals and benchmarks, which included necessary thresholds to maintain scholarships and other financial aid packages to those that could be described as arbitrary in nature. As the research participants progressed throughout their first two semesters, however, adjustments were made in terms of their expectations and goals in regards to their college grade point average. While a number of factors impacted this shift in importance, one of the most notable components was how interactions and conversations with professional representatives and corporate recruiters influenced how the research participants perceived the importance of college grade point average. Furthermore, the research participants shared examples of how their definition of academic success went beyond their grade point average and the marks they were receiving in their coursework as engineering majors.

Through their responses across the entire interview process, the research participants provided responses that indicate a comprehensive management of the transition from high school to college that occurred early on in their first semester on campus. By participating in a variety of events, activities, and programs that were provided by the institution, the research participants were given the opportunity to be immersed in crucial support that enabled them to manage both the academic and social responsibilities associated with being an undergraduate student. As a result of these programs offered by the institution, those involved within the research found it necessary to put themselves in situations where they would interact with others and to step outside of comfort zones that had been established prior to their arrival on campus. Each of the research participants, through their responses, suggested the possession of accountability, independence, and responsibility for their actions both in and out of the classroom.

While an overwhelming majority of those involved with the research had suggested that they had been successful in terms of their classes in high school, a certain adaptation of study skills and techniques was necessary in order to appropriately adjust to the level of difficulty associated with engineering-specific programs at the collegiate level. One of the very first steps that had to be taken on the part of the research participants was to make the adjustment to both the format and the amount of homework, assignments, and responsibilities that were being received in the courses they were taking during their first year. As a result, purposeful choices were being made in terms of the kinds of classes in which they enrolled, and the number of credit hours they enrolled in during their first two semesters in the program. Furthermore, quite a few of the research participants recognized early on in their collegiate tenure that the amount of time they would have to spend studying in college as engineering majors would have to far exceed that which they had spent in high school. With more demanding coursework, the first-generation engineering students had to decide between individual studying, group studying, or incorporating a combination of both in order to altogether address the rigorous program. Additionally, this required the research participants to employ a variety of new strategies to handle the demands of enrolling in an engineering major, including the construction of study guides, reading materials before the beginning of a specific class, and remaining on campus before, between, and after classes as a means to avoid distractions found in one's living situation.

The individuals at the focus of this study, as their answers during the data collection process indicate, were able to identify and successfully respond to a number of challenges and concerns that are associated with pursuing an engineering major at the university level. Although there was an initial adjustment period, a number of the research participants indicated an ability to comprehend the information and content being covered in their classes, the pace at which the

materials was being presented, and the format in which it was being covered, including environments like lectures, recitations, labs, and studios. The first-generation engineering students that participated in the study recognized that the transition from high school to college was going to be different and more demanding, and understood that they would have to take purposeful steps to manage that transition, including discovering ways to remain confident and motivated when it came to challenging classes and a new environment on campus. Furthermore, the individuals that were interviewed were aware of the importance of establishing balance between the opportunities and responsibilities inherent to the atmosphere both in and outside of the classroom. Overall, it was an encompassing comprehension of the idea that college was much more than the classes in which they were enrolled or the major they had declared; instead, college meant that they were on their own for perhaps the first time in their lives, which came with a combination of great independence and responsibility.

The first-generation students at the epicenter of this research noted how important the opportunities to develop strong connections with peers and relationships with friends were as a positive influence on their persistence efforts as engineering majors. Through their involvement with specifically designed programs made available to them through institutional initiatives, the individuals were encouraged to build and foster connections with friends and peers in the engineering college and in other majors across campus. As their first year progressed, the research participants recognized the need for a strong support system that would assist them in and out of the classroom with the overarching transition from high school to college. Furthermore, they understood the importance of branching out to their fellow colleagues and spending time outside of or expanding their comfort zone. Several of the research participants even went as far as to state that a crucial part of their transition to college was being selective in

terms of those with whom they spent their time, and comprehending how they were influenced by those with whom they surrounded themselves. Additionally, a number of those involved within the research study noted the importance of a mentality among their friend groups, study groups, and entire student body of not wanting to see one another fail and wanting to see each other remain in an engineering major.

In a reversal of many of the study habits they employed as high school students, the individuals at the center of the research study knew going into college, or discovered early on within their first semester, the essential nature of forming study groups with their fellow engineering students. Additionally, it was understood that they needed to be willing to either receive help from others or to give help on certain academic-related components. The similar structure during the first two semesters of any engineering major, including subjects like calculus, physics, and chemistry, made it more accessible for the first-generation students to form study groups with other engineering majors outside of their specific area of focus. As a result of the formulation of study groups for these particular courses, the research participants found that time would be freed up in their schedule which would have otherwise been spent studying on their own, as they were able to complete an assignment or understand the material quicker than if they attempted those efforts by themselves. While the study groups that several of the individuals mentioned could be made up of more colleagues than friends, it was also mentioned how crucial those groups were to managing the academic responsibilities of their first year in the engineering curriculum. In a manner similar to campus-wide organizations and living communities, a number of the research participants found that oftentimes they had to step outside of their comfort zone and initiate contact and conversations with their classmates in order to form those study groups that were essential to their success.

Through their responses over the course of the data collection process, the research participants interchangeably utilized the terms environment and atmosphere to describe their overarching interactions with friends, peers, classmates, and other constituents. Additionally, several of the research participants made note of how they felt a certain energy among other individuals during their time on campus in their first year. Others mentioned how the very structure of campus offered opportunities for community and collaboration among a variety of individuals at the university level. Furthermore, a number of the individuals involved within the research design portrayed the institution as a "family," even if the demographics at the university were starkly different than those they had grown up around at the high school level. Overall, those that participated in the research described the environment and atmosphere on campus as both inviting and welcoming from the start of their first year as an engineering major.

The last subcategory supporting the existence of strong connections with peers and relationships with friends centers on the collective opportunities on the part of the research participants to seek out and formulate a meaningful social life as first-year engineering students. By recognizing that the college atmosphere was different from that which they experienced in high school, several of the research participants were afforded opportunities to expand their horizons in terms of the individuals with whom they interacted on a daily basis. While it was discussed in greater detail in one of the other primary elements, on- and off-campus living communities also provided opportunities for the individuals involved within the study to foster and develop an impactful social life. Furthermore, a number of those that participated in the research stated that an essential component of their ability to pursue a meaningful social life was the formation of balance between their efforts and energy in the classroom environment and their involvement across campus in a variety of organizations and extracurricular activities.

As a part of their successful transition from high school to college and from their first year in the engineering curriculum to their second year, the research participants offered responses during their respective interviews that suggested a purposeful incorporation of habits related to the academic and social responsibilities associated with being a first-year student at a four-year university. Within the domain of time management skills and techniques, an overwhelming majority of the research participants mentioned adjustments that had to be made in regards to their approach related to their first year as engineering majors, whether it was adapting what they had learned in high school or completely starting over from square one. Several of the individuals involved in the study stated that the utilization of planners and calendars in both digital and print form enabled them to manage all of their various responsibilities and obligations. Furthermore, the recognition of and genuine respect for their independence as college students impacted the adjustments that were made to the skills and techniques they employed regarding sustainable time management. Overall, those involved within the study recognized that the most significant challenges related to effective time management in college were those associated with balancing their personal, professional, and academic responsibilities, and how those purposeful choices would influence their experiences in the present and future.

In addition to skills and techniques associated with sustainable time management, the research participants also provided responses that indicate the presence and possession of goals that can be described as both realistic and achievable. Several of the research participants mentioned specific academic thresholds and benchmarks as a part of their aspirations, while others suggested a primary focus to their academic pursuits that did not necessarily equate to their overall grade point average. A number of those involved with the study noted that the

development of connections with close friends and colleagues would be essential to their collegiate experience, while others suggested that their primary goal was the accumulation of career-related and professional attributes and qualities. Finally, there were a handful of individuals that made note of an overarching drive to work towards becoming a well-rounded individual throughout their collegiate tenure.

Efforts made prior to and throughout their first two semesters on campus as engineering majors encouraged the research participants to develop an encompassing understanding and comprehension of the educational investment associated with attending a four-year university. The aforementioned efforts impacted the amount of knowledge those involved within the research possessed in regards to the overarching cost of pursuing a college education. As a result of the conversations that occurred during the data collection process, the individuals at the center of this study maintained an awareness of the expenses associated with studying engineering at the postsecondary level, including but certainly not limited to tuition, fees, living communities, textbooks, and other materials deemed necessary for general and engineering-specific courses. An understanding of the underlying costs of pursuing an engineering degree, on the part of the research participants, led to a comprehension of the importance of financial aid packages, which included scholarships, grants, and participation in programs that offered financial incentives for completing certain requirements. Additionally, a number of those involved within the study were hyperaware of the cost of their time and effort as it related to their expenditures per credit hour in which they enrolled throughout their first two semesters on campus. For the most part, the research participants saw their work towards graduating with an engineering degree as an investment in their professional future and thus worth the associated financial costs.

In addition to the knowledge of the overarching costs of pursuing a college education, the research participants provided responses that suggested an encompassing awareness of the future opportunities available with an undergraduate degree in engineering. The demand for professional engineers and future vacancies led to an understanding of the incentives awaiting them with an engineering degree in hand from the university. One of the most intriguing and surprising findings as a result of the conversations with the research participants centers on their desire to pursue a degree and career in engineering not to make as much money as possible, but to make a comfortable living and to be able to care for current and future members of their family. Overall, the individuals at the epicenter of the study were fully aware of the fact that, despite the difficulty of engineering courses, the major would provide them with a rewarding degree that would set the stage for a career that they would find both exciting and fulfilling.

As they navigated their first two semesters on campus as engineering majors, the research participants recognized and understood that securing and completing an internship experience with a professional firm or company during the summer break between semesters would be a keystone of their collegiate tenure and would help set them apart from their peers when the time came for acquiring full-time employment following their graduation from the university. In order to help secure these post-graduate opportunities, those at the center of the study mentioned efforts throughout their first year on campus towards the construction of professional connections and networks. In terms of shaping their ideas and vision of professional development during and after their collegiate tenure, a number of the research participants mentioned that the opportunity to interact with recruiters and company representatives at career fairs and other related events were quite impactful. During their first semester, several of the individuals noted that the introductory class for each engineering major, including the DEN 160

course, would encourage or sometimes even require its enrollees to attend the institution-wide career fair, which oftentimes would take place just a few weeks into that first semester. The purpose of these assignments was to immerse individual students in the field of professional development early and often, which could be overwhelming at first but was generally seen as beneficial in the long-term.

The sixth and final primary element that positively influenced the first-to-second year institutional and major persistence efforts of first-generation students that participated in a first-year program focused on the utilization of a variety of institutional support and programming. From the very beginning, the opportunity to connect with advisors and mentors within a specific engineering major, program or department provided significant guidance and support for the research participants. Additionally, a handful of those involved within the research design noted that they had received support and encouragement from the advisors that oversaw certain clubs, organizations, professional societies, and competitive design teams that were located both in and outside of the engineering college. Furthermore, a few of the research participants mentioned the presence of upperclassmen students that served as mentors throughout their first year and the impact of the knowledge, advice, and reassurance that was shared through those relationships.

Given the inherent difficulty of the classes and coursework associated with the pursuit of an engineering degree at the university level, the research participants were unanimous in their recognition and appreciation of the opportunity to develop connections with the faculty members and professors at the front of those classrooms. Through office hours and open door policies, the accessibility of professors and faculty members made a significant difference in the first year experience of those involved within the study. The faculty were seen as instrumental in their success, given the support they provided and how their professors were focused on the seeing the

students as individuals instead of just ID numbers or lines in a gradebook. Overall, the professors and faculty in engineering and general education courses were instrumental, along with friends and peers, in establishing and fostering a supportive and welcoming environment.

In relation to the challenging nature of engineering coursework, tutoring also played a crucial role in the success of those involved within the research throughout their first year at the university. Signing up for or attending tutoring sessions were a new phenomenon for the individuals involved with the study, as they rarely, if ever, had to seek out those resources at the high school level. The research participants utilized formal tutoring programs offered by the university throughout their first year, especially in foundational courses like calculus and physics. Within the engineering program specifically, a program called Scholars Assisting Scholars tutoring was especially helpful, where upper-class engineering majors provide complementary group tutoring and review sessions for core classes in mathematics, physics, chemistry that are primarily taken within the first four semesters of an engineering curriculum. Institutional resources like the Career Closet, which supplies complementary business professional attire for career fairs and interviews, and the Writing Center, which offered free assistance on any written assignment, were mentioned by the research participants.

One of the closing components related to the utilization of institutional support and programming, as well as the primary elements that positively influenced first-to-second year persistence, centers on the research participants' association with a wide array of extracurricular activities, campus involvement, and living communities. From their responses during the one-on-one interviews, those involved within the research study suggested that the aforementioned factors provided them with the ability to connect with crucial support and programming, as well the opportunity to ensure a smooth and seamless transition from high school to the collegiate

environment. Furthermore, on- and off-campus involvement empowered the research participants to establish a balance between their academic and social responsibilities, and to further hone their skill set in regards to career development. Finally, those at the core of the study indicated, through their responses, that involvement in organizations, activities, and community living enabled them to expand their overarching knowledge on the importance of accountability as a first-generation and first-year engineering major at the university.

## Discussion of Primary Findings

Through the utilization and employment of a grounded theory methodology, this particular research design established a new theoretical model concerning the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program. The First-Generation Engineering Student First-Year Persistence Model supports, reinforces, and provides additional contributions to the existing body of literature concerning college student persistence, engineering student persistence, and the experiences and persistence efforts of those individuals that are first-generation and majoring in engineering at the collegiate level. In order to effectively and efficiently address the contributions that the findings of this study have made to the existing body of literature, the following section is organized by the six primary elements that positively influenced first-generation engineering student first-year persistence that were identified as a result of the comprehensive data collection and analysis procedures. However, it is necessary to first identify the ways that the study and its findings contribute to some of the earliest published work concerning the persistence of undergraduate students.

The early and later work of Tinto (1975, 1993) regarding the subject of college student attrition centered on the development of a theoretical model that, at its core, examined the role of

academic and social systems at the institution in which the students were enrolled, and whether or not said students had the opportunity to immerse themselves in those systems. Additional factors that had the potential to impact student attrition included the prospective employment opportunities available, the responsibilities associated with one's family, and any financial considerations that may have made it difficult to remain enrolled at the institution. Furthermore, Tinto's theoretical model suggested that an individual's academic abilities, prior educational experiences, and commitment to certain educational attainments were qualities or attributes that could influence college student attrition. The Student Attrition Model and its associated work, conducted by Bean (1980, 1982), found that institutional commitment on the part of the student, as well as the student's satisfaction with the institution itself, were significant factors related to persistence and retention. Additionally, Bean found that the backgrounds, opportunities for interaction with those at the institution, outcomes, attitudes, and intentions of the individual students all have the potential to impact their collegiate persistence efforts. By blending the theoretical models established by both Tinto (1975, 1993) and Bean (1980, 1982), the Integrated Model of Student Retention developed by Cabrera et al (1993) reasoned that the persistence efforts of individual students were impacted by the overarching campus atmosphere and environment. Additionally, the Integrated Model of Student Retention acknowledged the academic support provided by collegiate administration and professional staff members, which could have the potential to reinforce the level of institutional commitment that the students experience throughout their undergraduate tenure. Overall, the findings of this study reinforce Tinto's (1975, 1993), Bean's (1980, 1982), and Cabrera et al.'s (1993) theoretical models, and contribute new insight into a very specific subset of undergraduate enrollees: first-generation engineering students that participated in a first-year program at a four-year university.

When examining the support and preparation that the first-generation engineering students involved within this study experienced prior to their matriculation to the university, several notable components reinforced the existing body of literature on persistence efforts at the university level. In terms of involvement with programs and resources at the high school level, the study's findings support the idea that study habits developed prior to the students' arrival on campus, higher levels of exposure to dual-credit and Advanced Placement courses, and strength regarding academic preparation in courses like mathematics were significant predictors of persistence in engineering and other STEM majors (Veenstra et al, 2009; Habley et al, 2012; Hall et al, 2015). Furthermore, the results of the study support the concept argued by Honken and Ralston (2013) that students with interest areas in engineering should be encouraged to take upper-level mathematics and science courses in high school in terms of their future impact on the persistence efforts of engineering students. New contributions that the study makes to this specific area of literature include the concept of influential interactions and connections with teachers and counselors at the high school level, as well as the importance of the research that the individual students conducted on their own prior to the beginning of their collegiate tenure.

On the subject of interactions at home, the study recognized the work of Fernandez et al (2008), which found that family members who do not fully understand the demands of a college degree in engineering could potentially serve as a personal barrier to the persistence efforts of first-generation students. However, the findings of this study suggest that while the parents and family members of the first-generation students were not as informed about engineering as others may have been, the amount of support they provided as opposed to pressuring their students led to a formidable balance that positively impacted the students' decision-making processes.

Furthermore, parents trusted the would-be first-generation students to succeed in engineering based upon the students' previous academic accomplishments at the high school level.

The findings of this particular research design, on the topic of exposure to engineering and the undergraduate institution, acknowledged that a lack of understanding regarding the admission processes and criteria for university enrollment, as well as an absence of mentors and role models in the field, can be considerable barriers to the persistence efforts of first-generation engineering students (Fernandez et al, 2008). Furthermore, the findings support the idea that introductory coursework and professional mentors should be available to first-generation engineering students, as these components could positively impact first-year persistence (Navarro et al, 2014). New contributions that the study makes in this particular area focuses on the positive influence, when available, of participation in immersive engineering- and science-specific academies and programs at the high school level on the first-year persistence efforts of first-generation engineering majors.

In addition to the exposure to engineering and the undergraduate institution, the development of motivating factors and expectations on the part of the would-be first-generation engineering students was an important component of their preparation prior to university enrollment. The findings and results of this study reinforced the concept that certain experiences and characteristics established prior to college were influential regarding first-year persistence of undergraduate students (Reason, 2009). Additionally, the study supports the idea that self-efficacy was a significant predictor of academic satisfaction, which has the potential to lead to higher rates of persistence (Navarro et al, 2014). Furthermore, in terms of motivational factors, the study strengthened the argument that feelings of a genuine and positive contribution to society through scholarly pursuits could lend itself to increased persistence among undergraduate

students (Litzler & Young, 2012). In addition to the influence of the opportunity to make a positive impact on society, the study makes new contributions in the form of additional motivational elements that affected the persistence efforts of first-generation engineering students, including the presence of parents and family, as well as a desire to see what they were about to start through to the end goal of graduation.

Regarding the impact of academic measurements prior to arriving at the university, the existing body of literature on the subject of college student retention found that those individuals that had higher standardized test scores had higher first-year college grade point averages, that those who did not persist in engineering had lower standardized test scores and high school grade point averages than those that did persist in engineering, and that higher high school grade point averages and standardized test scores led to higher levels of first-year engineering persistence (Veenstra et al, 2009; Honken & Ralston, 2013; Hall et al, 2015). However, the findings of this study, on the subject of college grade point averages, noted a unique phenomenon: the first-year engineering students had experienced a shift in how they perceived the importance of their college grade point average. As a result, an intriguing contribution to the existing literature on the subject focuses on how interactions with company recruiters and representatives and a changing narrative regarding the correlation between academic performance and self-worth, on the part of the first-generation engineering students, altered the importance of the grades and academic outcomes of their classes throughout their first year as an engineering major.

When assessing the management of the transition from high school to college, the results of this study support the concept that both academic and social integration were essential to the persistence and academic success of undergraduate students (Xu, 2018). One of the primary contributions that the study makes to the existing body of literature on this particular subject

focuses on the significance of reaching out and connecting with others through the purposeful exodus out of one's comfort zone. Furthermore, the research study added that an understanding of the importance of accountability, independence, and responsibility, on the part of the first-generation engineering students, were key factors in how they managed the transition process.

Considering the inherent difficulty of classes and courses associated with an engineering major at the university level, the successful adaption of various study skills and techniques played an important role in the persistence efforts of the first-generation engineering students at the epicenter of this study. Regarding the existing body of literature, the study coincides with the idea that higher rates of persistence were found among those that were introduced to new learning styles and techniques, and that a first-year engineering orientation course can provide a comprehensive overview of the efforts necessary to succeed and persist in engineering academically (Ricks et al, 2014; Borgaonkar et al, 2015). New contributions that the study makes to the subject of study skills and techniques centers on how the individual students incorporated the resources around them to develop new strategies to acclimate to the change in the amount of content being covered in class and the volume of homework and assignments being received, as well as the methods in which the classes were being taught at the collegiate level.

As they made the transition from high school to college, the first-generation engineering students at the center of this study were able to successfully identify and respond to the array of challenges and concerns associated with the undergraduate experience. The findings of the study, on the subject of challenges and concerns that college students endure, support the idea that the inherent difficulty of engineering-related coursework and lower levels of academic preparedness in subjects like mathematics and science can both serve as significant barriers to the first-year persistence efforts of first-generation and engineering students (Fernandez et al, 2008; Ricks et

al, 2014). In terms of additional contributions to the existing body of literature, this particular study highlights the concept that the persistence efforts of first-generation engineering majors can be fortified by an overarching comprehension of and preparedness for the difference in difficulty between the courses and content they would face as engineering undergraduate students compared to what they had previously experienced at the high school level.

Previous work on the role of friends and peers at the university level, which is strengthened by the results of this study, includes the notion that the development of community among classmates and a feeling of belonging and community among their fellow students led to higher rates of persistence for both general and engineering-related undergraduate majors at the collegiate level (Atman et al, 2010; Litzler & Young, 2012). In addition to supporting the aforementioned concepts, the findings that the study produced include the idea that the first-generation engineering students were careful and selective of those individuals with whom they spent their time both in and outside of the classroom environment. Furthermore, the results contribute the belief, on the part of the student, that an overarching mentality on campus of fellow classmates genuinely wanting to see one another succeed as engineering majors was impactful in terms of the persistence efforts of first-generation students enrolled in the major.

In order to successfully manage the substantial workload commonly associated with the pursuit of an engineering major at the undergraduate level, the individuals at the core of this research design indicated that study groups and the ability to give or receive help from others were crucial in their efforts. As a result, the findings of this study confirm existing literature, which stated that a willingness to work in a group setting was found to be a significant predictor of first-year engineering persistence, and that the presence of support systems at the undergraduate level could reinforce expectations, which could then lead to increased rates of

persistence (Honken & Ralston, 2013; Navarro et al, 2014). Additionally, the study's findings are consistent with the work of Ricks et al (2014), which found that higher persistence rates were reported among those that were required to attend regular group meetings and study sessions throughout their first year on campus. Given the wide array of available engineering majors and programs, the study contributed the idea that the similar structure of core courses made it significantly easier and more manageable to form study groups and communities, which positively influenced the first-year persistence efforts of the first-generation engineering majors.

Although the terms were utilized interchangeably to refer to the same component, both the atmosphere and the environment on campus were described in length throughout the study in a generally positive manner. As a result, the study recognized the work of Ricks et al (2014), which suggested that the absence of a supportive environment and atmosphere on campus could be a significant barrier to engineering student persistence. Additionally, the study's findings reinforce the importance of peer environments, the existence of a campus culture and conditions that encourage the success of its students, and the presence of a comprehensive institutional environment as strong indicators of college student persistence and academic success (Reason, 2009; Habley et al, 2012; Xu, 2018). Regarding additional contributions, the results of this study suggested that a campus environment and atmosphere that was both inviting and welcoming to first-generation engineering majors was appreciated and seen as instrumental in their first-year persistence efforts at the institution.

As a result of the wide array of programs and resources available at the university, the first-generation students at the center of the research design indicated that the opportunities presented to them to formulate a meaningful social life were contributory in their first-to-second year persistence efforts. The findings regarding this particular subject provided support to the

work of Habley et al (2012), which conceptualized that institutions of higher education should establish programs that enable students to engage with one another to encourage greater academic and social integration among its enrollees. In addition to supporting the aforementioned concept, the findings of the study provide a new contribution in the form of the notion that on- and off-campus living communities were instrumental in providing a foundation for the formulation of a meaningful social life during the first-generation engineering students' first year at the university.

Given the increased volume of work associated with the pursuit of an engineering degree combined with the necessary responsibilities of being enrolled as an undergraduate student, the opportunities to develop time management skills and techniques were pertinent to the first-year efforts of the individuals at the center of this study. As a result, the findings of the study are consistent with the work of Fernandez et al (2008), which stated that an inability to balance work, school, and family could potentially serve as a barrier to first-generation engineering student persistence. Furthermore, the results support that the presence of conscientiousness, which implies purposeful actions and efforts that stem from a sense of organization, planning, responsibility, and determination, was found to have significantly predicted first-year engineering persistence (Hall et al, 2015). In regards to new contributions to the existing body of literature, the findings associated with this study add the concept of how the first-generation engineering students managed their time and responsibilities throughout their first year at the university, as well as a recognition of and respect for the freedom and independence they were in possession of as college students.

In addition to the successful management of time through specific skills and techniques, the composition of realistic and achievable goals on the part of the individuals involved within

the study were impactful in relation to their overarching academic and social responsibilities. As a result, the findings of the study support the concept that the educational expectations of individual students can affect undergraduate student persistence and academic success (Braxton et al, 2013). Furthermore, the results confirm the idea that academic discipline and a commitment to college could be a strong predictor of first-year undergraduate retention (Habley et al, 2013). New contributions that the study made to the existing body of literature within this specific area focus on the possession, on the part of the first-generation engineering students, of realistic and achievable goals that centered on one of three distinct categories: successful academic outcomes, the development of community groups, and the process of becoming a more well-rounded individual throughout their first year at the university.

Before and throughout their first year an engineering majors at the university, the first-generation students at the epicenter of the study demonstrated a thorough understanding and comprehension of what their educational investment would entail by continuing on to college after graduating from high school. On the subject of knowledge related to the overarching cost of a college education, the findings that emerged from the study recognize that first-generation students in engineering are more likely to have financial barriers or difficulties, and that the monetary challenges of remaining enrolled in college can be a significant barrier to engineering persistence (Fernandez et al, 2008; Ricks et al, 2014). However, from the perspective of the individuals involved within this study, new contributions include the concept of first-generation engineering students' understanding of the balance between tuition, fees, and expenses compared to income, scholarships, grants, and student loans. Although monetary challenges existed for these individuals, their understanding of the ways in which to combat the overarching costs helped contribute to their first-to-second year persistence efforts.

As the individuals at the epicenter of this study were exploring their options following graduation from high school, their awareness of future opportunities with an engineering degree contributed towards their individual persistence efforts. In relation to existing literature on the subject, the results of this study confirm that higher levels of commitment to the engineering degree could be found among those individuals that persisted in the major as compared to those that did not persist (Eris et al, 2010). In terms of new contributions to the existing literature, this particular study found that the determination to start and complete an engineering degree was not motivated by an ambition to make as much money as possible in the professional field, but to have the opportunity to live comfortably and provide for any current and future family members.

Within the overarching subject of their understanding of the educational investment of a college degree in engineering, the accessibility of opportunities for career and professional development had a profound impact on the first-to-second year persistence efforts of the first-generation engineering students at the core of this research study. As far as existing literature on the subject, this particular study supports the work of Borgaonkar et al (2015), which included the inherent benefits of a first-year orientation course that featured presentations from faculty on career and research opportunities available with an engineering degree, not unlike the DEN 160 course that served as the first-year program at the center of this study. In terms of contributions the study provides to existing literature, the determination to secure an internship at some point in their collegiate career greatly motivated the first-generation engineering students to engage in a wide variety of academic and social opportunities available at the institution, which had a positive impact on their first-to-second year persistence efforts.

The sixth and final primary element that positively influenced first-to-second year persistence that emerged from the collection and analysis of data within this particular research

design focused on the utilization of institutional support and programming on the part of the first-generation engineering students that participated in the study. On the subject of involvement and interaction with academic advisors throughout their first year on campus, the study's findings support the work of Habley et al (2012), which concluded that fostering relationships between academic and student affairs personnel and the students could positively impact the students' first-year persistence efforts. In regards to additional contributions that the study makes to existing literature, the presence of upperclassmen mentors in and outside of the classroom was a crucial factor the research participants mentioned as a part of their first-year experience.

Given the inherent difficulty of pursuing an engineering degree at the undergraduate level, the opportunities for connecting with faculty members and professors that oversee the associated coursework can positively contribute towards first-year persistence efforts. Through its findings, the study supports the concept that the opportunity for collaboration and engaging discussion with faculty members and professors could potentially be associated with higher levels of persistence for engineering undergraduate students (Litzler & Young, 2012; Honken & Ralston, 2013). Furthermore, the study recognizes the idea that support and encouragement from faculty and staff at the collegiate level could improve students' outcome expectations, which could lead to positively predicting persistence in an engineering major (Navarro et al, 2014). As far as additional contributions to existing literature, this particular study emphasized the importance of the accessibility and availability of professors and faculty members in and outside of the classroom to the first-year persistence efforts of first-generation engineering students.

In addition to advisors, mentors, professors, and faculty members, formal tutoring programs and other academic resources made available to the first-generation engineering students were influential towards their first-year persistence efforts. Through the results that

emerged from the inherent design of the study, the findings support the notion that the availability of on-campus resources and academic programming could positively contribute towards first-to-second year persistence of undergraduate students (Reason, 2009). Furthermore, the findings concur with the work of Honken & Ralston (2013), which argued that the opportunity to engage in peer tutoring could strengthen self-efficacy in mathematics and science, which could then potentially predict higher rates of persistence in an engineering curriculum. In regards to additional contributions, the study found that the influence of professional resources, like those that enable individuals to prepare for career fairs and on-campus interviews, were instrumental in the first-year persistence efforts of first-generation engineering students.

The last component to address in regards to the contributions of this study to the existing body of literature focuses on the opportunities for extracurricular activities, campus involvement, and living communities available to the first-generation engineering students during their first two semesters on campus, and how these components impacted the students' first-to-second year persistence efforts. As a result of the research design, the study produced findings that are consistent with the concept that a positive relationship exists between the level in which an individual student believes that the institution is invested and committed to student welfare and the likelihood of that student's social integration, which could positively impact their persistence efforts (Braxton et al, 2013). Furthermore, the findings support the work of Ricks et al (2014), which maintained that the development of learning communities on campus are pertinent to the persistence of engineering majors at the undergraduate level. Regarding this particular subject, the study provided new contributions through the recognition of how extracurricular activities, campus involvement, and living communities gave the first-generation engineering students

opportunities to connect with essential support and programming throughout their first year on campus, which impacted and influenced their first-year persistence efforts at the university.

## Implications

The findings and conclusions drawn from the overarching structure of this research design provide a unique set of implications, recommendations, and suggestions to a variety of constituents that individually and collectively affect the experiences and persistence efforts of first-year, first-generation engineering students that participate in a first-year program. Primary individuals and groups that interact with and influence the experiences of first-generation engineering students include their parents and family members, friends, peers and classmates, professors and faculty, collegiate administrators and staff, and teachers and counselors at the high school level. While drawn from a very specific subset of individuals, the findings of the study can be carefully applied to these unique populations in future endeavors to positively influence the persistence efforts and success of first-generation engineering students.

Among these various constituents, it could be argued that parents and family members play the most significant and influential role in the academic trajectories of first-generation college students pursuing degrees in engineering. When it comes to interaction between would-be first-generation engineering students and their parents or guardians, it is essential to note that the parents or guardians can still provide immeasurable support as an influential force to the students despite the absence of a four-year college degree. In addition to promoting enrollment in challenging courses at the high school level, parents and guardians should be encouraged to provide assistance to their soon-to-be first-generation engineering students through the scheduling of on-campus visits to a variety of institutions that interest the student.

Alternatively, parents and guardians should collaborate with their first-generation students to work towards an understanding of the financial elements of pursuing a college degree at a four-year university and to utilize the resources available at the high school level. Although fully comprehending all of the intricate details concerning available financial aid packages, scholarships, grants, student loans, and the Free Application for Federal Student Aid (FAFSA) may prove difficult, the results of this study suggest that a sense of independence regarding the financial responsibilities and obligations of pursuing a college degree was an important component related to the persistence efforts of the first-generation engineering students at the center of this research design. Overall, the message that would be imperative to convey to parents and guardians in regards to their interactions with their would-be first-generation engineering students focuses on the importance of establishing balance between gentle pressure to attend college after graduating from high school and support that encourages and motivates the students to select the pathway that feels right to the individual student. If that pathway is majoring in engineering at a four-year university, then the interest in attending college can come about organically and be reinforced by the support, trust, and approval of parents and guardians, which can be quite influential regarding the students' persistence efforts once college begins.

The peers and classmates that are enrolled alongside first-generation engineering students at four-year universities across the country serve a crucial role in the persistence efforts and success of their colleagues. The implications of the findings on friends, peers, and classmates center on comprehending the impact they have on the formation of support groups and systems with other students in the engineering major and individuals across the entire institution. Although many of the individuals that participated in the research study mentioned having to move outside of their comfort zone in order to connect with others, the findings suggest that

engineering students should be cognizant of their first-generation peers and be encouraged to initiate contact with their classmates for the purpose of forming study groups and meaningful interactions. The first step towards this overarching cognition would be an understanding that, from the viewpoint of fellow friends and peers, not all of their classmates may have had the same background or experiences prior to the beginning of college regarding exposure to engineering, upper-level coursework, and the expectations of succeeding within the collegiate environment.

Additionally, it would be greatly beneficial for the peers and classmates of first-generation engineering students to utilize and incorporate both formal and informal tutoring programs into their academic schedule. For a number of incoming engineering undergraduate students, tutoring programs were either unnecessary or unavailable at the high school level, and as a result may be underutilized at the collegiate level. By incorporating these programs as a part of their regular schedule, friends, peers, and classmates can normalize the employment of academic services and programming that, as the findings of this study indicate, are essential to the academic transition of first-generation engineering students during their first year on campus. Furthermore, a willingness on the part of friends and peers to serve as a mentor to others in a variety of roles and responsibilities within living communities, organizations, and other campus entities can build comradery, establish support groups and systems, foster involvement in extracurricular activities that contribute significant value to the undergraduate experience, and have a considerably positive impact on their first-generation engineering student colleagues.

Given their role on campus as the educators of future professionals, the implications and recommendations for professors and faculty members at the front of the classroom, in regards to their influence on first-generation engineering student persistence efforts, center on their accessibility and availability to the students in their classrooms. Scheduled and flexible office

hours, in addition to open door policies, have the opportunity to be instrumental to the success of engineering undergraduates. With these hours and policies, the students then have the ability to address the professor or faculty member for questions regarding specific assignments, course objectives, and professional aspirations with an individual that has been successful in the field of engineering. Connections built between what is being taught and its application to the professional field could help reinforce the career-related aspirations of all engineering students, especially those that are defined by the institution as first-generation.

Furthermore, professors and faculty members should be encouraged to be cognizant of the wide array of personal and educational backgrounds of their students, as well as how teaching methods and tactics can be adapted to accommodate a variety of learning styles and techniques. Lastly, given the inherent influence they have on the academic and social transition of first-generation engineering students to the university environment, professors and faculty members can further affect persistence efforts by encouraging their students to attend on-campus events, get involved with institutional programming, and incorporate other elements focused on student development into their collegiate experience. Professors and faculty members that are concerned for the welfare of their students outside of the classroom space, as the findings of this study suggest, can be a positive presence in the lives of first-generation engineering students.

In addition to the faculty members and professors that teach the engineering and general education courses, the professional staff and administration at the university collectively serve roles and fulfill responsibilities that enhance and promote the persistence efforts of first-generation engineering students. As a result of the findings within this particular research study, it is imperative that four-year universities with engineering programs provide comprehensive academic, professional, and personal advising, which could empower first-generation student

populations to remain focused on their educational goals and aspirations. Further implications introduced and reinforced by the findings of the research study indicate that administrators and professional staff should be encouraged to establish, develop, and foster first-generation student-specific resources and programming at the institutional level. First-generation specific programs can involve opportunities before and throughout the student's collegiate tenure, including summer bridge programs that can close the gap between high school and college expectations, as well as specific classes and seminars that introduce individuals to organized tutoring, review sessions, and other academic- and social-related experiences. Additionally, institutional initiatives that provide financial support in the form of scholarships, grants, and loan forgiveness programs for first-generation engineering students could further enhance their persistence efforts, considering how cognizant the individuals at the epicenter of the study were regarding the overarching cost of continuing their education into a four-year university experience.

The final group of constituents for whom the design of this research study impacts in terms of future implications and recommendations involves the teachers and counselors that first-generation students interact with at the high school level. As some of the very first individuals that introduce their students to the concept of engineering at the postsecondary educational level, high school teachers and counselors should be provided substantial resources that would enhance their capacity to recognize and connect with students that demonstrate mathematical- and science-related strengths and abilities. Knowing their role as mentors and advisors during a crucial developmental period in the lives of would-be first-generation engineering undergraduates, high school teachers and counselors could further impact this unique population through additional opportunities to provide support for university- and engineering-related goals during conversations with the parents, guardians, and family members of their students.

Considering the impact that they had on the first-generation engineering students involved within the study that mentioned them, engineering- and science-specific academies and programs, if there are available resources, should be a priority for high schools to develop in order to immerse prospective first-generation students in engineering-related concepts.

Through greater exposure and emersion, these individual students can be given the opportunity to establish and solidify an interest in engineering that will produce realistic expectations for the difficulty of college coursework and the inherent rewards of achieving a college degree in engineering. In lieu of engineering- or science-specific academies and programs, which require significant investment, infrastructure, and resources for their respective institutions and may not be possible at all high schools, teacher and counselors should be given the necessary resources to make upper-level mathematics and science courses more available to their students, as well as any dual-credit opportunities that may exist through community college partnerships and nationally-accredited programming, such as Advanced Placement and International Baccalaureate. As the findings of the research study demonstrate, these upper-level courses helped introduce the first-generation students to the demands of collegiate classes, the expectation of the work ethic necessary to complete university-level coursework, and enhanced concepts that better prepared them for managing the transition from high school to the institution to pursue a degree in engineering.

## Recommendations for Future Research

As a result of the inherent design of the study, I documented a number of concepts related to future research that could be conducted in the field of undergraduate student persistence efforts. Although this particular study produced findings that supported existing research and made new contributions to the current body of literature, future research is necessary given the

projected increase in first-generation student enrollment and the impact of engineering graduates on local, national, and global processes, systems, and infrastructure. Recommendations for future research in this particular field include an expansion of the study to several different institutions, the exploration of financial aid packages and scholarship opportunities, the presence of mentor interaction before and throughout the first year of college, and the specific relationships that first-generation students develop with the professors and faculty members that teach and oversee the coursework associated with the pursuit of an engineering degree at the undergraduate level.

Considering that this specific study was focused on the factors that positively influenced the first-to-second year institutional and major persistence of first-generation engineering students at Kansas State University, the first recommendation for future research centers on expanding the number of undergraduate institutions involved within a particular research design. By incorporating multiple undergraduate institutions, the results and findings of the study could greatly diversify and be applicable to a wide array of educational backgrounds. Involving students at institutions that are public and private, large and small, and resident and commuter campuses could provide further insight into the student experience in a number of different educational environments. Furthermore, expanding the number of institutions involved within the study could lead to the incorporation of a variety of first-year programs that are designed to support academic success for those individuals making the transition from high school to college. Through examination of multiple first-year programs, elements can be drawn from each to create a comprehensive curriculum founded on empirical research.

Given the current financial climate of higher education and how significant the presence of monetary support is to the success of undergraduate students, the second recommendation for future research is concerned with how the availability of financial aid packages and scholarship

opportunities impact the persistence efforts of first-generation engineering students. As noted from previous research and existing literature, the overarching cost of pursuing a college education can be a significant barrier to first-to-second year persistence (Fernandez et al, 2008; Ricks et al, 2014). When these barriers are managed, it would be beneficial to see if that leads to increased levels of institutional commitment on the part of the individual student, which has been previous associated with increased levels of persistence (Eris et al, 2010). Additionally, alternative forms of financial aid, including grants, work-study initiatives, summer bridge programs, and loan forgiveness contracts could be studied to examine how their existence impacts the persistence of first-generation engineering undergraduate students.

As a part of their preparation for and transition to the collegiate environment following their graduation from high school, the third recommendation for future research is related to the presence of mentors in the lives of the first-generation engineering students. Specifically, it would be valuable to see if the presence of mentors prior to the beginning of college would provide significant exposure to engineering concepts and various institutional environments. In addition to exposure to engineering and educational institutions, it would be noteworthy to explore the impact of support and encouragement from the mentor to the individual student, as well as the student's parents and family regarding opportunities to attend college as an engineering major. Lastly, knowing the importance of understanding what a degree and career in engineering entails, there are inherent benefits to studying the influence of mentors before and during the collegiate experience for first-generation engineering student persistence, given how mentors could assist the student in the construction of a meaningful professional network.

The last recommendation for future research focuses on the relationships that first-generation engineering students establish with faculty members and professors once the students

arrive on campus for the beginning of their collegiate tenure. The structure of the classroom, the content being covered in those classes, and the various teaching styles and methods employed by the faculty members and professors and how they influence the first-year experiences of first-generation engineering students could enable a greater understanding of the academic factors that require further examination. Additionally, as the findings of this study suggest, the accessibility and availability of faculty members and professors before, during, and after class could be advantageous in terms of discoveries that relate to profound academic connections between the students and the individuals that teach and oversee the courses associated with an engineering major. Finally, knowing the various backgrounds of faculty members and professors in engineering, it could be beneficial to see how professional guidance provided to first-generation engineering students outside of the academic domain could impact and influence persistence efforts, considering how important professional and career aspirations were to the research participants at the epicenter of this specific study.

## Summary

The primary function of this chapter was to present a brief synopsis of the study, which focused on the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering students that participated in a first-year program. A summary of the primary findings of the research, which was gathered from the collection and analysis of data, was also provided. Additionally, the implications of the study on certain populations and a comprehensive discussion of the primary findings were addressed. Finally, I developed recommendations in regards to future research in the fields of first-generation college students, college student persistence, and first-year program participation.

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# Appendix A - Informed Consent Form for Research Participants

Informed Consent Form

**PROJECT TITLE**

Institutional and Major Persistence among First-Generation Engineering Students in a First-Year Program: A Grounded Theory Study

**PROJECT APPROVAL DATE/EXPIRATION DATE**

To Be Determined/May 2020

**LENGTH OF STUDY**

The study will last approximately 12 to 18 months.

**PRINCIPAL INVESTIGATOR**

Dr. Christy Craft, Associate Professor, College of Education, Kansas State University

**CONTACT DETAILS FOR PROBLEMS/QUESTIONS**

Dr. Christy Craft
785.532.5940
ccraft@K-State.edu

**IRB CHAIR CONTACT INFORMATION**

Should you have questions or wish to discuss on any aspect of the research with an official of the university or the IRB, the contacts include the following:

Rick Scheidt
Chair
Committee on Research Involving Human Subjects
203 Fairchild Hall
Kansas State University
Manhattan, KS 66506
(785) 532-3224

Cheryl Doerr
Associate Vice President for Research Compliance
203 Fairchild Hall
Kansas State University
Manhattan, KS 66506
(785) 532-3224

**PURPOSE OF THE RESEARCH**

The purpose of the research is to develop a thorough understanding of the factors that positively influenced the first-to-second year institutional and major persistence efforts of first-generation engineering undergraduate students that participated in a first-year program at Kansas State University, a large, public, land-grant, four-year university in the Midwestern United States, through a data collection process involving interviews with the research participants.

**PROCEDURES/METHODS TO BE USED**

Throughout the course of this study, you will be reminded that you can remove yourself from the study at any point you wish, and can do so without explanation. As a research subject, you will be expected to participate in two one-on-one interviews; both will last approximately 60 minutes. Questions will explore concepts ranging from your preparation prior to entering college and the experiences that occurred throughout the course of your first year on campus. The one-on-one interviews will be digitally recorded with the utilization of the Voice Memos application on David's cellular phone and Speech Recognition feature in Microsoft Word to ensure an efficient transcription process. Your answers could potentially lead to a greater understanding of prospective college students that come from similar backgrounds and experiences. When the data collection process has been completed, a constant comparative analysis technique will be employed in order to review the transcripts with the intention of developing comprehensive themes to analyze and understand the data that has been collected, which can allow for inferences to be drawn from the study.

**BIOLOGICAL SAMPLES COLLECTED**

Whole genome sequencing will not be included as part of the research.

**ALTERNATIVE PROCEDURES OR TREATMENTS, IF ANY, THAT MIGHT BE ADVANTAGEOUS TO SUBJECT**

Not applicable.

**RISKS OR DISCOMFORTS ANTICIPATED**

It is believed that there are no foreseeable or known risks associated with participating in this study, given the nature of the methodology, the structure of the interviews, and the content of the questions being directed towards the participants.

**BENEFITS ANTICIPATED**

Incentives will be offered to those who participate in the study; those who meet the selection criteria and complete both interviews will receive a $25 gift card to the online vendor Amazon,

and each participant will then be entered into a randomized drawing for a $75 gift card to the online vendor Amazon.

**EXTENT OF CONFIDENTIALITY**

In order to protect your confidentiality, all notes, documents, NVivo and other associated digital files, transcribed interviews, and information related to the study will be kept in an encrypted folder on a secure laptop computer. Additionally, your name will be changed to a pseudonym to help further ensure anonymity. The one-on-one interviews will take place in settings that allow for privacy regarding conversations about experiences that could potentially enable identification of a specific individual participating in the study. Finally, David will keep any data or files related to the study within an encrypted folder on a laptop computer for five years. At the conclusion of the five year period, David will delete any and all data associated with the study.

Identifiers will be removed from the identifiable private information and that, after such removal, the information could be used for future research studies or distributed to another investigator for future research studies without additional informed consent from the subject or the legally authorized representative.

Terms of Participation: I understand this project is research, and that my participation is voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

Participant Name: _____

Participant Signature: _____ Date: _____

Witness to Signature: _____ Date: _____

# Appendix B - Initial Interview Questions

1) How and when did you make the decision that you were going to attend college?
    a. Enroll in this institution?
    b. Major in engineering?

2) With whom did you discuss the decision-making process?
    a. What did they think of your choices?
    b. Tell me of a specific interaction with one of these individuals.

3) How did you spend your time as an engineering student?
    a. Where, when, and how often did you study for your classes?
    b. What kinds of organizations/clubs/employment did you engage with?

4) What were some of your most significant concerns entering college as an engineering major?
    a. How were those concerns reinforced or lessened throughout your first year?
    b. What new concerns did you experience after the start of your first year?

5) What were some of your goals that you had at the beginning of your first year?
    a. Who or what have helped support or reinforce those goals?
    b. How have those changed or been reinforced by your experiences first year?

# Appendix C - Second Interview Questions

1) Since starting college, how would you describe your transition to the academic expectations of being an engineering major?
    a. What has been most difficult about that transition?
    b. What has been more manageable?

2) Since starting college, how would you describe your transition to the social expectations of being an engineering major?
    a. What has been most difficult about that transition?
    b. What has been more manageable?

3) What was the most significant challenge you faced during your first year as an engineering student?
    a. What steps did you take to combat this challenge?
    b. What was the result of your actions?

4) What have been some of your most significant motivators to succeed in college?

5) Before you started college, how would you have described your levels of confidence in being able to graduate with an engineering degree?

6) How would you define academic success?
    a. What factors helped shape this definition?

7) How would you describe the environment on campus?
    a. With friends and peers?
    b. Classmates?
    c. Members of the surrounding community?

8) How often did you interact with those employed by the university?
    a. Were they advisors, professors, researchers, administrators?
    b. In what capacity did you work or meet with them?
    c. How did those interactions affect your collegiate experience?

9) As a first-generation college student, what factors do you believe were most influential in your first year persistence?

10) What else would you like to share with me about your time as an engineering student thus far?

# Appendix D - Initial E-Mail to Prospective Research Participants

Dear [Research Candidate First Name],

My name is Dave Hoffman, and I am a Ph.D. candidate in the College of Education here at Kansas State University. As a part of my research and dissertation, I am conducting a study that focuses on the factors that positively influenced the first-to-second year institutional and major persistence efforts of undergraduate college students. In order to conduct this study, I will need to interview first-generation college students who are majoring in engineering and completed DEN 160 last academic year.

At this time, I would like to invite you to be a participant in the study, which will consist of two separate, confidential, and voluntary interviews with me regarding your experiences leading up to and during your first year as an engineering major at the university. Topics and subjects the will be covered during both interviews will include college preparation, interaction with faculty and peers, campus environment, and academic and social integration, among others.

In order to participate in the study, you will be asked to schedule and attend two separate interviews with me; both interviews will last approximately 60 minutes. Both interviews will be confidential, and the time and place of the interviews will be scheduled in a manner that is convenient for and cognizant of your schedule. Given the questions and the format of the interviews, I believe that there are no foreseeable or known risks associated with participating in the study. Throughout the course of this study, you will be reminded that you can remove yourself from the study at any point you wish, and can do so without explanation. If you choose to fully participate in the study, you will be provided with a $25 credit to the online vendor Amazon, and will be entered into a drawing to receive an additional $75 credit to the online vendor Amazon.

If you have an interest in participating in the study, please reply back to me via e-mail (DFHoffman@K-State.edu) and we can schedule the first interview, where you will be able to review and sign the informed consent form prior to the start of the interview. The Principal Investigator for the study and my major professor, Dr. Christy Craft, can be reached at 785.532.5940 or at ccraft@K-State.edu. Should you have any questions or wish to discuss any aspect of the research with an official of the university or Institutional Review Board, the IRB can be contacted at 785.532.3224 or at comply@K-State.edu.

Thank you very much for your time and consideration regarding participation in the research.

Sincerely,

Dave F. Hoffman
Ph.D. Candidate
College of Education

# Appendix E - Initial IRB Approval Letter

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Dr. Christy Craft
Special Education, Counseling, and Student Affairs
316 Bluemont Hall

Proposal Number: 9640

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 02/18/2019

RE: Proposal Entitled, "Institutional and Major Persistence among First-Generation Engineering Students in a First-Year Program: A Grounded Theory Study"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: iii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

203 Fairchild Hall, Lower Mezzanine, 1601 Vattier St., Manhattan, KS 66506-1103 | 785-532-3224 | fax: 785-532-3278
comply@k-state.edu | k-state.edu/research/comply

# Appendix F - IRB Approval Letter Following First Amendment

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Dr. Christy Craft
Special Education, Counseling, and Student Affairs
316 Bluemont Hall

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 04/10/2019

RE: Proposal #9640.1, entitled "Institutional and Major Persistence among First-Generation Engineering Students in a First-Year Program: A Grounded Theory Study."

A MINOR MODIFICATION OF PREVIOUSLY APPROVED PROPOSAL #9640, ENTITLED, "Institutional and Major Persistence among First-Generation Engineering Students in a First-Year Program: A Grounded Theory Study"

The Committee on Research Involving Human Subjects at Kansas State University has approved the proposal identified above as a minor modification of a previously approved proposal, and has determined that it is exempt from further review. This exemption applies only to the most recent proposal currently on file with the IRB. Any additional changes affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Unanticipated adverse events or problems involving risk to subjects or to others must be reported immediately to the IRB Chair, and / or the URCO.

It is important that your human subjects project is consistent with submissions to funding/contract entities. It is your responsibility to initiate notification procedures to any funding/contract entity of changes in your project that affects the use of human subjects.

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comply@k-state.edu | k-state.edu/comply

# Appendix G - IRB Approval Letter Following Second Amendment

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Dr. Christy Craft
Special Education, Counseling, and Student Affairs
316 Bluemont Hall

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 08/01/2019

RE: Proposal #9640.2, entitled "Institutional and Major Persistence among First-Generation Engineering Students in a First-Year Program: A Grounded Theory Study."

A MINOR MODIFICATION OF PREVIOUSLY APPROVED PROPOSAL #9640.1, ENTITLED, "Institutional and Major Persistence among First-Generation Engineering Students in a First-Year Program: A Grounded Theory Study"

The Committee on Research Involving Human Subjects at Kansas State University has approved the proposal identified above as a minor modification of a previously approved proposal, and has determined that it is exempt from further review. This exemption applies only to the most recent proposal currently on file with the IRB. Any additional changes affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Unanticipated adverse events or problems involving risk to subjects or to others must be reported immediately to the IRB Chair, and / or the URCO.

It is important that your human subjects project is consistent with submissions to funding/contract entities. It is your responsibility to initiate notification procedures to any funding/contract entity of changes in your project that affects the use of human subjects.

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comply@k-state.edu | k-state.edu/comply

# Appendix H - Post-Interview Member Checking Request

[Research Participant Name],

Thank you again for participating in my dissertation research project through your interview responses – after transcribing the interviews, I wanted to send the transcript your direction for review before I move forward with my project.

At your convenience, please review the attached transcript, and let me know if any changes need to be made.

Thanks again!

-Dave

Dave F. Hoffman
Doctoral Candidate
College of Education
Kansas State University
DFHoffman@K-State.edu