FRESHMAN INTEREST GROUP PARTICIPATION AND SECOND

YEAR ACADEMIC SUCCESS OF ENGINEERING STUDENTS

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The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

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and hereby certify that, in their opinion, it is worthy of acceptance.

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Abstract

Students in their second year of college experience changes in support that can negatively impact their success. This phenomenon is commonly referred to as the sophomore slump, which can manifest itself as a decline in success with regard to changes in grade point average. Typically, higher education institutions provide support for students that focus on positive learning outcomes during their first year in college. One specific type of first-year success initiatives is Freshman Interest Groups which combine the shared academic experiences of freshman learning communities with a residential component. This study investigates whether Freshman Interest Groups at the University of Missouri are related to second-year academic success for students who declared an engineering major during their first year of study. Specifically, a regression-based statistical model correlates first-year participation in a Freshman Interest Group with second-year academic success (GPA, credit hours attempted, and credit hours earned). The sample draws upon first-year engineering majors at the University of Missouri for the years 2013-2016. The results indicate that Freshman Interest Group participation had no significant relationship with second-year academic success. One explanation of these results is that engineering students who participated in a Freshman Interest Group had stronger academic backgrounds (ACT subtests and high school core GPA) than students who did not participate in a Freshman Interest Group.

Keywords: academic success, sophomore slump, engineering, freshman learning communities, freshman interest group, grade point average, regression, transition

Freshman Interest Group Participation and Second-Year Success of Engineering Students

Institutions of higher education are tasked with providing educated citizens who contribute to society. The demand for graduates in specific fields fluctuates, based on the needs of the labor market as well as the overall goals of the United States of America. Overall, employment is projected to increase by 7.4 percent by 2026 and engineering occupations are projected to increase by 8.3 percent (Bureau of Labor Statistics, 2018). Currently, workers with backgrounds in science, technology, engineering, and mathematics (STEM) are in high demand; however, companies are struggling to fill these positions (Langdon, McKittrick, Beede, Khan, & Doms, 2011). Specifically, Langdon, McKittrick, Beede, Khan and Doms (2011) conclude that "STEM workers command higher wages, earning 26 percent more than their non-STEM counterparts" (p. 1), which is a sign of high demand for STEM educated workers. New graduates in STEM fields, such as engineering, are poised to take advantage of an economy that values their degree and will be compensated accordingly.

Due to the high demand of workers with an engineering background and the fact that the number of graduates is below what is needed to fill these positions, retention of students studying engineering is important (Hein, Bunker, Onder, Rachaun Rebb, Brown, & Bohmann, 2012). The high attrition of engineering students may be due in part to the rigors of the program as a large number of students who initially choose engineering as their major leave the program to study other majors at the institution (Moller-Wong & Eide, 1997). By leaving an engineering major, students are limiting their opportunity to seek employment in the STEM fields post-graduation because approximately two-thirds of STEM workers have a degree in a STEM field (Langdon et al., 2011).

In order to fulfill their goal of providing graduates ready to contribute to society, institutions of higher education provide programming to support students beyond typical coursework. One factor that a university must consider is how they receive funding from various entities including federal and state governments. Changes in levels of funding from the federal and state governments impact how an institution provides services. According to the Pew Charitable Trusts,

> historically, states have provided a far greater amount of assistance to postsecondary institutions and students; 65 percent more than the federal government on average from 1987 to 2012. But this difference narrowed dramatically in recent years, particularly since the Great Recession, as state spending declined. ("Federal and State Funding of Higher Education", 2015)

The changes in funding may impact both academic and auxiliary units at the institution.

Due to limited resources based on available funding, institutions must target their efforts to provide the greatest impact on measures important to their institution. These measures include recruitment, retention, persistence, and degree completion. After all, when a student does not return to the institution, continued revenue from the student is lost. At the University of Missouri, a concerted effort is underway to include retention and persistence as factors indicating institutional success ("Enrollment management & strategic development", 2019). This expands on the existing factors of recruitment and degree attainment to show a more holistic view of student success.

Retention rates are also important for accreditation purposes. For example, when evaluating the teaching and learning criterion for accreditation and reaccreditation for institutions accredited by the Higher Learning Commission, one core component is that the college or university “demonstrates a commitment to educational improvement through ongoing attention to retention, persistence, and completion rates in its degree and certificate programs” (“Criteria for accreditation”, 2018). Changes to an institution’s retention rate may negatively impact their ability to remain accredited. Thus, institutions typically provide support for students transitioning from high school to college by implementing specific programming geared toward first-year students, in an effort to attract and retain these students. This type of programming may target a specific group of students, such as students who do not have parents who graduated from college (i.e. first generation). Another option is that the programming may focus on students studying a specific academic major, such as engineering.

One common type of targeted programming is known as a freshman learning community (e.g. Andrade, 2007; Barefoot, 2000; Pike, 1999). A freshman learning community is a group of first-year students who are co-enrolled in at least two courses (Tinto, 1997). As Zhao and Kuh (2004) explain “most learning communities incorporate active and collaborative learning activities and promote involvement in complementary academic and social activities that extend beyond the classroom” (p. 116). A freshman learning community may or may not include a residential component. Living in a residence hall allows students the opportunity to continue to learn and grow outside of the classroom (Pike, 1999). One key concept of the freshman learning community is to provide opportunities for support and engagement for students as they begin their collegiate career (e.g. Andrade, 2007; Barefoot, 2000; Pike, 1999; Rocconi, 2010; Zhao & Kuh, 2004). Both engagement and involvement are important for students transitioning from high school to college.

Researchers have provided many definitions of engagement and involvement. According to Krause (2005), engagement is “the time, energy, and resources students devote to activities designed to enhance learning at a university" (p. 3). Unless otherwise noted, this study used Krause's (2005) definition of engagement. Student engagement is not limited to activities that occur in the classroom. In addition, this study uses the term involvement, which is broadly defined to include participating in activities that promote interpersonal relationships. Examples of involvement include joining a student organization, spending time with fellow students in the residence hall, participating in programming on campus, and volunteering.

Freshman learning communities have shown positive impacts in various areas associated with learning outcomes including grade point average (GPA) (e.g. Andrade, 2007; Hotchkiss, Moore, & Pitts, 2006; Sidle and McReynolds, 1999; Zhao and Kuh, 2004) and retention.

The University of Missouri uses a Freshman Interest Group (FIG) model to provide targeted support for incoming students. A FIG is a freshman learning community that includes a residential component. The residential component lasts for the first two semesters. At the University of Missouri, a FIG has "15-20 first-year students who live near each other and enroll in a few general education classes together" ("Academic Success Programs", n.d.). For example, an Engineering FIG may have students co-enrolled in Chemistry, Mathematics, Psychology, and a FIG Seminar ("Co-Enrolled FIGs Courses FS2016", n.d.). At the University of Missouri, the FIG Seminar class (INTDSC 1001) is a weekly seminar that is co-taught by a faculty or staff member and an undergraduate student. The undergraduate student is typically an upperclassman who is studying that major or is involved with the focus area. This class is graded as satisfactory or unsatisfactory and does not count toward the student's GPA ("INTDSC 1001", 2019).

Unfortunately, many institutions reduce the level of programming that provide support after a student's first year in college (e.g. Ennis-McMillian, Ammirati, Rossi-Reader, Tetley & Thacker, 2011; Gahagan & Stuart Hunter, 2006; Graunke & Woosley, 2005; Pattengale, 2000;

Vuong, Brown-Welty, & Tracz, 2010; Wang & Kennedy-Phillips, 2013). The change in support for sophomore students has implications for their ability to successfully complete their second year of college and return for their junior year (e.g. Gahagan & Stuart Hunter, 2006; Gohn, Swartz, & Donnelly, 2001; Pattengale, 2000; Reyes, 2011; Sanchez-Leguelinel, 2008; Vuong et al., 2010; Wilder, 1993; Willcoxson, Cotter, & Joy, 2011). Research by Gohn, Swartz, and Donnelly (2001) and Pattengale (2000) suggest that the change in support lead second-year students to experience a negative trend in their academic performance. This phenomenon has been called *the sophomore slump*. One component of the sophomore slump is a decrease in student success as noted by a downward trend in their GPA when compared to their first year GPA (e.g. Pattengale, 2000; Vuong et al., 2010; Wilder, 1993).

Any changes in a student's GPA may impact their ability to continue their studies. Institutions of higher education may use a student's GPA to determine if they are allowed to return for a subsequent semester. For example, at the University of Missouri, "students whose term and cumulative GPAs are 2.0 or higher are in regular academic standing…students whose term GPA falls below 1.0 are ineligible to re-enroll" ("Academic Standing", 2018). GPA also plays a role in how confident the student feels in their studies. Sophomores experiencing a decrease in their confidence levels with regard to academic performance may choose to leave (Willcoxson et al., 2011). As previously discussed, attrition may have negative consequences at an institution of higher education.

The research question guiding the study is: For students who declared engineering majors during their first year, did participation in a FIG relate to second-year academic success (GPA, credit hours attempted, and credit hours earned)?

To answer this research question, I applied Schlossberg's (1981) Transition Theory to guide a quantitative analysis of second-year outcomes of engineering students who participated in a FIG compared to those who did not participate in a FIG at the University of Missouri. Regression analyses were applied to a subpopulation of all freshmen pre-engineering, undecided engineering, and engineering students during the 2013 to 2016 academic years. The purpose of this study was to determine the relationship, if any, between participating in a FIG and second-year success, as measured by the second year GPA.

It could be hypothesized that students participating in a FIG experience less of a decline in second-year success than students not participating in a FIG due to the structure of the FIG (Pike, 1999) and available support (Schlossberg, 1981). Alternatively, it could be hypothesized that students participating in a FIG experience a greater decline in second-year success than students not participating in a FIG due to the decline in support as they transition from freshman year to sophomore year (Schlossberg, 1981). The prominence of the decline in second-year success will be measured by the change in term GPA from freshman year to sophomore year for each group of students. Thus, this study will help answer the empirical question of which of the hypothesized effects is stronger.

Literature Review

I reviewed literature pertaining to evidence of the sophomore slump to understand the prevalence, rationale for, and mechanisms of the observed decline in second-year success. More specifically, I reviewed the literature to understand explanations for the sophomore slump and interventions to reduce the negative impact on student success. I also reviewed the literature pertaining to freshman learning communities to better understand successful outcomes of participating in these types of programs, such as a FIG. Lastly, I reviewed the literature regarding academic success for students studying engineering at the undergraduate level.

Generally, the qualitative literature consistently shows that the sophomore slump manifests through declines in various outcomes including GPA, motivation, and other measures of success. However, there is little quantitative evidence that describes the sophomore slump, or more specifically a decline in second-year GPA.

Sophomore Slump

Multiple researchers have identified a phenomenon, often called the sophomore slump, that is the observed decline in student success during their second year of college (e.g. Carr, 2003; Ennis-McMillian et al., 2011; Graunke & Woosley, 2005; Gohn et al., 2001; Lemons & Richmond, 1987; Pattengale, 2000; Reyes, 2011; Sanchez-Leguelinel, 2008; Vuong et al., 2010; Wilder, 1993; Willcoxson et al., 2011). The decline in student success is measured by a student's GPA and if they return for their junior year.

GPA is an important indicator of student success because it measures a student's level of proficiency in understanding materials presented while learning in the classroom. Gohn et al. (2001) concluded that once in college, a student's previous semester GPA is a better predictor of persistence than high school GPA and standardized test scores. A student's GPA provides empirical evidence that an institution uses to determine if a student will be continuing their studies at the university. Changes in a student's GPA signal changes in a student's success that impacts their ability to continue their studies.

Qualitative research has consistently found that a student's GPA drops in their second year of study compared to their first year of study (e.g. Pattengale, 2000; Vuong et al., 2010; Wilder, 1993). Pattengale (2000) surveyed Penn State sophomores about their experiences during the second year of college and found that the sophomore slump can manifest itself in a drop in a student's cumulative GPA. Vuong, et al. (2010) found that first-generation students experience a larger change in GPA and have a more pronounced sophomore slump than non-first-generation students.

Wilder (1993) researched how the sophomore slump impacted student success in two groups of students at one institution. The first group of students, referred to as decliners, experienced a decrease in student success from their first year of study (Wilder, 1993). Wilder concludes that "decliners had performed at an academic level ranging from above average to exceptional (2.75-4.00) during their freshman year and then exhibited a sustained and systematic decline (20%) during their sophomore year" (p. 20). The second group of students, the maintainers, either kept the same GPA or improved their GPA during the same period (Wilder, 1993). Wilder is an exception to the vast body of research because she provided quantitative evidence of the decline in student success as reported by changes in GPA.

Explanations for the sophomore slump. As Tinto (1988) explains, institutions of higher education provide the most support as students transition from high school to college. This support includes various programs specific to first-year students, such as freshman learning communities. According to Pattengale (2000), "sophomores are going through a transition as severe, if not more so, than first-year students" (p. 34). The noticeable decrease in support, such as specific programming available during the second year, is starting to change as institutions begin to cope with the sophomore slump. As Gohn et al. (2001) conclude, "support systems for second year-students are essential, especially for those who are struggling academically" (p. 292). Other explanations for this drop in a student's GPA during their second year of study includes a decline in engagement (e.g. Ennis-McMillian et al., 2011; Lemons & Richmond, 1987; Pattengale, 2000; Willcoxson et al., 2011) and a change in the student's perception of their ability to succeed (e.g. Lemons & Richmond, 1987; Vuong et al., 2010).

Students experiencing a sophomore slump during their second year in college are less engaged than during their first year in college (e.g. Ennis-McMillian et al., 2011; Lemons & Richmond, 1987; Pattengale, 2000; Willcoxson et al., 2011). As Ennis-McMillian, Ammirati, Rossi-Reder, Tetley, and Thacker (2011) conclude, "students at our institutions experience decreased motivation to continue their studies" (p. 6). As Lemons and Richmond (1987) explain, if a student is not achieving success or being recognized for their success in specific areas, such as the classroom, they can become dissatisfied. Dissatisfaction can lead to a decline in engagement (e.g. Gahagan & Stuart Hunter, 2006; Lemons & Richmond, 1987; Wang & Kennedy-Phillips, 2013). Engagement with faculty, staff, and peers is shown to impact a student's ability to successfully complete their second year of college as well as persist to graduation (e.g. Reyes, 2011; Sanchez-Leguelinel, 2008; Wilder, 1993). Positive interactions with faculty and commitment to major may reduce the change in GPA that occurs while students experience the sophomore slump.

Other positive interactions that may impact engagement involve integrating within the wider university community. Coghlan, Fowler, and Messel (2009) researched two groups of students, one that returned for their third year of study and another group that left after their second year of study. Students who returned for their third year of study were more integrated in their university community than students who left after their second year of study (Coghlan, Fowler, & Messel, 2009). These students had more interactions within their campus community and their perception of the campus was positive.

The student's perception of their ability to succeed in their second year directly impacts their persistence. As Lemons and Richmond (1987) allude, the students who are not confident in their ability to succeed may become less engaged, which may lead to other negative effects associated with the sophomore slump. As Vuong et al. (2010) explain "the perception college sophomore students have about their capabilities influences their persistence to maintain a grade point average that allows them to continue in their chosen program of study, as well stay enrolled until graduation from the university" (p. 60). Graunke and Woosley (2005) found that feeling confident in their choice of major had a positive impact on success.

In contrast, Gump (2007) reached a different conclusion about the decline in GPA during the second year of study. The author analyzed freshman, sophomore, junior, and senior students' grades in a specific general education course that he taught over multiple years. Gump concluded that more sophomores earned better grades than the other students. The sophomore students did not experience a decline in student success as reported by their course grade; however, the sophomore slump manifests itself in a decline in the semester GPA.

Interventions to reduce the sophomore slump. Lemons and Richmond (1987) recommended that institutions tailor their specific interventions to help support students experiencing the sophomore slump. Pattengale (2000) noted that institutions are developing specific programs to help students combat the developmental and quantitative issues associated with the sophomore slump. Effective programming should also provide tools for continued success. As Ellis (2009-2010) concludes institutions “should develop and implement second-year programs in order to address challenges and provide support for second-year students while creating a foundation for success throughout their college experience” (p. 55). For example, an institution can provide guided exploration during the sophomore year that provides an opportunity to strengthen academic engagement to improve student success (Ennis-McMillian et al., 2011). This approach to programming balances the need for support during the second year with the student’s growing sense of autonomy. The positive impacts of guided exploration follow the student in subsequent semesters (Ennis-McMillian et al., 2011).

The timing of course sequences in a student’s major is another way to provide support. Graunke and Woosley (2005) found that taking courses in the major sequence has a positive impact on GPA. In addition to positive impacts on a student’s GPA, taking courses pertinent to their major in their second year has a positive impact on engagement. Gohn et al. (2001) determined that the institution can change their curriculum so that sophomore students are taking at least one course relevant to their academic major to help combat issues associated with persistence.

Another benefit to curriculum changes is that students have exposure to faculty members in their major sooner (e.g. Gohn et al., 2001; Graunke & Woosley, 2005). As Gahagan and Stuart Hunter (2006) explain “for many students, the sophomore year represents the first time they will begin to take courses in their academic major” (p. 20). Having interactions with faculty members in their major during the second year allows the student to better understand the expectations associated with their major sooner.

Graunke and Woosley (2005) determined that positive experiences with faculty have a positive impact on GPA. According to the authors, "interactions with faculty was a significant predictor of GPA in both semesters" (Graunke & Woosley, 2005, p. 5). Ennis-McMillian et al. (2011) found that sophomore specific programming, such as the approach used to advise second-year students and collaborative research projects with faculty, received positive feedback. Willcoxson, Cotter, and Joy (2011) concluded that for second-year students, items categorized under support provided by teachers strongly correlated to attrition. Gahagan and Stuart Hunter (2006) note the importance of faculty-student interactions during the second year of college and they recommend that institutions "create sophomore-appropriate services, programs, and curricula" (p. 22). Wilder (1993) found that "variables such as …perceptions of faculty-staff interactions contributed most to the ability to discriminate between decliners and maintainers" (p. 23). By providing opportunities to interact with faculty, institutions are providing more opportunities for engagement to mitigate the effects of the sophomore slump associated with a decrease in student success.

Some research focuses on peer interactions as a method of support for sophomores (e.g. Reyes, 2011; Sanchez-Leguelinel, 2008). The University of Texas Pan American implemented a Sophomore Academic Mentoring Program (SAM Program) to address Latino/a student retention and persistence on their campus (Reyes, 2011). In the program, upperclassmen were matched up with sophomore students called protégés. Reyes (2011) concluded the SAM Program had a positive impact on retention and protégés were "more likely to return to the university for their junior year" (p. 380). Similarly, John Jay College of Criminal Justice implemented a program that included peer counseling as well as other activities for second-year students (Sanchez-Leguelinel, 2008). Sanchez-Leguelinel's (2008) results indicated that students reported higher rates of satisfaction with the peer counseling session than other activities. Kennesaw State University has developed a mentoring program where sophomores are paired with seniors in their academic major as a way to provide support (Gahagan & Stuart Hunter, 2006).

Freshman Learning Communities

To better understand FIGs, I provide a general overview of freshman learning communities available at various institutions of higher education. A freshman learning community is a specific type of residential learning community. Freshman learning communities are a general term used to describe first-year programming that targets student success. FIGs are a specific type of freshman learning community that goes beyond theme-based housing due to co-enrollment in courses including a freshman seminar ("Freshman Interest Groups", 2018).

The vast body of research regarding freshman learning communities of various forms notes the positive impact on students involved in the programs during their first year in college (e.g. Andrade, 2007; Barefoot, 2000; Hotchkiss et al., 2006; Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008; Pike, 1999; Sidle & McReynolds, 1999; Zhao & Kuh, 2004). As such, many institutions of higher education are using freshman learning communities on their campuses. Barefoot (2000) concluded that current research by the National Resource Center for the First-Year Experience has found that over 70 percent of U.S. colleges and universities offer special first-year seminars, to assure that new students have at least one small class in which a primary goal is the development of peer relationships. (p. 15)

As Pike (2008) explains, freshman learning communities "create conditions…that lead to student success" (p. 31). Many institutions of higher education use the unique conditions of the freshman learning community to provide students an environment for success.

Not only do freshman learning communities vary in length, but they also vary in style. The different styles of freshman learning communities reflect the institutional differences that include student body, campus culture, and mission (Stuart Hunter, 2006). Pike (1999) analyzed a freshman learning community with theme related floors that provided additional access and "peer-academic and social-academic support networks to improve student success" (p. 275). Pike found that students in specialized theme related floors had "significantly higher levels of … integration and gains in general education" when compared to students who were not involved with a specialized theme related floor at one institution (p. 277). Pike also analyzed a FIG that involved living in proximity with fellow students who were co-enrolled in three courses, one of which was a success strategy course co-taught by a student peer advisor and a faculty or staff member. Pike concludes that FIG participants' "intellectual development was most strongly related to two integration measures, involvement in residence halls, and interaction with faculty" (p. 281).

In the majority of freshman learning communities reviewed for this study, students choose to participate (i.e. Andrade, 2007; Pike, 1999; Rocconi, 2010; Sidle & McReynolds, 1999; Soldner, Lee, & Duby, 1999; Zhao & Kuh, 2004). However, in some instances, staff may select a student to reside in a specific residence hall to create a freshman learning community (Andrade, 2007). This is important for research purposes because there is no sample available where students are randomly assigned to participate in a freshman learning community, thus quantitative scholarship on the effects of freshman learning communities are potentially statistically biased (i.e. Andrade, 2007; Pike, 1999).

Freshman learning communities have been found to be positively associated with GPA (e.g. Andrade, 2007; Barefoot, 2000; Hotchkiss et al., 2006; Kuh et al., 2008; Sidle &

McReynolds, Zhao & Kuh, 2004). Andrade (2007) reviewed published research on 12 learning communities and found that “seven programs reported gains in student grade point average that were attributed to learning community participation” (p. 6). Andrade noted that students in all seven programs chose to participate in the learning community and thus there is potential for self-selection bias. Barefoot (2000) also found improved GPAs associated with the student participating in a freshman learning community. Sidle and McReynolds (1999) determined that “students who participated in the freshman-year experience courses tended to earn higher cumulative grade point averages than students who elected not to participate in the course” (p. 293). Specifically, Hotchkiss, Moore, and Pitts (2006) concluded that “belonging to a freshman learning community increases a student’s GPA from about three-quarters to one full letter grade, depending on the student’s race and gender” (p. 207). As previously mentioned, GPA is critical for a student’s persistence in college. Any gain in GPA associated with participating in a freshman learning community sets the student up to successfully continue their studies at an institution of higher education.

Explanations for this increase in a student’s GPA include an increase in engagement associated with participating in a freshman learning community (e.g. Barefoot, 2000; Kuh et al., 2008; Zhao & Kuh, 2004), change in the student’s perception of their ability to succeed (e.g. Besterfield-Sacre, Atman, & Shuman, 1997; Rocconi; 2010), and an increase in support among participants (e.g. Andrade, 2007; Barefoot, 2000; Pike, 1999; Soldner et al., 1999). The type of freshman learning community varies depending on the institution and may include co-enrolling in courses as well as a residential component based on an institution’s choice of programming.

One hallmark of a freshman learning community involves providing opportunities for engagement. Kuh, Cruce, Shoup, Kinzie, and Gonyea (2008) suggest that institutions can use specific programs, such as learning communities, first-year seminars, and theme-based housing to provide opportunities for student engagement. Students in specialized residential learning communities reported higher levels of involvement and interaction than their peers involved with more general theme related housing at the same institution (Pike, 1999).

Kuh et al. (2008) conclude that “student engagement in educationally purposeful activities is positively related to academic outcomes as represented by first-year student grades and by persistence between the first and second year of college” (p. 555). Zhao and Kuh (2004) found that “seniors with a learning community experience had higher grades compared with those who did not participate in a learning community at some point during college” (p. 124). As noted above, the freshman learning communities are intentionally designed to promote student engagement with faculty, staff, and peers during their first year on campus.

A student’s attitude regarding their ability to study a particular major during their freshman year impacts their ability to successfully complete their first year of study and persistence in subsequent semesters (Besterfield-Sacre et al., 1997; Besterfield-Sacre, Atman, & Shuman, 1998; Rocconi, 2010). One of the positive outcomes associated with freshman learning community participants’ increase in GPA is based on student perception during their involvement with the program. Rocconi (2010) concluded that “the major influence on students’ perceived gains is from the effort that they exert taking advantage of the opportunities for learning provided by the institution, such as interactions with faculty members and peers and effort in their coursework” (p. 188). The effort in coursework is reflected in a student’s GPA at the institution they are enrolled at for their undergraduate degree.

Many institutions provide freshman learning communities as a way to support students transitioning from high school to college. The type of support available is institution dependent.

In regard to the specific type of freshman learning community, Pike (1999) described both theme related housing in general and FIGs. FIGs are a type of theme related housing specifically designed to add a layer of student support. Andrade (2007) concluded that “the majority of learning communities with gains in persistence (69%) were characterized by peer mentoring, group tutorials, and/or faculty mentoring to assist participants with their course work” (p. 5). Findings associated with research conducted by Kuh et al. (2008) and Pike (1999) suggest that the majority of freshman learning communities have at least one of these characteristics. Soldner, Lee, and Duby (1999) found that “the faculty collaboration enhances opportunities for students to be successful in making the transition to college life” (p. 119).

A second positive outcome reported by researchers is an increase in retention after participating in a freshman learning community. Barefoot (2000) concluded that “through the use of learning communities, colleges and universities are changing the basic organization of the curriculum to achieve…many other positive outcomes, such as improved retention” (p. 15). Sidle and McReynolds (1999) found that

> students who participated in the institution’s freshman-year experience course continued their enrollment to the fall term of their second year at a higher rate than students who did not participate in the course. (p. 292)

When reviewing one institution’s first-year experience (FYE), Soldner et al. (1999) concluded that “FYE type programs have a consistently positive impact on the retention rates of those students who participate” (p. 125). These students successfully transitioned from high school to college and continued their education into their second year.

The research focusing on the transition from freshman year to sophomore year views this period similarly to research focusing on the transition from high school to the freshman year of college. Pattengale (2000) determined the available research supports the evidence that "sophomores are going through a transition as severe, if not more so, than first-year students" (p. 34). However, there is no specific research analyzing how participation in a freshman learning community, such as a FIG, may impact the transition from freshman year to sophomore year for students. In addition, there is no research analyzing how the sophomore slump phenomena may be mitigated by participating in a freshman learning community like a FIG.

Engineering Student Success

Similar to other students, engineering students face barriers to their success. As noted above, it is imperative for institutions of higher education to produce engineering graduates due to their high demand in the labor market. When a student decides to continue their studies in a different academic department, their ability to obtain employment in an engineering field decreases because undergraduates who have a STEM degree make up over two-thirds of the employees in STEM occupations (Langdon, et al., 2011).

Research involving students studying engineering has focused on what outcomes lead to success, starting with their first year in the program (i.e. Bernold, Spurlin, & Anson, 2007; Carr, 2003; Felder, Felder, & Dietz, 1998; Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth, 2014). As Besterfield-Sacre, Atman, and Shuman (1997) describe "success and retention in a freshman engineering program depends not only on the knowledge and skills a student learns during his/her undergraduate career but also on his/her attitudes, particularly at the start of college" (p. 147). The approach to teaching in the classroom, the grouping of students together, and perceived ability impact academic success.

In the classroom, providing a different style of teaching that emphasizes teamwork and a multidisciplinary approach to solving problems leads to engineering student success (Bernold et al., 2007; Carr, 2003; Felder et al., 1998; Freeman et al., 2014). This style of teaching promotes student engagement and is considered active learning (Freeman et al., 2014). Carr (2003) reviewed changes to Northwestern University's engineering program that included moving a design project to earlier in the first year. Carr noted that students who participated in the programmatic change had a better ability to work as teams, were more engaged with faculty, and experienced a smaller sophomore slump. Providing opportunities for hands-on learning allowed students to work as a team and use a multi-disciplinary approach to problem-solving that improved success (Felder et al., 1998). These types of activities that promote active learning lead to an increase in student performance (Freeman et al., 2014). In addition, active learning may also help students whose learning style is more conducive to creativity succeed in the program (Bernold et al., 2007). These characteristics are vital to engineering students because their career will involve teamwork and problem-solving.

Another way to increase student success involves creating a cohort of students who take specific courses together during their undergraduate career (Besterfield-Sacre et al., 1997; Felder et al., 1998). Depending on the institution, a cohort may extend beyond one academic year. Felder, Felder, and Dietz (1998) concluded that chemical engineering students who participated in the cohort "generally earned higher course grades" (p. 479). Students in the cohort demonstrated academic success by having a high GPA in their course sequences and remaining enrolled at their institution in subsequent semesters. At the University of Missouri, a FIG is one program that creates a cohort due to the shared classes during the first academic year.

As Felder et al. (1998) note, the students in the cohort also described their perceptions of the program and their ability to succeed more positively than students who did not participate in the cohort. A student's perception of their ability to succeed is a key factor in their decision to return to the program. Besterfield-Sacre, Atman, and Shuman (1998) reviewed self-assessment data for students who left an engineering program in good academic standing after their first year of study. One-third of students who left the engineering program reported the primary reason for leaving was due to their negative perception of their ability to succeed academically (Besterfield-Sacre et al., 1998).

We should expect that participation in a FIG would be helpful to engineering students because the program creates a cohort of students who are co-enrolled in multiple courses during their first year. The cohort structure may have a positive impact on engineering students' perception of their ability to succeed. In addition, FIG participants have the opportunity to work more frequently as a team to problem solve because they interact in the residence hall. This type of interaction may lead to a multidisciplinary approach to learning that involves creativity and collaboration.

Theoretical Framework

To study whether participating in a FIG is related to second-year success as determined by GPA, I applied Schlossberg's (1981) Transition Theory. Schlossberg's Transition Theory explains how a person reacts to a specific life event. The person uses available resources, knowledge, and support to work through changes associated with the life event. According to Schlossberg, a transition occurs "if an event or non-event results in a change in assumptions about oneself and the world and thus requires a corresponding change in one's behavior and relationships" (p. 5). Transitions also alter an individual's roles and routines (Chickering & Schlossberg, 2005). If the person incorporates the new assumptions into their life, then they have adapted to the transition. Returning to college for their sophomore year of study is an example of a life event. If someone was anticipating a specific event, such as taking a class with a friend, and the event did not occur, this is considered a non-event. The type of event directly impacts how a person moves through the transition and the outcome.

Schlossberg (1981) identified three factors that influence how an individual adapts to the transition and impact the outcome of the transition. One factor is the characteristics surrounding a specific transition. The second factor is the environmental characteristics before and after the transition. The third factor is the characteristics of the person experiencing the transition.

Characteristics Surrounding a Specific Transition

Schlossberg (1981) notes that the characteristics surrounding a particular transition when being faced with a life event include perceptions of the individual experiencing the transition, timing, duration, and stress associated with the transition. An individual may react differently to the transition if they believe the event is positive, if it is based on an internal choice, and if the timing is right. Whether or not the event is sudden and leads to a permanent change is another characteristic that influences the transition. For example, a student who is notified that they do not meet the prerequisite requirements for a specific class during the first week of the semester is experiencing a sudden event. This event may impact their entire second year of college.

The majority of students make an internal choice to participate in a FIG before starting their first year in college (Pike, 1999). Viewing a transition as positive would impact how a student approaches the transition (Schlossberg, 1981). FIG participants view the support and engagement of the program as beneficial in helping them transition from high school to college.

Environmental Characteristics Before and After Transition

Schlossberg (1981) explains that one characteristic of the pre-and post-transition environments involves the physical setting. Changes associated with the environment impact how a student perceives an event as well as their perception of available resources and support to assist during the transition. Available support systems, such as family and friends, impact the environment the student experiences before and after the event. Environmental characteristics may lead the student to respond differently to the transition. For example, students may live in a different residence hall for their second year of study. This change may alter how the family interacts with the student and may provide more opportunity for autonomy. Schlossberg notes that the institutional supports available, such as mentors and peer groups, may change after the transition.

The support available to guide students through this transition is different depending on if the student participated in a FIG during their freshman year. Pike's (1999) Theoretical Model of the Effect of Background and College Experiences on Learning and Intellectual Development explains that a student's college experiences impact their ability to change and grow during their first year in college. A FIG provides a unique environment to enhance a student's transition from high school to college by providing targeted support. Support is critical to successfully transitioning through an event (Schlossberg, 1981). The FIG also creates an opportunity to enhance learning and success by promoting two types of learning: differentiation and integration.

The four major elements of Pike's (1999) model include the background of the student, experiences in college that promote differentiation, experiences in college that promote integration, and "gains in learning and intellectual development" (p. 271). Both differentiation and integration are based on previous research conducted by Chickering (as cited in Evans, Forney, Guido, Patton, & Renn, 2010).

According to Chickering's theory of student development (as cited in Evans et al., 2010), differentiation provides a student with the opportunity to be exposed to different ideas that the student may not have previous experience with before attending college. Integration is the ability of a student to make connections from various disciplines in order to further their understanding. Without differentiation, a student is limited in their ability to integrate concepts presented from various courses which would inhibit any educational gains. Part of FIG participants' involvement is due to living as a community in the residence hall during the program. The FIG seminar class allows for interaction with peers, faculty, and staff. Pike (1999) also noted that students who participated in a FIG have positive outcomes due to gains in both differentiation and integration of concepts, available support, and opportunities for engagement.

Any change in the amount of support may be an unanticipated event during the transition. A student experiencing the sophomore slump may have a noticeable decline in their level of engagement and student success as indicated by their GPA.

Characteristics of the Individual

Schlossberg (1981) notes that characteristics of the individual experiencing the transition include gender, sex role identification, ethnicity, and age. As Schlossberg explains “males and females are socialized to different attitudes and behaviors, and the extent to which the individual man or woman internalizes these norms may significantly influence his or her ability to adapt” (p. 13). The individual’s values and their feelings of competence play a role in how they experience the transition.

Pike (1999) concluded that a student’s unique background also plays a role in their growth while in college. As Pike notes, a student’s interaction and involvement are shaped in part by their background characteristics. While the student backgrounds may be different, each student is provided opportunities for engagement as part of the FIG program specifically designed to help them transition to college.

These values and perceptions of ability differ between males and females. A student’s perception of their ability to successfully study a particular major is shaped in part by their upbringing and their role models. Cheryan, Siy, Vichayapai, Drury, and Kim (2011) conclude that “interacting with one member of a field, even briefly, can shape students’ beliefs about their potential for success in that field” (p. 661). For example, a student studying engineering may have a different perception of successfully completing their major courses if they have a relative or role model who is an engineer.

The type of event influences the outcome. When viewing students using Schlossberg’s (1981) model, students who complete their freshman year and start their sophomore year experience an anticipated event as they transition into their second year of college. Successfully adapting to a previous event, such as transitioning from high school to freshman year of college, provides students confidence when facing a similar event in the future. As Chickering and Schlossberg (2005) explain, self-confidence "rests on past successes and on learning from failures" (p.31). Sophomore students experiencing the negative effects associated with a decrease in support are faced with an unanticipated event. The decrease in support that accompanies the transition may impact their level of confidence in their ability to be successful in their studies.

Outcomes After Experiencing a Transition

An individual can experience two distinct outcomes after experiencing a transition, either successfully adapting or failing to adapt to the new situation. Schlossberg (1981) explains that "adaptation to transition is a process during which an individual moves from being totally preoccupied with the transition to integrating the transition into his or her life" (p. 7). The three characteristics of the transition play a direct role in the outcome. As Schlossberg explains "ease of adaptation to a transition depends on one's perceived and/or actual balance of resources to deficits in terms of the transition, the pre-post environment, and the individual's sense of competency, well-being, and health (pp. 7-8). The combination of characteristics is different depending on the individual and helps to explain why some individuals may have an easier time working through a transition and adapting than others experiencing the same transition.

Research Hypotheses

Based on Schlossberg (1981), two competing hypotheses could be formed. First, I hypothesize that students who participate in a FIG experience a smaller sophomore slump as defined by a decrease in second year GPA than students who did not participate in a FIG. According to Schlossberg, the support provided by participating in a FIG helps participants transition when facing a life event. As Pike (1999) explains, students who participate in a FIG have positive learning outcomes that help them develop. Second, I hypothesize that students who participate in a FIG may experience a greater sophomore slump as defined by a decrease in second year GPA than students who did not participate in a FIG. As Schlossberg explains, the lack of support is an unanticipated event for students who participated in the FIG that may hinder their transition.

Research Methodology

The research question guiding this study was: For students who declared engineering majors during their first year, did participation in a FIG relate to second-year academic success (GPA, credit hours attempted, and credit hours earned)? To answer this research question, I used a group comparative research design to quantify the differences in academic success over four subsequent semesters for students who participated in a FIG compared to those who did not. Quantitative analysis is appropriate due to analyzing the relationship between variables (FIG participation and term GPA) based on observed, pre-determined numerical data. This approach expands on previous qualitative studies that included self-reported data regarding the decrease in student success as reported by a decrease in GPA.

Specifically, I will determine if there is a relationship between participating in a FIG and second-year GPA through regression analysis. First, I calculated the Student's t-test to compare the mean background characteristics of students who participated in a FIG and students who did not participate in a FIG to better understand the self-selection into FIGs. Next, I utilized multiple regression analyses to calculate the effects of FIG participation on second-year academic success while controlling for important background factors.

Setting and Sample

The setting for this study is the University of Missouri in Columbia, Missouri. The university is a large, four-year public institution ("University of Missouri-Columbia", 2017). This institution is predominately white and located halfway between two metropolitan areas in the Midwest of the United States of America. The University of Missouri offers studies for undergraduates, graduates, and professional students. This university is a land grant institution, a member of the Association of American Universities, and is accredited by the Higher Learning

Commission (“About Mizzou”, 2019). Enrollment for the first year of the sample, the Fall 2013 semester, was 34,658 students, of which 26,965 were undergraduates (“Student Body Profile Fall 2013”, 2013).

At the University of Missouri, all freshmen are highly encouraged to live in a residence hall and if they choose not to, they must complete a waiver explaining their unique circumstance. The residence halls are available to all undergraduate students and include two programs for academic success: learning communities and FIGs. A learning community is a designated area or floor of the residence hall that is reserved for undergraduate students who share a common interest (“Academic Success Programs”, 2019). At the University of Missouri, students participating in a FIG live in the same residence hall and are co-enrolled in three courses. A FIG can be housed in the designated learning community for that specific interest.

The population included all first-time college students who enrolled during the Fall 2013, Fall 2014, Fall 2015, and Fall 2016 semesters at the University of Missouri. Each student in the subpopulation declared either pre-engineering, undecided engineering, or engineering as their intended major during their first semester. The subpopulation includes only students who were enrolled full-time taking at least 12 credit hours starting in the first semester of attendance. During the second year of study, the students were enrolled full-time taking at least 12 credit hours.

Data and Constructs

All data were collected using information from the University of Missouri Student Information Systems. All data were provided to the researcher in a de-identified form.

The Student Information Systems provided student data regarding race and ethnicity in a category titled ethnicity. The ten options a student can select under the ethnicity category are

American Indian/Alaska Native, Asian, Asian (Other), Black/African American, Hispanic/Latino, Multiple Race/Ethnicity, Native Hawaiian/Pacific Islander, Non-Resident International, Not Specified, and White. For analyses performed in this study, I collapsed the ten options for ethnicity into two options: white and non-white.

Dependent variables. For this study, three dependent variables were included and measured during a student's third-semester and fourth semester. The dependent variables were GPA, credit hours attempted, and credit hours passed.

As noted above, the sophomore slump will manifest itself in a decrease in student success as reported by term GPA. Analyzing the third and fourth semester GPAs allowed me to identify changes in student success. At the University of Missouri, GPAs are calculated using a 4-point scale. The university uses a plus-minus letter grading system (see Table 1). Courses graded as either satisfactory or unsatisfactory do not count towards GPA.

Table 1: Letter Grade and GPA Breakdown

Letter Grade	GPA
A+/A	4.0
A-	3.7
B+	3.3
B	3.0
B-	2.7
C+	2.3
C	2.0
C-	1.7
D+	1.3
D	1.0
D-	0.7
F	0

Credit hours attempted is a reflection of the number of classes a student takes each semester. A student should determine the number of credit hours attempted after consulting with their academic advisor. The number of credit hours attempted is also a reflection on a student's perceived ability to successfully complete the classes. Credit hours passed impacts student success because it plays a direct role in the timeline to graduate. At the University of Missouri, a student needs to complete at least 120 credit hours to receive a baccalaureate degree (“Graduation Requirements”, 2019). To graduate in eight semesters, a student needs to earn on average 15 credit hours each fall and spring semester.

Key independent variable. The key independent variable was FIG participation. Participation was identified in the student’s institutional record. A student was coded as a FIG participant if they participated in an engineering FIG, STEM FIG, or a non-STEM related FIG. Examples of non-STEM related FIGs include men’s leadership, women’s leadership, and social justice (Co-Enrolled Courses FS2016).

At the University of Missouri, there were 140 FIGs for academic years 2013 to 2016. In 2014, the National Science Foundation provided a list of Approved STEM Fields broken down into eleven categories (“NSF Approved STEM Fields”, 2014). The categories were: Chemistry, Computer and Information Science and Engineering, Engineering, Geosciences, Life Sciences, Materials Research, Mathematical Sciences, Physics and Astronomy, Psychology, Social Sciences, and STEM Education and Learning Research (“NSF Approved STEM Fields”, 2014). Using the National Science Foundation approved STEM Fields as a guide, 57 FIGs were considered STEM FIGs, of which 16 were engineering FIGs.

In the academic year 2016, there were thirteen engineering FIGs at the University of Missouri (Co-Enrolled Courses FS2016). Every student participating in an engineering FIG was co-enrolled in a mathematics class. The range of mathematics classes was pre-calculus to calculus three depending on a student’s ALEKS assessment (Co-Enrolled Courses FS2016). According to the Department of Residential Life (2016), eleven of the engineering FIGs included a Chemistry class with a laboratory component. Examples of other co-enrolled courses included Philosophy, Psychology, and American Government (Co-Enrolled Courses FS2016).

Control variables. Control variables were identified through the theoretical framework. They were gender (male/female), ethnicity (white/non-white), first semester credit hours passed, first semester GPA, second semester credit hours passed, and second semester GPA. As previously discussed, freshman year term GPAs are a stronger predictor of student success and persistence in subsequent semesters than high school GPA and standardized test scores (Gohn et al., 2001). In addition, the number of semester credit hours passed is a critical factor in student success.

Background characteristics, such as gender and ethnicity, shape a student's perception of success as well as their interactions (Pike, 1999). Interactions are different based on a student's gender and ethnicity. These interactions impact how a student transitions through an event (Schlossberg, 1981). Residential learning communities tend to include more female students and fewer students who identify as a minority (Pike, 1999).

Other control variables included ACT English, ACT Math, ACT Reading, ACT Science, high school core GPA, first-generation status, and Pell Grant eligibility. The Pell Grant is a federal grant for students who demonstrate great financial need. These specific control variables were included to determine if students who self-select into a FIG were not significantly different from students who choose not to participate in a FIG.

Analytical Procedures

To understand the data, I performed descriptive statistics on the background variables for the 3,166 students in the subpopulation as well as the 20,506 students who declared a non-engineering major. Second, I calculated the number of students in the subpopulation who participated in a FIG and who chose not to participate in a FIG. Third, to determine if there were differences between students who participated in a FIG and students who chose not to participate in a FIG, I performed a Student's t-test on all control variables. Fourth, to determine if there was a relationship between participating in a FIG and second-year GPA, I performed regression analyses.

For the primary analysis, which seeks to examine differences in FIG participation on the second-year outcome variables, I calculated standard ordinary least squares regression analyses for each dependent variable. I used a covariate adjustment to reduce self-selection bias. As Pike, Hanson, and Linn (2011) note, the covariate adjustment mitigates the unusually high strength of correlation due to self-selection. The specific regression formula was as follows:

$$Y_i = \alpha + \beta FIG_i + \gamma' X_i + \varepsilon_i$$

Where Y_i represents the second-year outcome variable (GPA, credit hours attempted, credit hours earned) for student i, FIG_i indicates whether student *i* participated in a FIG during their first year, X_i is a vector of control variables for student i, and ε_i is an idiosyncratic error term. All statistical analysis assumed a .05 or .01 level of significance.

Results

Descriptive Statistics

Table 2 presents descriptive statistics for the subpopulation used in this study. Of the 3,166 students who declared pre-engineering, undecided engineering, and engineering as their major, there were 551 females and 2,615 males. The subpopulation had 2,460 white students and 706 non-white students. In the subpopulation, 713 students identified as first generation and 2,453 were students who had parents who graduated from college. Of the subpopulation, 653 students were Pell Grant eligible and 2,513 students were not Pell Grant eligible. The students in the subpopulation on average had a score of 27 on each of their ACT English, Math, Reading, and Science subsections. On average, a student had a high school core GPA of 3.36. The majority of subjects in the subpopulation were male, white, have parents who graduated from college, and are not Pell Grant eligible.

Table 2: Descriptive Statistics of Control Variables for Engineers Year One

Variable	N	Mean	SD	Median	Min	Max
ACT English	2973	26.88	4.65	26	13	36
ACT Math	2973	27.49	3.85	27	15	36
ACT Reading	2967	27.16	4.90	27	12	36
ACT Science	2973	27.37	4.19	27	16	36
Male	3166	0.83	0.38	1	0	1
White	3166	0.78	0.42	1	0	1
HS Core GPA	3016	3.36	0.54	3.44	0	4
First Generation	3166	0.23	0.42	0	0	1
Pell Eligible	3166	0.21	0.40	0	0	1
Fall 1 Hours Passed	3128	12.78	3.28	14	0	19
Spring 1 Hours Passed	2963	13.18	3.38	14	0	20

In comparison, Table 3 presents descriptive statistics for the students who did not declare an engineering major during their first semester at the University of Missouri (i.e. non-engineers). Of the non-engineers, 12,006 were females and 8,500 were males. There were 16,167 white students and 4,339 non-white students. Of the non-engineers, 4,876 did not have parents who graduated from college and 15,630 students had parents who graduated from college. For students who did not study an engineering major, 4,244 students were Pell Grant eligible and 16,262 students were not Pell Grant eligible. Non-engineering students on average had a score of 26 on their ACT English and ACT Reading subsections. On average, students who did not study engineering had a score of 25 on ACT Math and 25 on ACT Science subsections. Non-engineering students on average had a high school core GPA of 3.30. The majority of students who did not declare an engineering major were female, white, have parents who graduated from college, and are not Pell Grant eligible.

Table 3: Descriptive Statistics of Control Variables for Non-Engineers Year One

Variable	N	Mean	SD	Median	Min	Max
ACT English	19380	26.04	4.52	25	10	36
ACT Math	19380	24.53	3.87	25	12	36
ACT Reading	19342	26.33	4.73	26	7	36
ACT Science	19380	25.00	3.79	25	0	36
Male	20506	0.41	0.49	0	0	1
White	20506	0.79	0.41	1	0	1
HS Core GPA	19976	3.30	0.52	3.34	0	4
First Generation	20506	0.24	0.43	0	0	1
Pell Eligible	20506	0.21	0.41	0	0	1
Fall 1 Hours Passed	20331	13.20	2.69	14	0	21
Spring 1 Hours Passed	19092	13.47	2.77	14	0	22

Table 4 presents evidence that GPAs for pre-engineering, undecided engineering, and engineering students grew across their time at the University of Missouri. Specifically, they had a term GPA of 2.88 during their first semester, 2.94 during their second and third semesters, and 3.01 for their fourth semester. In general, this positive trend in GPA for the subpopulation would not support a conclusion that engineering students at the University of Missouri experienced a sophomore slump.

Table 4: Descriptive Statistics of Term GPAs for Engineers Year One

Control Variable	N	Mean	SD	Median	Min	Max
Fall 1 Term GPA	3128	2.88	0.89	2.99	0	4
Spring 1 Term GPA	2963	2.94	0.86	3.07	0	4
Fall 2 Term GPA	2662	2.94	0.83	3.06	0	4
Spring 2 Term GPA	2539	3.01	0.80	3.14	0	4

In comparison, Table 5 presents evidence that GPAs for non-engineering students fluctuated across their time at the University of Missouri. Specifically, they had a term GPA that increased from 3.04 to 3.08 during their first two semesters. Their term GPA decreased to 3.07 during their third semester and then rose to 3.10 during their fourth semester. In general, this negative trend in GPA between the second and third semesters supports a conclusion that non-engineering students at the University of Missouri experienced a sophomore slump during their second year of study.

Table 5: Descriptive Statistics of Term GPAs for Non-Engineers Year One

Control Variable	N	Mean	SD	Median	Min	Max
Fall 1 Term GPA	20331	3.04	0.78	3.20	0	4
Spring 1 Term GPA	19092	3.08	0.75	3.23	0	4
Fall 2 Term GPA	17555	3.07	0.74	3.20	0	4
Spring 2 Term GPA	16946	3.10	0.74	3.25	0	4

Self-Selection of Engineering Students into FIGs

For the subpopulation, 32.6 percent of students participated in a FIG during their freshman year. Of the students in the subpopulation who chose to participate in a FIG, 90.2 percent participated in a STEM-related FIG. During their freshman year, 81.4 percent of the subpopulation who participated in a FIG participated in an engineering FIG. For FIG participants, 18.6 percent chose a FIG that focused on a specific interest other than STEM.

Thus, the majority of engineering students at the University of Missouri did not have the support in their freshman year that a FIG provides. An important consideration in evaluating whether FIG participation is related to second-year academic success is the self-selection of student participation in FIGs. Table 6 presents descriptive statistics of the background variables by FIG participation status, including t-tests of difference.

Table 6. Comparing FIG Students and Non-FIG Students

Variable		FIG Yes	FIG No	*t*-value	*p*-value
ACT English	N	1011	1962		
	M	27.43	26.60	-4.64	**
	SD	(4.65)	(4.62)		
ACT Math	N	1011	1962		
	M	28.10	27.18	-6.34	**
	SD	(3.67)	(3.91)		
ACT Reading	N	1008	1959		
	M	27.72	26.87	-4.53	**
	SD	(4.81)	(4.92)		
ACT Science	N	1008	1959		
	M	27.72	27.07	-4.53	**
	SD	(4.81)	(4.12)		
HS Core GPA	N	1024	1992		
	M	3.42	3.34	-4.31	**
	SD	(0.48)	(0.56)		
Fall 1 Hours Attempted	N	1034	2094		
	M	13.70	13.07	-7.01	**
	SD	(2.32)	(2.46)		
Fall 1 Hours Passed	N	1034	2094		
	M	13.43	12.46	-8.43	**
	SD	(2.82)	(3.44)		
Fall 1 Term GPA	N	1034	2094		
	M	2.97	2.84	-4.08	**
	SD	(0.83)	(0.92)		
Spring 1 Hours Attempted	N	999	1964		
	M	14.08	13.45	-6.32	**
	SD	(2.55)	(2.57)		
Spring 1 Hours Passed	N	999	1964		
	M	13.66	12.94	-5.58	**
	SD	(3.28)	(3.40)		
Spring 1 Term GPA	N	999	1964		
	M	3.03	2.90	-4.01	**
	SD	(0.83)	(0.87)		

Note: Significance levels denoted by * $p < .05$, ** $p < .01$

Key differences emerged in the students who chose to participate in a FIG when compared to those who chose not to participate in a FIG. Engineering students who participated in a FIG performed statistically better on ACT subtests, specifically, 0.83 points for English, 0.92 points for Math, 0.85 points for Reading, and 0.65 points for Science. FIG participants had a

0.08 higher high school core GPA. FIG participants attempted 0.63 and passed 0.97 more credits during the fall semester of their first year. Similarly, FIG participants attempted 0.63 and passed 0.72 more credits during the spring semester of their first year. Finally, FIG participants had a 0.13 higher fall semester and 0.13 spring semester GPA during their first year. Overall, it is clear that FIG participants had stronger pre-college academic backgrounds and performed better during their first year of college.

Regression Analyses for Second-Year Outcomes

Table 7 presents regression results for the relationship between FIG participation and fall semester second-year academic outcomes when controlling for relevant variables. The first column presents results for the outcome variable credit hours attempted, the second column for credit hours passed, and the third column for term GPA. The subpopulation consisted of 2,482 pre-engineering, undecided engineering, and engineering students who attempted at least 12 credits during the fall semester of their second year.

Table 7: The Relationship Between FIG Participation and Fall Second-Year Success

	Fall 2 Hours Attempted	**Fall 2 Hours Passed**	**Fall 2 Term GPA**
FIG Participant	0.023 (0.110)	0.026 (0.126)	-0.0002 (0.025)
ACT English	0.004 (0.017)	0.012 (0.020)	0.007 (0.004)
ACT Math	0.012 (0.020)	-0.017 (0.022)	-0.001 (0.005)
ACT Reading	0.007 (0.015)	-0.010 (0.017)	-0.006 (0.004)
ACT Science	0.015 (0.019)	0.021 (0.021)	0.002 (0.004)
Male	0.060 (0.140)	0.102 (0.160)	-0.035 (0.032)
White	0.189 (0.148)	0.338* (0.170)	0.090** (0.034)
HS Core GPA	0.157 (0.128)	0.114 (0.146)	0.112** (0.029)
First Generation	0.111 (0.137)	-0.084 (0.157)	-0.069* (0.032)
Pell Eligible	0.131 (0.141)	-0.110 (0.162)	-0.055 (0.033)
Fall 1 Hours Passed	0.141** (0.025)	0.181 (0.029)	0.010 (0.006)
Fall 1 Term GPA	0.207 (0.117)	0.434** (0.134)	0.296** (0.027)
Spring 1 Hours Passed	0.091** (0.023)	0.109** (0.026)	0.007 (0.005)
Spring 1 Term GPA	1.033** (0.108)	1.535** (0.123)	0.492** (0.025)
Constant	4.522** (0.558)	2.054** (0.638)	-0.182 (0.128)
Obs.	2482	2482	2482
Res. Std. Error	*2.579*	2.948	0.594
	*F(14, 2467) = 38.95***	*F(14, 2467) =58.29***	*F(14, 2467) =160.3***
Mult. R-squared	0.181	0.249	0.476
Adj. R-squared	0.176	0.244	0.473

Note: Standard errors in parentheses. Significance levels denoted by * $p < .05$, ** $p < .01$

The results indicate that students who participated in FIGs attempted 0.23 more credits during the fall of their second year when compared to those who did not participate in a FIG. However, this estimate was not statistically different from zero. Similarly, the results indicate that students who participated in FIGs passed 0.26 more credits during fall 2 when compared to those who did not participate in a FIG. Finally, FIG participation was related to a 0.002 reduction in fall term GPA, although this estimate is statistically insignificant from zero. Overall, FIG participation appears to be unrelated to engineering student academic success in the fall semester of the second year.

First-year academic success was consistently found to statistically predict second-year success in the fall semester. Hours passed in the fall semester of a student's first year was significantly positively related to both the hours attempted and passed in the student's fall semester of their second year. The GPA in the fall semester of their first year was significantly positively related to hours passed and GPA in the fall semester of their second year. Hours passed in the spring semester of a student's first year was significantly positively related to both the hours attempted and passed in the student's fall semester of their second year. The GPA in the spring semester of their first year was significantly positively related to hours attempted, hours passed, and GPA in the fall semester of their second year.

Interestingly, when first-year academic success was included in the model, there was no relationship between any ACT subtest and academic success in a student's fall semester of their second year. White students were found to pass more credit hours and have higher GPAs in the fall semester of their second year, even when controlling for first-year academic success. Finally, Pell Grant eligible students were found to have a significantly lower second-year fall term GPA by 0.69 points when compared to non-Pell Grant eligible students.

Table 8 presents regression results for the relationship between FIG participation and spring semester second-year academic outcomes when controlling for relevant variables. The first column presents results for the outcome variable credit hours attempted, the second column for credit hours passed, and the third column for term GPA. The subpopulation consisted of 2,365 pre-engineering, undecided engineering, and engineering students who attempted at least 12 credits during the spring semester of their second year.

Table 8: The Relationship Between FIG Participation and Spring Second-Year Success

	Spring 2 Hours Attempted	Spring 2 Hours Passed	Spring 2 Term GPA
FIG Participant	-0.235* (0.111)	-0.238 (0.130)	0.005 (0.028)
ACT English	0.001 (0.017)	0.006 (0.020)	0.005 (0.004)
ACT Math	-0.019 (0.020)	-0.045* (0.023)	-0.003 (0.005)
ACT Reading	0.010 (0.015)	0.005 (0.018)	-0.003 (0.004)
ACT Science	0.043* (0.019)	0.041 (0.022)	0.002 (0.005)
Male	-0.347* (0.140)	-0.263 (0.164)	-0.074* (0.035)
White	-0.136 (0.150)	-0.052 (0.177)	0.051 (0.038)
HS Core GPA	0.405** (0.131)	0.512** (0.154)	0.159** (0.033)
First Generation	-0.442** (0.140)	-0.555** (0.165)	-0.079* (0.035)
Pell Eligible	-0.162 (0.144)	-0.242 (0.170)	-0.032 (0.036)
Fall 1 Hours Passed	0.103** (0.026)	0.112** (0.030)	-0.004 (0.006)
Fall 1 Term GPA	0.142 (0.122)	0.267 (0.143)	0.249** (0.030)
Spring 1 Hours Passed	0.199** (0.024)	0.234** (0.028)	0.014* (0.006)
Spring 1 Term GPA	0.596** (0.112)	0.897** (0.132)	0.423** (0.028)
Constant	5.434** (0.577)	3.435** (0.678)	0.246 (0.144)
Obs.	2365	2365	2365
Res. Std. Error	2.536	2.979	.634
	*F(14, 2350) =33.03***	*F(14, 2350) =38.01***	*F(14, 2350) =94.54***
Mult. R-squared	0.164	0.185	0.360
Adj. R-squared	0.159	0.180	0.357

Note: Standard errors in parentheses. Significance levels denoted by * $p < .05$, ** $p < .01$

The results indicate that students who participated in FIGs attempted 0.24 fewer credits during the spring of their second year when compared to those who did not participate in a FIG ($p < .05$). Similarly, the results indicate that students who participated in a FIG passed 0.24 fewer credits during spring 2 when compared to those who did not participate in a FIG ($p < .05$). However, this estimate was not statistically different from zero. Finally, FIG participation was related to a 0.005 increase in spring term GPA, although this estimate was statistically insignificant from zero. Overall, FIG participation appears to be unrelated to engineering student academic success in the spring semester of the second year.

First-year academic success was consistently found to statistically predict second-year success in the spring semester. Hours passed in the fall semester of a student's first year was significantly positively related to both the hours attempted and passed in the student's spring semester of their second year. The GPA in the fall semester of their first year was significantly positively related to GPA in the spring semester of their second year. Hours passed in the spring semester of a student's first year was significantly positively related to hours attempted, hours passed, and GPA in the student's spring semester of their second year. The GPA in the spring semester of their first year was significantly positively related to hours attempted, hours passed, and GPA in the spring semester of their second year.

Interestingly, when first-year academic success was included in the model there was no relationship between ACT English and ACT Reading subtests and academic success in a student's spring semester of their second year. There was a relationship between ACT Math and ACT Science subtests and academic success in a student's spring semester of their second year. Students who did not have parents who graduated from college were found to attempt fewer credit hours and passed fewer credit hours in the spring semester of their second year, even when controlling for first-year academic success. In addition, these students were found to have a significantly lower second-year spring term GPA by 0.08 points when compared to students who had parents who graduated from college.

Discussion

This study attempts to provide evidence related to the following research question: For students who declared engineering majors during their first year, did participating in a FIG relate to second-year academic success (GPA, credit hours attempted, and credit hours earned)? It was hypothesized that students participating in a FIG would experience less of a decline in second-year success than students not participating in a FIG due to the structure of the FIG (Pike, 1999) and available support (Schlossberg, 1981). Alternatively, it could be hypothesized that students participating in a FIG experience a greater decline in second-year success than students not participating in a FIG due to the decline in support as they transition from freshman year to their sophomore year (Schlossberg, 1981).

Overall, the results would indicate that for engineering students at the University of Missouri, participation in a FIG did not have a relationship with second-year academic success. In particular, there was no statistically significant relationship between FIG participation and credit hours earned or GPA in the fall or spring semesters of a student's second year. There was only a statistically significant relationship between FIG participation and credit hours attempted in the spring semester of a student's second year. During a student's spring semester of their second year, the only statistically significant relationship occurred between FIG participation and credit hours attempted. The hypothesis that FIG participation leads to a smaller sophomore slump as shown by a decrease in success as measured by second year GPA is not supported by the results. The alternate hypothesis that FIG participation leads to a greater sophomore slump as shown by a decrease in success as measured by second year GPA is also not supported by the results. It could be the case that these two mechanisms cancel each other out.

The findings of this study are divergent from the existing literature that second-year students experience a transition of the same magnitude as when they started college (Pattengale, 2000). While second-year students are experiencing a transition, the students in the subpopulation do not show a negative impact on academic success as indicated by a decline in GPA. The results indicate that engineering students are adapting to the transition (Schlossberg, 1981).

In addition, the findings of this study are in opposition of the need for sophomore year programs that provide support to combat the various negative outcomes associated with the sophomore slump, including engagement and GPA (Gohn et al., 2001). However, this study did not specifically review data pertaining to engagement, student perception regarding their ability to succeed, and self-confidence. A decline in engagement during the sophomore year has a negative impact on success (e.g. Ennis-McMillian et al., 2011; Lemons & Richmond, 1987; Pattengale, 2000; Willcoxson et al., 2011). In addition, a decline in a student's perception of their ability to succeed is a factor impacting the second-year success (e.g. Lemons & Richmond, 1987; Vuong et al., 2010). Changing the perception of ability plays a role in a student's self-confidence, which may lead the student to not continue their studies (Willcoxson et al., 2011).

The findings of the study are convergent with existing literature that freshman learning communities have a positive impact on academic success (e.g. Andrade, 2007; Barefoot, 2000; Hotchkiss et al., 2006; Kuh et al., 2008; Sidle & McReynolds, Zhao & Kuh, 2004). The FIG program at the University of Missouri provides the support necessary for students to successfully transition through a specific event (Schlossberg, 1981). The engineering students who participated in a FIG attempted more credit hours, passed more credit hours, and had higher term GPAs for the fall and spring semesters.

However, the findings of this study show that students who did not declare an engineering major are more likely to experience the decline in term GPA associated with the sophomore slump than students who declared an engineering major. For non-engineering students, their term GPA declined during the fall semester of their second year of study. Interestingly, the decline in term GPA did not last for the entire second year, as their term GPA rebounded during the spring semester of their second year of study.

This finding was convergent with the literature that a student's GPA drops in their second year of study compared to their first year of study (e.g. Pattengale, 2000; Vuong et al., 2010; Wilder, 1993), which is a negative effect of the sophomore slump. It can be argued that non-engineering students are experiencing a transition of the same magnitude as when they started college (Pattengale, 2000), which is impacting their academic success as measured by term GPA.

Limitations

Limitations of the study are that all data were collected from one institution. The population included data for the four most recent academic years. The study focused on a specific subpopulation that declared one specific academic major. Students in the subpopulation tended to be male, white, and did not meet the qualifications to receive the Pell Grant. The analysis performed focused on two groups of students within the subpopulation, students who chose to participate in a FIG and those who chose not to participate in a FIG. The study did not analyze whether or not students in the subpopulation took a mathematics course as one of the co-enrolled courses as part of a FIG. The same conclusions may not be applicable to different types of institutions, different academic years, or for students who do not declare an engineering field as their intended major. In addition, the conclusions based on this specific subpopulation may not generalize to other institutions who have a more diverse student body of engineering majors. The conclusions of this study may not be appropriate to provide guidance on programming for more diverse populations.

Another limitation of the study involved the absence of an experimental control group due to the fact that students self-select to participate in a FIG. This poses a challenge for statistical analysis as the students may not have similar backgrounds before participating in the FIG and there may be bias due to students choosing to participate in a FIG. Soldner et al. (1999) determined that students participating in their institutions' freshman year experience are "virtually identical in terms of academic credentials to those choosing not to participate" (p. 121). Pike, Hansen, and Lin (2010) did a statistical analysis which showed that including instrumental variables, such as choosing a major and participating in a summer bridge program, diminished the effects of self-selection bias with respect to grades and participating in a thematic learning community. The authors conclude that "when instrumental variables were used to account for omitted variable bias due to self-selection, the effect of thematic learning community participation on Fall semester grades was not statistically significant" (Pike et al., 2010, p. 13).

The results of the study concluded that students with higher scores in ACT English, ACT Math, ACT Reading, ACT Science, and high school core GPA were more likely to self-select into a FIG at the University of Missouri. One reason the students may choose to participate in a FIG is the support provided to help them continue to be successful as they transition from high school to college (e.g. Andrade, 2007; Soldner et al., 1999; Spanierman, Soble, Mayfield, Neville, Aber, Khuri, & De La Rosa, 2013). However, the impact does not last into the second year of study. While self-selection was shown to play a role in the results, it may not have as much of an impact for students who declare different academic majors.

The number of students in the subpopulation steadily decreased from 3,166 for term one to 2,365 for term four. The data does not indicate if the 801 students left the engineering program or left the University of Missouri. One explanation was the students left the engineering program or the University of Missouri because of a change in their perception of their ability to succeed (Besterfield-Sacre et al., 1998). This change in perception may have been an indication that they were struggling and needed support. If the students would have remained enrolled in the engineering program through the four terms, the number of credit hours attempted, number of credit hours completed, and term GPAs would have been lower. The resulting regression analyses may have shown lower academic success as reported by term GPA and as such, FIG participation may have had an impact.

Lastly, it is unknown if students in the engineering program reached out for support during their sophomore year in order to help them succeed. As previously noted, the University of Missouri does not provide a formal program to support sophomore students. This information may have influenced second-year success. For example, a student may have created a mentoring relationship with an older student in order to provide support and guidance during their sophomore year.

Future Research

More research is needed to determine the effects of FIG participation on second-year success for students who have declared other academic majors. Widening the subpopulation to include all STEM majors may provide information on how FIG participation impacts their success of similar academic majors. Similarly, including non-STEM majors would allow for a broader view of FIG participation and second-year success at the University of Missouri. By focusing on a broader population of students, the results may show a relationship between participation in a FIG and second-year academic success. This information could assist institutions of higher education when making funding choices to programs that target student success.

Future research should include information regarding second-year support in order to provide a more complete picture of activities that may impact second-year success. This research could be expanded to include a qualitative assessment, such as a survey of what a student is involved with during their second year and focus on activities related to engagement (e.g. Ennis-McMillian et al., 2011; Lemons & Richmond, 1987; Pattengale, 2000; Willcoxson et al., 2011), perception of ability to succeed (e.g. Lemons & Richmond, 1987; Vuong et al., 2010), and self-confidence (Willcoxson et al., 2011) since they impact second-year success. If students are found to be taking advantage of specific programs currently not being offered at their university, then their institution may want to review the type of support offered.

Further investigation on the impact of self-selection is needed for a more diverse group of students to determine its role on student success. For example, do students who participate in a STEM major and choose a FIG have stronger academics from high school as noted by ACT component scores and high school core GPA? In addition, providing information on the overall picture of FIG participants' high school readiness may impact the type of courses for co-enrollment.

Lastly, the research findings suggest that specific populations, such as first-generation students, are not as successful during their second year of study. Widening the group to include first-generation students studying other STEM disciplines may provide further data that an institution of higher education could use to develop a program to help this specific group be successful in subsequent years. In addition, tacking these student's experiences with the FIG program may provide better insight into what students need to succeed in subsequent semesters. Students who did not have parents who graduated from college are not as successful during their second year of study as indicated by their term GPAs. These students may be missing much-needed support during their first year of study and may also benefit from programming during their second year of study.

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