



An Integrated Supplemental Program to Enhance the First-year Engineering Experience

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Abstract

Student retention in Science, Technology, Engineering, and Mathematics (STEM) disciplines, especially engineering, continues to be a challenge for higher education institutions. Engineering retention has attracted increasing attention from many stakeholders in academia including faculty, staff, administrators and students. Its significance goes beyond the benefits for the academic institutions to encompass national concerns.

At a large land-grant university in the mid-Atlantic region, between 2003 and 2012, an average thirty percent of first-year engineering students left engineering before their second year. A three-year study (2007-2010) implemented to gain insight into this attrition rate, showed that students left primarily because of lack of interest in and knowledge about engineering and the institution, disconnection from the engineering profession, low self-efficacy and academic difficulty. Underrepresented minority (URM) students left at a disproportionately higher rate than non-URM students. In an attempt to address these issues, a modified, integrated first-year orientation program, consisting of a summer bridge and in-semester curricular and co-curricular components, was implemented and funded first by a NASA Space Grant and later by NSF. The program targeted first-time, full-time (FTFT) students from URM groups, including females, and provided opportunities for students to develop strategies for academic success, explore engineering careers, and start building a professional network through a multi-level peer, faculty and alumni mentoring system.

The challenges, logistics and results of the implementation of this program are detailed in this paper. Preliminary results not only advance retention efforts within the college and university, but also have potential for a broader societal impact by increasing and diversifying the pool of potential engineering talent that is needed in the United States' workforce. Recommendations to include long-term studies of the participants are discussed.

1.0 Introduction & Background

The inability of academic institutions in the United States to attract and retain URM populations in STEM fields has long been associated with the lack of workforce diversity [1]. URM retention in STEM is an accepted urgent national priority and has attracted increasing attention from many stakeholders in academia. This focus is evident from the many successful programs that have been implemented nationally, dedicated to attracting underrepresented students to engineering and supporting them through graduation and beyond [2]. Even though many gains have been

made, a significant disparity in STEM degree attainment among the URM and non-URM populations remains. Poor retention rates have been attributed to academic and institutional isolation [3], [4], exclusion from social networks [5], unsupportive peer and family communities [6], a lack of knowledge about the academic community [7] and financial obstacles [8] and lack of interest in engineering [9], [10].

At a large land-grant university in the mid-Atlantic region, between 2003 and 2012, an average thirty percent of first-year engineering students left engineering before their second year. Several actions were taken and programs were implemented to attempt to increase first-to-second year engineering student retention, including revising placement standards for first-year math, science, and engineering courses; enhancing advising structures; and creating a “freshman engineering home” that serves as a one-stop shop where students can access tutoring, advising, space to work on team projects, and find other resources they may need. A supplemental program, called the Academy of Engineering Success (AcES), which includes a summer bridge component and an academic success and professional development course, was also developed to recruit, equip, and retain first-time, full-time (FTFT) underrepresented minority students. AcES participants are systematically and deliberately immersed in curricular and co-curricular activities as they develop strategies for academic success, explore engineering careers, and start building a professional network through a multi-level peer, faculty and alumni mentoring system. The program also provides direct pathways to academic enrichment activities such as undergraduate research. The AcES program, which utilizes high-impact educational strategies designed to support academic success and professional development while encouraging persistence, was piloted with a NASA Space Grant in 2012 and fully funded by NSF in 2016.

Research Question: Does the AcES program improve retention? This paper shares the challenges, logistics, results of the implementation of this program as well as lessons learned over the years and suggestions for improvements and future study.

2.0 Retention Philosophy and Theoretical Frameworks Utilized in Program Design

The retention philosophy of the researchers is grounded in the observation that no true one-size-fits-all model of retention exists [11]. An integrated design approach [11] was adopted in which faculty, staff, upperclassmen and industry partners collaborated on the design, development, delivery, and assessment of program contents. The strength of the program stems from the diversity and adaptability of its content. The various types of program activities work together to provide many safety nets [12] that serve the dynamic demographics of the target student population.

The design of the supplemental program is based on the high-impact educational pedagogies and student engagement strategies outlined in the literature surrounding first-year initiatives [11], [12]. It draws on the knowledge that students who are more engaged and supported are more likely to realize academic, professional, and personal development goals and ultimately persist to graduation. The primary theoretical models and principles used in the AcES program design are presented in the following sections.

Institutional Inclusion

Considering prior experiences, commitments, and personal characteristics, a student's long-term commitment to an academic institution is directly related to the involvement and experiences of the student within the institution [3], [4]. This commitment is a complex and longitudinal process [3], [4] which encompasses student engagement in the institution's academic, social, cultural and professional micro-communities. These experiences help to define the student's perception of and commitment to the institution. In addition, they affect the amount of learning and development that occur which has been shown to be proportional to the nature and amount of student involvement [5]. This involvement relates to the amount of physical and psychological energy a student invests in the institution and has both qualitative and quantitative features. To increase the likelihood of students excelling academically and personally, as well as persisting to graduation, they must be meaningfully and actively engaged within the institutional micro-communities [5]. As academic and social integration increases, so does the likelihood of student persistence [13], [14].

Faculty-Student Interactions

Academic success, personal development, and professional preparation are positively affected by substantive in-class and out-of-class faculty-student interactions [14]. More frequent interactions between faculty and students around course-related and other intellectual issues result in a significantly positive effect of the persistence of first-year students [15].

Academic Advising

To cultivate meaningful relationships with students and provide clear and coherent views of the college experience, academic advising and pre-enrollment orientation must be inextricably linked [16]. In addition to the advisors serving as critical points of cultural assimilation into the institution, research has underscored the vital role the relationships between academic advisors and students play in helping students assess academic and personal interests [16]. These relationships and associated benefits become even more pronounced when the academic advisors also serve as first-year course instructors. In such cases, they can effectively align academic advising goals with the broader professional and institutional goals [17].

Success Skills Workshops

One of the major challenges faced by first-year students, and URM students in particular, is the ability to balance their academic and personal life. For these students to succeed, they must understand both the academic and non-academic paradigm shifts associated with the transition to college. Therefore, the traditional curriculum must be augmented with co-curricular offerings geared at addressing needs in areas such as study skills, and organizational-, time-, interpersonal- and money-management skills. For instance, research literature shows that organizational skills have a stronger, positive relationship to conceptual learning test scores compared to total study time [7], [18]. Institutions then, must teach students how to organize and manage their time, as well as how to integrate their learning in order to excel [19].

3.0 Evolution of Program Structure

The AcES program comprises a summer bridge component and in-semester activities including mentorship, advising and curricular and co-curricular activities. Since the literature shows that there is no standard template for effective retention [13], models vary by institution. The main challenges for any stakeholder involved in student retention efforts are identifying, creating and utilizing best practices related to the specific demographics of the students being served. However, while AcES addresses the unique needs of the target population in this specific engineering college, it is adaptable with components that can be easily implemented in other institutions. The AcES program is a product of many model iterations with variations in parameters such as duration of the summer component, content, cohort size, curricular and admission requirements.

3.1 Enrollment and Cohort Size

Students are admitted to the FYE program in this college under three classifications: Engineering Track 1 (ENGR T1 or Track 1), Engineering Track 2 (ENGR T2 or Track 2), and Engineering Track 3 (ENGR T3 or Track 3). Engineering Track 1 students enter college-level calculus in their first semester. Students who are directly admitted to the Computer Science program also meet the ENGR T1 admission criteria. Engineering Track 2 students place into pre-calculus as their first college math course and expect to complete an engineering degree in 4.5 years. Students who start their college careers in college algebra and earned high school GPAs above 2.5 are designated as Engineering Track 3 students. These students expect to complete an engineering degree in approximately 5 years. Most engineering colleges at major institutions do not directly admit students who comprise this institution's Engineering Track 3.

The FTFT enrollment within FYE at this institution during the five-year period from 2012 to 2016 ranged from a low of 881 in 2013 to a high of 977 in 2014 and averaged 919 students per

year, with a standard deviation of 36.3. As shown in Figure 1, the distribution of Track 1, Track 2, Track 3, and Computer Science students varied slightly during this period.

Figure 1. FYE enrollment distribution by engineering track, 2012 - 2016

Track 1 students comprised an average of 35% of each cohort, with a standard deviation of 0.03, varying from a low of 32% of the 2013 cohort to a high of 39% of the 2016 cohort. Track 2 students comprised an average of 36% of each cohort, with a standard deviation of 0.02, varying from a low of 33% of the 2012 cohort to a high of 38% of the 2016 cohort; while Track 3 students comprised an average of 25% of each cohort, with a standard deviation of 0.04, varying from a low of 20% of the 2016 cohort to a high of 29% of the 2012 cohort. Computer Science students (who meet the same criteria as Track 1 students) comprised an average of 4% of each cohort, with a standard deviation of 0.01, varying from a low of 3% of each of the 2012, 2015, and 2016 cohorts to a high of 6% of the 2014 cohort.

While the overall college FTFT enrollment and distribution remained relatively stable during this period, the AcES enrollment varied greatly, both in overall enrollment and in distribution of Track 1, Track 2, and Track 3 students, as shown in Figure 2. Since its inception in 2012, cohort sizes for this program have ranged from 12 to 37 students. During this period, Track 1 students averaged 12% of the total AcES enrollment, with a standard deviation of 0.10, ranging from 0% of the 2013 cohort to 25% of the 2016 cohort. Track 2 students averaged 24% of the total AcES enrollment, with a standard deviation of 0.32, ranging from 0% of the 2016 cohort to 70% of the 2015 cohort. Track 3 students averaged 63% of the total AcES enrollment, with a standard deviation of 0.33, ranging from 16% of the 2015 cohort to 95% of the 2013 cohort.

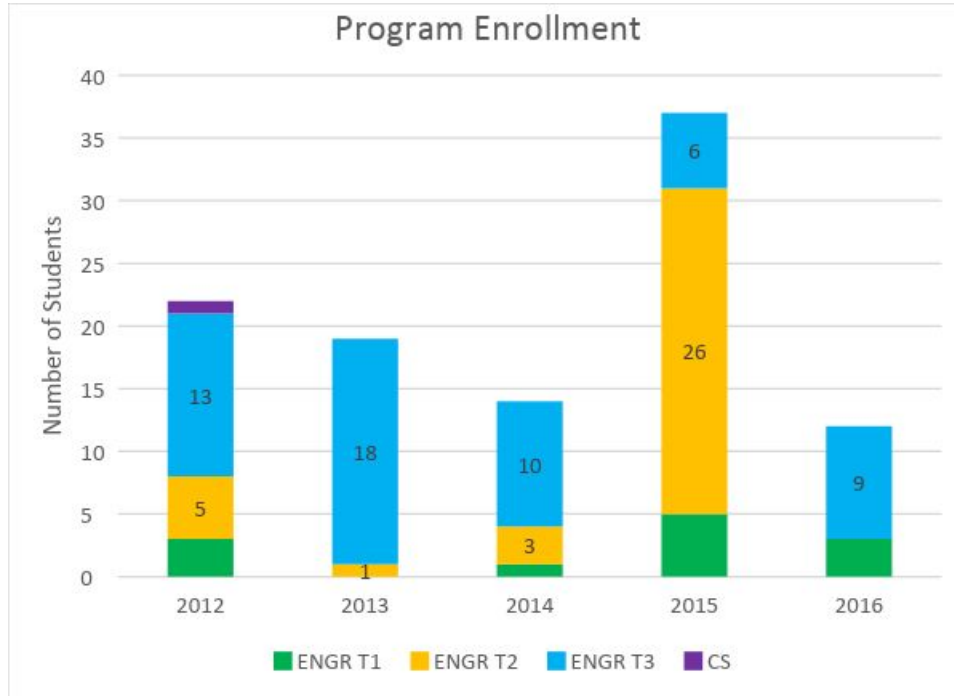


Figure 2. [Program] enrollment distribution by engineering track, 2012 - 2016

Historically, recruitment efforts for AcES focused on students who are not ready for college level calculus (Tracks 2 and 3) because preliminary studies showed that they were in the majority of students leaving engineering. In fact, in 2013, students who did not meet the Track 3 admission criteria were conditionally admitted to the engineering college in Track 3 if they completed the AcES program. Figure 2 also indicates that four of the five cohorts had a majority Track 3 students, and only the 2015 cohort had a majority of Track 2 students.

Cohorts entering in fall 2016 and later were eligible for AcES specific scholarships funded by an NSF S-STEM grant. The scholarships were awarded based on students' financial need and academic performance, and are renewable for up to five years for students maintaining a college cumulative GPA of 3.0 or higher and remaining in the engineering college.

3.2 Curricular Structure

In years 2012-2015 the AcES program consisted of a summer bridge experience, a professional development course during the fall semester of the freshman year, followed by co-curricular activities in subsequent semesters. Starting in 2016, a three-credit hour spring semester course

was added which allows for more cohort-building in an academic setting throughout their entire freshman year. The three-credit course, Engineering in History, counts towards the students' graduation as a liberal arts requirement and is taught by an AcES faculty mentor.

Summer Bridge Experience

The summer experience consists of a hands-on engineering design challenge, field-trips, work sessions, seminars, and social activities. Faculty, staff, and peer and industry mentors participate in various activities throughout the summer session. The summer bridge component varied over the years. Typically, the AcES summer bridge experience lasted one week and was held the week directly before the fall move-in day.

Initially students were housed together in a common residence hall for the summer bridge program and then moved into their selected fall residence hall at the beginning of the fall term. More recently, students have been permitted to reside in their selected fall residence hall a week before the semester started. Allowing students to move directly into their fall housing selection increases student convenience and helps them acclimate to their environment before they are joined by several other students at the start of the fall term.

The 2013 summer bridge component was extended from one week to four weeks. The four-week long program allowed students to earn six hours of college credits prior to the official start of their freshman year. While the extended bridge component provided additional time for the students to form relationships amongst themselves and faculty mentors, it proved to be financially burdensome for students and the college. Also, feedback from the students revealed that the bridge and fall terms seemed to merge into one unusually long fall term. The one-week model was reinstated in 2014.

The summer bridge program schedule also has evolved over the years into what appears to be the optimum layout for the week of activities for this institution. The students move into their residence halls on a Sunday evening and the program starts with a welcome breakfast on Monday morning. The key features of the week include: (a) work sessions and seminars geared toward introducing students to campus resources and helping students develop academic, professional and personal success skills; (b) a hands-on engineering design project competition; (c) participation in activities exploring the science and engineering behind select sports (e.g. bowling, biking) and systems (campus monorail system); (d) meet-and-greet from the university's president and engineering college deans; (e) daily social events that include a team-building challenge course run and an evening campfire cookout. An overview of the week's activities is shown in Table 1 below.

Table 1. Sample Summer Bridge Component Schedule

Bridge Component Schedule					
	Day 1	Day 2	Day 3	Day 4	Day 5
8:30 AM	Meet Program Coaches/walk to campus				
9:30 AM	Welcome Breakfast	Innovation Center Tour	Keys to Success in Engineering	Utilizing Campus Resources	Team Building Activities Off Campus
10:30 AM	Goal Setting Lecture		Getting Involved Outside of Class	Managing Time and Relationships	
11:30 AM	Introduction of Design Project		President of University Address	Project Work	
12:30 PM	Lunch	Lunch	Lunch	Lunch	Lunch
1:30 PM	Science Behind the Strike Lecture	Rocketry Activity with NASA	Tour of Transit Station	Project Work	Team Building Activities Off Campus
2:30 PM	Bowling Field Trip	Managing Money Lecture		Design Competition	
3:30 PM		Project Work			
4:30 PM	Project Work		Project Work	Pizza Social	
5:30 PM					
6:30 PM	Project Work				
7:30 PM		Dinner	Dinner	Dinner	

AcES undergraduate mentors meet the students at their various residence halls on the first morning to guide them to the engineering facilities. During the breakfast, AcES participants are introduced to faculty and peer mentors, and the administrator who oversees the first-year engineering program welcomes the students. Ice-breaker activities and student introductions are also conducted as part of the welcome breakfast. Key stakeholders such as peer and faculty mentors participate in the schedule of activities in order to start building rapport with the new students.

Throughout the week a variety of lectures (denoted in gray in Table 1) are given by faculty, members of industry, and university staff. While most meals (shown in green in Table 1) are covered by the students’ meal plans and are individual options, four meals (shown in orange in Table 1) - the welcome breakfast, Thursday pizza party, Friday lunch and final cookout/campfire - mark significant points for the students and are provided and organized by the AcES program. The design project activities (shown in blue in Table 1) provide students opportunities to work on teams to design, build, and test a product. Activities that occur outside of the engineering campus (shown in yellow in Table 1) provide opportunities for bonding, viewing engineering principles in action, and becoming familiar with the region.

The final day of the summer bridge component is a unique experience that re-emphasizes team building. The students and mentors travel to a local rural facility that incorporates nature into team building activities. They spend the day conquering obstacles and learning teamwork skills lead by trained facilitators. A campfire cookout closes the day, providing time to unwind, reflect upon the week, and look forward to the semester ahead, and highlighting the support that is

available through connections gained during the bridge week. This schedule achieves the balance of educational, professional, and social events which aid in the transition to a new chapter in the students' lives and the development of a core cohort.

Fall Professional Development Course

The fall professional development course is a two-credit hour course, open only to AcES participants. The course consists of lectures, laboratory and company site visits, design projects, and guest speakers. Lectures cover topics such as learning styles, goal setting, teamwork, professional communication, and career paths. The class visits faculty research labs on campus to learn about undergraduate research opportunities and emerging research in engineering fields. Students in the class participate in two team design projects, in which they develop their teamwork, design and professional communication skills. Guest speakers are also an important component of the first semester course, covering topics such as building a resume, career planning, professionalism, undergraduate research opportunities, emotional maturity, and demonstrations of engineering principles. Each fall semester, AcES students tour an industrial facility, such as a pharmaceutical plant or a wind turbine site.

Spring Common Course

In the spring semester of their first year the AcES participants take a second course, Engineering in History, as a cohort. This course explains how engineering advancements throughout history have shaped society. The purpose is twofold, to foster a greater interest and appreciation for engineering topics and to continue the development of the cohort. This course is currently taught by the students' faculty mentor and academic advisor, which allows for additional faculty-student contact time, thus enhancing their relationships.

At the end of each academic year all current and former AcES participants, including graduate and undergraduate student assistants, staff and faculty attend a social event. This facilitates the continuous networking and cohort-building among all stakeholders. In particular, former students in ranks above their freshman year remain engaged in the program and share their experiences with younger students.

3.3 Mentorship

In addition to faculty and peer mentors, AcES students also receive mentorship from industry professionals. Industry mentors who are alumni of the college of engineering were assigned to first semester students in the program in 2012. The students were paired with mentors based on professional and social areas of interest. Feedback from both students and the industry mentors after the first semester resulted in a change in the industry alumni mentoring program for future years. Because many of the students were unsure of a desired major or career path in their first term, the quality and nature of the mentor-mentee relationship was negatively impacted.

Subsequently, industry mentors were assigned to the students after the completion of their freshman year. At this point in their development, the students are more confident in their engineering major selection and career path and can develop a more meaningful relationship with their mentors. As students from the program begin to graduate and enter the workforce, they continue to participate as alumni mentors.

3.4 Academic Advising

AcES participants are assigned to AcES faculty as their academic advisors to increase the likelihood that students are comfortable to approach them for advice and guidance. This pairing has been successful and is recommended for similar programs.

4.0 Challenges

Challenges experienced were related to recruitment of AcES participants, as well as the cost and length of the program.

4.1 Recruitment

One significant challenge is recruiting students to participate in the AcES. The structure of the institution does not permit faculty members to directly communicate with admitted students until they arrive on campus in early summer for new student orientation. Due to the lack of access to admitted students, the organizers of the AcES program must rely on the College's enrollment management office to disseminate information and recruit students. It has been challenging in past years to ensure consistency and frequency of messaging to prospective AcES participants in a timely manner.

In earlier years of the AcES program, letters with information about the program were mailed to the home addresses of admitted students. An advantage of this communication method was that parents often accessed the letters and encouraged participation in the program. The disadvantages were physical resources of letterhead, envelopes and postage, along with the manpower to prepare the mailings. More recently, admitted students receive program information via email. The advantages of this method are the savings of time and resources, preferred communication method for current generations, and the ease of inclusion of links to other related information. One disadvantage is that the information is less likely to make it to the parents. In addition to reaching out to admitted students via mail or e-mail, information is presented at college visitation days, where interested high school students and their parents visit campus and flyers are available at locations where prospective students visit campus.

Regardless of whether information is sent by physical letter or email, invitations and messaging to the students targeted for the AcES program need to be restricted to those eligible to participate in the program. Past cohorts have included some enthusiastic Track 1 students (for whom the program was not designed) who requested admission after receiving program information from the enrollment management office and space was available.

Lessons learned from the recruiting efforts in years 2012-2016 have crafted the communication plan moving forward. The AcES faculty leader has worked with the enrollment management office to craft a series of emails to go out to admitted students in February, March, April and May. The email directs students to visit the program's website for additional information and to register for the AcES program. The faculty leader ensures the website is updated and manages the registration process. In March this faculty leader runs a calling campaign, where admitted students who meet the AcES program entrance criteria are contacted via phone and given information about the program. If spaces remain at the start of new student orientation in June, information on the program is presented during the academic sessions for parents and students.

4.2 Cost of Enrollment

Before the AcES program was fully funded, all applicants were required to pay a nominal application fee which covered administrative costs for activities such as field-trips. This cost negatively impacted the number of applicants from the target populations. This barrier to enrollment was eliminated once AcES was funded by NSF. AcES applicants can receive a waiver of the application fee in addition to program specific scholarships.

4.3 Length of Program

In the first year, 2012, the AcES program ran for one week. With anecdotal evidence of success, feedback from participants (students and faculty), and a need to find a model that best suited the institution, a four-week long model was launched in 2013.

The four-week long program allowed students to earn six hours of college credit prior to the official start of their freshman year. The students completed courses titled: *Engineering in History* and *Fundamental Competencies in Engineering*. In addition to taking the courses students also participated in a hands-on design project, planned co-curricular activities, and weekend field trips. While the extended bridge component provided additional time for the students to form relationships amongst themselves and faculty mentors, it proved to be financially burdensome for students and the college. Students paid additional tuition for the six credit hours of classes and room and board rates for summer housing. The college supplied funding for the class instructors, co-curricular activities, and student workers. Also, feedback from the students revealed that the bridge and fall terms seemed to merge into one unusually

long fall term. In 2014, the one-week model for the summer component was permanently adopted.

5.0 Results and Discussion

The AcES program is designed to enhance the first-year engineering experience of first-time, full-time (FTFT) from URM groups by providing avenues for students to develop professional and academic success skills, start building a supportive professional network, gain knowledge of available academic and non-academic resources and gain insight into the engineering profession. Gains in these areas are expected to improve student engagement and ultimately, retention. Hence, the research question: “Does this program improve retention?” is investigated. One reasonable and appropriate measure of success of the program is, therefore, the first-to-second year retention rates. Figure 3 shows the retention data for AcES participants in each engineering track (1, 2, or 3) compared to the overall retention rate of first-time, full-time (FTFT) engineering students.

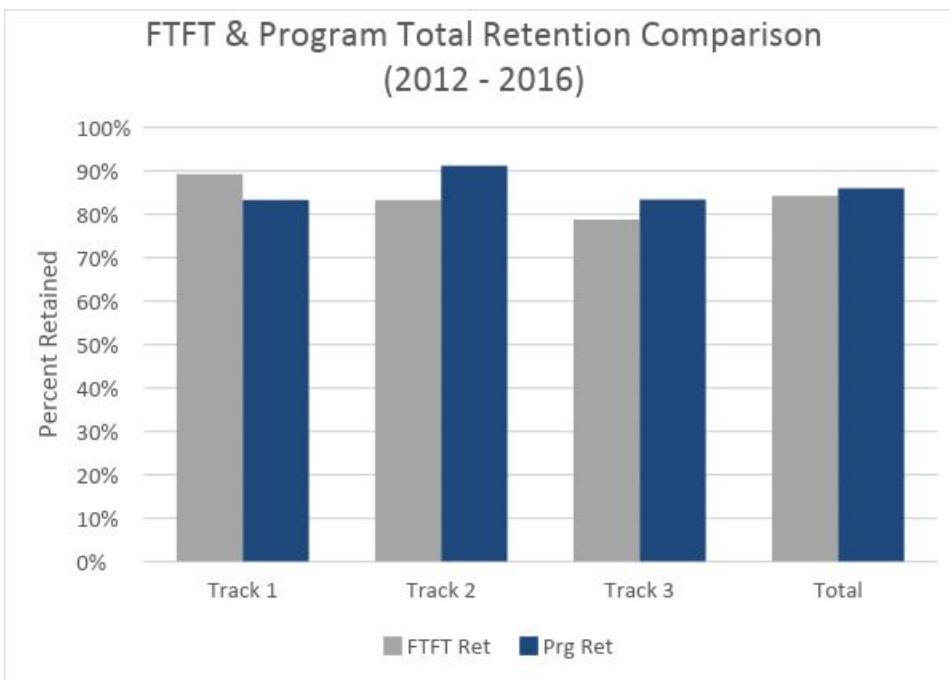


Figure 3. Comparison of retention of FTFT students in FYE (FTFT Ret) and FTFT students in the AcES program (Prg Ret) by engineering track.

Figure 3 appears to indicate that the AcES program does not improve retention of Track 1 students, but does improve retention for Track 2 students. The program neither helped nor hurt retention of Track 3 students. A closer look at the data, however, reveals that none of the apparent differences are statistically significant. While the program appears to make the biggest

difference for Track 2 students, the p-value for Track 2 was 0.07, still greater than the desired 0.05 level of significance (but closer than any other measures).

Since females and other underrepresented minority (URM) students were among the target populations for the AcES program, data regarding retention of these two populations was collected and assessed. As shown in Figure 4, of the 14 female students in the AcES program, 13 were retained to the second year, representing a 92.9% retention rate, compared to the 78.3% retention of the 92 males in the program (p-value=0.1003). Similarly, 22 of the 24 (91.7%) other URM students in the program were retained to the second year, compared to 78.8% of the 80 non-URM student that were retained to the second year (p-value = 0.0749). Because of the small number of females and other URM students in the program to date, these results, while dramatic and encouraging, are not statistically significant at the 0.05 level, but are at the 0.10 level. As the program continues and increased efforts are made to recruit more women and other URM students to the AcES program, it is expected that the results will continue to be promising.

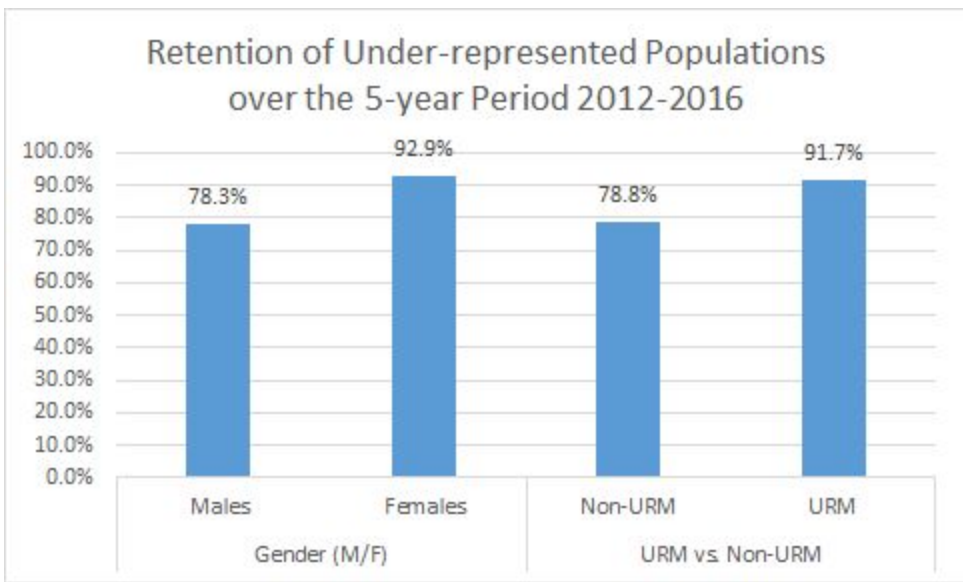


Figure 4. Retention rates of underrepresented populations in the AcES program between 2012-2016.

Comparing the retention rates of all first-time, full-time females and URMs in engineering at this institution with those who completed the AcES program, however, indicates that the program is significantly more successful in retaining URM students in engineering. As shown in Figure 5, 92.9% of FTFT females who participated in the AcES program were retained to the second year in engineering compared to only 78.6% of females who did not participate in the AcES program. Significantly (at the 0.05 level of significance), 91.7% of FTFT URM students who participated in the AcES program were retained to the second year in engineering compared to only 70.1% of FTFT URM students who did not participate in the AcES program.

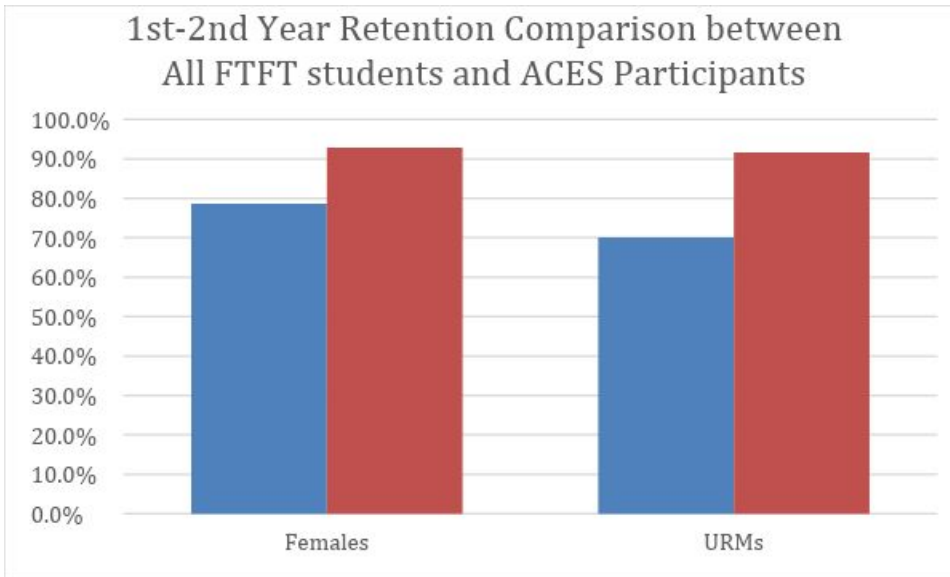


Figure 5. 1st to 2nd year retention rates of underrepresented populations in the AcES program compare to retention rates of all FTFT students in engineering at this institution (2013-2016).

By disaggregating the data by engineering track, gender, and other URM status, the results, while mostly not statistically significant, appear to indicate that this program helps retain pre-calculus-ready students, as well as females, while having little effect on students who are significantly under-prepared upon admission to the FYE program. Additionally, the AcES program appears to help retain URM students in engineering.

6.0 Conclusions and Future Work

Through participation in a combination of a summer bridge program, shared coursework, and various co-curricular activities during the first year of a challenging engineering academic program, students get a chance to form supportive professional networks, gain insight into and connect with the engineering profession, learn about institutional resources and develop success strategies. These are expected to increase retention in engineering and at the university [15]. The findings, however, provide evidence of only a small positive effect on overall retention, but do provide evidence that the AcES program is successful in retaining URM students in engineering to the second year. The AcES program utilized best practices and tools from previous studies to address the issues surrounding attrition in the engineering college (e.g. lack of knowledge about engineering and the institution, disconnection from the engineering profession and academic difficulty), and these results imply (1) the need to increase recruitment of females and other URM students who are not calculus-ready in the study, and (2) the possible interaction of factors outside the scope of this initial study or institutional control. For instance, the influence of family, a wider university social experience and a student's developmental stage may be more

influential on a student's decision to stay or leave engineering. The connections that a student makes in his or her first-year, while appreciated, may not be perceived as strong connections to the engineering profession at that early stage in college. Having a deeper knowledge and understanding of the engineering profession may not be sufficient to motivate a first-year student during periods of academic difficulties, alluding to a possible complex interplay of personal and institutional factors on the outcome of retention efforts within the first-year experience, and the need to explore the impact of the comparatively less investigated personal factors such as mindsets [20]. Other questions are being investigated and will be presented in future work relating to this project. Questions include:

- (1) What is the relationship between the program participation and the participant's academic success?
- (2) What aspects of this program most significantly impact participants' success in engineering?
- (3) How do students in this program seek to overcome the challenges in studying engineering?
- (4) What is the longitudinal impact of this program in terms of student motivation, perceptions, feelings of inclusion and outcome expectations?

Data is currently being collected from participants each term and will be analyzed using a convergent parallel mixed-methods approach in which qualitative and quantitative data will be merged to provide a comprehensive analysis of student progress and assessment.

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