

Promoting Engagement through Innovative and Pragmatic Programs

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Abstract

Adapting to a growing student enrollment within any college is difficult, particularly when you are competing against colleges/universities that receive more funding and have an evolving campus climate. As enrollment increases, colleges desire to ensure they are creating a diverse student population and building an inclusive environment within day and evening student populations to ensure they feel a part of the department/school culture. Over the past seven years enrollment has grown by 49% within the engineering programs. The following will provide insight into the structure of current programs and cover results from several initiatives. These programs were introduced to: 1) improve retention of engineering students, and 2) as a result also enhance inclusivity and diversity. Funding for the programs came from several sources including: National Science Foundation (NSF) grants, corporate funds, operational funds, and discretionary funds.

Introduction

The Citadel has a well-known and highly-ranked engineering program. For a number of years it has been rated as one of the top 25 engineering programs by US News and World Report for Universities that offer a Master's degree as the highest degree.¹ With the arrival of a new Dean in 2011, he was challenged by the President of The Citadel to grow the size of the engineering program. However, the actual school culture dominated by senior faculty was that no change was required based on the high US News and World Report ranking and continual success of graduates.

An assessment of student accession, retention, graduation, and hiring data showed many trends that are seen and being addressed by many engineering programs across the country – loss of 40 percent or more of entering freshman engineering students in the first year due to lack of high school preparation, loss of motivation based on performance in courses that were normally strengths in high school (mathematics and sciences), poor teaching, and inadequate advising or mentoring. These issues are listed along with many more in Seymour and Hewitt's book *Talking About Leaving*.² As many department heads can attest, many of the same issues exist almost 20 years after this ground breaking study.

Graduating less than 40 percent of the entering freshman in six years is seen by some programs as a badge of honor that only the strong survive – a culture that did exist at The Citadel. To address these statistics and limit the need to report them officially, many large programs have pre-engineering programs that only allow a student into an engineering discipline once the student has successfully passed basic mathematics (Calculus I and II, and sometimes Calculus III), sciences (Physics and Chemistry), and engineering science courses based on the engineering discipline (Statics for civil engineering, Circuits for electrical engineering, and Statics and

Circuits for mechanical engineering). Therefore, graduation rates for engineering majors are based on only those that make it through these Gateway courses. At The Citadel, students must declare a major before they arrive to campus for their first semester. The Registrar's Office then builds the appropriate course schedule around their major choice. So each student counts in graduation statistics from the day they enter The Citadel. Therefore, some type of plan was needed to address the issues mentioned above.

The new Dean led an inclusive team to establish a six year strategic plan (LEAD 2018) while presenting data noting areas for improvement, including retention and graduation numbers. The team established the following goals (which were a subset from the institution's strategic plan) that established the foundation for creating new initiatives to address the most pressing issues: 1) enhance student retention, 2) expand engineering student enrollment, 3) enhance the non-cadet student experience by transforming the delivery of student services, 4) expand veteran, reservists, and active duty enrollments, 5) expand diversity, and 6) recruit and retain a diverse faculty and staff. Armed with the new strategic plan, the leadership team began developing new programs and setting priorities to build a culture of inclusion and resilience to stay in engineering.

Programs

Scholarship Program

The Citadel's Department of Civil and Environmental Engineering was awarded an NSF S-STEM award with the goal of graduating 23 students with diverse backgrounds with a degree in Civil Engineering. So far 30 EXCEL-SC scholarships have been awarded totaling \$436,000. In addition, approximately \$30,000 in stipends have been awarded to 20 EXCEL-SC students for enrollment in The Citadel's College Success Institute (summer school program prior to freshman year to acclimate students to military college life while taking up to four academic credits).

The program has many elements that contribute to student success and engagement. For example, The Citadel's Academic Support Center, through funding from a Foundation Grant, provided a graduate student to serve as the Instructional Strategist and counselor to the EXCEL-SC students. They facilitated a number of related activities and provided students with valuable support in academic and life-skill matters. An alliance with The Citadel Registrar's Office allowed students to register early and be block scheduled for a majority of their courses facilitating better alignment with supplemental instruction (discussed in academic programs below) course sections while preserving an open 2-hour time slot for EXCEL-SC cohort leadership activities on Monday afternoon. The following table summarizes some of the engagement and support activities:

Table 1: Example AY Summary of Student Enrichment Activities for EXCEL-SC Program

Term	Description of Activity	Program Service
Summer 2014	Summer program to assist incoming students	College Success Inst.
Fall 2014	Assignment to designated on-campus dormitory	Learning Community
	Group sessions on college success and life skills	Instruction Strategist
	College and civil engineering student mentoring	Life Mentoring
	Multi-part diversity training	Professional Skills
	College Leadership Day, K-12 outreach (Freshman)	Community Service
	Field trip/mentoring session (construction & engr)	Professional Skills
	Field trip/mentoring session (humanitarian engr)	Professional Skills
Spring 2015	Assignment to designated on-campus dormitory	Learning Community
	Group sessions on college success and life skills	Instruction Strategist
	College and civil engineering student mentoring	Life Mentoring
	Moral and Ethical Development Educational Seminar	Professional Skills
	Multi-part diversity training	Professional Skills
	Girl Scout Engineering Outreach Event	Community Service
	Local engineering competition	Learning Community
	Field trip/ mentoring session (construction and engr)	Professional Skills
	Field trip/ mentoring session (humanitarian engr)	Professional Skills
	Field trip/ mentoring session (project management)	Professional Skills
	Field trip/ mentoring session (environmental engr)	Professional Skills
	Academic competition at student conference	Learning Community

Within the Department of Civil and Environmental Engineering, the EXCEL-SC program is piloting a number of activities that will be expanded to larger groups of student participants once procedures are modified for wide-scale implementation including: professional mentoring program, student mentoring program, student learning communities, institutional academic support structure, student leadership development, and embracing diversity through effective teamwork. Methods used to establish and support of the EXCEL-SC student cohort and learning community, as well as impacts on student learning and academic success, have been of great interest for possible replication by other departments on campus including: Electrical Engineering, Math and Computer Science, Chemistry, Biology, Physics, School of Education, and The Citadel STEM Center. The EXCEL-SC scholarship program has recruited a number of women and minority students into Civil Engineering. These students have joined The Citadel's

collegiate chapter of the Society of Women Engineers and have allowed us to start a collegiate chapter of the National Society of Black Engineers. The presence of these organizations on campus strengthens our support of women and minority students and thus strengthens the institution and their engagement.

Academic Support Programs

Revamping academic support programs has become a priority for the School of Engineering to engage and retain students in the engineering majors. In the fall 2012, the focus was on final grade reports for engineering, math, and science courses. The courses were 100 and 200 level engineering prerequisite courses with the majority of freshman and sophomore student-enrollments. It was evident there was a high trend of losing students that received a D, F, or Withdraw (DFW) as their final course grade in Mathematics and Chemistry courses.

The results shown in Figure 1 outline Math and Chemistry results with approximately 50 percent DFW rates, while Engineering was only at 13 percent DFW beginning in the fall 2012. The large gap that occurred between the subjects left many Engineering freshman and sophomore students wanting to switch out of their current major into Business, Criminal Justice or another major before taking significant engineering level courses since they could not complete their required Mathematics and Chemistry courses and maintain progress toward graduation in four years.

It should be noted that in Figure 1, the significant decrease in Chemistry DFW rates from fall 2014 to fall 2015 could be the addition of a new course, Chemistry for Engineers (CHEM 140) as well as the assignment of a gifted teacher to that course. Previously, engineering students only had the option of taking General Chemistry (CHEM 151) for their chemistry course. The fall 2015 was the first time CHEM 140 was offered for engineering majors. The Chemistry DFW rate went from 46.6 percent down to 25 percent between the semesters for engineering majors only.

To circumvent the high DFW rate shown in Mathematics and Chemistry, the School of Engineering turned toward the Supplemental Instruction (SI) program. The SI program was in place on campus; however, there was not a heavy emphasis on Science, Technology, Engineering, and Math (STEM) courses. Researchers have noted that some course instructors simply lecture but rarely help students make the connection between teaching and learning.³ The SI program is based on group sessions led twice a week for one hour by a peer leader who has already completed the course with a grade of an A or B. These group sessions include collaborative learning techniques such as: think-pair-share, jigsaw/clusters (smaller groups), learning cell, and round robin. SI leaders were assigned to target courses based on prior semester DFW rates and professor willingness to have an SI leader. Whenever possible, the SI leader sits in class and gains firsthand knowledge of the areas students are struggling with.

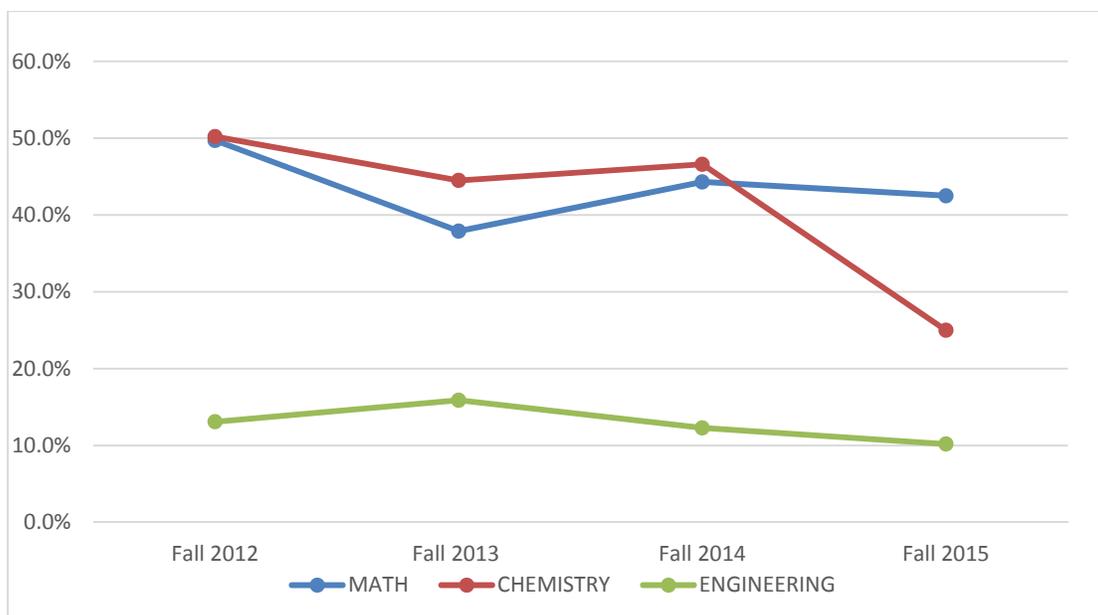


Figure 1: Percent DFW by Subject Area

In order to examine the effectiveness of the SI sessions, we examined the number of SI sessions that students attended and the final grades that they received in their course. The SI program began in fall 2012 with two SI leaders assigned to only 2 courses. As of fall 2015, the program has an average 25 SI leaders supporting multiple sections in 32 sections. SI sessions are held twice a week for a total of 13 weeks for a total of 26 possible sessions that students can attend. The number of SI sessions was broken into three categories: 1) Attended five or more sessions, 2) Attended one to four sessions, and 3) Did not attend any sessions. This break-out of number of attendances was based on showing a trend of consistency in a student actively going to SI sessions, which would be five or more times. The one to four sessions could be students going to get one or two homework questions answered and some may only attend before a test, midterm or final exam throughout the semester. We compared the students who attended five or more sessions to the students who never attended. For course grades, we looked at the percent of students who earned an A, B, or C in their course. These are the grades that are considered “passing” in many courses. We wanted to show that among the students who went to five or more SI sessions, a higher percentage of them passed their course (received an A, B, or C) than among the students who never went to an SI session.

Data collected by SI leaders provides a record account of two academic years and was compiled by the Academic Support Center. Table 2 data is solely based on the following STEM courses for those four semesters: Pre-Calculus, Calculus I, Calculus II, Calculus III, General Chemistry I and II, Statics, Dynamics, Circuits I and II, Computer Applications for Electrical Engineering, Signals & Systems, Electromagnetics, and Mechanics of Materials.

Table 2: SI Attendance and Final Course Grade

	Course grade: A, B, C	Course grade: D, F	Course grade: W
Attended 5+ SI sessions n=249	80.7%	14.9%	4.4%
Attended 1-4 SI sessions n=689	66.9%	23.5%	9.6%
Did not attend any SI sessions n=1649	67.0%	20.3%	12.7%

As shown in Table 2, 80.7 percent of the students who attended five or more SI sessions received an A, B, or C in their course, compared to only 67.0 percent of students who never attended. Additionally, students who did not attend had a higher DFW percentage of 33 percent when compared to 19.3 percent of those who attended 5 or more sessions. Therefore, there is sufficient evidence to support the claim that STEM students who regularly attend SI sessions (went to five or more sessions) have a higher pass rate than those who do not attend at all. These results definitely indicate that the SI program is meeting its goal of improving student success (more students receiving A, B, or C grades in STEM courses) which leads to greater retention of engineering students. Furthermore, both Figure 1 and Table 2 show a continual decrease in the DFW rate since the SI program was introduced to STEM courses. In the paper Using Supplemental Instruction to Increase Retention in Engineering (based on SI program at The Citadel, the change in grade from mid-term to final is compared to number of attendances.⁴ Students with more than five attendances received an average of 0.2 increase in their GPA.

The data collected for Figure 2 includes student attendance averages for fall (blue) and spring (red) semesters on the x-axis. In addition, the y-axis indicates grade point change. The dashed lines are a best fit linear trend line of each semester. Figure 2 below demonstrates that regardless of subject matter area students who attend five or more sessions show a significant improvement in grade point average (GPA) between midterm and final grades. Since session attendance has shown an increase in GPA, some faculty members are now including bonus points for students to attend SI sessions as a means to motivate them to get extra assistance in a course.

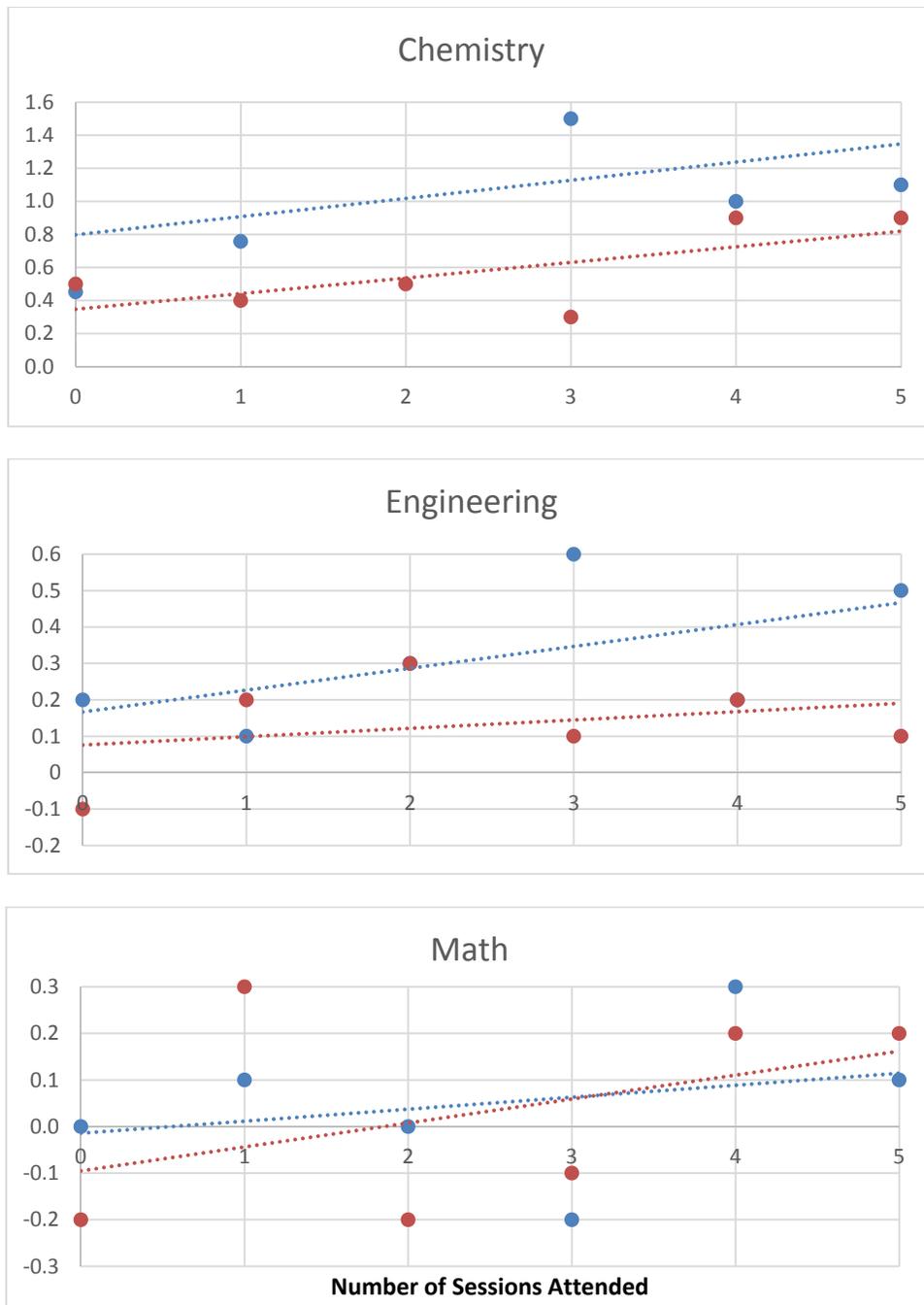


Figure 2: Grade Point Improvement by Subject Area & Number of Sessions Attended

Beginning in the fall 2014 another resource was launched called “STEM Lab” to support courses that an SI leader was not assigned directly to cover. STEM Lab is run by senior level students who have demonstrated an ability to tutor students across multiple subject areas, and also possess a cumulative GPA of a 3.0 or higher. Advertisement for STEM Lab is primarily for freshman and sophomore students; however, junior students often attend when they have difficulty on

homework problems. The STEM Lab is centrally located in the Academic Support Center¹ on campus. Figure 2 below shows a gradual increase in attendance over the past three semesters.

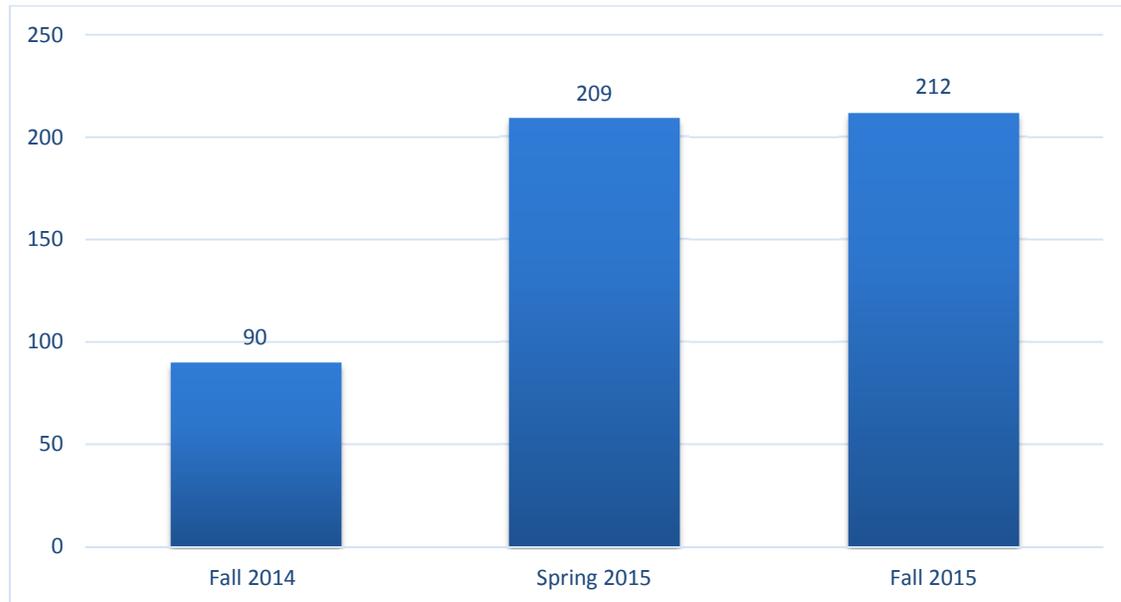


Figure 3: Overall attendance in STEM Lab by semester

The addition of STEM Lab has allowed students who may have not felt comfortable going directly to their professor an avenue of support from a peer. Also the scheduling of the STEM lab each night ensures a student has a resource four nights a week. Throughout the School of Engineering the primary mindset is for students to help other students within the engineering major. Many students received help during their first two years and often want to give back of their time to assist new engineering majors; therefore, they seek to become SI leaders.

The Citadel has run for about a dozen years The Citadel Success Institute (CSI). The program allows students to attend The Citadel the summer before their first fall semester and earn up to four credit hours of credit, usually in humanities type courses. However, the critical path for most STEM majors is being prepared to enter Calculus I during the first semester. The School of Engineering not only requested the offering of Pre-Calculus, but provided the professor for the first two years until the mathematics department could encourage one of their faculty to teach the course in the summer. When an engineering student must take Pre-Calculus as their first mathematics course and if they struggle in that mathematics course as many students do in their first semester in college, the feeling of falling so far behind is overwhelming for many. The fact that the School of Engineering is working to assist the students to graduate on time builds tremendous community. SI, STEM lab, and CSI are supported through operational funds and targeted donations specifically for SI and providing scholarships for students with need to attend CSI.

Math Review

Entering freshman STEM majors at The Citadel without AP math credit must take a Math Placement Exam (MPE) before enrolling in courses. The MPE is used as a filter to determine whether a student should be placed in Pre-calculus or Calculus 1. Students beginning their preparation for a degree in engineering at The Citadel must complete a series of math courses that include Calculus 1-3 and Differential Equations 1 for civil engineers and Differential Equations 2 for electrical and mechanical engineers. Even among those who declared engineering as their major, nearly 50% of students are placed into the Pre-calculus math course. The results of the math placement test have serious and adverse consequences for these students' timely completion of lower-division courses. It becomes quickly obvious that under-prepared students will face many challenges completing an engineering program.

To assist the transition of students from high school to the rigor of college level engineering courses, The Citadel developed a Math Review program to attract and retain more engineering students. Over the past two years, the Citadel saw over 30% of the incoming freshman class select one of the engineering majors. The challenge was to make these students successful and keep as many of them in the engineering programs as possible. During the past year, the Math Review was offered and provided as a two and a half week (10 sessions) review of Pre-Calculus designed to prepare students for different freshman math courses. An indirect benefit of the Math Review was the encouragement of good work habits early in the semester with daily work and learning where to find help. Veenstra et al. reported that success in an engineering program was highly correlated to “confidence in math and computer skills, actual math and science knowledge/skills, and career goals”.⁵

Faculty from the civil, electrical, and mechanical engineering programs conducted one-hour math review sessions in the evenings during the first 10 days of classes. All freshman engineering majors take an Introduction to Engineering course in their respective major, so classrooms were identified based on the sectioning of the Introduction to Engineering courses. The faculty member who taught the section was the lead instructor for the Math Review sessions. When an instructor could not be present in the evening, another instructor was able to substitute in for the session. Instructors worked problems or had students work problems on the board and discussed the solutions. Often when the session was over, students stayed in the rooms to continue working or work on actual math homework.

Pre-Survey Data

A survey to assess the incoming student population of 202 students was administered during the first session of the math review. Basic data was collected to gauge their study habits from high school, confidence in their math skills and knowledge, and their grade expectation of their first college level math course. Figure 4 shows that more than 73% of the incoming students coming

from high school spent three hours or less per week on math. Figure 5 shows that nearly two-thirds (64.2%) felt confident about their math abilities, using the standard Likert Scale.

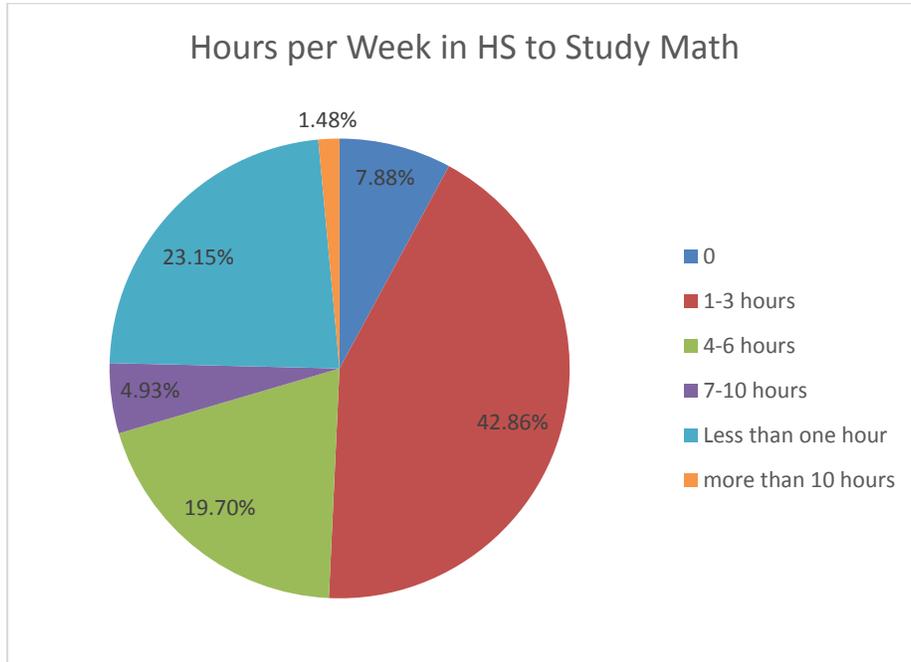


Figure 4: High School Math Study Time per Week

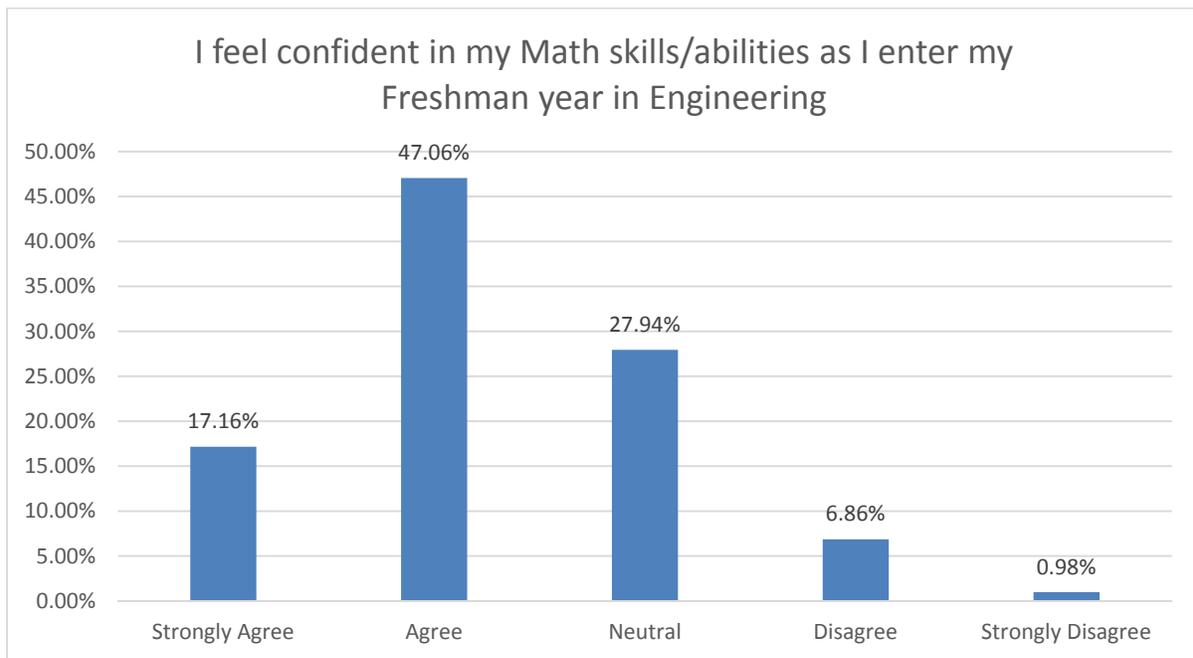


Figure 5: Incoming Engineering Freshman Math Confidence

Figures 6-7 asked the students what they thought they would earn in their math course, Pre-Calculus or Calculus, respectively. Blue indicated an A, red was a B, and green was a C. The horizontal axis compared the students' expectations with their final grades, clearly showing the reality of the rigor of college math courses.

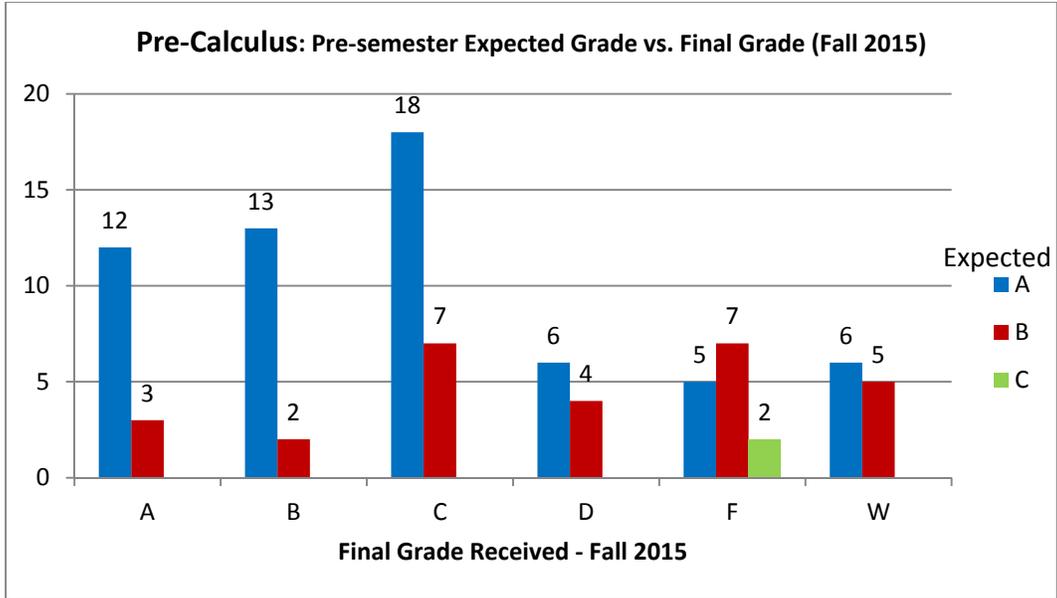


Figure 6: Pre-Calculus Expected Grade vs. Final Grade

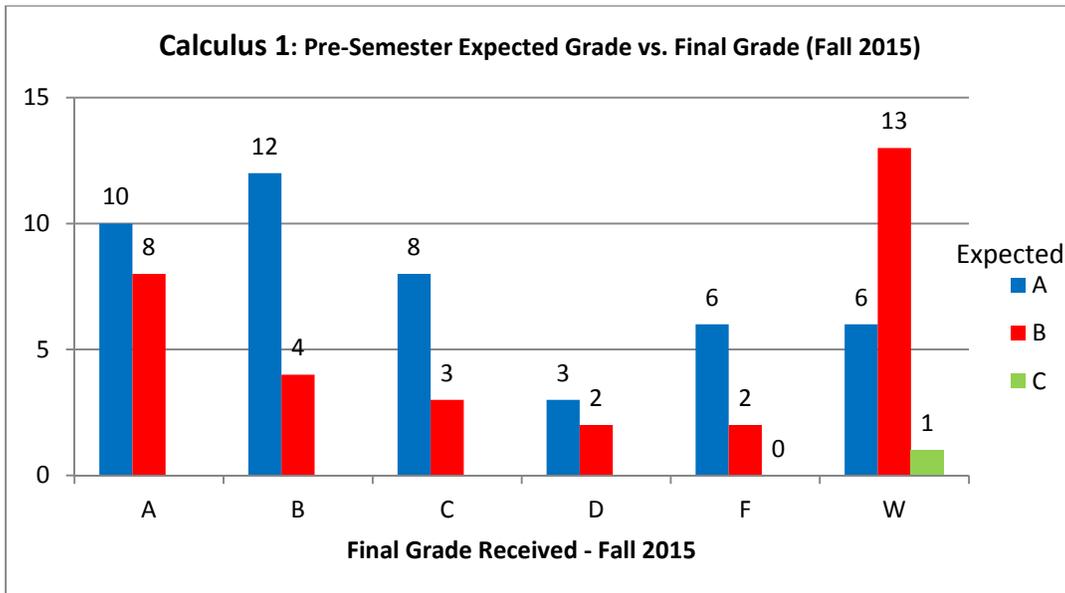


Figure 7: Calculus 1 Expected Grade vs. Final Grade

It is clear that many students entering from high school did not spend much time on math coursework, but felt very confident about their math skills. This is evident with the majority earning a much lower grade than expected and the number of course withdrawals.

Post Survey Data

The student survey data was collected after the Math Review and focused on measuring students' assessment of the Math Review. For the fall semester course, the data from approximately 195 students was included in this study. The survey shows the results from a first offering of the Math Review. The results (Figure 8) are fairly positive, all above 3 points on a 5 point Likert scale. Questions 1 and 2 are omitted on the figure since they address the number of sessions and the schedule conflicts encountered. Some limitations of the survey include limited information to other math reinforcement conducted in math and science courses as well as the introduction to engineering courses.

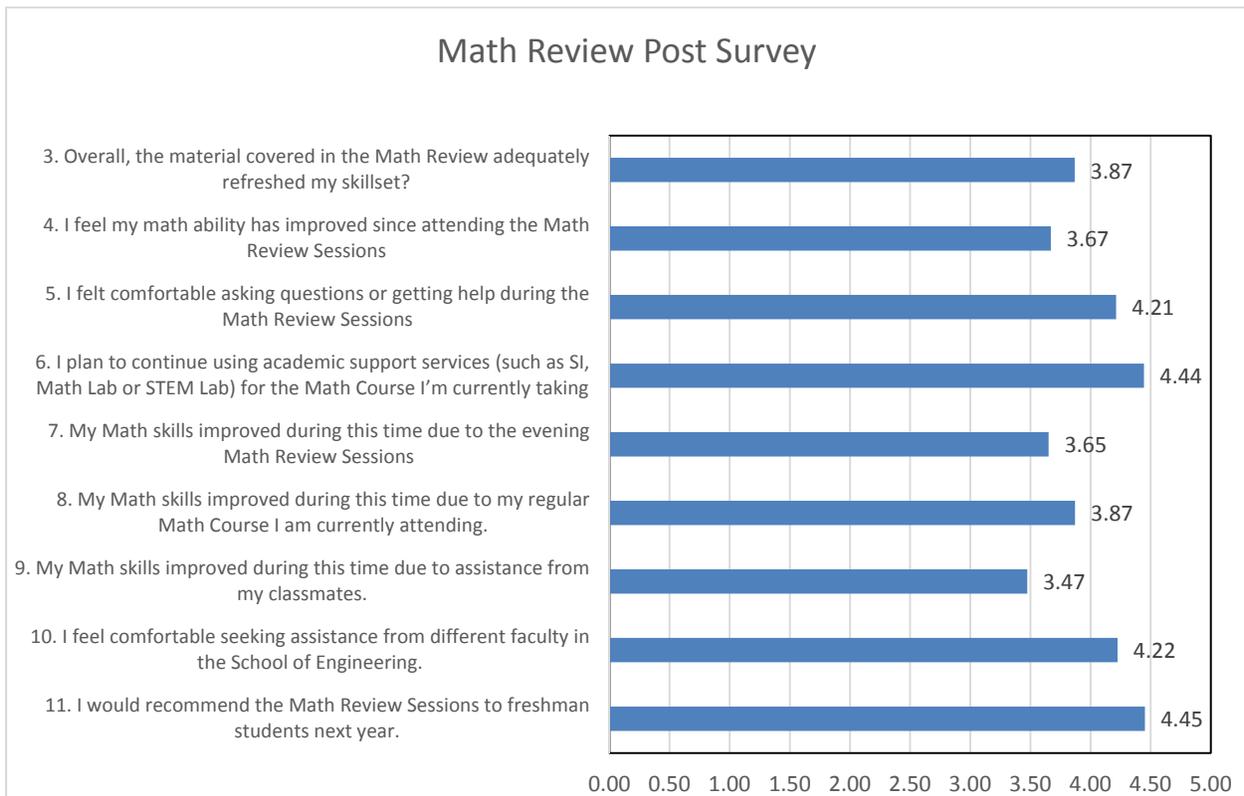


Figure 8: Math Review Post-Survey Results

To evaluate the success of the Math Review in achieving its secondary goals of increasing student awareness of tools, skills and resources needed to succeed in college, questions 5, 6, 9, and 10 inquired about external assistance. Question 9 was the lowest in this area and the lowest overall. Given the fact that the students had only been on campus for three weeks and in classes for two, they did not feel overly comfortable seeking help from their peers. However, they felt

comfortable asking for help during the sessions, using the academic support resources, and seeking assistance from the faculty. This greatly enhanced communication between freshmen and their course faculty. To enhance opportunities for the creation of academic and social integration, an approach that is of increasing popularity in colleges is the use of learning communities. Small groups of students take several classes together to enhance academic and social integration of students, and strengthen their cognitive skills.⁶

Lower rated categories included the content of the Math Review sessions which was biased more to the Pre-Calculus students, although many were beginning Calculus 1 or 2. The students who had AP credit for these higher math courses were peer tutors during the Math Reviews. It is interesting to note that overall, the highest rated question, 4.45, was to recommend the Math Review sessions to students next year.

While some aspects of the class were successful, the instructors received some feedback and are considering some revisions to the Math Review. One criticism was with the overall effectiveness of the review for some students. Some students already were quite advanced in their math and much of the math review was repetition. Some students already had some college classes, and math review sessions aimed at student success were not useful to them. There were several time conflicts with the scheduling of the Math Review sessions, such as athletes being released from practice and dinner in time to attend the sessions, and other clubs, organizations, and religious activities occurring on the same evenings.

Correlation between performance in the Pre-CALC and CALC I and attendance at the Math Review was not as strong as anticipated. Students who attended more math review sessions earned higher grades (A,B,C) in general. While correlation does not necessarily imply a cause-effect relationship, the authors believe that the applied quantitative nature of the material in the Math Review, along with an emphasis on problem solving in classes, is very useful in developing the skills needed for success in engineering course work, and the rapid connection between freshmen and faculty was incredible.

As The Citadel's School of Engineering continues to attract a large number of entering freshmen, the School must ensure early experiences for the freshmen have a positive impact to prepare them and retain them through graduation. The School of Engineering will continue to implement and improve the Math Review and contribute to the strengthening of academic skills for engineering students.

Veterans Center

The Citadel expanded the college's services by opening the Office of Military and Veterans Affairs to veterans and their families and with the opening of a new Veterans Center on Veterans Day 2014. The new programs are part of The Citadel's Strategic LEAD Plan 2018. A part of the plan identifies the need for the expansion of veteran student services and programming for those wanting to further their education at an institution that appreciates and understands their

sacrifices and educational needs. The Institution is ranked by U.S. News and World Report as the No. 3 Best College for Veterans in the South.

The Veterans Center, which is open to all campus day and evening veterans, includes: kitchen, lounge, and study room equipped with WiFi. The space is designed to foster social interaction and community-building with the use of trending technology.

The campus also has a chapter of The Student Veterans Association which was created in order to facilitate a supportive environment for veterans transitioning into a student civilian environment. The goal is to connect student veterans through social functions, intramural sports, academic support, and mentor leadership. The association was founded by veteran students, for veteran students, run by veteran students to assist veteran students.

Required Advising

ABET requires that faculty are knowledgeable about the engineering curriculum and mentor young engineers on future careers. Add the very constrained schedule at a small college where a student who misses taking a required course for follow on courses may have to wait an entire year to take the course. To decrease the likeliness a student will not enroll in a course and to improve mentoring, the school of engineering requested programming to allow each department to place advising holds each semester that can only be removed after a student is formally advised. This simple step ensures a minimum of 30 minutes each semester for every engineering major with their advisor. Setting aside required advising time helps stimulate discussion on future careers, minors, and the possibility of continuing their education through a MS and/or PhD program. These discussions assist in greater communication and meaningful connections between students and faculty, connections and dialogue that improve retention of engineering students. The addition of the programming module to Banner through operational funds made advising holds possible.

Pre-College Visits

The School of Engineering has adjusted the perspective student college visit schedule for students interested in an engineering major. Prior to fall 2014, a prospective student would shadow a single student for an overnight stay and then attend with them their Friday morning classes. The School of Engineering wanted to meet and engage engineering prospective students so they developed a separate schedule. On Fridays, the prospective engineering students now attend an interactive one hour class on what is engineering, how society benefits from engineers, and what career options are available upon graduation that is given by the dean or department heads in the school. Then, the next two hours are spent visiting lower level and upper level engineering courses versus whatever the freshman host's classes were (humanities, leadership, ROTC, physical education, etc.). Each year the number of engineering students accepting offers to attend The Citadel has increased. There is no additional cost for this activity beyond checking with engineering faculty to ensure there will be minimal disruption to their class having guests

observing. If a faculty member is administering a quiz or exam, their course is removed from the schedule for that day. Each perspective student who can see themselves sitting in that class as a sophomore or junior has a greater probability of working through the challenges to actualize their dreams which increases freshman retention.

STEM FRESH

In an effort to increase community building among engineering freshman in a unique small-college environment, the School of Engineering began hosting STEM FRESH (Freshman Retention, Enrichment, Scholastic Hub) events to bring STEM freshman students together to provide an opportunity to listen to a speaker who persevered in their career, share a meal with students from other STEM majors, and then “speed mentoring” occurs where students are exposed to leaders in STEM fields who spend 1 minute telling about themselves and their career to date and then 7 minutes responding to questions from the students. Every eight minutes the mentors rotate to the next table. In about an hour, students are exposed to 7-8 potential mentors/leaders in different STEM fields. The goal is to provide professional mentoring about STEM careers as well as expand the future possibilities that await those that persevere. The first STEM FRESH activity occurs during the first week on-campus when freshman meet with their faculty adviser. The events continue roughly once a month in the fall and spring semesters. These activities are funded through a gift from a major industrial company in the area. Expanded details on the full program have been written for the 7th First Year Engineering Experience (FYEE) Conference.⁷

Society of Women Engineers (SWE) Student Chapter

The School of Engineering started a chapter of the Society of Women Engineers in 2007. The Chapter was started with the mission to provide this small community, at the time, a place to discuss their challenges and encourage success. Since 2011, the Chapter has grown to include 99% of the women in engineering at The Citadel through an increase in meaningful outreach activities and conference attendance (mentoring, professional development). Annual activities include: a Girl Scout outreach event that brings in 25 engineers from the community to lead 120 girls in fun engineering activities, 5-10 SWE members travel to the SWE National Conference, 2-5 SWE members travel to the Region D SWE Conference, and they participate in several social function with the local professional section. Until the program could increase the number of women in engineering, engineering men would volunteer to be leaders and assist in many of the activities just mentioned. Targeted donations and the academic grant from our foundation support these activities.

National Society of Black Engineers (NSBE) Student Chapter

The Institution started an NSBE student chapter in fall 2015 to assist minority students in their transition to college through speakers, mentors (student and professional), and community outreach. The first meeting had over 20 students and this spring the chapter has non-black

members as well as non-engineering students due to the community outreach activities planned by the chapter. The students also meet with prospective students during pre-college visits mentioned above.

Senior/Freshman Dinner and Mentoring

The Department of Civil and Environmental Engineering Department sponsors an annual senior/freshman dinner in September. Unlike freshmen at most institutions, those that attend a military college have some unique challenges they are facing during the first few months of the school year. In addition to the challenges of the rigor of an engineering curriculum, the students are confronted with a significant lifestyle change that stresses them physically and mentally outside of class. The senior ASCE officers host the activity, which lets the freshman see a different side of their senior leadership than what is occurring in the dormitories. The seniors lead a group of 1-4 freshmen through a mentoring and encouragement discussion that in most cases initiates a relationship that lasts throughout the year. Freshman access to a senior mentor who has the same major provides many benefits allowing for encouragement and support and a broader sense of belonging to the larger community. Discretionary dollars support this dinner.

Active Duty Military and Veteran Lounges in Department Areas

Each department has used limited available space to establish locations for veterans and active duty military to use as a base of operations: study, eat lunch, and visit between classes. These students in concert with the department head have added refrigerators, microwaves, and coffee pots to improve the availability of comfort items as they push to complete their undergraduate degrees in three years (time line for active duty military). One department worked with the campus soft drink contractor to move one of the dispensers being removed from campus into the designated space for active duty military and veterans. This simple act had a huge effect on these students. These spaces are now being used by a number of the active duty military and veteran students who are part of the Supplemental Instructor team (mentioned previously) to tutor students throughout the day. This effort to meet basic needs and help the military student feel wanted has helped in the recruiting of additional students with a military background.

Results

As shown in Table 3, the programs that have been initiated and others reenergized have had the desired effect of improving retention (retention from entering freshmen was less than 50%, now 70%, Table 4). Once a student makes it through the gateway courses at The Citadel, 82.5% (was 74%) graduate in 4 years and 92-95% (was 89%) graduate within six years. Every faculty member knows the key to overall retention is retaining the incoming freshmen in significant numbers. However, based on poor high school preparation which is compounded by poor teaching and faculty advising, many incoming engineering freshmen lose their motivation for the hard work associated with engineering and switch out to another major or leave the institution. Add the limited number of total acceptances possible for freshmen because of constraints

associated with the dormitory beds (full residential campus for cadets) and no discipline specific targeted acceptance numbers except for women and minorities, engineering must focus on retaining every student that walks in the door and declares they are an engineering major.

Table 3. Engineering Enrollment

Student Type	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	Fall 2015
Active Duty Students	10	16	24	22	19	14	10	10
Evening Undergraduate Students	59	65	69	71	65	66	64	88
Fifth Year Students	12	18	13	17	12	16	22	11
SC Corps of Cadets	328	342	340	318	356	370	423	471
Veteran Students (Day & Evening)	2	1	12	16	20	42	43	33
Total	411	442	458	444	472	536	562	*613

Most of the programs mentioned above were initiated to help build a positive culture, build community between diverse groups of students, improve teaching as connections between students and faculty, and provide focused activities for select underrepresented groups in engineering such as females and minorities. As seen in Table 4, the retention of freshmen from fall matriculation to fall of sophomore year has been steadily climbing with the recent jump most likely a result of the STEM FRESH events added fall 2014. Figure 9, shows the improvements in female and minority numbers over the last few years as a result of all of the activities noted above, but none more important than the hiring of the first three tenure-track female faculty.

Table 4. Freshman Retention

	Fall Freshman Yr.	Fall Sophomore Yr.	% Retained
Class of 2014	116	63	54 %
Class of 2015	118	79	67 %
Class of 2016	162	101	62 %
Class of 2017	159	99	62 %
Class of 2018	175	122	70 %

During the fall 2015 total undergraduate enrollment was 2,666 day and evening students at the institution. Within that population, 613 students were enrolled in day or evening engineering programs. Upon reviewing gender and minority enrollment in the engineering programs, it was

found that over the past four years the School of Engineering has increased their female student population by almost 30 percent as shown in Figure 9 below. Beyond invigorated SWE and S-STEM activities and hiring the first female engineering faculty, The Citadel has begun the last two years to target qualified females with early acceptance and scholarships. No particular discipline is focused on, but the results are promising for engineering.

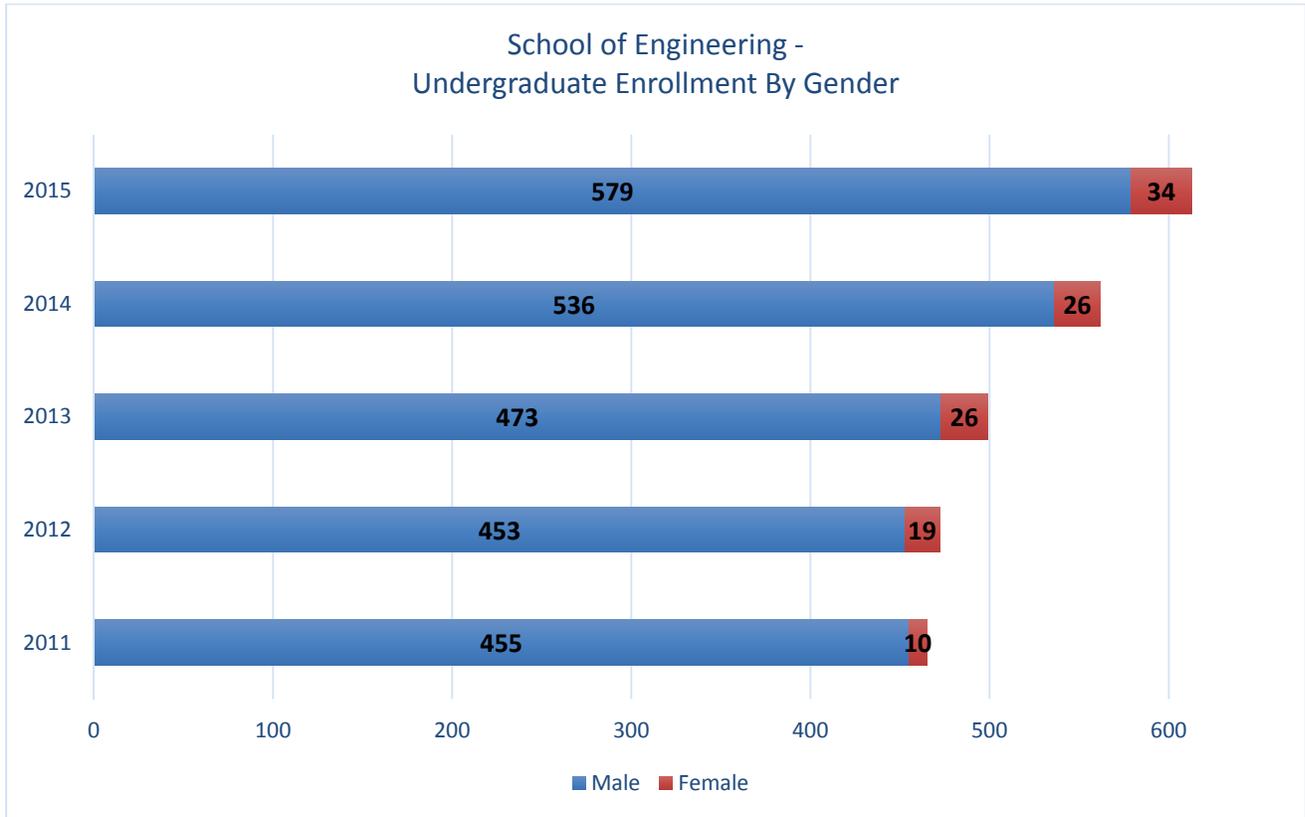


Figure 9: Female Enrollment in Engineering Programs

Figure 10 shows minority enrollment within engineering programs has improved by 3 percent within the past four years. More importantly, the overall number of engineering students has nearly doubled which means the overall number of minorities has more than doubled. Many of the minority students are part of the athletic programs and the current capital campaign is increasing the number and size of athletic scholarships. Another key program is targeting the top academic minority athletes with early acceptance and academic scholarships since keeping an athletic scholarship while trying to graduate in four years in engineering can be difficult. The academic scholarship provides a financial path after being an athlete.

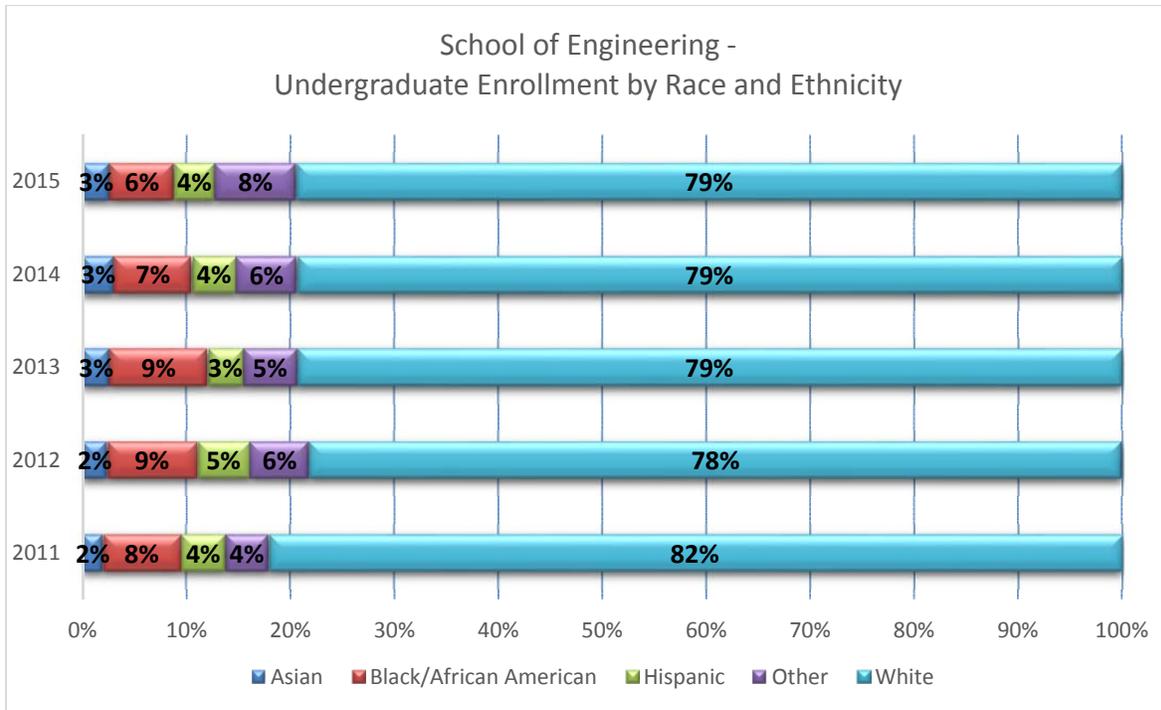


Figure 10: **Minority Enrollment in Engineering Programs**

Analysis

The plethora of new programs focused on building engagement of engineering freshmen has had a positive effect on the retention and timely graduation at The Citadel. The exact impact of every program is hard to measure since so many new programs have been initiated over the last four years to dramatically grow the number of engineering students and engineering graduates each year (now over 100). What is clear is that faculty buy-in is needed to establish and maintain quality programs that provide a helping hand to incoming freshmen. Overall retention of freshman and targeted programs for female and minorities leads to the desired diverse growing engineering student body.

Conclusions

Each student has individual needs and the faculty are obligated to seek a continuum of experiences that allows each student to maximize their potential. We hear every day that the US, and the world, needs more engineers, especially female and minority engineers. The first step is to retain those that show up as freshman wanting to be engineers. They are not always prepared, but faculty can provide the necessary assistance and mentorship to improve eventual success.

The Citadel has used a multi-prong approach that focuses on organizations, activities, assistance, and mentoring. Students seek organizations (student chapters and even departments) to be a part of and experience speakers, conferences, and community service surrounding the group's basic needs. Some students look to socialize and begin to connect with like-minded peers within

activities such as those in STEM FRESH and focused study areas and activities for our veterans and active duty military. Improving faculty teaching skills⁸⁻⁹ while ensuring each student receives face-to-face counseling/advising each semester builds the bonds and creates the environment where true passion and learning combine to lead to better prepared students. The Math Review conducted by the freshman engineering faculty displayed the reality that engineering faculty want their students to be successful in all of their courses and are there for them every step of the way. However, nothing depicts how much you care about the success of your students than to set up supplemental instruction and STEM lab opportunities for your freshman (and sophomore's). An added benefit that was not discussed in this paper is the development of the upperclassmen that are SI leaders,⁴ the leadership and mentorship skills they develop while being an SI Leader sets them apart from their counterparts. Many freshmen walk into the SI Coordinator's office at the end of their freshman year seeking information on how they can be like their SI Leader and assist others overcoming academic difficulty.

The School of Engineering at The Citadel has determined that single disparate programs do not provide the broad positive impact that is desired, but that a plethora of opportunities are needed to meet the needs of the diverse, vibrant student body that is inherently future engineers.

Path Forward

The leadership team is working on pre- and post-surveys for each incoming group to better measure the impact of each program to maximize the yield while minimizing the required activities. Tracking measures are being established for each initiative to improve the quality of the data collected to provide greater detail on the best methods to improve the quality of each activity. Additionally, each member of the team continues to search for the next best practice that could be inserted and possibly replace a current activity.

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