STEM Scholarships to Engage Exceptional Students

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Abstract

Every university works extremely hard at recruiting exceptional students. At The Citadel, the honors program has been doing that for over two decades. The honors program does not ensure a scholarship, but provides a curriculum that brings together the best students from programs across the college in honors courses (e.g., Honor 101 - English 101, Honors 103 – History 103, Honors 131 – Mathematics 131 (Calculus I), etc.). The program is supplemented with activities that strengthen a student's connection to the community through diversity, mentorship, and leadership opportunities. A number of these students receive full scholarships.

Over the past year, the honors program was expanded to include discipline specific scholars programs and small disciplinary cohorts in order to assist in the recruitment and retention of exceptional students, specifically females and minorities in STEM (Science, Technology, Engineering, Mathematics). The STEM scholars program will launch in the Fall 2017, but has potential for application at other schools.

Current honors and other program data will be presented, analyzed, and best practices summarized. These practices may be modified based on mathematics, science, and engineering departments working together to execute the first year of a STEM scholars program that integrates these program students into a single cohort.

Introduction

The honors program at The Citadel provides an exceptional learning experience for outstanding students. It has been admitting 20-24 students each year and has an 85 percent retention rate for all four years. The honors program attributes its success to a number of specific high impact practices including; 1. Assigning a honors faculty advisor; 2. A honors student association responsible for social and academic activities; 3. Maintaining cohesion by placing each cohort into nine honors courses in the first three years; 4. Providing honor seminar classes; and 5. Requiring two honors directed research projects. Together these practices provide students help in their acclimation and later academic performance. The percentile of students from each academic program participating in the honors program is shown in Table 1.

In light of the above success, a second program using a similar model was established. The School of Engineering has an S-STEM grant which is currently in its final year of administration to support scholarships for females, minorities and economically challenged students. The activities produced for this cohort have been singled out by the students and through program assessment as being impactful for student success to aid them in maintaining the grade point averages to keep their scholarships (> 2.5 for freshman; >3.0 all years after).

Table 1. Percentage of Honors Students in Each Discipline from 2006-2016[1]

Discipline	# of Students	Percentage
Computer Science	5	1%
Education	6	1%
Psychology	6	1%
Languages	11	1%
Mathematics	12	1%
Mechanical Engineering	15	2%
Chemistry	28	3%
English	29	4%
Health, Exercise, and Sports Management	30	4%
Physics	32	4%
Criminal Justice	33	4%
History	71	9%
Electrical Engineering	82	10%
Business	91	11%
Civil Engineering	99	12%
Biology	100	12%
Political Science	154	19%
Overall Total	**804**	**100%**

Note: Mechanical Engineering began in 2014.

The combination of a recent change in academic leadership (provost), and the current celebration of notable diversity milestones, provided an opportunity to combine lessons learned in the honors and S-STEM scholarship programs to increase the number of scholars, especially females and minorities in STEM fields. A look at institutional scholarships (excluding ROTC and Athletic scholarships) over the last five years (Figure 1) as well as a closer look at the data for minorities and females (Figures 2-5) support the need for change.

The STEM Scholars Program

A review of the scholarships provided, especially the full scholarships, highlighted a number of programs not attracting the same percentage of scholars as others. This led to the creation of a Provost initiated scholars program. In this program a number of scholarships will be offered to students in identified disciplines initially based on need and few based solely on merit. The primary list of scholars would be in the areas of: honors, business, cyber and intelligence, teaching, and leadership. The obvious missing cohort was STEM programs since a majority of scholarships listed in Table 1 were in biology, civil engineering, and electrical engineering, even though they are smaller programs than business, criminal justice and health, exercise, and sports management. Additionally, the biggest need was to increase the number of female and minority STEM students. Therefore, a request to include a STEM focused

scholars program was submitted and approved. Each program was directed to draft a list of cohort activities and course scheduling to prepare these students for success.

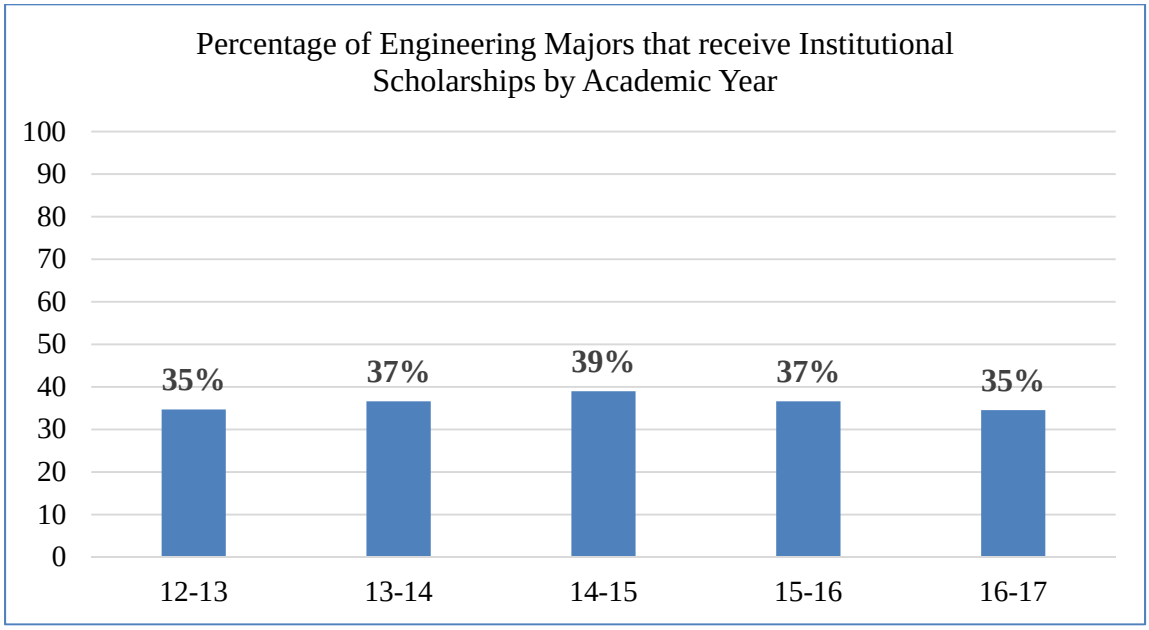

Figure 1. Institutional (excluding ROTC and Athletic) Scholarship for Engineering Majors[2]

Program Activities

The first step is to identify a STEM scholars cohort course where most of the students are assigned each of the first 4 semesters if possible, similar to the honors and the S-STEM programs. This cohort course would provide focused activities for discipline-specific groups that would not be available over all of the Calculus I or English I courses. Cohort scheduling will allow for blocking an open period on a given day for additional cohort activities that continue to build community, but more importantly, increase retention and persistence in a difficult environment during the first two years of a military school.

The Citadel's Department of Civil and Environmental Engineering was awarded an NSF S-STEM award (ExCEL-SC) in 2011 with the goal of graduating 23 students over the five years of the program with diverse backgrounds and a degree in Civil Engineering. In total, the ExCEL-SC program has funded 34 scholarship recipients at an average of $3400 per semester, per student ($541,600 in total scholarship funds). 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). This program and many others activities have had an impact on engineering's recruitment and retention of females and minorities as seen in Figures 2 and 4. According to ExCEL-SC student feedback, community structure, site visits, and peer mentoring positively impacted

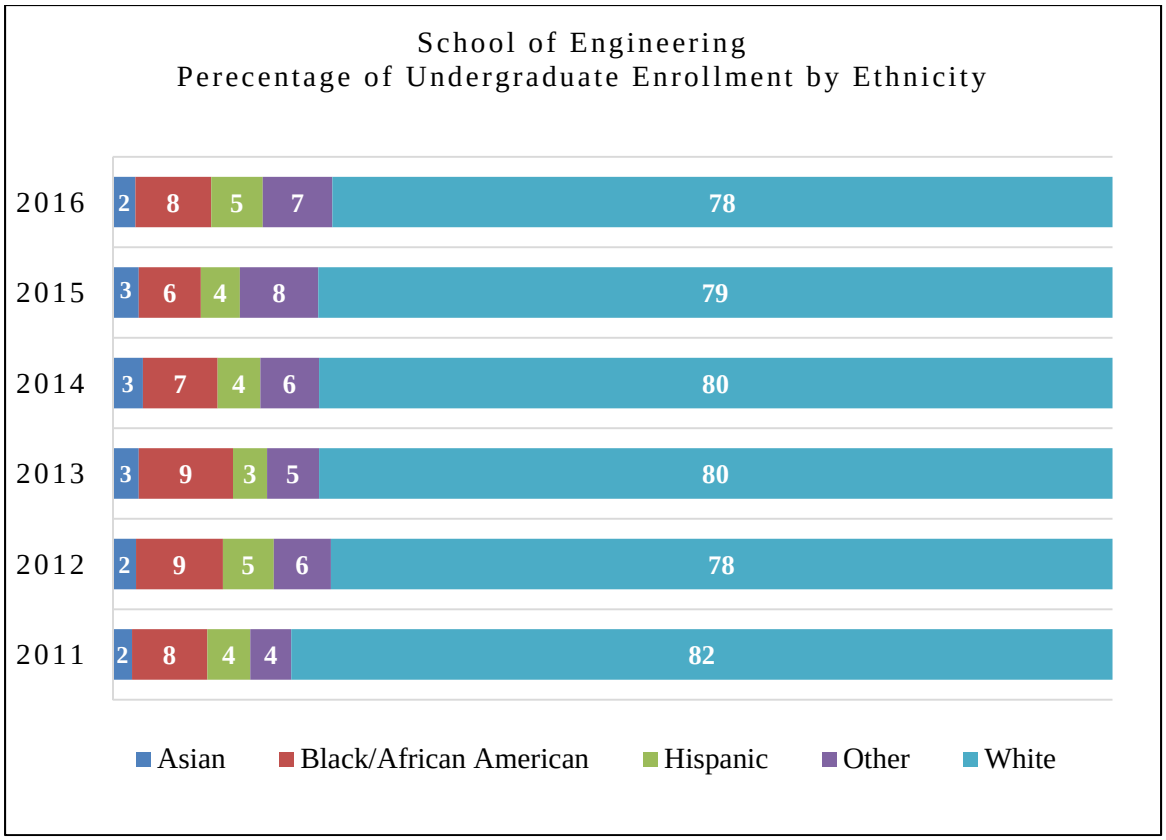

Figure 2. Undergraduate Enrollment by Race and Ethnicity[3]

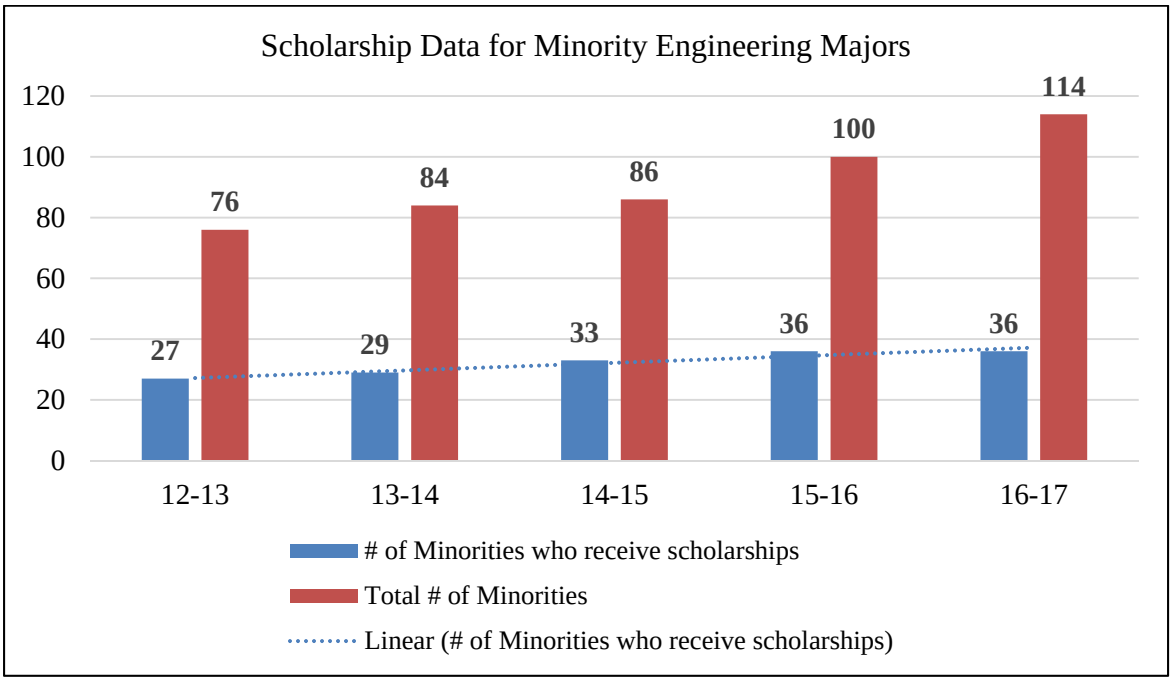

Figure 3. Scholarship Data for Minority Engineering Majors[2]

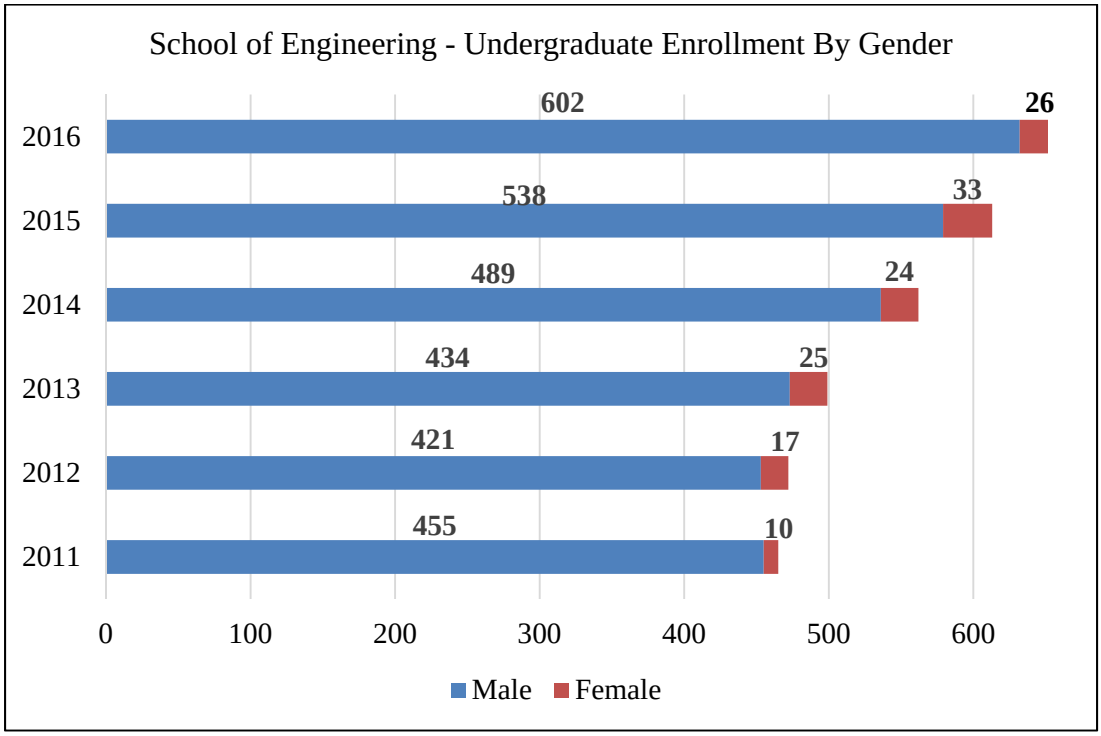

Figure 4. Undergraduate Enrollment by Gender[3]

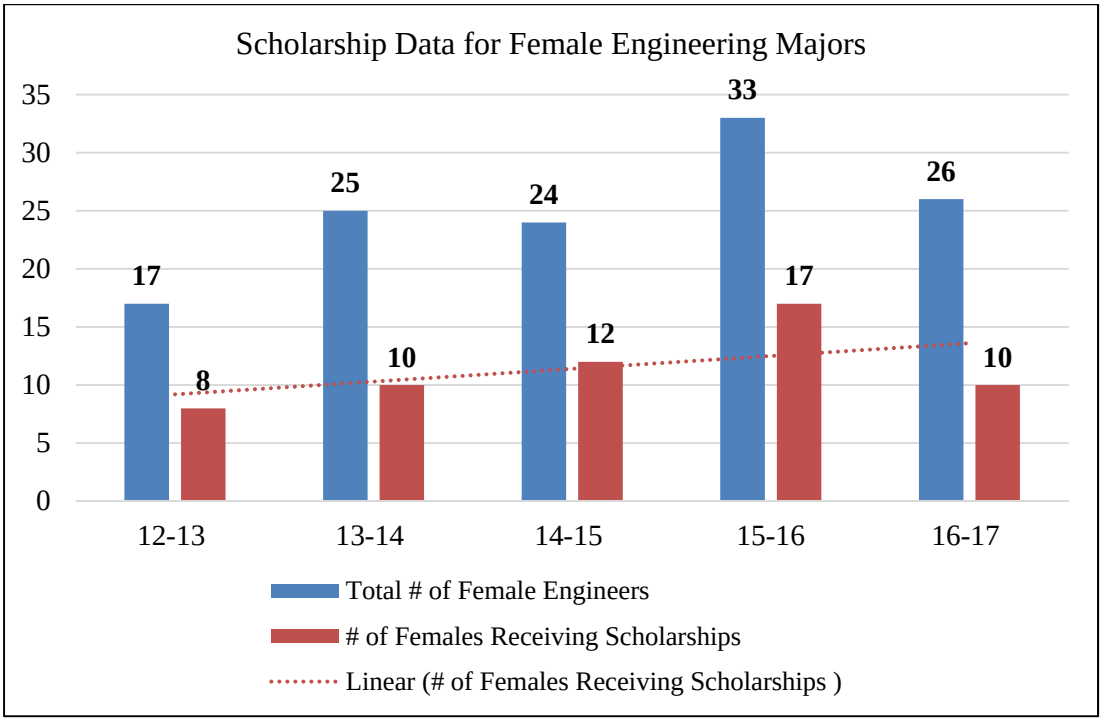

Figure 5. Scholarship Data for Female Engineering Majors[2]

their success as civil engineers. However, more needs to be done as shown in Figures 3 and 5 with the superimposed linear projection that would be expected…the main reason for pushing for a STEM Scholars program as well.

The S-STEM 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. The Instructional Strategist 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 (tutoring) supported course sections while preserving an open 2-hour time slot for EXCEL-SC cohort leadership activities on Monday afternoons. The following table summarizes some of the engagement and support activities:

Table 2: Example AY Summary of Student Enrichment Activities for EXCEL-SC Program[4]

Term	**Description of Activity**	**Program Service**
Summer	Summer program to assist incoming students	College Success Inst.
Fall	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	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	Professional Skills

Seminar	
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

The EXCEL-SC program piloted 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. As stated previously, the most impactful activities included community structure, site visits, and peer mentoring which all positively impacted their success as civil engineers. Methods used to establish and support 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. The use of many of these processes for another cohort of STEM students that are not limited to civil engineering is an additional step to wide-scale implementation.

Results and Discussion

Literature shows, overall, the number of women enrolling and graduating in STEM disciplines nationally has grown over the past twenty years. However, they remain underrepresented in

most STEM disciplines. Minority enrollments in higher education have also grown, but nationwide the minority student graduation rate remains low. For instance the black student college graduation rate is about 20 percent lower than for white students. There are many reasons for the low college graduation rate for minorities, but one of the most cited factors is money. Studies show that nearly two thirds of all blacks who drop out of college do so because of financial reasons[5,6].

The programs and processes implemented in the past have a strong impact for our under-represented populations, such as in 2012-2013, there were 17 female engineering majors with eight receiving an institutional scholarship totaling $20,804. By 2016-2017, there were huge improvements. There were 26 females engineering majors with ten receiving institutional scholarships and three of those ten awards representing full scholarship packages for a total of $86,631. This commitment to improve under-represented populations is occurring on the national front as well. In 2016, the Society of Women Engineers awarded 230 new scholarships and renewed scholarships valued at more than $750,000. This is an increase of 30 new scholarships and $200,000 in renewed scholarships from 2013 when the value was $550,000[7].

The fall 2016 offerings to potential STEM scholars with need based scholarships allowed The Citadel to offer 6 STEM scholarships to females and minorities as well as one full scholarship. Each group of students that selects one of the dates to attend The Citadel is considered for a STEM scholar's scholarship if their completed application based on SAT scores identifies them to be interviewed to become a STEM scholar. There have been sixteen STEM scholar offers (need based) and four full scholarships to potential STEM majors (once offered a student can change STEM majors while at The Citadel).

In the past all potential honors program and full scholarship recipients would be interviewed by the same team (representatives from each program) on a Friday afternoon. Each program would meet with candidates the previous Thursday evening prior to them being linked up with a freshman to attend dinner, stay overnight in the dorms, and attend classes Friday morning with their assigned freshman. For the past two years the School of Engineering has been using the time that candidates are attending class with other freshmen on Friday morning to host a one hour visit with the Dean to talk about engineering at The Citadel. Then the students are released with a schedule to sit in engineering classes, sophomore to senior level, over the next two hours to help them visualize themselves sitting in a Citadel engineering class the next year. This change to the visit schedule and all of the other retention programs began in 2012 have been extremely valuable as the School has nearly doubled its engineering enrollments (Table 3).

Since honors and full scholarship interviews are still being conducted, each program must conduct their own interviews to determine how to distribute the need based scholarships. Once the actual fall scholar's weekend approached, most programs had a plan for their

interviews. The School of Engineering began using the first hour of the two hours to view actual engineering classes on Friday morning to interview potential STEM scholars. This allowed those students being considered for the honors program or full scholarships to still be interviewed Friday afternoon.

Table 3. Undergraduate Student Growth from 2008-2016 [8]

Student Type	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17
Active Duty Students	10	16	24	22	19	14	10	13	9
Evening Undergraduate Students	59	65	69	71	65	66	64	127	95
Fifth Year Students	12	18	13	17	12	16	22	21	26
SC Corps of Cadets	328	342	340	318	356	370	423	412	497
Veteran Students	2	1	12	16	20	42	43	37	33
Total	**411**	**442**	**458**	**444**	**472**	**508**	**562**	**610**	**660**

**Note: A variation from Figures 4 & 5 due to the inclusion of Active Duty students*

The interview process was modeled after the honors interview process by engineering faculty who have been part of those interviews in the past. Faculty formed a STEM interview team to ensure a calibration of those conducting the interviews. This has also allowed the school to validate its interview results with those from the honors program as well as provides recommendations when the honors program misses interviewing a strong candidate. The interview form is provided at Appendix 1.

The Admissions Office and Financial Aid Office provides a list of candidates for each visit with strong performance in SAT or ACT, class rank, and involvement in extracurricular activities. Every effort is made to interview potential STEM scholars, but some may not visit campus that day or may change their intended major. The STEM interview team can also request to interview candidates not on the suggested Admissions Office list. It is important to note that the interview is in a group setting and some prospective students have short notice that they will interview, thus the group interview process is more relaxed than the full scholars or honors interviews.

Once candidates are identified as 'highly recommended' for the STEM Scholars program, names are forwarded to the Office of Financial Aid to verify need and any additional scholarships. A meeting is also held within a week of the candidates' visit to see if any have risen to the level of a full scholarship or honors program recommendation. If a student will receive a full scholarship, it allows the STEM Scholars team to offer another highly qualified candidate a STEM scholarship opportunity.

Provisions have been articulated that a STEM scholar can change major without losing the financial support from the STEM Scholar program as long as the student stays in a STEM major. Additionally, as the college strives for a 50% in-state and 50% out-of-state mix for the entering class, the STEM Scholars program is not constrained by this geographic target as some financial aid may be.

The success of offering need based scholarships after each visit is currently being assessed college-wide. The assessment results and lessons learned during the interview and scholarship offering process will be presented at the conference.

Conclusions

As shown, The Citadel has increased the number of females and minorities in engineering. The lessons learned from the S-STEM NSF grant and the current honors program are being used to develop 6 different discipline specific scholars programs with 16 students in each using early offers of need based scholarships as well as some merit based scholarships. The goal is to improve the number of scholars at The Citadel and the retention after they arrive. In STEM, the goal is to continue the improvement in number of female and minority scholars attending The Citadel.

Using best practices learned from other program successes, a future paper will bring results and new lessons learned as The Citadel plans to expand smaller programs (S-STEM) and apply them on a wider-scale in six different scholar programs.

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Appendix 1

Date _____

Operational Parameters: Interviews to be conducted in groups no larger than 5. Multiple interview times and multiple interviewers will be utilized as necessary. The total interview time should be less than 30 minutes.

Objective: To gain insight and gage if applicant has the necessary resilience for engineering at The Citadel and whether or not they will be an asset to our classes.

Questions:

1. Where are you from and something interesting about yourself.
2. Why have you selected engineering as a potential major?
3. What major are you considering and why?
4. What other schools are you considering and why?
5. Why are you interested in a military school and specifically why The Citadel?
6. What are you career goals?
7. What is a great engineering innovation in the past 100 years and why?

Recommendation (Name in Order of Preference, *Highly Recommend, Recommend, Don't Recommend* and why)

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