

## **Board 109: Retention-Focused, S-STEM Supported Program**

### **Dr. Melissa Lynn Morris, West Virginia University**

Melissa Morris is currently a Teaching Associate Professor for the Freshman Engineering Program, in the Benjamin M. Statler College of Engineering and Mineral Resources at West Virginia University (WVU). She graduated Summa cum Laude with a BSME in 2006, earned a MSME in 2008, and completed her doctorate in mechanical engineering in 2011, all from WVU. At WVU, she has previously served as the Undergraduate and Outreach Advisor for the Mechanical and Aerospace Engineering department and the Assistant Director of the Center for Building Energy Efficiency. She has previously taught courses such as Thermodynamics, Thermal Fluids Laboratory, and Guided Missiles Systems, as well as serving as a Senior Design Project Advisor for Mechanical Engineering Students. Her research interests include energy and thermodynamic related topics. Since 2007 she has been actively involved in recruiting and outreach for the Statler College, as part of this involvement Dr. Morris frequently makes presentations to groups of K-12 students, as well as perspective WVU students and their families.

Dr. Morris was selected as a Statler College Outstanding Teacher for 2012, the WVU Honors College John R. Williams Outstanding Teacher for 2012, and the 2012 Statler College Teacher of the Year.

### **Dr. Robin A.M Hensel, West Virginia University**

Robin A. M. Hensel, Ed.D., is the Assistant Dean for Freshman Experience in the Benjamin M. Statler College of Engineering and Mineral Resources at West Virginia University. While her doctorate is in Curriculum and Instruction, focusing on higher education teaching of STEM fields, she also holds B.S. and M.A. degrees in Mathematics. Dr. Hensel has over seven years of experience working in engineering teams and in project management and administration as a Mathematician and Computer Systems Analyst for the U. S. Department of Energy as well as more than 25 years of experience teaching mathematics, statistics, computer science, and freshman engineering courses in higher education institutions. Currently, she leads a team of faculty who are dedicated to providing first year engineering students with a high-quality, challenging, and engaging educational experience with the necessary advising, mentoring, and academic support to facilitate their transition to university life and to prepare them for success in their engineering discipline majors and future careers.

### **Mr. Joseph Dygert, West Virginia University**

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## **Retention-Focused, S-STEM Supported Program**

### **1.0 Introduction**

This work in progress paper discusses the Academy of Engineering Success (AcES), an NSF S-STEM supported program, which employs known best practices to support and retain underrepresented students in engineering through graduation. The goal is to graduate more students from underrepresented populations in an effort to ultimately diversify the engineering workforce.

This paper describes this program's unique implementation of a specific subset of retention best practices, such as facilitating (1) the development of both a feeling of institutional inclusion and engineering identity by providing opportunities for faculty-student and student-student interaction as well as major and career exploration, (2) academic support, including support for the development of broader success skills, such as time management, and (3) professional development. These opportunities are embedded in an organized, cohort-based, program consisting of: (1) a brief summer bridge program, (2) a common fall professional development course, and (3) a common spring course exploring the role of engineering in societal development. Throughout its implementation, the program faced and addressed challenges related to recruitment as well as program length and cost.

Now, in its eighth year, three with S-STEM funding, an analysis of program data provides evidence of increased retention of the targeted populations in engineering to the second year, but only a small positive effect on overall retention. Results of investigations of why students leave, lessons learned through the development, implementation, and assessment of this program, and suggested actions for continued progress in increasing retention of underrepresented populations are presented.

### **2.0 Program Description**

The AcES program was developed with an overarching goal of increasing the number of high-achieving, low income, underrepresented group (URG) students who pursue and ultimately graduate with engineering degrees. For the purposes of this paper underrepresented groups include women, first-generation students, and underrepresented minorities (URM). On average over the past eight years First Time Full Time (FTFT) enrollment is approximately 900 students each year for the engineering college at this large Mid-Atlantic institution. Students are accepted into one of three engineering tracks. Students who enter the institution ready for college calculus or higher are admitted to ENGR Track 1, students entering ready for pre-calculus are admitted to ENGR Track 2, and students entering ready for college algebra with high school GPAs of 2.5 or higher are admitted as ENGR Track 3. This program targets students in ENGR Tracks 2 and 3. Students who are admitted into ENGR Track 3 are unlikely to be directly admitted into engineering programs at other large institutions and are expected to take at least 5 years to complete their engineering degrees.

Since its inception in 2012 the AcES program has evolved based on lessons learned, feedback from students and faculty, and data analysis. The summer bridge component of the program has ranged in length from one to four weeks, cohort sizes have ranged from 12 to 37 students, and the academic program has consisted of either a one or two semester course requirement. Since 2016 the program has been supported by an NSF S-STEM grant, which provides scholarships to eligible applicants and funding to operate the program. Engineering students with at least a 3.0 high school GPA, and who have demonstrated significant financial need are eligible to apply for the S-STEM supported

scholarships. First priority is given to URG students with the greatest financial need. The scholarships are renewable for up to 5 years, and increase by an increment of \$1,000 per year for years two through four. Students who remain enrolled in the engineering college and maintain a cumulative GPA of 3.0 or higher have their scholarships renewed. Students who fail to meet the GPA requirement are given a one semester probation prior to the removal of their scholarship.

The summer bridge component consists of a one week program, which requires students to move into their campus housing one week early. The students participate in planned programming from 8:30 am to 8:00 pm for the week prior to the start of their first semester in college. The programming consists of facilitated ice-breaker and team building activities, fieldtrips, a team design project, project presentations, exposure to campus resources and faculty, hands-on activities facilitated by industry partners, and connecting with program graduate and undergraduate student mentors. During the first semester students enroll in a professional development course taught by a faculty mentor, restricted to only students in the program, maintaining the comfort aspect of a known cohort. This two credit hour professional development course covers topics such as teamwork, the engineering design process, technical communication, career exploration, study skills, emotional maturity, and goal setting and achieving. Faculty mentors visit the course and make presentations about current research projects and the class participates in tours of research facilities on campus. During the second semester their freshman year, program participants enroll in an Engineering in History Course, which fulfills a liberal arts requirement and serves to educate the students about how engineering developments throughout history have shaped society.

Beyond the completion of the first-year in the program, students are assigned industry mentors, all of which were once program participants themselves. Students remain under the academic advisement of a program faculty mentor until they meet the requirements to move into their desired engineering discipline. Annual social events including graduation celebrations for program participants are held in an effort to foster feelings of inclusion and maintain connections between faculty, student mentors, and program participants.

### **3.0 Preliminary Results**

The retention of program participants was examined over the evolution of the program, and compared to the retention rates of their peers. The retention rates were compared across engineering tracks and other demographics such as gender. An analysis of the retention data showed only a small increase in retention rate for program participants compared to the general FTFT population. Figure 1 shows a comparison of the retention rates of all program participants from the 2012 through 2016 cohorts compared to retention rates for all FTFT freshman divided by Engineering Track.

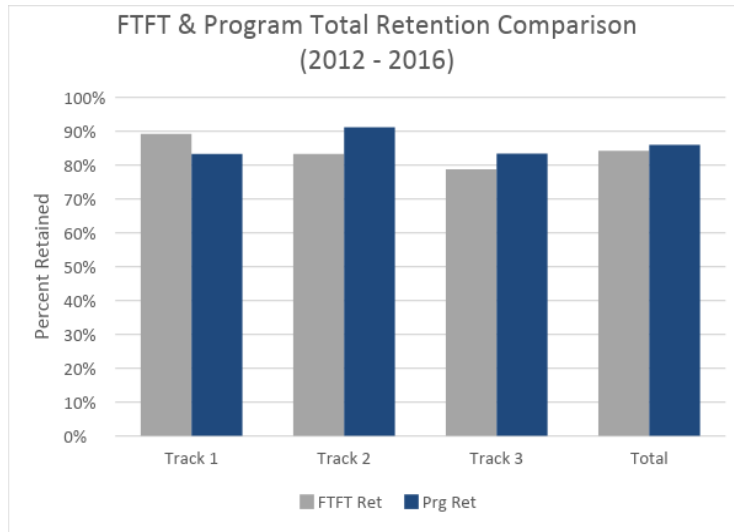


Figure 1: Retention comparison of FTFT program participants and FTFT students in the first-year engineering program by engineering track. [1]

The data displayed in Figure 1 indicates that the AcES program increases the retentions of ENGR Track 2 and ENGR Track 3 students, while appearing to be detrimental to the retention of ENGR Track 1 students.

Examining the retention of the program’s target population, URGs, showed more promising results. Figure 2 indicates that 91.7% of FTFT URG program participants were retained, compared to only 70.1% of all FTFT URG students. FTFT females were retained into the second year at a rate of 78.6%, compared to 92.9% of FTFT females who participated in the program.

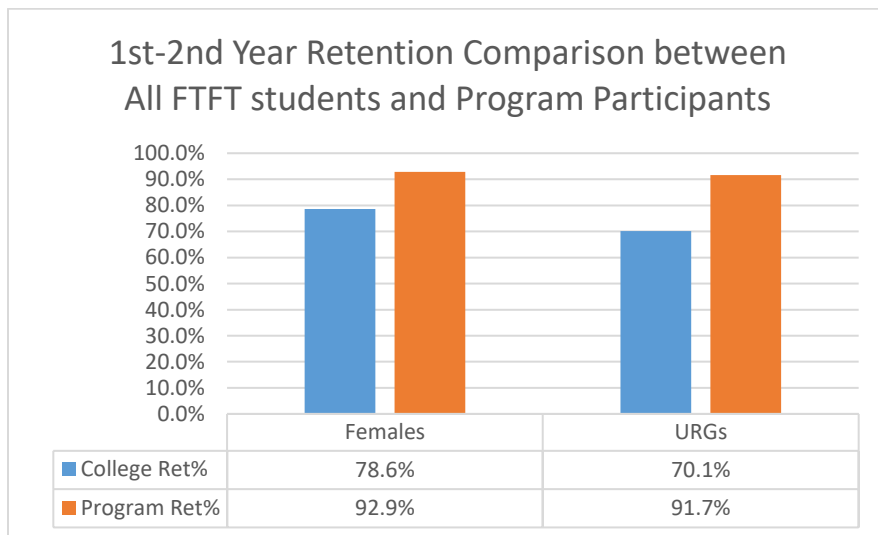


Figure 2: Retention Comparison of FTFT URGs who participated in the program compared to the retention of all FTFT URGs [1]

While the majority of the results were not statistically significant, the analysis of the retention data indicated that the AcES program has the greatest impact on the retention of ENGR Track 2 students and also increases the retention of females and URGs.

Eighteen S-STEM supported scholarships have been awarded since fall 2016. Table 1 displays the number of scholarships awarded per cohort year and the number of program participants who have maintained the scholarship as of spring 2019. From the fall 2016 cohort, of the five scholarship recipients, one student has maintained the requirements to renew the scholarship for spring 2019. From the fall 2016 cohort, two of the students who did not meet the renewal requirements are still pursuing engineering degrees and are working towards regaining their S-STEM supported scholarships, and two of the students who did not meet the renewal requirements have left the institution. From the fall 2017 cohort one of the students who did not meet the renewal requirements is still pursuing an engineering degree and working to regain his scholarship and the other student who did not meet the scholarship renewal requirements left the institution.

*Table 1: S-STEM Supported Scholarship Recipients per Year*

	<b># of S-STEM Scholarships Awarded</b>	<b># of S-STEM Scholarships Renewed for Spring 2019</b>
Fall 2016 Cohort	5	1
Fall 2017 Cohort	7	5
Fall 2018 Cohort	6	6

#### **4.0 Conclusions and Recommendations**

A program consisting of a summer bridge experience, a first semester professional development course, a second semester common course, and a structured mentor program focused on cohort formation and student success skills has the ability to increase the first to second year retention of URG students, females, and students entering an engineering major in pre-calculus.

Many lessons were learned throughout the evolution of the AcES program. After analyzing various lengths of the summer bridge component, cohort size, and curricular requirements the optimum format for this institution was established. Annual cohort sizes have been limited to 20 – 25 students, who participate in a one week summer bridge component immediately prior to the start of the fall semester, a two credit hour professional development course during their first semester and a three credit hour engineering-focused liberal arts requirement course during the second semester of their first year. Recruiting the targeted demographics was a challenge addressed over the evolution of the program. To continue the increase of URGs in the program the faculty mentor will continue to work with the college’s enrollment management office to identify admitted ENGR Track 2 and ENGR Track 3 students who identify as first-generation college students, females, or URM. These students will then be contacted with information about the AcES program both via email and telephone calls. Personal phone calls from faculty and student mentors resulted in an increase in URG participation for the 2018 cohort, compared to previous years.

The majority of program participants who have not remained in the engineering program have left due to academic difficulty. The program facilitators plan to explore additional student success resources

which could be incorporated into the program in an effort to provide students with support they need to succeed academically at a greater rate.

## **5.0 Future Work**

Scholarship recipients have been participating in one-on-one interviews and focus groups as well as taking Grit, MSLQ, and LAESE surveys since fall 2017. Data from surveys are currently being analyzed by the project researchers with the goal of finding attributes which are indicators of student success. A review of the qualitative data in the form of student responses is being analyzed to determine the most impactful program aspects and to assess the participant's feelings of belonging and inclusion.

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## **6.0 References**

[1] O. Brown, M. Morris, R. Hensel, and J. Dygert, "An Integrated Supplemental Program to Enhance the First-year Engineering Experience," ASEE Annual Conference & Exposition, Salt Lake City, UT, USA, June 2018.