**Stage II DIG Report – Diversity and Inclusion in Elon Engineering**

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**Project Overview**

 Engineering has lagged behind other disciplines in efforts to promote diversity and inclusion. When Elon launched the Bachelor of Engineering degree in 2018, Dr. Hargrove-Leak and Dr. Blackmon applied for the Stage I Diversity and Inclusion Grant (DIG) from Elon’s Center for Advancement in Teaching and Learning (CATL) to promote diversity and inclusion efforts within the program. After seeing an impact from Stage I implementation, we applied for the Stage II DIG. In Stage II, we worked to further our efforts to increase visibility of support for diversity within our program, and to build into a program more permanent features to ensure a legacy of diversity and inclusion in Elon Engineering. The following sections outline the different methods implemented to achieve this effort, along with conclusions drawn from those experiences. We look forward to continuing to promote diversity and inclusion in Elon Engineering, and to build a program that deviates from the status quo in the Engineering profession.

**Stage II Plans and Outcomes**

**New Assignments – Statics**

For Fall 2018, Dr. Hargrove-Leak developed a project that required students to consider whether or not they and their experiences are reflected in textbook problems. The textbook used in the course for a number of years primarily features white males and athletic themed images. The assignment asked students to create a problem that reflected who they are in the broadest sense. It included an example from an old edition of the textbook: a problem which required calculation of the force a high heel exerts on the ground. Unfortunately, Dr. Hargrove-Leak chose to prioritize the course content and did not leave much time to introduce the project. She distinctly remembers emphasizing that as a woman, she was excited to see the problem, but that student questions focused on logistics of when and how to submit. There was also some discussion about using existing problems as was done in the example. The quality of submissions ranged widely. It turns out that the latter point about using existing problems was the primary takeaway for many students; therefore, several copied a problem from Chegg.com without making changes or citing the source.

Considering that students were not adequately prepared for the assignment in Fall 2018, Dr. Hargrove-Leak explored different ways to introduce and conduct the project in Fall 2019. First, the example in the assignment was updated to an authentic photo of Statics in real life and handwritten work connecting the photo to course content. Second, plans were devised to ease students into the project by showing the TED talk “The Danger of a Single Story” by novelist Chimamanda Ngozi Adichie. In the talk, Ms. Adichie explains that single stories about individuals most often lead to misrepresentation. This would have been followed by a pause to flip through the pages of their textbooks while considering who is and is not represented in the images. Last, the project would have been introduced as an invitation to generate more inclusive mechanics problems, perhaps ones that reflect their identity.

You can probably tell by the tone of the previous paragraph, that a pivot occurred. As luck would have it, class was disrupted by a power outage on the day Dr. Hargrove-Leak planned to show the TED talk. After doing her best to give the students a preview of the talk without spoiling it for them, she promised to post the link on the course Moodle site as soon as power was restored and asked the students to watch it. Dr. Hargrove-Leak tried to salvage the remaining moments in class by facilitating the exercise asking students to flip through the pages of their textbooks. At first, the students flipped mindlessly, showing few signs of connecting the TED Talk to what they were being asked to do. After a few pointed questions, some students gave audible responses (verbal and non-verbal) indicating their newfound discovery that the images in the book were not fully representative of society. To drive the point home, Dr. Hargrove-Leak drew attention to herself, an African-American female engineering professional, explaining her good fortune to have risen above this one-dimensional messaging. Although Dr. Hargrove-Leak was not willing to sacrifice more class time to show the TED Talk and none of the students actually took the time to watch the TED Talk on their own, the Fall 2019 results were better. Students were more engaged in designing problems based on personal experience as evidenced by the number of questions raised about the project after class and during office hours.

In the spirit of “the third time is the charm,” Dr. Hargrove-Leak intends to try this exercise once again with the hope of actually showing the TED Talk in class. She is motivated by the data that shows introducing diversity and inclusion in the first year yields more positive responses to the project activity and shifts in perceptions. In addition, student survey responses suggest that students who were in this class think that diversity and inclusion is important, but that faculty should spend more time thinking about when and how it fits in technical engineering courses.

**New Assignments – Challenges in Engineering**

In 2018, Dr. Blackmon spent a class period solely on the importance of Diversity and Inclusion in Engineering. Students read the article “The Importance of Diversity in Engineering” by WM. A. Wolf to recognize the need for diversity in Engineering before being guided through an exercise to identify inclusive practices they could establish to promote diversity. In 2019, Dr. Blackmon did not teach this course but instead guest lectured in the two sections that were offered. The professor for each of those sections was asked to assign the Wolf article as a reading exercise for homework. The next day, Dr. Blackmon gave a short lesson on why we need diversity in engineering. Students were guided through an exercise to first identify engineering projects that would benefit from a diverse perspective, then to identify the unique perspectives they bring to the table, and finally to identify inclusive practices they could start now that would promote diversity.

The results from one section were very promising. Students were engaged and genuinely interested in the perspective being explored during that module, as evidenced from student feedback. The results from the second section were a bit lackluster. Due to time constraints, the module had to be trimmed to only 15 minutes. This haste was reflected in the feedback from students. Based on their feedback, we concluded that 1) students were being asked to do too much in one class period and many students misunderstood what was being asked of them and 2) the participants recognized more than 15 minutes should have been spent on this important issue. This feedback was part of the motivation to embed diversity and inclusion instruction in all sections of EGR 121, and is being discussed with faculty teaching the course in the Fall. Instruction on diversity and inclusion has also been included in Elon Engineering’s ABET Learning Objectives – which means whomever teaches the course moving forward must include lessons to introduce these concepts, making those lessons and conversations a permanent feature in Elon Engineering.

**Continuous Improvement – Survey**

As part of our continuous improvement efforts, students in EGR 121 and EGR 206 were surveyed in 2019 as they were in 2018. We opted to make minimal changes to the survey in order to more directly compare results from this year and last year. This was especially important for comparing responses from the Class of 2022, who were surveyed in EGR 121 in 2018 and in EGR 206 in 2019. Our results found that there was a general improvement in the perception of diversity and inclusion in Elon Engineering when comparing 2018 and 2019 responses for both the Class of 2022 and for all students in each year.

The average survey scores for all students in both EGR 121 and EGR 206 are presented in Figure 1. The 2019 responses showed that overall, students understood diversity and inclusion efforts, why we are making them, and what they can do to promote inclusivity. We also compared the histograms of responses for each question in 2018 and 2019 to find there were fewer bimodal distributions in 2019, implying a greater percentage of students have a positive perception of diversity and inclusion in Elon Engineering this year (histogram plots not included for brevity, but available upon request). We attribute this to the increased visibility of Elon Engineering’s support for diversity on our webpage and the visibility of engineering faculty and students in events promoting diversity and inclusion. We also recognize that attitudes toward diversity and inclusion in general are improving among our youth, which could have also impacted these results.



**Figure 1.** 2019 DIG Questionnaire Responses

**Institutionalization**

Our initial plan to institutionalize our efforts was, in part, to deliver a presentation to our colleagues on our findings and hold a workshop to encourage them to consider what they are doing to promote diversity and inclusion in the classroom. This was based on feedback from some students that noted a lack of being visibly inclusive is perceived as being non-inclusive. Unfortunately, by the time we completed Stage II and processed the data collected at the end of Fall 2019, the Pandemic of 2020 had forced Elon to operate virtually. In an effort to not add to an already busy and stressful agenda, we chose to postpone the workshop until the 2020/21 academic year. With that said, personal conversations in our department are happening that are yielding the same results we were hoping to get through the workshop. For example, Dr. Blackmon will be teaching Challenges in Engineering with a colleague who is getting up to speed on the diversity and inclusion module for that course, so that they can lead this conversation rather than leave it to a guest lecturer. Embedding assignments like this into our courses taught by multiple faculty members will reinforce to students the importance of diversity and inclusion in Engineering.

We also aimed to create inherently inclusive programs and cohorts. The Engineering Scholarship program has been launched, with the first class arriving in 2021. We implemented strategies to ensure the choice of finalists was equitable as part of our effort to promote diversity. The student organization oSTEM, an LGBTQIA+Ally group for STEM majors, was also launched this year. Dr. Blackmon serves as a co-advisor for the student organization. Lastly, we continued the motivational speaker series started from Dr. Hargrove-Leak’s Fund for Excellence Grant. Speaker Terri Mitchell gave a virtual workshop entitled “Accelerate Success” designed for women in STEM to “increase confidence and learn to self-promote your authentic style.” The Engineering Club agreed to sponsor this workshop in order to adopt Elon Engineering’s overall diversity and inclusion promotion efforts. Ms. Mitchell accepted our invitation to come back in Fall 2021 to deliver a 3rd workshop for the series. In summation, we have made significant advances in our effort to make promotion of diversity and inclusion a permanent component of Elon Engineering.

**Reflections of Drs. Blackmon and Hargrove-Leak**

Overall, we feel we successfully implemented Stage II of the Diversity and Inclusion Grant. In addition to keeping up our efforts from 2018 to instruct students on the importance of diversity and inclusion, we implemented new norms within our program:

1. We have built into our continuous improvement plans for accreditation a learning objective where ”Team members demonstrate inclusivity and foster an inclusive team atmosphere as evidenced through peer-evaluations, no record of unresolved conflict, and in-class observation,” which will be assessed and improved upon yearly.
2. Dr. Blackmon serves as a co-advisor for oSTEM and continues to work with them to promote their student organization through the Engineering Club and by creating hall display and bulletin board advertisements.
3. Engineering Club officers have gotten involved by not only promoting oSTEM, but by working with motivational speaker Terri Mitchel to organize a virtual workshop during the pandemic.
4. Dr. Blackmon is working with a colleague who will be teaching EGR 121 to better incorporate diversity and inclusion learning objectives into that course.
5. With support from the CAS Fund for Excellence and CATL, Drs. Hamel, Olive-Taylor, and Hargrove-Leak Hosted two workshops, one for faculty and one for students:
	1. “Examining Power, Privilege, and Critical Self-Reflection: Maintaining Inclusive Practices in STEM Classrooms” led by Dr. Dorinda Carter Andrews, Professor and Chairperson of the Department of Teacher Education at Michigan State University, September 10, 2019
	2. “Accelerate Success” led by Terri Mitchell, Retired IBM Executive and founder of *College Women in STEM: Accelerate Success,* a program to support and enable women during their education in STEM majors while preparing them for industry careers, September 26, 2019
6. Our surveys have identified weaknesses within the program that enable us to focus our efforts on issues that are most impactful to our students. With all this work, we have provided a solid foundation to ensure a diverse and inclusive Elon Engineering program.