

Redshirting in Engineering - The Engineering GoldShirt Program: Creating Engineering Capacity and Expanding Diversity

Tanya D. Ennis, Beth A. Myers, Jana B. Milford, Sarah M. Miller, Beverly Louie, Amanda S. Parker, and Cara F. Lammey

University of Colorado Boulder, Tanya.Ennis@colorado.edu, Beth.Myers@colorado.edu, Jana.Milford@colorado.edu, Sarah.M.Miller@colorado.edu, Beverly.Louie@colorado.edu, Amamda.S.Parker@colorado.edu, Cara.Lammey@colorado.edu

Abstract - The University of Colorado Boulder has pioneered an innovative, academic redshirt model to expand access to engineering. Like athletic redshirting provides a year of preparation for student athletes, academic redshirting provides a year for students to develop and prepare to succeed in challenging engineering programs. The Engineering GoldShirt Program, CU Boulder's academic redshirting program and first of its kind in the country, supports motivated and talented students who need additional math, science, or humanities preparation before diving into the full undergraduate engineering curriculum. For this five-year curriculum, students are directly admitted into the College of Engineering and Applied Science. The GoldShirt team provides mentoring, academic, and social support for all Engineering GoldShirt students. The goal of this workshop is to educate others about this program and equip them with information necessary to create a redshirt program at their institution, with a focus on the interview and selection process, the curricular components, and the unique design of the summer bridge program. Additional critical program features will be discussed. We encourage deans, faculty and staff from all engineering institutions interested in broadening participation of underrepresented groups to attend this workshop.

Index Terms - Access Pathway, Broadening Participation, Diversity, RedShirt, Minorities in Engineering.

ENGINEERING GOLDSHIRT PROGRAM WORKSHOP

Since implementing our redshirt program in 2009, access to our College has grown significantly: In the fall 2015 semester, 18% of first-year students were Underrepresented Minority (URM) - up from 9% in 2009. The first graduating GoldShirt student graduated Summa Cum Laude in 4.5 years in Civil Engineering and won the College's Student Service Award at graduation. Although this result is uncommon, it demonstrates the possibilities for students who need a little assistance to get them on the right track. Since the program's inception in 2009, twenty-eight students have graduated and most have already committed to job offers (one student is

completing a master's degree in Computer Science). It is projected that the number of graduates from the Engineering GoldShirt Program will continue to increase as the program scales and continues to improve.

The Engineering GoldShirt Program's components were designed based on engineering education research and best practices. As part of the program's implementation, the Engineering GoldShirt Program team continues to use a research-practice-research model to improve the program's innovative approach to diversifying and broadening access to engineering. Findings from the research are seriously considered when modifying the implementation of the Program's components.

Workshop facilitators will present and elaborate on core components of the current Engineering GoldShirt Program. Facilitators will share best practices of the Engineering GoldShirt Program in a presentation that incorporates active learning strategies that we often use when working with GoldShirt students. These best practices could be implemented at any university and require a willingness and ability to make changes at the institution. These components include the following:

- Interview and Selection Process: Instead of receiving students from Admissions for admittance blindly, we've created a partnership with Admissions and the College of Engineering and Applied Science to conduct an interview and selection process for GoldShirt students. The interview process begins before students arrive on campus for the interview day, as students are required to provide a personal statement before arriving. The College of Engineering and Applied Science faculty and staff conduct one-on-one interviews and rate students using the Program's designed rubric. Several group activities are conducted, and GoldShirt candidates are evaluated throughout the day by current GoldShirt students and staff. The GoldShirt team also conducts a parent workshop for parents and family members who attend the day with candidates. Group active

Workshop M8

learning activities will provide workshop participants with first-hand experience with this process.

- Curriculum Development and Academic Support - The GoldShirt Program designed and created courses to improve students' skills in mathematics, physics, and self-management and leadership. Pre-Calculus for Engineers and Engineering Explorations through Physics courses are designed to build a strong foundation in preparation for the engineering curriculum. Participants will explore concepts as GoldShirt students do, and will review exemplars of students' math and science academic profile as well as self-management and leadership tools.
- Summer Bridge Program - After several iterations of the two-week GoldShirt Summer Bridge implementation, we have discovered what works well for GoldShirt students. The Summer Bridge plan focuses on developing skills in the areas that engineering education research recommends for student success. These focus areas include spatial visualization, engineering design, and success in mathematics. Other activities include community building and bonding, professional networking events, seminars on academic and professional development, industry tours, community service, campus awareness and engineering knowledge, identity and sense of belonging. Although Summer Bridge is not a unique concept to the University of Colorado Boulder, the GoldShirt Summer Bridge Program is unique. Every university could create their own summer bridge program based on their own unique goals, objectives and community resources. Facilitators will lead fun and engaging activities taken from the GoldShirt Summer Bridge Program.
- Residential Life: The GoldShirt living and learning community fosters a spirit of community as well as academic success. GoldShirt students are required to live in the residence hall on campus for two years. Several GoldShirt students in their second year serve as near peer mentors to first year students and also live in the same residence hall. Various events are hosted each year including community building and social/cultural events, faculty and industry networking events, and free academic tutoring in the residence hall (provided free of charge). Participants will encounter some of these fun activities in the workshop.

Additional information will be provided on these other components:

- Scholarship and Financial Support - How are students incentivized through scholarships and financial awards?

- Advising and Navigation - How does advising work for the Engineering GoldShirt Program? What does navigation mean and how is it different from advising?
- Near Peer Mentoring - How does the GoldShirt near peer mentor differ from a regular mentor? How is leadership developed through being a near peer mentor?
- Student involvement and engagement - How do students remain engaged in the GoldShirt Program? How do students engage in student societies and campus life?
- College faculty engagement - How does the Program engage students with College faculty? How has the College faculty responded to engaging with Engineering GoldShirt students?
- Self-Management and Leadership course - What does this course emphasize to support self-management and leadership practices in GoldShirt students?
- Partnerships (industry, K-12, campus, faculty) - How has the GoldShirt Program developed partnerships with K-12, the campus, faculty and industry to recruit, retain and graduate students?
- Future Component: Family - What does the student's family have to do with their success in college?

The strength of each component as well as the challenges and lessons learned over the last eight years will be presented. Outcomes including retention and persistence, performance and graduation are included in this workshop. In addition to sharing best practices for starting a program, facilitators will share best practices for scaling such a program. Because of the program's success in support of the College's inclusive excellence goals, the College has financially invested in scaling the Engineering GoldShirt Program by 50% this year (from ~30 students to 45 students) and then 100% (from 30 to 60 students) in subsequent years.

Attendees will be equipped to develop research questions about their newly developed program and institute research based on their areas of interest. The Engineering GoldShirt Program has been supported by the National Science Foundation (NSF) and replicated by two other universities with future plans to expand to three others. The commitment from NSF was critical when obtaining financial support from the University of Colorado Boulder campus. Furthermore, industry financial and professional support have come to the table to support the Program and the students in it.

Research results from summer bridge surveys, mid-year surveys, focus groups, and other assessments will be shared with workshop attendees. The research questions pertain to student identity as it relates to engineering, how students describe and relate to the program, why students persist, as well as feedback on components of the Engineering

GoldShirt Program. The ongoing assessment of the GoldShirt Program has led to changes in the program over time. The research-practice-research model has informed the Engineering GoldShirt Program in a number of ways and attributed to graduating successful engineering students who were once considered unqualified.