

Interim Results of an Engineering S-STEM Program

Dr. Tanya Kunberger, Florida Gulf Coast University

Dr. Kunberger is an Associate Professor in the Department of Environmental and Civil Engineering in the U. A. Whitaker College of Engineering at Florida Gulf Coast University. Dr. Kunberger received her B.C.E. and certificate in Geochemistry from the Georgia Institute of Technology and her M.S. and Ph.D. in Civil Engineering with a minor in Soil Science from North Carolina State University. Her areas of specialization are geotechnical and geo-environmental engineering. Educational areas of interest are self-efficacy and persistence in engineering and development of an interest in STEM topics in K-12 students.

Dr. Chris Geiger, Florida Gulf Coast University

Chris Geiger is an Associate Professor and Chair of the Department of Bioengineering in the U.A. Whitaker College of Engineering at Florida Gulf Coast University. He received his M.S. and Ph.D. degrees in Biomedical Engineering from Northwestern University in 1999 and 2003, respectively, and his B.S. in Chemical Engineering from Northwestern University in 1996.

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Abstract

The U. A. Whitaker College of Engineering at Florida Gulf Coast University is in the fourth year of a S-STEM grant and currently engaging 35 students from freshman to senior level across every engineering program at the University. Last year witnessed a major milestone with the graduation of six individuals from the first cohort of participants. This year we anticipate adding to that number with an additional eight graduates. The program has fostered both horizontal (by class) and vertical (by major) cohort cohesiveness through various informal activities as well as overall program participant bonding through larger group experiences and a dedicated program space within the engineering building.

One of the primary goals of the proposal was to develop cohorts that met or exceeded national standards with respect to diversity. Because of this, the authors find it notable that the program currently involves women and under-represented minorities in engineering at levels above those of national averages, and significantly above levels (with respect to gender and select URMs) seen in the larger engineering population at the University. This paper will discuss general program information, present programmatic activities and resources, summarize participant characteristics, and present lessons learned and future direction plans.

Background

Florida Gulf Coast University (FGCU) is a relatively young, primarily undergraduate liberal arts institution that predominately serves the surrounding five county region. The university enrolls approximately 15,000 students and offers 53 undergraduate degree programs and 23 graduate degree programs. A majority of the students enrolled are female (~56%) with the top three racial / ethnic distributions being 66% Caucasian, 19% Hispanic, and 7.5% African American. Engineering at FGCU began within the College of Business in 2007. In 2011 the school transitioned to the U. A. Whitaker College of Engineering (WCE) and currently enrolls just under 1,000 students in four ABET accredited programs: Bioengineering, Civil Engineering, Environmental Engineering and Software Engineering. Unlike the University, engineering students are predominately male (80%). The three most prominent racial / ethnic groups represented in the WCE are Caucasian (59%), Hispanic (25%) and African American (6%), which is comparable to the overall university population.

General Program Information

The National Science Foundation S-STEM program at FGCU is entitled Encouraging the Next Generation of Innovative iNtelligent Engaged Engineers to Reach Success (ENGINEERS). Coordinated by faculty from Bioengineering and Civil Engineering, the program currently includes 35 students across all four programs from freshman through senior level. In order to identify qualified students, the Principal Investigators (PIs) work with individuals from both the

Foundation Office and the Office of Financial Aid. The University has a general scholarship application process where students complete a single Foundation scholarship application and a FAFSA form and are placed into consideration for any scholarships for which they qualify. In addition to this pool of students, the PIs also ask Financial Aid to identify students currently enrolled at the University who meet the program criteria, but have yet to complete the first course in the engineering curriculum offered by the College (Introduction to the Engineering Profession). As familiarity between Financial Aid officers and the PIs has grown, the Financial Aid office has also begun to identify select upper level students meeting program criteria who would benefit from the program and present them for PI consideration. The combination of these connections and the PIs placement as instructors in the introductory course has resulted in the identification of a number of qualified students to fill mid and upper level cohort vacancies. These vacancies stem either from students leaving the program, spaces in the cohort originally not being filled, or the ability to offer an additional scholarship due to variations in financial need of current program participants.

Once individuals have been identified, they are informed by financial aid of their award and scholarship requirements as well as being contacted by the PIs about the broader programmatic activities associated with involvement in the ENGINEERS Program. Current program participants are required by the University to complete a Foundation application and FAFSA form each spring. Not only does this benefit the PIs in ensuring continued eligibility, but also benefits the students by placing them into consideration for additional scholarship funding (both need and merit-only based).

Program Physical Space

One of the key resources of the program is a dedicated space accessible only to program participants. The 375-square-foot room is located on the first floor of the engineering building and serves as not only a central point for formal and informal group gatherings, but also functions as the location for program resources. The room contains 10 desks along the two longer walls and a set of tables and chairs that is typically arranged for large group meetings but can also be split for smaller group discussions. White boards hang on two walls and two additional double-sided rolling whiteboards are included in the room. The space also contains two computers that are updated annually with relevant engineering course software, a color printer with scanning and copying ability, a plotter, and multiple charging stations. Copies of textbooks for general engineering courses and office supplies including consumables (e.g. engineering graph paper, pencil, post-it notes) and non-consumables (e.g. staplers, 3-hole punch) are stored in this space. Non-educational resources including a refrigerator and microwave are included to foster community building. Additional resources are available through the program's virtual space within the university Learning Management System (LMS).

Program Virtual Space

The virtual space of the ENGINEERS program, provided by the University's LMS, allows program coordinators to centralize informational resources including support activities (e.g. tutoring, workshops, etc.) and opportunities (e.g. research opportunities, internships,

scholarships, presentations, etc.). It also houses resources for the technical writing module and information on student enhancement plans and professional development funding. The development and implementation of personalized student enhancement plans (SEPs) which allow program participants to identify long-range plans and set associated short to long range goals in support of these plans is one of the primary aspects of the program (Kunberger & Geiger, 2016). Originally implemented for upper level students, the activity has been expanded to all program participants for this academic year. In conjunction with these SEPs, students have the opportunity to apply for professional development funds, which can provide modest support towards the achievement of identified SEP goals. Examples of past awards include funding for conference travel and GRE or FE study material and exam fees.

Program Activities

Over the three-and-a-half years that the grant has run, several activities have been implemented with varying degrees of success. This section will present details on the most successful and ongoing activities as well as a brief summary of activities with limited success.

Faculty mentoring and SEP creation is one of the flagship aspects of the program. Students meet formally with one of the PIs at least once every semester to discuss both academic progress as well as plans for future courses and other academic and professional endeavors. These meetings have allowed participants to become more comfortable with the PIs, resulting in students often stopping by either PIs office informally to discuss a wide variety of topics. All students within the College of Engineering are assigned to a faculty mentor upon enrollment in either Engineering Mechanics or Introduction to Programming (sophomore level courses). As ENGINEERS Program students have already had meetings with the PIs, Civil and Environmental students are initially assigned to the Civil faculty member, while the Bio faculty member covers Bio and Software majors. Once students enter their junior year, environmental students are transitioned to the Environmental Program Leader, while software students become mentees of the Chair of the Software Engineering Department. This transition allows all program participants to have a mentor in their specific field of study. Program PIs remain mentors for all students with regards to SEP development and serve as additional resources for professional development. Meetings for SEPs can occur with either PI, allowing students to meet with whom they prefer.

Tied to SEP creation is the ability for program participants to apply for Professional Development Grants. This application is available in the program's virtual environment and requires students to complete a one-page application detailing the request, providing a budget, and demonstrating how the request aligns with a goal on their SEP. Students may apply for up to \$500 per year in grant funding, either in a single application or multiple requests. A request must focus on a single objective, but can contain multiple items that achieve that objective (for example study material and test registration for the GRE). Applications are submitted within the virtual environment and are evaluated on a published schedule of 5 times a year (roughly every 2 months with a longer time in summer and over the December break).

The two most successful community-building activities are the welcome/welcome back event and the finals week refresher. The welcome event typically occurs in September, a month or so after the start of the fall semester. Hosted in the ENGINEERS Program room, the 2 – 3-hour event provides new participants a chance to meet both the program coordinators and fellow program participants, see the program physical space, and learn more about the program in general. Returning participants can catch up and simply enjoy food and conversation in addition to meeting new participants. The schedule is designed such that the PIs attend the entire time, but participants can come and go as their schedules permit, although several stay for the full event. The finals week refresher provides snacks and drinks in the program room starting the Friday before finals. Students are encouraged to refuel while studying, grab a snack between finals, or simply stop by and decompress after a final. Aside from the room itself, this is probably the most talked about “perk” of the program.

A face-to-face technical writing workshop was not as well received as anticipated. When program participants were initially polled as to their interest, almost half indicated that a series of technical writing workshops would be something they would attend. The workshop structure was such that students were asked to complete approximately 15 minutes of interactive online activities prior to the workshop. The session would commence with a 10 – 15 minute discussion of the online content, followed by a 10 -15 minute practice session and culminating with the remaining 20 – 30 minutes dedicated to obtaining feedback on current assignments. The final time was optional, and students could bring work from any class in which they might have a writing assignment. The resulting implementation resulted in only 1 or 2 students attending the first two sessions, and no attendees at the later sessions. Because of this the workshops were transitioned to a technical writing module that is completely online within the virtual program space, allowing participants to complete activities on their own time, consult references as needed, or contact the PIs with specific questions they may have.

A second activity that underwent a trial phase with limited success was a series of student success workshops. The University’s Center for Academic Achievement offers a series of student success workshops throughout each semester covering topics such as effective study habits, note-taking strategies, working effectively in groups, and several others. Additionally, Career Development Services offers numerous seminars on resume writing, interviewing, and internships. The PIs collaborated with these groups and arranged for a seminar series to be hosted within the engineering building and targeted specifically towards engineering students. The workshop topics were selected based on the interest survey completed by program participants, but were also open and advertised to all students enrolled in the introductory engineering courses during the semester the workshops were offered. Attendance at the workshops ranged from three to eight students, representing, on average, less than five percent of the invited population. This relatively small attendance, coupled with changes in the Center for Academic Achievement’s schedule prompted a different approach. The CAA greatly expanded their workshop offerings to the general University population, adding to both the number of workshops as well as to workshop locations (including multiple main campus locations as well as different dorm locations). This meant that over the course of the semester, any workshop might be offered 6 – 8 times, where previously it might only be offered 3 – 4 times and typically

only at the library. Because of this, the program coordinators chose to advertise the existing workshop offerings, rather than try and schedule specific ones that historically had low attendance rates. During the same time frame, the resume and internship seminar hosted by Career Development Services was integrated into the revision of the introductory engineering course. This maintained the engineering focus, but expanded the offering to cover all individuals enrolled in this freshman level course.

From a community building standpoint, cohort and major specific events have had limited success – most likely due to the relatively small numbers in these sub-sets of the overall program. Cohorts range from 8 – 10 individuals and major divisions run from 4 – 10 people. Scheduling typically results in 40 – 60% participation rates, sometimes lower depending on the time in the semester. Rather than expend time and energy on events for only a handful of individuals, the program coordinators have chosen to focus on a few larger events that allow for interaction across majors and grade levels. Recently, this has resulted in a number of informal mentoring experiences between several upper and lower classman in different majors who have found common experiences and interests in engineering in general. A more established approach for fostering these near-peer mentoring relationships is under development, as well as the creation of an alumni meet and greet event tied to the alumni panel presentations in the introductory engineering course.

Participant Characteristics to Date

The 2013 – 2014 academic year witnessed enrollment of the first two cohorts of ENGINEERS Program participants. Eight freshman and eight sophomores were selected including 4 bio, 6 civil, 4 environmental and 2 software majors. The group included 10 males and 6 females (38% female), and was 68% Caucasian, 19% African American, and 13% Hispanic. From a diversity standpoint this initial enrollment was well aligned with the current division of majors, as civil represented the largest major at the time, followed by bio and environmental. The gender distribution of the cohort was higher than that of the College, but still below the overall University ratio. African American students were represented in the cohort at levels comparatively higher than the College or University, while Hispanic individuals were represented at levels slightly lower than the larger populations. Six students from the first cohort graduated in the Spring of 2016, most of whom have entered the workforce in an engineering position. One graduate has chosen to enter graduate school. The current 2016 – 2017 academic year includes 35 individuals: 12 bio, 10 civil, 7 environmental, 3 software and 3 dual civil and environmental majors. The groups is 51% female and includes 60% Caucasian, 14% Hispanic, 11% African American, 6% Asian, 3% American Indian, and 6% multiple races or not reported. These demographics represent a diversity broader than that of the general engineering population at FGCU and nationally.

Future Program Direction

Based on the time remaining on the current grant, the program will not be enrolling any additional cohorts. Individuals may be added to the current cohorts depending on existing participant eligibility and financial need. The focus that was previously on recruitment will now

shift to keeping in contact with program graduates. Plans for this include follow-up surveys and potentially phone interviews to determine not only how well programmatic resources supported student success, but also what can be added to further benefit current program participants. Focus within the program will remain on fostering personalized achievement programs aligned with individual academic and professional goals.

Bibliography

Kunberger, T. and C. Geiger, "Implementing Student Enhancement Plans for Student Growth and Goal Attainment," *2016 American Society for Engineering Education Southeast Section Conference*, Tuscaloosa, Alabama, March 2016.