

Work-in-Progress — Experiential Learning Activities to Enhance Freshman Student Learning, Retention, and Success

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ABSTRACT - One of the key challenges in engineering education is the low retention rate of engineering students. It is well known that attrition is very high in engineering, particularly during the first year. Nationally, approximately one-half of students who enter engineering majors finish within six years. The attrition of minority and female students is even more acute. There have been a wide variety of efforts to improve the retention and graduation rates of engineering students in recent years. These have involved pre-college education, university/college enrichment programs, improving the image/perception of engineering, etc. The present paper will review the implication of high impact educational practices, or experiential learning activities, to enhance freshman engineering student learning, retention, and success. Specifically, we will elaborate on the impact of service-learning activities, peer-mentoring programs, supplemental instructions, relevant national student competitions, internship opportunities, and leadership/entrepreneurship development programs. The author draws from his past experience in the Lyles College of Engineering at California State University, Fresno.

The Pathways Student Services Division in the Lyles College of Engineering has been administrating many of the aforementioned activities. We have devised a multi-step intervention process to help students, considered academically at risk. Accordingly, during the fall semester, all lower division-engineering students who are on the borderline of going into probationary status are sent a notice to attend a mandatory informational session with both the associate dean and the director of the Pathways Student Services. Following an interactive discussion about the possible challenges and general overview of how to succeed in college, students are directed to meet with their faculty advisors, department chairs, associate dean, or director of Pathways. During those assigned follow up advising/mentoring sessions, specific needs of each student is identified. Subsequently, a series of workshops, tutoring, peer mentoring, and other helps/supports are provided to assist the student to overcome his/her challenge and succeed. Other experiential learning opportunities that have been very beneficial involve internship programs and community-based service-learning engagement that provide students real life perspective.

Index Terms – experiential learning, retention, pathways, high impact practices

INTRODUCTION AND BACKGROUND

In a report entitled: “Moving Forward to Improve Engineering Education,” published by the National Science Board in 2007, three key challenges were identified for engineering education (1). These essential challenges comprise: (a) responding to the changing global context of engineering, (b) perceptions of engineering, and (c) retention of engineering students. The report suggests that the changes taking place in the global environment will be the drivers of changes in engineering education. As a result, new skill sets will be needed by the future generation of engineers in the U.S. to respond to the changing context. Furthermore, the report states that engineering is not attracting enough students to the field, especially those with diverse background. Female and minority students are, in particular, intimidated with the rigor required in engineering. Finally, the report highlights the challenge of retaining students who are initially attracted to engineering. It is well known that, on the average, nationally only 50 to 60% of students enrolled in engineering majors actually complete their degrees within six years (2). This range drops down to as low as 30% in certain schools (3). Also, there is a relatively large retention and graduation gap in the case of under-represented students, as much as 20% in some cases (3). The third challenge, mentioned above, constitutes the basis of discussion in this paper, a work in progress.

Freuler, et al. (4) reports the Ohio State University College of Engineering’s success in aggressively developing a framework that involves two “tightly-coupled” course sequences. The reference two-course sequence retains part of the traditional material, with additional hands-on laboratory experiences that lead to design-build projects. The authors indicate that this evolutionary process “has had notable success and continues to assess its own progress to foster change for keeping pace with changing needs and student population.” The main goal of present paper is to elaborate the challenges and ways of overcoming the obstacles regarding the frosh student success and retention

in the Lyles College of Engineering at California State University, Fresno.

CALIFORNIA STATE UNIVERSITY SYSTEM – STUDENT SUCCESS AND GRADUATION INITIATIVE

California State University (CSU) System, comprising 23 campuses launched a graduation initiative in 2009 to raise the freshman six-year graduation rate by eight percentage points by 2015, and to cut in half the gap in degree attainment by under-represented minority students (5). At CSU Fresno, also known as ‘Fresno State,’ a student success task force was established originally in 2002 (6). In 2015, the Task Force was broken into six subcommittees to focus on the specific aspects of student success. The tasks entailed: (a) remediation, (b) campus employment, (c) class availability, capacity, and bottlenecks, (d) first year experience and University One, (e) future high impact practices (HIPs) for student success, and (f) high advising ratios and uneven student to advisor ratios in college. The guiding question for this major initiative was: “What are the current high impact practices that contribute to student retention and degree completion?” One of the sources used in this process was the LEAP (Liberal Education and America’s Promise) report (7). A primary driver of the LEAP is the high impact educational practices, which promotes ways of engaging and challenging students. The following opportunities constitute examples of the HIP activities: first year programs, intensive writing, collaborative assignments, undergraduate research, internships, and major projects that help students achieve essential learning outcomes (7). Subsequent sections outline the various relevant initiatives/activities in the Lyles College of Engineering.

Pathways: Student Services

The Pathways is a “one-stop” student resource center within the college. It provides a broad range of services and programs to prospective and current students as well as alumni. Academic coaching, tutoring services, professional speaker series, field trips and company visits/tours, peer mentoring, leadership retreats, and supplemental instructions are but a few of the services provided by the Pathways. These, an integral part of the HIP, will be further elaborated below.

High Impact Practices (Experiential Learning)

It is well known that high impact practices (HIP) deepen students learning and engage them in hands-on activities related to their chosen fields, providing transformational learning opportunities inside and outside of the classroom (8). These kinds of hands-on practices include service learning, internships, community engagement, study abroad, undergraduate research, and innovative instructional experiences. The Lyles College of Engineering (LCOE) at

California State University, Fresno has introduced several of these endeavors in various programs.

The following activities have been an integral part of the Construction Management (‘CM’) students’ education in the Lyles College of Engineering: (a) Mandatory internship – students are required to work in a CM related company for a semester (this has been staged, starting at 150 hours to a total of 600 hours by the time of graduation). (b) Service learning – three required courses are “S” designated to indicate that they have service learning components. These courses include: CM 1S (orientation class), CM 7S (materials and methods class), and CM 180A-S (the first of two-semester sequence capstone courses). Students are required to spend a minimum of 20 hours during the semester in construction related community service work at a community-based organization (CBO) for each individual aforementioned course. The CM Department has established a close partnership with the great majority of CBOs locally to provide opportunities for students to participate in community service projects to gain real-life hands on experience. (c) Leadership/entrepreneurship development program – introduced in the orientation class, these are integrated vertically throughout the curriculum as well as outside the classroom activities. (d) Peer mentoring – upper division high achieving CM students are paired with the incoming freshmen, including occasional interaction opportunities, to get them engaged and to develop a sense of “belonging.” (e) Also, students are encouraged to participate in annual CM competitions such as ASC (Associated School of Construction), NAHB (National Association of Homebuilders), Tiny House, etc.

Conclusions

Anecdotal evidences reveal the viability of high impact experiential practices along with enhanced student success and retention, especially at the freshman level. A combination of internship and construction related community service-learning activities have provided valuable experiential learning opportunities for freshmen, the peer-mentoring program has engaged them and the peer mentors have served as their role models, the leadership/entrepreneurship development program has provided opportunities for them to interact with professionals in the field of construction as well as job shadowing in some cases, and annual academic competitions have honed their soft skills such as team-building, communication, and networking while gaining real-life perspective of major construction projects. In conclusion, the high impact practices complement students formal education, provides real world perspective early on, afford them a sense of belonging, and much excitement through interaction/engagement with upper division students, engage them in various student clubs and organizations, regional/national competitions, as well as interacting with industry professionals. Furthermore, a

comparison of students' success and learning assessments in high failure courses with and without supplemental sessions (SI) indicate the positive impact of SI sessions in students learning and better performance in these classes. Quantitative assessment data is being collected as part of continuous improvement process and will be reported in the future.

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