

Student Success through College of Engineering Freshman Year Experience Program

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Abstract

This is a Work in Progress (WIP) paper and will focus on the Freshman Year Experience (FYE) program implemented at New Mexico State University, a Hispanic serving institution. Due to the low retention rate of 63.9% for first-year, full time engineering students, prior to the 2014-2015 school year, (persistence from matriculation to their sophomore year) the College of Engineering (COE) made a decision to implement a FYE program. The program was designed to help retain students in the COE and in addition, provide students with strategies to succeed in college. The COE first-year student retention rate rose by 14.6% to a total of 78.5% from freshman year to sophomore year. The overarching goals for the program were to help facilitate the transition from high school to University learning environments. The program implemented problem based learning, flipped classroom instruction, discovery of student resources on campus, among numerous other FYE and engineering curriculum instructional strategies.

We have made several key changes to the ENGR 100 course since the first semester of its implementation in the fall 2014. Some of these modifications include changing the mathematics co-requisite course to college algebra, in order to reach more students. We have also implemented a mandatory peer mentor led workshop for all students. Peer mentors provide the students with an upper classman peer who can provide support inside and outside of the classroom. In our paper we will continue to discuss specifics regarding the ENGR 100 course, peer mentoring, intervention strategies, and FYE components.

Literature Review

According to Kuh (2008)¹ freshman year experience programs are highly influential in improving student success and create positive impact on their pathway to a degree. Key components of successful FYE programs are utilizing learning communities. In addition Kuh (2008) recommends writing intensive curriculums that focus on writing across the curriculum to create a deeper sense of content through writing. One of the key components of the FYE program is the peer mentoring program. As stated by Rode and Kubic, in Johnson (2009)² peer mentoring can serve as a supportive liaison between the classroom, students, and faculty. In addition, mentoring can also provide beneficial college experiences for both the mentor and mentee, (Johnson, 2009). Because our University is a Hispanic serving institution, the program developers felt mentoring could play a strong role in retention of all students, including our minority students. According to Liang and Grossman (2010)³ mentors can aide youth from

diverse backgrounds. In addition, minority students who have had a mentor, show greater success in academics.

Introduction

The low percentage of retention of students in engineering programs throughout the United States is a growing concern for Universities and engineering programs nation-wide causing them to reevaluate their programs and implement strategies to offset low retention rates. Graduating students in STEM fields is not only a concern at New Mexico State University but across the nation. According to the Department of Education (2013)⁴ STEM majors account for only 14% of all undergraduates, in addition, an alarming 56% of students who declare a STEM major in their freshman year do not graduate with a degree in a STEM field. These statistics raise concern and a demand for implementation of freshman year experience programs that focus on retention to encourage students to graduate from a STEM field. In the fall of 2014, the COE initiated a program for freshman to increase retention and graduation rates. There was an additional concern as the state funding formula for the College was transitioning from the previous focus on number of students in the program to a focus on graduation rates.

In the fall 2015 all sections followed the same curriculum, allowing us to analyze outcomes for the entire ENGR 100 cohort. The course objectives will be assessed for each section. Since all sections followed the same curriculum we will be able to analyze outcomes for the entire ENGR 100 cohort. Our assessment will entail student and instructor surveys based on the FYE and ENGR 100 learning outcomes. The data will provide us with the ability to make comparisons to determine the most effective way to encouraging students to persist in the COE. After reviewing the results, we will be able to reflect and research other strategies that can be implemented to assist in student success.

Faculty and Staff within the NMSU College of Engineering.

Beginning in the fall of 2014, the COE implemented an ENGR 100 course and freshman year experience program to provide students with the necessary skills to succeed during their first year of college. Throughout the first semester of implementation, the ENGR 100 course was taught by seven different professors in seven sections. Four of the professors were also serving as department heads. After assessing each course, it was discovered that some sections did not follow the approved curriculum, thus making it difficult to assess the program. The following year the COE implemented a program manager to oversee the program and a lead instructor to further develop the curriculum, to ensure course objectives were being met, and assist with student success strategies. The lead instructor has over 14 years of industry experience in the Civil Engineering field along with teaching experience in the high school level.

During the fall of 2015, an increase in the number of instructors had to be addressed due to the increase in the number of sections offered as compared to the previous fall. Each department evaluated their staffing needs and the administration decided to look at alternative options for

instructors for the course, due to budgetary constraints. The College considered hiring adjunct faculty to teach the course but, the administration had concerns about the availability and cost of adjunct faculty. The COE proposed several different options to fund possible instructors and ultimately agreed on a mixture that would include both faculty and graduate assistants. As the options were evaluated the decision to hire graduate students was chosen with the understanding that professional development would be provided for them prior to and throughout the semester. Though graduate assistants were not the first option for instructors for FYE, they have proven to be effective teachers for the ENGR 100 course. In the fall of 2015, 12 sections were taught by three faculty members and six graduate students. Each faculty member taught one section, three graduate assistants taught one section each and the other three graduate assistants each taught two sections.

Professional Development

At the beginning of the fall 2015 semester the lead instructor and program manager developed a schedule for the faculty and graduate assistants to participate in professional development (PD). The PD was aimed to help all instructors become acquainted with and understand the vision of the program. The PD was created to encourage fidelity to the curriculum, develop classroom management strategies, further understanding of pedagogy, assist with course preparation, and provide assistance with assessment. There was an emphasis on developing strategies to assist the freshman with their transition from high school to a University setting. FYE content was implemented into the curriculum to help the first year freshman grow during their University experience. Some of the topics included were; college expectations, time management, stress management, balancing work and school, note taking strategies, exam taking strategies, adjusting to independence, and exposure to the various engineering disciplines available in the College of Engineering. Other techniques in all sections included; daily 5-7 minute quizzes, balancing presentation with lecture time, flipped classrooms, and the Learning Management System (Canvas). The strategy to use the 5-7 minute quiz at the beginning of each class was implemented to encourage students to prepare for class, attend regularly, and arrive punctually.

Other PD focused on understanding the flipped classroom model and the challenges that can sometimes occur in using this model. The flipped classroom approach requires students to prepare and learn outside of class time. This changes the classroom design from a traditional lecture format to an emphasis on group work and hands-on activities. Most of the students we have in class are first year freshman coming straight to the University from high school. Many of these students are encountering the flipped classroom approach for the first time. Students were experiencing difficulty adjusting to this approach and some of the instructors returned to a more traditional lecture format when their students had difficulties. According to research conducted by Bergmann (2013)⁵ university instructors have difficulty changing their instructional styles. To resolve this issue, we worked together with the professors and graduate students to assist them in adapting to the flipped classroom model. We met once a week to discuss curriculum and other concerns regarding the program. One issue we discovered during our meetings was that students

wanted additional class discussion time to help understand content before embarking on the class hands-on activities. Since the class meets twice a week we have class discussion one day and a hands-on activity the second day. During the weekly mentor led workshop students engage in a hands-on activity or use this time to finish up problem exercises and ask for additional help. Also, we are implementing additional short writing assessments based on the objectives for the week to help instructors understand what additional help students may need.

We continued to guide the instructors to implement flipped classrooms and by the end of the semester most of the instructors had developed a good balance between the flipped classroom approach and class discussion format for their sections. PD focused on providing assistance with the learning management system. This system enables the instructors to set up modules, create assignments, organize content pages, develop Canvas quizzes, and utilize speed grading. Future PD will contain an additional focus on the transition from high school to college. The lead instructor taught his section on Monday mornings which made it possible for the graduate assistants to observe his class prior to teaching their own classes. This format was beneficial to the graduate assistants as they were able to model the teaching strategies they had observed.

Curriculum Adjustments Fall 2015 to Spring 2016

Fall 2015 course objectives were assessed by each section and are currently being analyzed. Since all sections followed the same curriculum, we will be able to analyze outcomes for the entire ENGR 100 cohort. Our assessments included student and instructor surveys based on their experience with FYE and ENGR 100 learning outcomes. This data will give us the ability to make comparisons and determine what changes need to occur in the program to ensure student success in the COE. After reviewing the results, we will be able to reflect and develop other strategies that can be implemented to assist students. The lead instructor and program manager are entering and reviewing the data in the COE database to provide each department with a method for reviewing the findings from the first semester.

Several key changes to the ENGR 100 course have been made since the first semester of implementation in the fall of 2014. Some of these modifications include changing the mathematics co-requisite from pre-calculus to college algebra to allow more students to enroll in ENGR 100. According to the Department of Education Statistical Analysis Report on STEM Attrition: Students' Paths Into and Out of STEM fields(2013)³, states that one of the reasons students leave a STEM field is due to their lack of college readiness in the STEM field. The college made a conscious decision to reach more students by reducing the math prerequisite for enrolling in ENGR 100. Our goal is to identify and support those students during their first semester and give them strategies through the FYE so they can achieve their goal of becoming engineers.

During the current spring semester the lead instructor is working on the shortcomings encountered during the past fall semester and creating revisions to the curriculum for the fall of

2016. These revisions will include impromptu design challenges, and implementation of the FYE components during instructional time as well as during the mentor led workshops. Students will also be required to attend two engineering student organization meetings and two student success seminars during the spring 2016 semester.

New Mexico State University implemented a Quality Initiative Program (QIP)-Writing to learn in fall 2015. The QIP- curriculum will increase the number of writing assignments required of engineering students. The lead instructor was selected as a member of the team to develop assignments and assessments for this program. There is an effort under way to normalize the grading of three different QIP assignments throughout the semester. The assignments will be given at the beginning, middle, and end of the semester and graded based on a published rubric produced by the COE and University personal. The QIP is designed to encourage students to express what they are learning and to feel safe with what they are writing. Short writing assignments throughout the semester along with lessons in writing memos and reports will facilitate students in their ability to present structured writing assignments. Students will develop the understanding that writing must be understood by the instructor to be graded. The COE and the English departments are working together to develop these assignments and have hosted four trainings for instructors throughout the fall 2015 semester. The University and the COE will implement the QIP-Writing to Learn Initiative for all majors. According to Bean (2011)⁶ we should not think of writing just as a way to communicate, but also as a means to improve our students' critical thinking abilities. The implementation of the QIP-Writing to Learn is to encourage students to feel safe in their writing about engineering and FYE content rather than to emphasize grammatically correct papers. We are also working with the English department in developing strategies for our English Language Learners. Many of these students do not feel safe expressing what they have learned in writing.

Another method implemented into the curriculum was frequent impromptu design challenges. According to Reidesma (2005)⁷ "Impromptu design competitions are a very effective starting point in the model for engaging students in problem identification, formulation, solution and group work, as well as providing an opportunity for students to develop a sense of identity with the discipline and meet other students in the course" (para. 1). In our courses we randomly assign students in groups for the impromptu challenges rather than have them work in their regularly assigned groups. These challenges have created an opportunity for students to engage in critical thinking, problem solving, and developing team work. Many students have learned that they can work in groups and gain valuable team building skills. We have also given them four major design challenges that take one to two weeks to complete. These design challenges have given the students the chance to present their work to the class or write a documented report on their project. Students have enjoyed these design challenges and we are continuing to find additional impromptu design challenges to supplement the content of the curriculum.

Data

Our preliminary data shows promising results from our ENGR 100 course. 78.5% of students who were enrolled in ENGR 100 in fall 2014 matriculated from their freshman to their sophomore year. This is an increase of 14.6% from the previous year's retention rate of 63.9%. The data is currently being evaluated to determine the retention rate for the fall 2015 cohort. The analysis of the fall 2015 data will require comparing students who traditionally began their career in college algebra instead of pre-calculus since ENGR 100 reduced the co-requisite. This data is encouraging that we will continue to see an increase in retention as modifications are made to the program and instructors and mentors become more acquainted with the goals and outcomes of the program. In addition, the COE is tracking each student individually in each cohort. We see a need to track each student individually to better understand the students we are retaining, and the students who are leaving engineering. Tracking each student will also help us focus on the students who began in college algebra rather than pre-calculus.

Peer Mentoring

Peer mentors provide the students enrolled in ENGR 100 with support both inside and outside the classroom. These peer mentors have been a crucial part of the FYE program since its implementation. Each semester we have budgeted to hire one peer mentor for each 16 freshman enrolled in ENGR 100. The mentors are hired at \$10.50 an hour, and can work up to 20 hours a week. The majority of the mentors recorded 15-18 hours per week throughout the semester. The peer mentors are required to attend the ENGR 100 course with their mentees, teach a weekly 75 minute workshop, and host office hours for mentees to receive assistance in coursework and general mentoring. Each mentor is required to attend a mandatory training session each semester which includes mentoring techniques, information on mentoring young adults and the legalities regarding mentoring. The program manager for ENGR 100 has observed that the process of becoming an effective mentor includes prior experiences with mentoring and the ability to lead. This understanding has resulted in a change in the interviewing process to select effective mentors who have prior experience and have shown leadership qualities.

One of the key components of the peer mentor program is the weekly 75 minutes workshop that is solely led by the mentors. This component of ENGR 100 was implemented in the spring of 2015 and has proved to be very valuable for the both the mentors and mentees. Each workshop consists of the 16 mentees assigned to their peer mentor. During the semester the 16 mentees work in groups of four. The mentees work on hands-on assignments that complement the instruction occurring in the traditional ENGR 100 course. According to the Engineering Accreditation Commission (ABET, 2014) students must acquire the "ability to function on multidisciplinary teams" (p. 3)⁸. The students work on a multidisciplinary team throughout the semester in their ENGR 100 course and in their peer mentor led workshop. The mentors also assist their mentees with resume building, provide peer advising, and develop strategies for

student success during the workshop. During the workshop mentees have the opportunity to ask their peer mentor questions that they might not feel comfortable asking their instructor in class.

In addition to teaching the workshop, peer mentors host office hours in a central location in the COE. It is common for students to re-visit their mentor on a regular basis for help with the adjustment to college life or the understanding of coursework. During office hours freshman can visit with their mentor or seek assistance from another mentor from a different section of ENGR 100 if they are available. The mentor program has proven to be an essential component of the FYE program. Many of the freshman have stated on evaluations that that their mentors were helpful and easy to approach. Some of the freshmen have continued to seek out their mentor for support even after they have completed the ENGR 100 course.

Interventions

A new component to peer mentoring that we implemented in fall 2015 was the use of interventions. Professors of all 100 and 200 level courses are required by mandate from the President of the University to post mid-term grades. Students receiving a C grade or lower in any of their courses were required to meet with their mentor for an intervention. The number of C or below grades the student received determined how many times the student was required to meet with their mentor for an intervention. The mentors were trained by the Program Manager on various intervention strategies. During the intervention mentors had in depth conversations regarding how to help their mentee succeed. The interventions implemented ranged from helping a student with time management to assisting them with furthering their understanding of course content. Data is currently being compiled regarding the students who attended these interventions and the impact the interventions had on their final grades.

Advising

During the fall of 2014, ENGR 100 students participated in group advising sessions. The goal of this strategy was to ensure all first semester students were properly advised. One of the biggest obstacles for first semester college students is learning the procedures of a University. Offering a group advising session during a regular class session alleviated the process of students having to make appointments with their advisor and creating a schedule without the guidance from instructors, mentors or their classmates. Due to the large increase in sections of students enrolled in ENGR 100 from fall 2014 to fall 2015 group advising by instructors was not possible. Instead instructors gave a lesson on the advising process in class and peer mentors spent an entire workshop navigating students through the process of registering for classes, how to create a schedule for the next semester, and recommendations for future courses.

Program Funding

The College of Engineering implemented the FYE program with funding from the Presidential Performance Funds. The funding was provided in fall 2014, and guaranteed payout until fall

2015 dependent on success of the program. The funding provided by the Presidential Performance Funds were used to pay for the instructors, graduate assistants, mentors, and consumable materials each semester. Due to the large increase in sections from fall 2014 to fall 2015 the expenditures increased by approximately 20%. The Presidential Performance funding will end in spring 2016. The COE is discussing absorbing the costs of the program since the retention rates have been so successful.

Synergistic Efforts Across Campus

In addition to the strategies mentioned above, the College of Engineering works closely with University wide initiatives in an attempt to retain engineering students. The College oversees the Engineering Living Learning Community (LLC) which actively engages students in the College and University community from the day they move onto campus. Each semester the LLC cohort consists of 75-90 engineering students. In addition, the University implemented a Student Success Navigator program which coincided with the ENGR 100 mentoring program. Engineering freshman were contacted by navigators throughout the semester to offer support, set up advising appointments, and speak with students who were struggling based on their mid-term grades.

Transition to College Life

As we all know the transition to college life for many students can be difficult. The lead instructor taught in a comprehensive and early college high school prior to working at the university. The focus on testing mandated by the public education department has taken time away from the curriculum and from opportunities to work on transitional goals. High school counselors and teachers are dealing with additional things, such as their school grade, teacher evaluations, etc. These added tasks take time away from planning and helping students' succeed. When students reach the college classes many instructors feel that they are not emotionally and educationally ready for college level courses. Some pre-assessment could help students with curriculum along with guiding students into a remedial course or introductory course.

According to Bernold (2007)⁹ time management and procrastination are skills that engineering freshman struggle with while transitioning from high school to college. During fall 2015 students engaged in multiple in class and workshop activities to develop strategies for time management. Along with time management strategies the curriculum included other key components to ease the transition from high school to college.

Conclusion

In the first two years of the Freshman Year Experience program we have seen an increase in retentions rates for first time freshman students enrolled in ENGR 100. ENGR 100 students were involved in design based projects and assignments which we believe have resulted in increased student engagement. The College of Engineering has plans to continue to implement

new programs that will be taught concurrently with English 100 courses to increase retention. Some of the college initiatives include a central location known as Becoming Academically Ready (BAR) where students will have access to tutoring, mentoring, 3D printers for design projects, and computers with engineering software. In addition, the college plans to implement a formal process for internships and undergraduate research opportunities to encourage student engagement. The college also plans to implement a bridge program for incoming freshman that will enrich soft skills learned from the FYE program to ensure a better transition from high school to college. We will continue to evaluate the programs both qualitatively and quantitatively to make educated decisions on new implementations and changes in the programs.

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