Work in Progress Paper: Facilitating the Success of Academically Under-Prepared Students

Abstract

From 2005 through 2018, the College of Engineering and Applied Sciences at a midwestern university received funding through various iterations of the NSF STEP (STEM Talent Expansion Program) to improve retention and student success. A cohort model was implemented that now covers over 95% of incoming first-year students in the college. Members of each cohort have almost identical schedules for the first two semesters in the college. Student services, including tutoring, a living-learning community, and one-on-one student interventions, were implemented. Results have shown significant increases in first-to-second year retention as well as graduation rates. However, students entering the college at the low end of the mathematics spectrum, in particular, continue to be retained and succeed at a much lower rate than first-year students in general. This cohort of students tends to have a higher proportion of underrepresented minority students and a higher portion of students with financial need. It has also been the fastest growing portion of the first-year student class for the past several years. This paper discusses past, current, and planned efforts to increase the success of incoming first year students at the lower end of the mathematical skill spectrum. Suggestions are welcomed regarding both specific interventions as well data that might be the most effective in judging success. Potential collaborators working with similar student groups are also sought to investigate outcomes across multiple campuses.

Introduction

The College of Engineering and Applied Sciences (CEAS) at a midwestern university offers thirteen ABET accredited undergraduate engineering programs. CEAS also offers eleven master's programs and seven doctoral programs. Fall 2018 enrollment consisted of 3,031 students, including 2,449 undergraduates and 582 graduate students.

Indiana University's National Survey of Student Engagement (NSSE) recognizes that placing first-year students into learning communities or cohorts is one of six high-impact practices that positively affects both student success and retention [1]. Gabelnick *et al*. also recognizes that placing students into cohorts or learning communities not only helps students to connect to other students in their chosen major, but also helps to promote the connection of students to university staff and faculty [2]. In 2005, the University was awarded a STEM Talent Expansion Program (STEP) grant from the National Science Foundation to improve second-year retention by adopting the cohort model and creating a strategy to place incoming students into cohorts. In 2010, the University received a second STEP grant (STEP IB) to scale-up our efforts by increasing the number of students placed into cohorts and to improve 6-year retention rates. In 2017 the University transitioned the cohort program from NSF funding to institutionalized funding provided by differential tuition [3].

CEAS Cohorts

CEAS uses cohorts to serve as the starting point of academic and social support for incoming students. In Fall 2018, 98 percent of incoming CEAS students were placed in cohorts of 10-25 students based on their major and math placement. These students take the same 3 to 5 courses together in the fall semester and 2 to 4 courses together in the spring semester. As students begin their courses, the college hopes that the presence of familiar faces in each class will encourage the formation of natural study groups. Each cohort is led by a faculty or staff mentor who facilitates co-curricular activities and tracks academic progress for follow-up within the groups. The cohort mentor is used as the focal point to channel information about student support programs such as available tutoring resources, one-on-one student academic interventions, and other college-wide programming. Students who cannot be placed into a cohort (typically due to athletic or musical schedule restrictions) still have access to all success programs and resources associated with the STEP program.

Overall results have shown a significant increase in first-to-second year retention (for the 2010 to 2016 cohorts, 2nd year retention rates to the University increased from 75.8% to 81.0%, with increases from 62.2% to 70.8% retention to CEAS). However, students entering the college who are at the low end of the mathematics spectrum continue to be retained and succeed at a much lower rate than first-year students in general (for example, for the 2016 cohort, the second year retention rate to the University for students placing into Algebra II was 70.3% versus 95.2% for students enrolled in Pre-Calculus or higher, and 51.4% versus 85.7% to CEAS, respectively). In addition, these students tend experience more financial difficulties and also represent a larger proportion of underrepresented minority students (typically, around 25% of students placing into Algebra II are underrepresented minority students versus about 15% for CEAS as a whole). This group of students has also been the fastest growing portion of the first-year class for the past several years.

CEAS Exploratory and ENGR 2100

Starting in 2015, the STEP program placed students who enter the college at a lower math level into CEAS-Exploratory (EXEP) cohorts designed to help promote academic success. These cohorts are not formed based on major. Cohort classes for these groups include MATH 1110, (Algebra II); ENGR 2100 (an engineering-flavored first-year experience seminar course), and ENGR 1002 (a problem-solving course designed to complement MATH 1110), along with one or two general education courses. ENGR 2100 is designed to expose students to effective study habits, time management skills, and to help them recognize and implement the habits needed to pursue engineering, computer science, or engineering technology as a major of study. The course makes heavy use of material from *Studying Engineering: A Road Map to a Rewarding Career* [4], presented in workbook format for students. The workbook encourages writing and reflection, group work and group sharing for students and provides opportunities for detailed instructor feedback and intrusive academic advising.

Moving Forward

Students in EXEP cohorts sign an Academic Success Contract during summer orientation which specifies they must receive a B or better in their Algebra II course in no more than two attempts in order to be admitted to their desired pre-engineering program. Initially, the procedure for

students who failed to pass Algebra II with a B or better in their first semester included the submission of a written essay to a committee of academic advisors who decided if students should be allowed to continue in the CEAS. We are investigating whether alternative methods will increase student success.

Entering University students without AP/IB/transfer credit in mathematics are placed into a math class based on their SAT or ACT math score. In 2016 CEAS included the option for students to use the ALEKS (Assessment and Learning in Knowledge Spaces) program in an effort to provide a pathway for students to increase their math placement up to Calculus I before starting classes in the fall. ALEKS is an online learning program that offers an initial math assessment and provides subsequent online remediation modules to improve math skills [5]. The college covers the cost to the student for use of this program. A proctored exam provides the final math placement score for students and is recognized by our math department as a valid placement score. We are exploring the option of incorporating ALEKS into ENGR 2100, especially for those unable to pass Algebra II in their first attempt.

We will also be implementing an increased focus on study group formation not only in EXEP groups but in all STEP cohorts. The previous approach was largely passive, assuming groups would naturally form based on cohort class schedules. Class times have been updated, particularly for EXEP students, to allow for extra time after ENGR 2100 and before ENGR 1002 where students can use the classroom for group study. Students will be highly encouraged by the instructor to stay behind in between classes to study with their peers in the classroom. Cohort mentors are also being asked to take a more active role in ensuring the formation of study groups.

Conclusion

This paper has described past, current, and planned efforts to increase the success of incoming first year students at the lower end of the mathematical skills spectrum. Recommendations are welcomed regarding both specific interventions as well as suggestions to effectively assess success. Those working with similar student populations are also sought to investigate outcomes across multiple campuses.

References

1. The National Survey of Student Engagement (NSSE) at Indiana University, http://nsse.indiana.edu
2. F. Gabelnick, J. MacGregor, R.S. Matthews and B.L. Smith, *Learning Communities: Creating Connections Among Students, Faculty, and Disciplines*. San Francisco, CA: Jossey-Bass, 1990.
3. ***Reference omitted for purposes of blind review***
4. R.B. Landis, *Studying Engineering: A Roadmap to a Rewarding Career*. Los Angeles, CA: Discovery Press, 2007.
5. ALEKS – McGraw-Hill, https://www.aleks.com/.