
From Nothing to *Something*

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A national group of engineering educators at secondary, 2-year, and 4-year schools is developing a cooperative coalition to build effective alternative pathways for students to receive degrees in engineering. Collaborations are being formed to establish systems and implement methods with the goal of reversing the current trend of declining engineering enrollment and increasing the number of students from underrepresented groups who pursue engineering careers. The conference that initiated this project was held at Itasca Community College (ICC) because of the leadership and success that the college has demonstrated in achieving these goals.

The ICC Story

ICC is a small (1,000 full-time enrolled), rural 2-year college in Grand Rapids, Minnesota, on the western edge of Minnesota's iron range, approximately 180 miles north of Minneapolis/St. Paul. The primary enrollment consists of first-generation, traditional college students who come from blue-collar families who have struggled in recent times because of the scaling back of iron mining and paper production in the region. Most students earn associate's degrees and transfer to universities to complete their education.

The modern engineering, math, and science transfer programs at ICC began in 1983 with the hiring of Aaron Wenger when there were four engineering students at the college. The enrollment slowly grew and was supported by implementation of pedagogical changes such as learning communities, student-owned cohorts, lab-centered instruction, freshman design, project-based learning, and increased attention to high school recruiting activities. By 1992, the

program had grown to 18 students, and Ron Ulseth, PE, joined Wenger in the program. They have teamed together and over the last decade built a nationally recognized 2-year college engineering transfer program. Today, ICC Engineering enrolls 130 students who are organized into cohorts of 20–25 scholars. Pedagogical changes initiated in the early reorganization are still in place and remain key to the continued program growth. Of the ICC students who enroll in the first engineering physics course, 80% complete an associate's degree, transfer to a university, and graduate with an engineering degree.

The Itasca Community College Engineering Center is the heart and soul of the process. The center houses state-of-the-art classrooms, a concept lab for student design projects, and an integrated 36-bed student dormitory on the third floor. Students have access to classroom space, including computers, 24 hours a day, 7 days a week. Methodologies include project-based learning, portfolio assessment, weekly student dialogue journals, and a myriad of other teaching pedagogies and assessment methods.

Keys to success

For Ulseth, Wenger, and their team, their success boils down to effective recruiting and successful retention. It is through the following retention and recruitment strategies that this dedicated team has had such a dramatic increase in engineering enrollment and achieved such a high level of student success.

Retention. The retention effort includes a number of strategies. A key element for the effective retention of the students is through intensive personal coaching (IPC), which focuses on quality interactions between scholars, instructors,

counselors, and staff. This time-intensive methodology encourages students to interact and develop a supportive learning community. One of the college counselors is assigned to engineering students to provide a real voice of expertise in engineering, such as helping students make a conscious decision to be an engineer rather than simply thinking engineering might be a profession that they would consider pursuing.

The classroom serves both an academic and entertainment purpose to create an atmosphere where students want to be. In addition to educational equipment, each room is outfitted with a refrigerator, microwave, television, DVD player, sofa, and telephone. This environment helps students build strong relationships that provide a built-in support system where they work together on homework and deal with difficult issues.

There is a considerable amount of close contact between instructors and students through a system of electronic journaling, personal interviewing, and evening help sessions. Faculty members from math, chemistry, physics, and engineering engage students weekly as coaches. Faculty members do not have offices but have a designated space within the students' environment where they interact with the scholars.

A comprehensive plan for student activities includes not only time spent in class, project work, and study groups, but also community volunteer work, picnics, steak dinners, trips to sporting events, and engaging in workouts or other athletic activities.

The Problem:

Lack of effective retention strategies to reduce attrition of freshman and sophomore students in the early stages of collegiate STEM education.

The ICC Engineering Solution:

Use a proven combination of intensive personal coaching, learning community, and extracurricular activities to increase likelihood of successful graduation in the STEM field.

The Result:

Over 80% of ICC engineering students who start Physics I go on to complete degrees.

Figure 1. Effective retention.

When students don't see the relevance of course material, interest often declines, which can lead to poor performance, disillusionment, and, ultimately, student attrition. For this reason, the program places a high priority on giving students opportunities to experience STEM in action. This is accomplished through tours of industrial facilities and increased exposure to universities. There are two industry field trips and seven university visits per year available to engineering students.

Block scheduling of classes has also contributed to improved retention. In block scheduling, students take one class at a time for approximately 3.5 weeks. At the end of that time, the class is completed and the final is taken. It was demonstrated that such scheduling aids retention because students do not fall into the oscillation among pressures from different classes so often seen among freshmen engineering students. Not only did retention increase, but student satisfaction increased as well. As a result of this successful demonstration, all engineering classes, including all required liberal arts classes, are now being taught via block scheduling. Figure 1 summarizes the success of the program.

Recruitment. All engineering faculty members participate in recruitment as a requirement of employment. Currently, they visit about 20 high schools per year and expose over 3,000 students to a 50-minute interactive presentation about engineering as a career. Parents are invited to join their son or daughter to visit a local engineering facility, followed by a question and answer period, and are then treated to a dinner at a local hotel or business

The Problem:

Lack of effective exposure to STEM careers throughout a student's K-12 education.

The ICC Engineering Solution:

Use a proven combination of classroom visits, summer programming, and immersion events to increase student exposure to STEM careers.

The Result:

ICC Engineering has doubled enrollment in the past 5 years and delivered STEM information to dozens of teachers and literally thousands of K-12 students.

Figure 2. Effective recruitment.

to hear from a keynote speaker on his or her experience as a STEM professional.

The institution holds a senior-high Women in Technology Day plus an interactive 1-day event for 300 girls in grades 6–8 that showcases careers in STEM fields. In addition, ICC holds eight Engineering Days per year, where students can meet with ICC instructors and students, tour the Engineering Center, and participate in a variety of hands-on projects designed to create greater STEM awareness. There are summer engineering camps that stimulate interest by helping students better understand the fun and exciting opportunities in STEM fields, strengthen analytical and problem-solving skills, and strengthen communication and team-building skills. Figure 2 summarizes effective recruitment.

Conclusion

The engineering transfer program at Itasca has clearly demonstrated that effective recruitment and retention activities can be successfully implemented and sustained. This lets Itasca serve as an exemplary model for other engineering transfer programs. Whereas Itasca has certain unique features not easily duplicated elsewhere, most of its programs can be easily transferred and sustained at a variety of similar programs throughout the nation.