

The Engineering Entrepreneurs Program at NC State University

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The Engineering Entrepreneurs Program (EEP) was established in 1993 in the Department of Electrical and Computer Engineering at NC State University with support from the National Science Foundation as a part of the SUCCEED (Southern University and College Coalition for Engineering Education) “Curriculum 21” initiative. The objectives of the EEP included retention, leadership and teamwork skill development, and preparation for the 21st century workplace by exposing students to the dynamics of small, entrepreneurial companies. The EEP has been featured in various local and national media^{1,2,3,4,5}, including National Public Radio⁶, and is currently featured in the university’s undergraduate recruiting materials. This article will describe the EEP model and highlight some of its successes.

The EEP model

The EEP is open to undergraduate students at all levels, including freshmen, and integrated with the capstone design program in Electrical and Computer Engineering. Underclassmen and seniors not participating in capstone design can participate for multiple semesters, and earn one credit for each semester of participation. Seniors enrolled in capstone design earn four credits, and play the role of founders of a high-tech company. Development of the company’s “product” is the basis of the capstone design project. The one-credit students are “ground floor employees” of the start-up companies. This model allows EEP to fit easily within the already crowded undergraduate curriculum at NC State, and provides a framework for developing teamwork and leadership skills, mentoring of underclassmen by seniors, and a “real world” experience that gives the students a feel for life in a start-up company.

The EEP model places a great deal of emphasis on the leadership role of the senior students. They are told up front that this is the major difference between pursuing capstone design in EEP and more traditional approaches. The senior “founders” are required to come up with an organizational structure and a defined role in the company for each member of their team. All students participate at a level commensurate with their background and skills. Lower division students, for example, will typically have roles which are critical to the company’s success, but less technically challenging, such as product testing and market surveys. Anecdotally, the senior leadership role appears to be the most critical factor in the ultimate success or failure of the team. Senior leaders who have participated in EEP as underclassmen are usually the most successful leaders.

Perhaps the most powerful component of the program is a weekly seminar series that features members of the Research Triangle high-tech entrepreneurial community. These include venture capitalists, service providers, and most importantly, engineers and computer scientists (many of whom are NC State alumni) who have pursued entrepreneurial careers. Engineers who have become entrepreneurs always have fascinating stories to tell, and by virtue of their trade are typically excellent and enthusiastic presenters. As such, they are highly motivating role models for the engineering students.

Program results

Upon completion the initial three-year SUCCEED supported project, a detailed assessment to determine the extent to which the program achieved its stated goals was undertaken. Self-reports by the EEP students were highly positive. Ninety-two percent of participants surveyed at the end of the spring '94 semester either agreed or strongly agreed with the statement "I would recommend this course to others," and 83% agreed or strongly agreed with the statement "I wish I had this course earlier in my academic career." (Note: 10% of the participants were freshmen.)

Subjective assessment as well as survey results indicate that vertical integration within the student teams foster mentoring. Eighty-four percent of respondents agreed or strongly agreed with the statement "I learned a great deal from my senior leaders," and 72% agreed or strongly agreed that "I learned a great deal from my other team members."

Multi-semester participation in the program has proven to be beneficial in at least two ways. First, it reduces faculty load. Having senior leaders who have previously been involved as participants in the program greatly reduces the initial effort required to get the team organized and under way. Second, it improves team performance. Senior leaders who have previously participated in the program appear to have developed good leadership skills. In the spring '94 semester, three of the six teams in the program each had at least one senior leader who had participated for the two previous semesters. Those teams organized much more quickly and had better defined goals and strategies than the teams whose leaders had not previously participated.

The students' self-assessment of teamwork and leadership skill enhancement concurs with our observations. Eighty five percent of survey respondents either agreed or strongly agreed with the statement "My teamwork skills have improved as a result of this course," while 74% (including the students in non-leadership roles) felt that the leadership skills had been improved.

An independent assessment of the EEP found evidence that the program had a positive effect of student retention in engineering⁷. Recently, the SUCCEED assessment team performed a longitudinal study to determine whether EEP had an impact on retention of students in engineering. In a paired study of 92 EEP students matched with non-EEP students with similar demographics and SAT scores. The study found a significantly higher probability ($p < .005$) for EEP students to graduate in engineering than non-EEP students. The 95% confidence interval for increased retention was 6.3 to 32.8%; in other words, students participating in EEP were somewhere between 6.3 and 32.8% more likely to graduate in engineering than non-EEP students.

Current status and future plans

Several former students have cited the EEP as a significant factor in their personal successes. Former students and alumni connected with the program have recently provided \$1.8 million in endowment support to ensure its continuation. These funds will be used to grow and enhance the program. Current activities include establishment of an Engineering Entrepreneur in Residence program, and expansion of the program to include a 3-credit course option in addition to the current 1-credit and 4-credit options. Establishment of an external advisory board and development of a certificate program in engineering entrepreneurship are in the planning stages.

References

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