Engineering Education Degree Gives Students Best of Both Worlds

by Kenneth Reid

Ohio Northern University engineering education major Meghan Letizia tests the robot arm designed by her team in an introduction to engineering course.

Ohio Northern University (ONU) in Ada, OH, introduced a new bachelor's of science program in engineering education in 2011. Graduates of the program will earn a bachelor's degree in engineering and meet the requirements to obtain licensure as a high school and adult and young adolescent mathematics teacher. This plan of study is similar to a general or interdisciplinary engineering degree offered at a few universities.

An initial cohort of four students began in fall 2011. Six more students joined the program in 2012. The second-year total was brought to 12 when two students transferred into the program in 2012.[1-3]

Why would a student choose this major when a typical, discipline specific major would offer, on average, a much higher salary than the earnings of a secondary school teacher? Clearly, students who select engineering as their field of study and are motivated by potential financial gain would tend to be attracted to typical disciplines within engineering. Students with an interest in engineering who also want to teach might have selected a more traditional teaching major from an education program. This paper provides insight as to why students find multidisciplinary degrees, such as the engineering education degree at ONU, attractive. It also discusses the reasons and influences behind students' selection of an engineering education degree.

Motivation to study engineering

A report from the Center for Advancement of Engineering Education (CAEE) [4] found that students were motivated to study engineering, in order of importance, because of:

1. Intrinsic (psychological) factors
2. Intrinsic (behavioral) factors
3. Social good
4. Financial
5. Influence of mentors
6. Influence of parents

Students who were motivated to study engineering for their own intrinsic reward were more likely to persist. These findings are supported by research from Purdue University. Additional studies from an American Society for Engineering Education (ASEE) committee emphasized the importance of student motivation toward their success, which is strongly linked to self-efficacy, a belief that the individual student can succeed at a specific task. [4- 6]

These findings indicate that students who may be more driven toward engineering for intrinsic factors and the desire "to do good for society" often select engineering as a field of study. Desire for future financial gain is not the primary motive of many students entering engineering.

The students in the new engineering education major at ONU were sent an online questionnaire to shed light on their motivations for pursing this track. Nine students responded.

The questions on the survey included:

1. What did you plan to study in college?
2. Why did you choose engineering education?
    a. Were there any influences?

b. Would you say you selected this degree because it was brand new and unique or because it matched your interests (or both)?

3. Why should someone select this major? Any reasons why they should not?
4. Why should someone select a major that is unique or new?
5. How is it going so far? Is it meeting your expectations?
6. Where do you see yourself in five years?

Results

Plans prior to college and influences:

All students said that they specifically had planned to major in engineering while in high school, although one was more interested in teaching in some capacity. One said that he repeatedly heard the message that, because he was good at math and science, he "should be an engineer," a common message in K-12. Two specifically cited playing with Legos and K'Nex toys as children developed their interest design.

All respondents said they possess an interest in teaching or working with children in some aspect. Each student said their parents influenced their decision to pursue engineering. The two transfer students said they chose this program after discovering the possibility of obtaining an engineering education degree in four years.

One student in the first cohort said:

> "The thought of becoming a teacher and coach was always lingering in the back of my mind as I was deciding what to do for the rest of my life. But my parents (who are both teachers), kept deterring me away from this idea and urged me toward my other interest of engineering."

A student entering with the second cohort said:

> "I had always enjoyed the idea of being a teacher, but I was unsure of which subject I would end up getting a licensure for. My calculus teacher served as one of my biggest

> influences for wanting to teach math, and my parents were receptive of that goal. This surge of inspiration didn't hit until after I had toured colleges for engineering. Once I heard about the new program, it seemed like the perfect combination of my interests. It was an opportunity that I just couldn't ignore."

Each student cited an interest in teaching and engineering, and had parental influence toward engineering.

Selection of a unique major:

Each student said they selected engineering education because it bridged the gap or brought their two interests together. Furthermore, each student said that the fact that the major was new and unique had no influence in their decision. Two students specifically recommended against selecting a unique degree program based on its novelty. The program's strong foundation in two disciplines played an important role in students' decision making, more so than the novelty of a new, unique or innovative degree program. Again, while the sample size is small, it is rewarding to hear students report that they selected the major on its merits rather than its novelty.

On the subject of the selection of his program of study, one student said:

> "I was torn between engineering and teaching, and [the recruiter] told me about this new program that ONU was starting called 'engineering education.' The very next day, I set up a tour of the school. When the tour was over, I knew this was perfect for me and I didn't even apply to another school. After choosing to go here, participating in the [science, technology, engineering and mathematics] STEM day at Washington Intermediate School in Piqua, OH, made me certain of my choice. I could see myself teaching those topics every day of my life and loving every minute of it. Although it is very exciting that I am in a brand new program, it had no influence on my overall choice; it's just a stroke of luck that I found it. I am solely in this because it is THE perfect fit for me."

One student discusses the advantages of being one of the first in an innovative major:

> "I got to participate in a STEM field day at an elementary school; I was on the front page of the university website; I authored a paper about my major; I was interviewed on television about a scholarship I received and what engineering education is; and I am co-authoring conference papers. The professors really care about you and go out of their way to make these the best four years of your lives. Who wouldn't want that? We only started with four students in this major and it is growing bigger and bigger each year. Now, we are up to 12 and we are planning on getting larger and showing the world what we can do."

What will you do in five years?

None of the students had a specific plan, which is not surprising given the fact that they were first-semester students at the time of the survey. Four students mentioned the possibility of master's and doctorate degrees, and two discussed their goal to enter academia. Three students mentioned a strong possibility of teaching in the K-12 environment. Two students mentioned working as an engineer; it may be significant that this was not the first option mentioned by these students.

One student's summation was typical of conversations we have had this year:

> "Where and what type of employment this might lead to is still unclear due to the foggy career options that this major entails."

Regarding graduate school, one student said:

> "In five years, I see myself being a graduate of ONU and in graduate school somewhere getting a master's degree in engineering education. Getting this degree will help me find a job easier and will enable me to be ready for whatever comes at me."

Another said:

> "I wasn't expecting graduate schools to take such interest in the engineering education program and the students. What I've experienced so far has exceeded my expectations."

Overall, we found that students who formed the initial two cohorts of a brand new plan of study in engineering education had some similar experiences and paths toward their selection of majors. Each had interest in both areas prior to college and found that the major fit their interests rather than constructed a new vision based on the uniqueness of the major itself. This can be an important finding for universities planning innovative degree programs. It may be important to establish an interest in the program based on its merits rather than simply for its novelty.

The responses indicated that support is important when a program is in its infancy. These students have a built-in support system and the degree does allow them to have some unique experiences through their course of study. Offering adequate support toward their success is important.

Finally, the visions of these students include working as a practicing engineers, becoming K-12 teachers and pursuing advanced degrees. The outlook for these students seems to be no more uncertain than a student in a typical engineering discipline—it may be similar to asking a first-year electrical engineering student if he or she prefers controls, microprocessors or analog design in four years.

Engineering Education students contributing to this article include junior Liz Spingola, sophomores Tyler Hertenstein and Graham Fennell, and first-year students Meghan Letizia and David Reeping.

References

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About the Author

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