

Work in Progress: Am I an engineer yet? Perceptions of identity among first year students

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Abstract

This project is a Work in Progress. The development of a professional identity is believed to be a critical pathway to persistence in an engineering major. Engineering programs increasingly realize that this identity development begins in the first year of college (or even before). Students who perceive themselves to be engineers and to use engineering ways of thinking are believed to be more likely to persist and to engage in important professional development experiences like co-op, internship, research experiences, and discipline-related extracurricular clubs. This paper reports preliminary findings on common concepts and themes that appeared when first-year pre-engineering majors were asked to describe the nature of engineering and their own development as engineers. We used qualitative text analysis approaches to understand the breadth of responses that these students had to open-ended prompts.

Keywords

Engineer identity; occupational value; gender differences

Introduction

The development of a professional identity is believed to be a critical pathway to persistence in an engineering major¹²³. Engineering programs increasingly realize that this identity development begins in the first year of college (or even before). Students who perceive themselves to be engineers and to use engineering ways of thinking are believed to be more likely to persist and to engage in important professional development experiences like co-op, internship, research experiences, and field-related extracurricular clubs, such as honor societies.

Previous studies⁴ explored students' perception that they had a "knack" for engineering and distinguished three levels of conceptions of engineering: engineers as tinkerers, engineers as those who apply science to practical problems, and engineers as 21st century interdisciplinary problem-solvers with a social impact. They argued that the last, most modern, and inclusive conception of engineering was most likely to support students' development of an engineering identity. This effect was expected to be greater for traditionally underrepresented groups such as women and racial/ethnic minorities.

The goal of the present research was to (a) replicate their categorization of perceptions in a different university context and (b) to explore the relationship between perceptions of engineering and race, ethnicity, and gender. To address these questions, surveys were gathered

from approximately 200 first-year engineering students. Qualitative themes are being used to sort student responses and quantitative methods will be used to consider the prevalence of different themes among subgroups of students.

Methods

We administered a survey on engineering attitudes to a large sample of first-year students enrolled in a pre-engineering introductory course at a large four-year, research focused institution. The survey, which was administered as part of a larger project, included scales related to students' attitudes about engineering and demographic question (race/ethnicity, gender, etc.). It also included our focal four open-ended questions. We currently have Spring 2016 data and will soon have Fall 2016 data to add to our analyses.

Participants

The focal university offers a pre-engineering course designed to offer students an opportunity to learn more about the key concepts in their intended major as well as help them develop or review the fundamental skills needed for advanced engineering coursework. To gather a representative sample of the pre-engineering majors at this university, we therefore approached the instructors of this course (required for all pre-engineering majors) to invite their students to participate. This survey occurred within the last two weeks of the semester and was conducted online.

In Spring 2016, six course instructors allowed us to survey their students. A total of 208 students completed the survey. Along with the focal questions, students were asked to report their gender, race, and whether they were a first-year student, transfer student, or other (occasionally students do not take this course until their second year at the university).

Consistent with the College of Engineering reported demographics, the student makeup in this sample was predominantly white (87%). Just 7% reported being Asian or Pacific Islander, 5% reported being African-American, 2% were multi-racial. About 3% reported being Hispanic. About 20% of the students were female, which is lower than typical engineering school, but accurate for this institution (the freshman engineering class at this university was 18% female). As expected, 91% of respondents were first year students, while 7% were transfer students. Participating faculty came from a range of engineering programs including Biosystems, Chemical, Industrial and Systems, Mechanical, Polymer and Fiber, and Computer Engineering.

In addition to a series of Likert-type rating scales (developed for a related evaluation study), students were asked to respond to four open-ended question prompts:

- In your own words, define “engineer”.
- In your own words, define “engineering”.
- Do you consider yourself an engineer? Why or why not?
- What are your professional goals in becoming an engineer?

We used a qualitative approach to analyzing the open-ended questions as narrative data.⁵ First, we reviewed the responses for broad themes, then worked as a group of two raters to create a

shared understanding of the range of responses to the questions. We then condensed our themes into a coding scheme to represent our findings.

Results

Students answered four open-ended questions as part of a course survey. In Spring 2016, these questions were only administered at the end of the semester. In Fall 2016, we will collect both pre- and post-semester responses and will analyze those responses before the spring conference. For now, we have analyzed one of the four questions and can share those findings.

Do you consider yourself an engineer? Why or why not?

When students were asked if they considered themselves engineers, 45 students answered positively that they were while 37 indicated they were not. Among students who indicated they were not engineers, by far the most common reason given was that they had not completed the coursework required by their degree (17 responses). This suggests that students are oriented towards engineering as a profession more than a field of practice or a way of working. Other reasons given were that the student struggled with physics (2 students), that they hadn't solved any "real" problems or worked outside of their classes (4).

Among students who stated they *were* already engineers, the reasons they gave most commonly mentioned problem solving or being problem oriented (17 responses), seeking to improve the way things work or help others (17 responses [respondents could be counted as having multiple reasons]), and being creative with new ideas or inventing new solutions (13 responses). Less common responses included enjoying building (4) and learning how things work (4), being good at math and science (4) or analysis (4), and having the skills, "brain", or work ethic of an engineer (3).

A third group of students could also be identified that represented students who expressed both positive and negative answers to this question. These students focused on the training and learning of skills needed to be an engineer; that it was a process they were actively pursuing. In our sample, 19 students responded in this manner and represented students who identified as engineers (7) and those who did not (12). What was different about this group of students was that they viewed engineering as a combination of skills to be learned and not just a degree title or a mindset they already possessed.

We created a word cloud to help visualize common themes across all students. We were pleased to see that creativity, problem solving, making the world better, and solution-oriented design thinking were common in students' responses. It is less clear whether it is a good thing that many students focus on being good at science and math as being a requirement of being an engineer.

Discussion and Conclusions

We will continue to analyze the new data as it is received. Importantly, we will apply similar methods to the other three open-ended questions. We will also have pre- and post-semester answers from students enrolled in this course for Fall 2016. This should provide a rich dataset to explore how students' perceptions of their engineer identity change during their first year.

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Ashley Hill

Ashley Hill is currently a doctoral student in Educational Psychology at Auburn University. She is interested in examining the various factors that influence female engineering students' commitment and retention in the major.