Research Brief
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I'm Graduating This Year! So What IS an Engineer Anyway?

Authors: Holly Matusovich, Ruth Streveler, Ron Miller, and Barbara Olds
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We often assume that graduating engineering students readily envision what it means to be an engineer and what type of work they will be doing as engineers in the future. How can we know if this is true? This research begins to answer these questions by aiming to understand undergraduate engineering students' perceptions of themselves as engineers in the future as well as by considering how these perceptions shape their choice to become engineers.

...this research identified a theme of uncertainty about what it means to be an engineer.

Implications of Findings

This research has implications for both future research and for practitioners (as described in more detail in the full paper at the link below). For future research, we begin to define an aspect of identity, self-perceptions as a future engineer, in a way that could be useful for developing quantitative identity measures. Also by demonstrating that some students are still uncertain about what it means to be an engineer even into their third year in college, we open the door for future research questions as well as considerations for practice. As researchers, we need to ask how our students learn what it means to be an engineer and conversely why uncertainty persists for some students. For practitioners, we need to ask ourselves what messages we are sending about being an engineer and if these are the right messages. We also need to understand what this uncertainty could mean for our students.

Methods and Background

The theoretical framework for this research is Eccles' expectancy-value model. This model highlights ability beliefs, *how people judge their ability for a particular activity*, and value or importance beliefs, *how important an activity is to a person*. Eccles' model suggests that people typically choose to engage in activities 1) that they believe they can do well (positive ability belief) and/or 2) activities that are important to them (positive importance belief). Within this model, identity beliefs contribute to ability and importance beliefs. Identity is broadly defined as *the kind of person that one is now or wants to be in the future*.

This research begins an exploration of the choice process to become an engineer by examining identity and career choice as motivational constructs within Eccles' expectancy-value theory. More specifically, identity has been framed as engineering students' perceptions of themselves as engineers in the future. Career choice has been framed as continued enrollment in an undergraduate engineering major.

In conjunction with the theoretical framework described in the full paper (see link below), this research employed a multiple case (multicase) study research method. Together, expectancy-value and multicase method frameworks shaped participant selection and data analysis choices.

Further, although this study limits the scope of identity to the participants' self-perceptions as future engineers, this one aspect can still encompass a broad range of individual beliefs. To further operationalize this aspect, we incorporated Gee's conception of identity. Gee defines identity as "being recognized as a certain type of person." He profiles four different, but simultaneous and interactional identities. These identities are: 1) nature identity, 2) institutional identity, 3) discourse identity, 4) affinity identity. A single identity is an interconnection of all four identity types, although any particular one can dominate under specific circumstances. (See full paper at the link below for additional detail and citations.)

The data analyzed for this study were collected as part of a larger body of work, the Academic Pathways Study (APS), conducted by the NSF-funded Center for Advancement of Engineering Education (CAEE). Overall study design and data collection strategies have been described previously. Data collection specifically at Technical Public Institution (TPub, pseudonym) has also been described. A subset of APS data was used in this analysis as described in the following sections. (See full paper at the link below for appropriate citations.)

Participants in this study included five male and five female undergraduate students majoring in engineering programs at TPub. These ten students were purposefully selected from 16 possible APS participants who had engaged in semi-structured interviews because they had completed the full set of semi-structured interviews, i.e., one interview each year for four years. The primary data for this study were these semi-structured interviews conducted annually with all participants. The interviewers followed a loosely scripted set of questions but had the freedom to diverge from the list as deemed appropriate to probe for further information.

A multi-phase process was used to develop a set of themes and a coding strategy that was applied to all semi-structured interviews. Informal conversations were also analyzed to verify that themes identified in the semi-structured interviews also appeared in the informal conversations. See the detailed explanation of this coding scheme in the full paper at the link below.

What We Found

The results of this analysis support two primary assertions. First, the participants' self-perceptions of being engineers in the future include visions of themselves as being good in math and science, being good communicators, being good at teamwork, enjoying activities they believe engineers do, doing problem-solving, and having/applying technical knowledge. Second, despite almost four years in engineering-related classes and activities, three of ten participants remained unsure of what it means to be an engineer.

Gee's four interrelated aspects of identity (nature, institution, affinity and discourse identities; see above) were used in a priori coding. Within each coding category, e.g., institutional identity, the data were grouped into key themes found within that category across participants.

Discourse identity is believed to provide a lens through which nature, institution, and affinity identities are viewed. A discourse identity involves interactions with others, therefore the primary data source—the interviews themselves—need to be viewed as a form of discourse (see Figure 3 in the full text at the link below for an illustration).

Nature identity was operationalized for this study as a perceived trait that is ingrained or characteristic of an engineer. In other words, this is not a matter of choice or level of effort. In this study, math and science ability was the most common nature identity. Seven of the ten participants talked about being good at math and science in one or more interviews.

Institutional identity was operationalized as a trait or characteristic needed to perform an engineering job in a real or implied setting. Being a "good communicator" and "good team worker" are the two most cited themes grouped as institutional identity. Eight of the ten participants talked about good communication skills as being important in engineering careers.

Affinity identity was operationalized as engaging in an activity or process perceived to be engaged in by engineers. For the participants in this study, three main affinity-related themes emerged including 1) having an interest or passion for math and science, understanding how things work, design, engineering, etc. 2) being a problem-solver, and 3) having and applying technical knowledge. At some point over the four years of interviews all ten participants reference each of the three affinity identity themes.

A commonality among the affinity identity themes is the participants' perception that these are things that all people who call themselves engineers do to be part of a shared membership in this group called "engineers." Affinity identity is distinguished from institutional identity because the affinity traits are perceived as universal and are not associated with working in specific environments. Affinity identity is distinguished from nature identity because affinity identities represent activities one chooses to participate in rather than being inherent traits.

In addition to the themes related to Gee's aspects of identity, this research identified a theme of uncertainty about what it means to be an engineer. Three participants had lingering or persistent uncertainty throughout their four years about what engineers do. These participants described nature, institution, and/or affinity identities. However, they also repeatedly reported not knowing what engineering is or what to expect in the future.

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