

Engineering a Culture of Engagement

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Abstract

This paper presents the current status of a research project underway at Montana State University investigating student “dis-engagement” and how it relates to a student’s ultimate motivation to enter the engineering workforce. This research aims to understand why engineering students show less and less concern over time for how engineering contributes to public welfare. Prior work has shown that when the engineering profession is viewed as one that holds only agentic value (i.e., advancement only for one’s self), it is often unappealing to certain student groups, especially women and first generation college students. If interventions can be implemented that change the value system among engineers to create a culture that views engineering as having important prosocial, communal value, this cultural shift will have a transformative impact on the formation of engineers by attracting a more diverse population into the profession. This will in turn spur innovation and support an inclusive engineering workforce. This two-year project is currently in its first year through funding from the National Science Foundation’s Research Initiation in Engineering Formation (RIEF) program. This paper will present the initial findings of a comprehensive survey deployed in a 100-level, electrical engineering course to measure student attitudes about, stereotypes of, and overall level of (dis)engagement in engineering. This paper will benefit engineering educators interested in improving student persistence, retention, and graduation rates through cultural interventions. The ultimate goal of this work is to contribute to the body of knowledge of how to produce graduates that choose to stay in the engineering workforce with a commitment to benefiting society through their work.

Project Overview

The overall objective of this project is to initiate boundary-spanning research on how a culture of disengagement hinders the professional formation of engineers. This research aims to understand why engineering students show less and less concern overtime for how engineering contributes to public welfare (Cech, 2014). We propose to conduct the preliminary research needed to design and test a future intervention that will change the value system among engineers to as to create a culture that views engineering as having important prosocial, communal value. This cultural shift will have a transformative impact on the formation of engineers by attracting a more diverse population into the profession. This will in turn spur innovation and support an inclusive engineering workforce. This research is grounded in *Utility Value Theory* (e.g., Harackiewicz et al., 2014; Hullerman & Harackiewicz, 2009; Brown, Smith et al., in press) with a specific focus on fostering and maintaining engineering students’ view that engineering affords an important prosocial, communal utility. The long term plan for this research (5 years) is to design and test the effectiveness of a large scale intervention guided by Utility Value Theory to contribute to a long lasting culture of engagement within engineering. The focus of *this* research initiation project (NSF RIEF 2 years) is on selecting and refining the theory-informed instruments to measure engagement of electrical engineering students at MSU and propose interventions to create change.

Background – Utility Value Theory

Research in social psychology has continually shown that students' expectancies for success (e.g., self-efficacy) and the perceived value of a particular career predicts motivation to pursue that career. Classic work within this *Expectancy-Value* framework (e.g., Eccles et al., 1983) has examined this relationship for decades on primarily non-engineering students (e.g., math and biology, Eccles, 1984; Wigfield & Eccles, 1992; Sullins, Hernandez, Fuller, & Tashiro, 1995). Until relatively recently, the focus of expectancy-value research has centered predominately on the "expectancy" side of the theory (and has extended into other theories such as social-cognitive career theory, Lent, 1996) with an emphasis on supporting students' feelings of competence and confidence. Recent work by Dr. Smith and others shows it is possible to "add value" to otherwise value-less domains (Brown, Smith et al., in press; Diekman et al., 2011; Harackiewicz et al., 2014). There are different types of subjective values (Eccles, 2009) and the bulk of recent work has centered on Utility Value. Utility – how something is useful – can take many forms. Something can have utility because it helps other people or because it results in a lucrative career or other various examples. There are generally two categories of utility; self-focused and other-focused (Bakan, 1966). We focus here on other-focused utility values.

In the emerging line of work on Utility Value Theory, the typical study involves pointing out to people - or having them point out to themselves – the way in which a given topic affords prosocial values. For example, providing students with a description of the day in the life of a scientist that was manipulated to focus (or not) on the scientist's communal activities (mentoring others, helping others) resulted in more students showing interest in pursuing a science career (Diekman et al., 2011). Similarly, when introductory biology students are asked to complete a series of homework assignments that focus on the utility of what they are learning (they most often spontaneously generated utility connections that focused on helping others), the students show improved motivation for and performance in the biology course (Harackiewicz et al. 2014). These new findings in the literature suggest one way to increase un-motivated students' interest in science is to help them see its utility value. But our proposal differs in an important way from this work. The findings in Cech (2014) suggest that engineering students will not spontaneously see the prosocial value of their field on their own and that reading about ways in which engineering does translate and have public welfare impact will not serve any motivational purpose.

Our research focus is thus on the novel aspect of "creating value." Eccles herself has suggested that understanding value, particularly in terms of how it relates to students' perceptions of their own identities and social roles, is key to understanding motivated action (Eccles, 2009). Instead of focusing on the value that students already see – or the value they desire to see – in a given career or subject (Brown, Smith et al, in press; Diekman et al., 2011; Harackiewicz et al., 2014; Hullerman & Harackiewicz, 2009) we test the feasibility of an intervention to catalyze engineering students' *internalization* of a value; a prosocial, communal value of engineering.

Methods

In this project, we will attempt to duplicate Erin Cech's study on students' lack of engagement. We will administer surveys in a 100-level course in electrical engineering and again in a 400-level electrical engineering course using Cech's original instruments. We will determine if the same level of disengagement exists at Montana State University, specifically with electrical engineering students. We will then devise an intervention based on the Utility Value Theory to counteract this disengagement. Since this project is an NSF RIEF program, a significant amount of the effort is in training the engineering faculty (Dr. LaMeres) in the research methods used by social psychologists (Dr. Smith).

Current Status

The survey instruments were selected, refined, and used to create a codebook that was approved by the MSU Institutional Review Board in the summer of 2016. The survey was implemented in the Qualtrics system and administered in a 100-level electrical engineering course in fall 2016. This data is currently being analyzed to see if it matches Cech's results. The survey will be administered in the spring 2017 semester to a 400-level course. By the time of the ASEE poster session, our team will have both surveys analyzed and be able to present our findings.

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