

Do Students Value the Pro-Social Side of Electrical Engineering?

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Abstract: The engineering workforce of tomorrow must be prepared to solve problems that are on a scale never seen before. The National Academy of Engineering (NAE) has determined that there are 14 *Grand Challenges* that must be solved in the 21st century to ensure the continued prosperity of humanity. The enormity of these challenges is so great that no one professional discipline can solve them alone. As the stewards of technology, the engineering profession has the onus of taking the lead in finding solutions to these grand challenges. In 2004, the NAE's report titled *The Engineering of 2020* called for a transformation of engineering higher education to move beyond the traditional, in-depth, discipline-specific training it has provided for the past century in order to produce students who are prepared to meet the grand challenges. The intended outcomes of this transformation were students prepared to lead multi-disciplinary teams and think about problems in a global context. What made this NAE charge so unique was that the skills required to reach these outcomes were not necessarily technical, but instead were *pro-social*, or what engineering often refer to as *soft skills*. These pro-social skills include more exposure to a broad general education, enhanced communication skills (reading/writing/presenting), project management training, multidisciplinary design experience, and more critical thinking exercises on the ethical consequences of technology. Around this time, the accreditation board for engineering and technology (ABET) began altering its learning outcomes for higher education programs to reflect the new skill requirements of engineering graduates. This ultimately had the impact of altering engineering curriculums to meet these outcomes by increasing general education through more core requirements, infusing communication training through writing and presentation assignments, and adding in the now ubiquitous *senior capstone* project. Today, higher education has been implementing this revamped curriculum for over a decade. It would be expected that at this point, engineering students understand the reason for, and strongly

value, the new pro-social skills they are acquiring in higher education. However, this is not the case. In 2014, a large, multi-university, longitudinal study showed that engineering students across multiple disciplines valued technical skills significantly higher than pro-social skills (Cech, 2014). Of even more concern was that how much they valued pro-social skills *decreased* from the time they entered an engineering program until they graduated. This is a cause of great concern for numerous reasons. First, the pro-social skills that the NAE called for to meet the grand challenges are not being embraced by engineering students and are still seen as *soft* compared to the traditional, discipline specific technical training they receive. When students do not fully embrace these skills, they will not have the intended impact on student preparation to meet the grand challenges. Second, the fact that the level of pro-social value decreased while in college indicates that faculty are reinforcing the notion that pro-social skills are not as important as technical skills. This is occurring despite ABET setting firm requirements that these skills are indeed important and need to be integrated throughout the curriculum. Finally, research in social psychology has demonstrated that there is a direct relationship between how much value an individual associates with an activity and their motivation to fully engage in it. This means student motivation to persist in an engineering degree program and ultimately join the engineering workforce is diminished when they are continually exposed to activities they don't value. Additionally, if a student initially values pro-social skills, they may not choose engineering because the culture is perceived as not valuing their own beliefs. This has the impact of making engineering non-inclusive and can contribute to the alarmingly low participation of women in the profession. This paper presents the results of a study funded by the National Science Foundation that measured value beliefs of students enrolled in an electrical engineering program at a medium sized, land grant institution in the pacific northwest. The study duplicated the results of Cech, 2014 but extended the study to measure communal goal affordance of engineering, intention to persist in engineering, and levels of trait empathy.