

Impact of Service on Engineering Students: Preliminary Findings on Knowledge and Skills of Students

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Over the last few years, concerns have escalated among many national organizations that technical expertise is no longer solely sufficient for the development of future engineers^{1,2,3,7}. Additionally, in the United States engineering programs continue to struggle to attract students, especially women and minorities, despite decades of strategies to change these patterns. The need for a “paradigm shift” is recognized; one that broadens the attributes provided by, the diversity of those who participate in, and the benefits developed from engineering education. With respect to many of these desired aims, recent research has discovered and espoused the positive contributions of Learning Through Service (LTS) in engineering education^{5,6,9}. This awareness has often come obliquely with some of the most engaging LTS opportunities originating outside formal academic learning (i.e., the classroom). For example, since 2002, students in more than half the nation’s engineering colleges have developed student chapters of Engineers Without Borders-USA (EWB-USA) that serve developing communities through project work⁸. There are few, if any, other such dramatic and widespread movements within engineering education, yet, with such a rapid change, a thorough understanding of best practices and outcomes, beneficial and otherwise, are lagging⁴. How service efforts affect the developmental processes of engineering students requires a coordinated, comprehensive, and longer-term examination.

The ISES project, also termed the Engineering Pathways Study, is the first step in this desired, long-term examination. The project aims to evaluate what desired attributes of future engineers are impacted by a student’s involvement in LTS efforts *and* how these attributes develop over the time of a student’s undergraduate education. The project consists of a sequential, but staggered longitudinal study of engineering students at four institutions; namely Michigan Technological University, Tufts University, University of Colorado Boulder, and James Madison University. In addition, another group of students associated with EWB-USA student chapters from across the country was assembled. The project uses various quantitative and qualitative instruments to explore the impacts of LTS on engineering students’ learning; specifically, traditionally technical attributes (e.g., ABET Criteria 3a-e) as well as a mix of non-technical attributes (e.g. global awareness, social context of problems, self-efficacy, identity, civic development, intercultural sensitivity, and psychosocial well-being).

This presentation focuses on a preliminary analysis of the first round of quantitative results. In summary, preliminary analysis of these quantitative-only results indicates that LTS experiences have a positive impact on students. Specifically, over 250 student responses were collected during the Spring 2011 term with students categorized by their self-proclaimed level of LTS experience as either none, low, or high. Analysis focused on specific knowledge and skills that students perceive they possess at a given snapshot in time. Comparisons; between

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first-year and junior students, male and female students, and students with low/moderate/high GPAs, strongly indicate that increased LTS experience leads to a perceived, higher achievement in desirable engineering attributes. Future quantitative data reduction and analyses will focus on 1) other surveyed attributes, such as attitudes, self-efficacy, and general well-being; and 2) how student responses may change over time. These quantitative results will also be compared to qualitative data collected from student interviews; creating a stronger and richer characterization of the impacts LTS has on engineering students. It is hoped that the project will add to the growing body of evidence that LTS has a positive benefit on an engineer's ability and desire to learn.

Keywords: learning through service, engineering, technical knowledge, quantitative evaluation

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