Engineering Education Research Methods to Determine Conceptions of Engineers and of Engineering

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Engineering education research has been categorised into the five research areas of 'engineering epistemologies', 'engineering learning mechanisms', 'engineering learning systems', engineering diversity and inclusiveness', and 'engineering assessment' (Adams et al., 2006). Of particular importance to research concerned with engineering diversity and inclusiveness are definitions and conceptions of engineers and engineering. While the National Academy of Engineering (2008, p.5) defines engineering as a profession in which engineers "constantly discover how to improve our lives by creating bold new solutions that connect science to life in unexpected, forward-thinking ways", they do acknowledge that most students have a limited understanding of what engineering is and what engineers actually do. A substantial number of empirical studies examining students understanding of engineers and engineering corroborate this, finding that the concept of an engineer is often narrow and stereotyped (Capobianco, Diefes-Dux, Mena, & Weller, 2011; Ergün & Doğukan Balçın, 2018; Fralick, Kearn, Thompson, & Lyons, 2009; Karatas, Micklos, & Bodner, 2011). This creates a significant implication of engineering education research as when constructs such as interest or motivation in engineering are being investigated, study participants, who are typically students, may be operating with varied conceptions of engineering. Therefore, while they may all be asked the same questions, but they may all be answering relative to different concepts.

This presentation will focus on two methods for eliciting conceptions of engineers and of engineering based on two ongoing studies. The Draw-an-Engineer Test (DAET) (Knight & Cunningham, 2004) which asks participants to "draw an engineer doing engineering work" will be discussed as a tool to capture stereotyped understandings of engineers and engineering at an individual or group level. Additionally, a method for capturing prototypical definitions of engineers and engineering will be discussed. This method, based on the work of Rosch (Rosch, 1977; Rosch & Mervis, 1975; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976), allows for a prototype of a construct to be captured at a group level and the qualities that are most important to the prototype to be identified. Both methods will be discussed in the context of on-going studies with advantages and limitations presented for each relative to engineering education research.

These two methods offer significant opportunities for engineering education research because of the difficulty in ascribing a precise definition to engineering and engineers. This is particularly true for people who are not directly involved in engineering themselves, who are often the subject of pertinent investigations. Being able to capture stereotyped images of engineers can allow misconceptions surrounding engineering to be addressed. This, for example, would allow students who are considering entering engineering to make decisions on more accurate information. Capturing prototypical definitions of engineering allows for the sociocultural validity of associated constructs to be examined (Sternberg, 2000) and group differences in understandings of engineers and engineering to be explored.

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