

Abandoning creativity: The evolution of creative ideas in engineering design course projects

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Creativity training has been widely integrated into engineering education as a means to prepare students to be an innovative force in design industry. However, much of this research has focused on training students to be creative idea generators, with limited attention to what happens after this generation. Thus, the current study was developed to understand how creative ideas are promoted or filtered throughout the design process in order to focus our educational efforts. In order to accomplish this, an 8-week study with 136 engineering students was conducted. Our results point to the reduction in creativity throughout the design process and student abandonment of novel concepts. We also expose the influence of the design task on student creativity.

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Training our future engineers to be creative is an important and often required component of engineering education (Canadian Engineering Accreditation Board, 2014; Dym, Agogino, Eris, Frey, & Leifer, 2005; International Engineering Alliance, 2013). This is due in part to the fact that industry is placing a larger emphasis on recruiting creative engineers because of the impact of innovation on economic and societal success (McAloone, 2007). Since product success can be linked to early ideas (Goldenberg, Lehmann, & Mazursky, 2001), research in engineering education has focused on creativity during idea generation (Daly, Yilmaz, Christian, Seifert, & Gonzalez, 2012; Linsey et al., 2011; Vargas Hernandez, Schmidt, Kremer, & Lin, 2014). While effective concept generation is imperative for innovation (Daly et al., 2012), little research has explored what happens after creative ideas are developed in engineering courses.

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properly evaluate and select creative ideas (Harms & Van der Zee, 2013). In addition, researchers have shown that people avoid rather than seek radical innovations during the design process (Goldenberg et al., 2001). This research implies that while the availability of creative ideas is necessary for innovation to occur, idea generation is only a part of the innovation process and merely developing creative ideas is an insufficient condition for innovation (Nijstad & De Dreu, 2002). Therefore, while training engineering students to develop creative ideas is an important component of engineering education, it is essential that we understand how these creative ideas progress or are filtered out throughout the design process, and what factors can influence this process. Without this knowledge, we do not know where we should focus our creativity training efforts.

In light of this inherent research gap, the current study was developed to understand how the novelty, quality, and overall creativity of student design teams' ideas change throughout the design process and what variables mediate this process. In order to answer these questions, an empirical study was conducted with 136 first-year engineering design students over the course of an 8-week (half-semester) design project in an engineering design course. The results of this study contributes new knowledge on the relationship between design outputs and the flow of creative ideas throughout the design process in an engineering design class and provides recommendations for how to focus engineering pedagogy to increase student creative outputs. Prior related researches that motivate this research study are presented in the following sections.

1 Background & motivation

Although not focused on the flow of creative ideas throughout the design process, there has been research focused on creativity in engineering education. This section serves to highlight research in this area and lay the groundwork for the current study by starting with a broad overview of creativity in engineering education and narrowing in on moderating variables such as the influence of task selection.

1.1 Creative idea development in engineering design education

Engineering educators have devoted much time and attention to integrating creativity training into the engineering curricula (Charyton, 2014). The thinking is that by teaching students the design process, individuals will be better able to connect and energize innovation processes in industry (Brown, 2008; Dym et al., 2005). While there are many stages to the design process including idea generation, idea screening (selection), idea development and solution verification (Zhang, Zhang, & Song, 2015), engineering design research has focused largely on understanding how to improve student idea generation

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