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Engineering Design Leadership within Undergraduate Design Teams and Multiteam Systems

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Biography

James Righter completed his Bachelor of Science in Mechanical Engineering at the United States Naval Academy, and his Masters of Science in Military Studies at the Marine Corps Command and Staff College, Marine Corps University. James served in the Marine Corps as a logistics officer and as a program and project manager. His primary research interests are in design team leadership and collaborative design.

Overview:

Leadership is a fundamental component of collaborative design teamwork[1]. The objective of this study is to investigate the development and changes in leadership and communication structure within undergraduate design teams. A secondary objective is to explore the possibility of the development of leadership tools and intervention techniques for design teams.

Motivation

Collaborative design and leadership within teams are recognized as critical elements of most engineering design endeavors[2]. As engineered systems become increasingly complex, the prevalence of design teams, and the size and degree of distribution of teams has undergone a corresponding increase. There can also be corresponding requirements for leadership at multiple levels of engineering teams. Leadership theories in the fields of psychology and management have attempted to describe, model, and analyze leadership within multi-level teams. The motivation for this study is to improve the understanding of where and when leadership emerges within the design team and how this changes with time. This understanding could enable future development of design leadership intervention or education techniques and tools.

State of the Art

Leadership has been theorized and studied as contingent[3], multi-level[4], and complex[5]. Contingent leadership theories contend that effective techniques will vary depending on the context of the people, the environment and the task[3,6]. In the case that the components of a team have distinct, interdependent tasks, they can be described as multiteam systems. Formal and informal leadership also exist at multiple levels of these organizations and teams[4,7]. Complex leadership theories attempt to reconcile the formal leadership structure with the complex functioning of organizations[5].

Design research has identified a taxonomy for collaborative design, and investigated the flow of information within design teams. The presence and impact of transformational and transactional leadership has been explored. Some research has been conducted on the impact of personality on the success of undergraduate design teams.

Intellectual Merit

This research seeks to answer three questions regarding collaboration in design teams: (1) how do leadership structures emerge and change through the lifecycle of a design project or design team, (2) how are effective undergraduate design teams formed, and (3) what methods or intervention techniques mediate effective leadership in design teams.

Broader Impact

Teamwork skills are readily identified by industry as critical skills for successful engineers functioning in design teams. Deeper understanding of the development of design team leadership structures is applicable to design education and multidisciplinary design practice. It may also enable the development of methods or intervention techniques to assist with teamwork skills in engineering education.

Research Approach

The research approach will be a combination of collaborative design research methodologies. A case study of collaborative design utilizing observation, document analysis, survey, and interview results will be conducted. Other experimentation techniques such as user study or protocol study will also be conducted.

Findings to Date

Preliminary review of the literature and observation suggest that team composition and leadership within design teams require further exploration, analysis and experimentation. This research is needed to increase understanding of their impact on design teams and collaborative design, and to assist with development of intervention methods.

Conclusions

Leadership and communication are components that have been identified as key skills for engineers functioning in design teams. This research will increase understanding of the development and change of leadership during the design process and assist with developing intervention methods for undergraduate design teams.

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