Productive Interactions in a Complex Engineering Project: Influence of Team Members, Engineering Practice, and Emergence of Roles

By Kritsa Chindanon
Candidate for Doctor of Philosophy in Materials Science
Major Professor: Dr. Milo D. Koretsky

Abstract

Engineering capstone projects are intended as a bridge from school to professional practice in which students work in teams to use learned knowledge and skills to complete real-world engineering projects. However, while the majority of time in many undergraduate programs is devoted to development of technical knowledge and skills, there are other important aspects for being an effective team member. This dissertation seeks to characterize more completely the aspects of professional work that manifest in three student teams and one expert team during completion of a complex engineering project. A microgenetic approach is applied to two studies of engineering teams completing a complex capstone project. In particular, the discourse is coded in terms of the types of productive interactions that the team members demonstrate as they interact to make progress. The context for the study is the completion of a complex engineering design task where teams are tasked with developing a process "recipe" to release to high volume manufacturing. All meetings of the teams were audio recorded and the transcripts of their interactions from the primary data source for this study. The first study characterizes, in depth, the interactions of one team at two times during the project. Discourse analysis of these two stages shows a concurrent shift in the social nature of the team members’ interactions. It is argued that this shift allows the roles of the lower status team members to emerge. Furthermore, the findings suggest possible key features of the complex engineering project which cultivate the more collaborative team dynamics. Results from this study emphasize the importance for both instructors and students to be aware of different ways that are related to the unique competency that each student bring when engaging in a complex engineering project. In the second study, Epistemic Network Analysis (ENA) is applied to the discourse from three student teams and a team of expert engineers to uncover the entanglement between the three aspects of engineering practice. All teams engage in conceptual, material, and social aspects of practice, but they are connected in different ways. Sample excerpts from each of the teams are provided which illustrate the different ways the conceptual, material, and social aspects of practice can "interlock," leading to the conjecture that the expert teams use conceptual tools differently than the student teams.

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School of Mechanical, Industrial and Manufacturing Engineering
Oregon State University