



**University
of Victoria**

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Arts

of

REBECCA EDWARDS

BSc (Tufts University 2009)

**“Exploring Novice Engineer’s Mental Models of Collaboration and
Engineering Design”**

Department of Educational Psychology and Leadership Studies

Monday, April 23, 2018
1:00 p.m.
Clearihue Building
Room B007

Supervisory Committee:

Dr. Allyson Hadwin, Department of Educational Psychology and Leadership Studies, University of
Victoria (Supervisor)

Dr. Peter Wild, Department of Mechanical Engineering, UVic (Outside Member)

Dr. Todd Milford, Department of Curriculum and Instruction, UVic (Additional Member)

External Examiner:

Dr. John Nesbit, Faculty of Education, Simon Fraser University

Chair of Oral Examination:

Dr. Helena Kadlec, Department of Psychology, UVic

Dr. Stephen Evans, Acting Dean, Faculty of Graduate Studies

Abstract

Engineering educators have called for research on how best to foster and assess the development of collaborative expertise, particularly around engineering design. Mental models are internal representations depicting understanding. The quality of mental models and their similarity amongst group members have been found to influence performance and group processes in a range of disciplines: For example, flight, military, medical, and business teams. The purpose of this thesis was to examine three attributes (content, structure, within-group similarity) of the mental models of first-year undergraduate engineering students hold about both collaboration and engineering design in the context of a course-based engineering design project. Participants were 251 undergraduate engineering students enrolled in a first-year engineering course. Mental models were measured using relatedness ratings. This exploratory study drew upon network analysis indices and used descriptive, correlational, and comparative statistical techniques. Findings indicate (a) monitoring was viewed as the least important collaborative idea represented in the engineering students' mental models, (b) quality or expertise is indicated by the level of connection pruning in students' mental models, (c) performance and the quality of mental models of collaboration are associated, and (d) within-group collaborative mental model compatibility was more related to performance than mental model overlap. This study contributes to engineering education by suggesting mental models of the collaborative process are an essential factor to consider when preparing undergraduate engineering students to engage in collaborative engineering design.