Computer-Supported Agile Teaching

A Dissertation

Presented to

The Faculty of the Graduate School of Arts and Sciences

Brandeis University

Department of Computer Science

Timothy J. Hickey, Advisor

In Partial Fulfillment

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Doctor of Philosophy

by

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The signed version of this signature page is on file at the Graduate School of Arts and Sciences at Brandeis University.

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Dedication

To my family, and especially my parents, Tadei and Agnes Tarimo, for your unwavering encouragement and support of my academic journey. My father, you worked very hard to make sure that I ultimately understand and embrace my strengths, discipline, academic excellence and hardworking. You all believed in me as you taught me to be influenced, not by our shortcomings and struggles, but in our faith, strengths, milestones and the numerous blessings. Thank you for supporting me the best way that you could.

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Abstract

Computer-Supported Agile Teaching

A dissertation presented to the Faculty of the
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Agile methodologies have revolutionized the software development process through continuous assessment and adaptation of the development effort, collaboration with customers, and incremental delivery of features towards a complete product. In this dissertation we are proposing an analogous methodology for pedagogy called Computer-Supported Agile Teaching (CSAT). The CSAT framework is founded on the principles of agile teaching, active learning, and a reliance on technology in achieving pedagogy design that is efficient with decision-making that is evidence-based.

In CSAT, the discovery of effective learning and teaching methods is similar to agile-based development, where students, teaching assistants (TAs) and instructors work as a cross-functional and self-organizing team. Just as in agile, the team works in transparency (collaboration among students and the teaching staff around explicit teaching and learning objectives), inspection (of the learning and teaching processes and their effectiveness towards achieving optimal curriculum results), and in adaptation of the pedagogy (teaching and learning methods and resources) in response to the observed needs and potentials of the learners. Constant use of learning analytics, formative assessments and feedback activities are used as learning opportunities and ways to evaluate learning and teaching processes. Throughout this design, we take advantage of the affordances and capabilities of modern information technology in achieving better efficiency and effectiveness of the supported learning and teaching activities.

In the four years of this doctoral work, we designed and developed the TeachBack web-based application to support the CSAT methodology. This process involved continuous engagement with teachers and students inside and outside of the classroom as we refined our pedagogy ideas and the corresponding TeachBack features. Through the use of TeachBack and various experimental studies we evaluated the feasibility and effectiveness of the proposed CSAT methodology.

We discovered that pedagogy-based use of computers in the classroom can effectively support learning and teaching. Moreover, data generated in computer-mediated classrooms can be used to more accurately discover learning characteristics of the individual students, to better evaluate the effectiveness of learning and teaching methods, to rapidly detect students at-risk, and to adapt the pedagogy to the needs and potentials of the learners using an evidence-based approach. These are the processes that define the implementation of CSAT in the classroom. Based on these results, we believe that the proposed CSAT methodology is both feasible and pedagogically effective, and has the potential to positively transform college teaching and learning.