Leveraging Course-Based Communities of Transformation to Effect Change in STEM Education

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Motivation and Overview

Active and inquiry-based learning techniques have been shown to improve student engagement, retention, and understanding in STEM, especially for historically underrepresented groups. This is particularly relevant at GMU, which enrolls large numbers of underrepresented minority (49%) and first-time college students (37%).

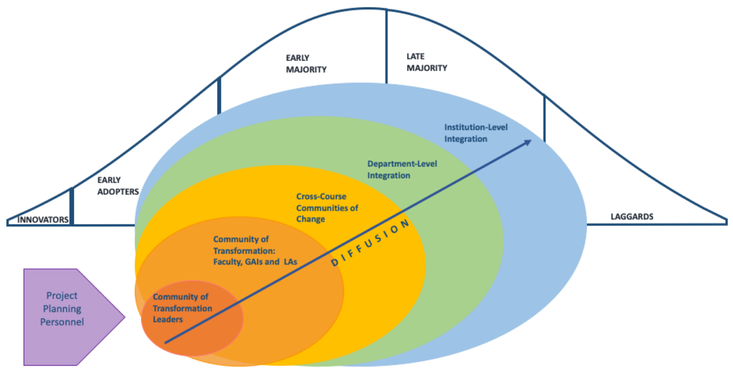
As a part of the university's strategic plan and ongoing infrastructure improvements, Mason is poised to scale its implementation of active learning by engaging faculty, graduate students, and undergraduates in changing the culture of teaching and learning.

This project will build course-based communities of transformation (CCTs) within four STEM departments (Mathematics, Physics, Biology, and Computer Science) that teach thousands of students in targeted gateway courses. These CCTs will act as a lever to expand effective pedagogical innovations beyond an individual and department to improve campus-wide teaching and learning.

Theory of Change

The proposed change model combines a bottom-up, or grassroots, approach via individual faculty operating within STEM programs with top-down (university administrative) support. The literature on organizational learning, faculty development, and active learning are brought together as the basis for this work. Building on this foundation, the effort will develop and test a model of organizational change catalyzed within and diffusing from academic departments and classroom-level change in order to finally overcome the barriers that have impeded the spread of active learning beyond the early adopters.

Innovation Diffusion & Organizational Change Model



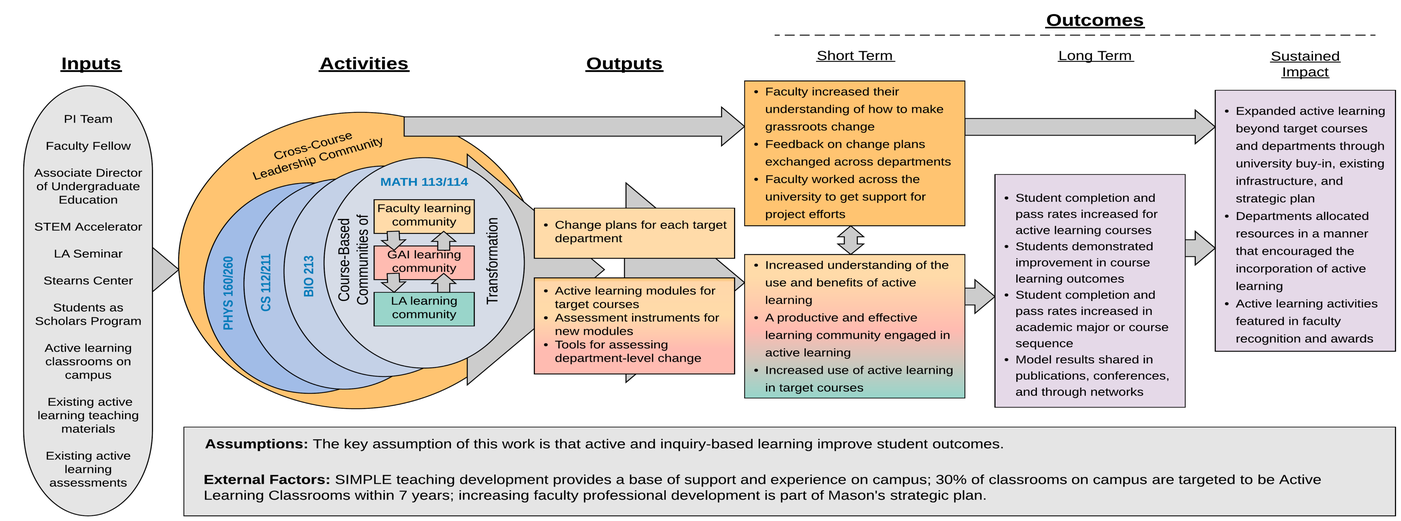
Project Goals

- Use multi-generational (faculty, graduate teaching assistant, and undergraduate learning assistant) teams to spread the culture of active learning beyond early adopters within the STEM faculty and facilitate broad adoption at Mason.
- Develop an understanding of how a faculty-driven grassroots approach, combined with institutional support, can build a culture of active learning across institutions of higher education.
- Study strategies to remove barriers for faculty implementing new evidence-based teaching methods.
- Prepare the next generation of STEM educators by involving graduate and undergraduate students in the implementation of active learning in the classroom.

Research Questions

- To what extent do the tactics, including team management and facilitation, outlined in the grassroots change theory and taught in the trainings, help to create sustainable course-level and department-level changes toward the use of inquiry-based learning across those departments?
- To what extent do graduate apprentice instructors and undergraduate learning assistants assist in diffusing course-level change to the department or college level?
- How do grassroots tactics, implemented through communities of transformation, interact to impact the diffusion of course-, department-, and institution-level change, and to influence organizational learning?

Project Logic Model



Initial Project Activities

A day-long active learning and organizational change training was held for the Math CCT in early February 2019. The Math CCT has identified several focus areas for their efforts:

- **Restructure recitations for intro calculus courses to implement active learning practices**
- **Create a seminar series on Teaching and Learning of Mathematics**
- Study effectiveness of a pre-calculus course relative to two-semester calculus with integrated pre-calculus
- Examine the effectiveness of the current course placement process
- Create a site with a compilation of teaching materials to share

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