Reimagining Calculus Through Team-Based Course Redesign

Samara Chamoun
University of Notre Dame

Kathy Quardokus Fisher
University of Notre Dame

Neil Nicholson
University of Notre Dame

Kathryn Mulholland
University of Notre Dame

Anne Pilkington
University of Notre Dame

Richard Hind
University of Notre Dame

Kuangchen Hsu
University of Notre Dame

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Change guided by a shared vision and aligned with a department's cultural norms can be transformative. With a charge from administrative leadership, Notre Dame (ND) Learning has established the Foundational Course Transformation Academy (FCTA) as a team-based process grounded in literature to facilitate sustainable change. Currently, ND Learning is partnering with the Department of Mathematics to redesign the Calculus I course with an eye toward building learning-centered environments that are better for students and instructors.

According to Henderson et al. (2011), effective change strategies must align with the beliefs of those involved, avoid uniform policies that deter individualized solutions, and be compatible with the complex ecosystems of the university. Reinholz & Apkarian (2018) emphasize that sustainable changes require attending to the structures, symbols, people, and powers that define a department. Quardokus Fisher & Henderson (2018) and Quardokus Fisher & Koretsky (2021) further argue that change is impactful when it grows from faculty's concrete visions, aligns with their aspirations, and provides them with autonomy and resources.

In Phase 1 of the process, informed by this literature, the FCTA team created community norms, reviewed literature on course redesign and effective mathematical practices, and created a shared value-based vision. They also engaged with stakeholders within and beyond the Department of Mathematics, benchmarked with peer institutions, and acquired data from the Office of Institutional Research. Aligning their individual proposals with the data, stakeholder feedback, and relevant literature, the team crafted the following transformational goals: a) implementing a learning cycle of exploration, sense-making, formalization, and application (Schoenfeld, 2016); b) redesigning content to include targeted precalculus review; c) redesigning assessments to align with the five strands of mathematical proficiency (National Research Council, 2001); d) embedding holistic students' support structures (Johnson & Hanson, 2015); e) restructuring course coordination and formalizing ongoing training and support for graduate student instructors and postdocs (Rasmussen & Ellis, 2015); and f) designing 1-credit support courses (one for pre-calculus review, and others connecting calculus to disciplinary contexts).

Currently, the team is in Phase 2, applying the backward design framework (Wiggins & McTighe, 2005) to define course competencies and learning outcomes aligned with the transformational goals crafted in Phase 1. Next, the team plans on creating instructional material (syllabus, modules, assessments) informed by the learning outcomes, while continuously sharing progress and receiving feedback from stakeholders. In Phase 3, the team will implement the redesigned course, meet regularly with instructors, revise and assess the course redesign, develop a sustainability process, and conduct further research. In this poster, we share our redesign process, along with how we plan to assess it for faculty, administrators, and students involved.

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