

# INTERDISCIPLINARY COLLABORATION TO DEVELOP MEANINGFUL MATHEMATICAL EXPERIENCES

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## ABSTRACT

This issue of the Journal of Mathematics and Science: Collaborative Explorations (JMSCE) is the second special volume highlighting the impact of the consortium for Synergistic Undergraduate Mathematics via Multi-institutional Interdisciplinary Teaching Partnerships (SUMMIT-P). The development and goals of SUMMIT-P were outlined in the preface of the first special issue of JMSCE devoted to this project (Ganter & Haver, 2020). Full participation from partner discipline faculty is key to the success of redeveloping introductory mathematics courses in a way that incorporates the contextual needs of the other disciplines. As such, SUMMIT-P's first task was to find ways to best engage colleagues in the partner disciplines. The first special volume's preface detailed these recommendations. The seven papers in this second special issue, written two years later in the cycle of the project, describe how the collaborations evolved under specific institutional circumstances while also describing the outcomes and products of the collaboration. The papers also focus on the processes used to support and promote successful interdisciplinary collaboration, including the use of: fishbowl discussions to enable mathematics faculty to understand the perspectives of faculty in partner disciplines; site visits to strengthen collaboration among faculty from different disciplines and different institutions; collaboration protocols to provide a structured format for discussions; faculty learning communities to develop ongoing institutional structures for collaboration; and assessment and evaluation measures to provide a long-term overview of impact at all levels.

## KEYWORDS

interdisciplinary collaboration,  
MAA/CRAFTY, Curriculum Foundations,  
SUMMIT-P

This issue of the *Journal of Mathematics and Science: Collaborative Explorations* (JMSCE) is the second special volume highlighting the impact of the consortium for Synergistic Undergraduate Mathematics via Multi-institutional Interdisciplinary Teaching Partnerships (SUMMIT-P). Specifically, the seven papers in this issue describe collaborations among mathematicians and faculty from partner disciplines that were developed as a part of the SUMMIT-P work. The development and goals of SUMMIT-P were outlined in the preface of the first special issue of JMSCE devoted to this project (Ganter & Haver, 2020).

The Curriculum Foundations (CF) project of the Curriculum Renewal Across the First Two Years (CRAFTY), a committee of the Mathematical Association of America, featured 22 multi-day disciplinary workshops, each consisting of roughly 20 partner discipline (e.g. engineering, sociology, business, etc.) participants and 10 mathematicians (Ganter & Barker, 2004; Ganter & Haver, 2011). For each workshop, the partner discipline faculty produced a report focused on the mathematical needs of students in their discipline. The same message was repeated in the reports again and again: introductory collegiate mathematics courses should provide students with an appreciation and understanding of fundamental mathematical topics while grounding the discussion in a variety of contexts. SUMMIT-P was formed as a response to the work initiated through CF.

Full participation from partner discipline faculty is key to the success of redeveloping introductory mathematics courses in a way that incorporates the contextual needs of the other disciplines. As such, SUMMIT-P's first task was to find ways to best engage colleagues in the partner disciplines. The first special volume's preface detailed these recommendations and described the specific strategies undertaken by the original 12 SUMMIT-P institutions in response to the CF findings.

The papers in this second special issue, written two years later in the cycle of the project, describe how the collaborations evolved under specific institutional circumstances while also describing the outcomes and products of the collaboration. The papers also focus on the processes used to support and promote successful interdisciplinary collaboration, including the use of:

- **fishbowl discussions** to enable mathematics faculty to understand the perspectives of faculty in partner disciplines;
- **site visits** to strengthen collaboration among faculty from different disciplines and different institutions
- **collaboration protocols** to provide a structured format for discussions;
- **faculty learning communities** to develop ongoing institutional structures for collaboration;
- **assessment and evaluation measures** to provide a long-term overview of impact at all levels.

Each of the seven papers reports on aspects of this interdisciplinary collaboration.

### *JMSCE Special Issue Articles*

**A Tale of Four Departments: Interdisciplinary Faculty Learning Communities Informing Mathematics Education** discusses how a faculty learning community (FLC) was created and cultivated at Lee University and how it was used to implement interventions in different mathematics courses. Individual perspectives of participating faculty from mathematics, behavioral and social sciences, natural sciences, and education are provided.

**Improving Student Knowledge Transfer Between Mathematics and Engineering Courses Through Structured Cross-Disciplinary Collaboration: A SUMMIT-P Initiative** describes the decision to initially focus on collaboration between engineering and mathematics faculty at Virginia Commonwealth University (VCU). This collaborative effort concentrated on the Differential Equations course offered by the mathematics department and the use of differential equations in engineering courses. This decision was based on faculty surveys and the high level of interest and sense of urgency during fishbowl conversations. The paper presents several examples of disparate terminology, including problems with notation and convention in mathematics and engineering, and describes strategies for bridging this gap.

**Using an Interdisciplinary Case Study to Incorporate Quantitative Reasoning in Social Work, Nursing, and Mathematics** outlines ways in which faculty from social work, nursing, and mathematics developed a case study about Hurricane Katrina—as a response to the potential for a malaria breakout, and including the necessary calculations of financial costs for emergency shelter, water, food, and medicine. The case study allows faculty to use the lens of social justice to teach mathematical concepts and provides an avenue for nursing and social work students to engage in mathematics through a situation germane to their profession. The paper includes sidebar contributions from other SUMMIT-P institutions describing similar cross-disciplinary collaborations.

**Just in Time Mathematics Review for Accounting Students** describes how initial conversations clarified the biggest concern in the minds of many business faculty: weaknesses in mathematical backgrounds of many students entering business classes. In this case, the faculty learning community took the form of a mathematics-business committee that met monthly, undertaking such initiatives as: developing a college algebra course with a business focus; using GeoGebra as an in-class visualization tool; and providing mathematics reviews for accounting students.

**Leveraging Interdisciplinary Expertise in Developing an Alternative Mathematics Pathway** highlights ways in which faculty from mathematics, statistics, humanities, and communication collaboratively developed two mathematics courses designed to meet the needs of students not majoring in Science, Technology, Engineering, and Mathematics (STEM) disciplines. Because these courses contain humanities- and communication-focused elements, as well as sufficient mathematics content, they can help students attain multiple and diverse general education competencies. The paper describes the content of the courses, communication issues among faculty with differing ideas, and navigation of the administrative process for non-conventional courses and team teaching across disciplines.

**Statistics for Nursing and Allied Health at Saint Louis University in the Spirit of SUMMIT-P** describes the interdisciplinary collaboration that resulted in the development of a statistics course designed to meet the needs of students majoring in nursing and allied health disciplines. The environment for the collaboration was unique because the course development was not formally part of SUMMIT-P. Instead, it was a spin-off from the SUMMIT-P work supported by the broader university, highlighting the importance of the institution's long-term support for interdisciplinary collaboration.

**An Examination of Factors that Support Sustainable Cultural and Curricular Change in STEM Teaching and Learning** outlines how the evaluation team collected data from the interdisciplinary faculty learning communities at SUMMIT-P institutions through participants' responses to periodic prompts, participation in site visits, and individual interviews and focus groups. An emergent model has been developed to assist in understanding the factors

that contribute to the sustainability of innovations in educational settings. Important outcomes from the SUMMIT-P work are discussed, including the impact of institutional leadership, the creation of sustainable change, and the need for comprehensive buy-in and support.

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