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Recommended Citation

Ganter, S., Hofrenning, S., Eaton, C.D., and Piercey, V. 2019. "Introduction to the Special Issue on Interdisciplinary Conversations (Part 2): The Impact of Interdisciplinary Conversations on Courses." PRIMUS 29(9), 903-907. <https://doi.org/10.1080/10511970.2019.1626959>

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PRIMUS

Problems, Resources, and Issues in Mathematics Undergraduate Studies

ISSN: 1051-1970 (Print) 1935-4053 (Online) Journal homepage: <https://www.tandfonline.com/loi/upri20>

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To cite this article: Susan Ganter, Stella Hofrenning, Carrie Diaz Eaton & Victor Piercey (2019) Introduction to the Special Issue on Interdisciplinary Conversations (Part 2): The Impact of Interdisciplinary Conversations on Courses, PRIMUS, 29:9, 903-907, DOI: [10.1080/10511970.2019.1626959](https://doi.org/10.1080/10511970.2019.1626959)

To link to this article: <https://doi.org/10.1080/10511970.2019.1626959>



Published online: 15 Jul 2019.



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Introduction to the Special Issue on Interdisciplinary Conversations (Part 2): The Impact of Interdisciplinary Conversations on Courses

Susan Ganter, Stella Hofrenning, Carrie Diaz Eaton , and
Victor Piercey

Abstract: The two parts in this special issue address interdisciplinary conversations involving mathematics courses in the first 2 years of undergraduate work. The special issue was inspired by work funded by the National Science Foundation under a grant titled “SUMMIT-P.” The special issue includes papers written about projects both from SUMMIT-P and from outside of SUMMIT-P. Part II focuses on what the results of interdisciplinary collaboration look like in the classroom.

Keywords: interdisciplinary, collaboration, mathematics applications, mathematics education

1. INTRODUCTION

This editorial is an introduction to the second of a two-part special issue on Interdisciplinary Conversations. In our previous editorial (Part I), we considered the role of working with partner disciplines in mathematics broadly. The articles in Part I addressed frameworks, mechanisms, and programs resulting from collaboration. In Part II, we consider specific projects and courses developed as a result of interdisciplinary collaboration.

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2. COURSE-LEVEL INTERDISCIPLINARY CONVERSATIONS

The papers in this part of the special issue provide concrete examples of collaborative teaching in mathematics. Aldrich [1] identified three forms of collaborative teaching: collaborative design, linked courses, and team-teaching. Collaboratively designed courses arise from a team, often but not exclusively interdisciplinary, contributing to the development of one or more courses that will be taught by a single faculty member or faculty from a single discipline (see also [2]). Reforms to courses that were inspired by the Curriculum Foundations project [3, 4] typically take this form. Linked courses, sometimes expanded to full learning communities with shared living spaces or extracurricular activities, involve two or more courses that bring different disciplines to bear on a common cohort of students, often with a common theme. For example, Northern Illinois University offers a curated and coordinated list of themed linked course clusters to all of their first year students as an alternative to a first year seminar [8]. Team-taught courses involve two or more faculty members sharing in the teaching of a course. This might involve two faculty from a common discipline, but different specialties, as well as two faculty members from different disciplines teaching together. See also [5–7].

3. THE IMPACT OF INTERDISCIPLINARY CONVERSATIONS ON COURSES

One of the primary benefits of collaborative teaching is found in the rich contexts it affords, contexts that enable learners to connect to prior understanding and experiences and create concrete opportunities for new and further learning. Our first entry in Part II illustrates this powerfully. Fisher, Warner, and Mickelson, the authors of “Cardboard Cities, Real Mathematics: Employing Quantitative Literacy to Study Gentrification in NYC,” describe an interdisciplinary module in which students not only apply mathematics skills to the issue of gentrification, but also to discuss issues of social justice, economics, and social studies. In “Interdisciplinarity and Inclusivity: Natural Partners in Supporting Students,” Greer continues the theme of collaboration and social justice by chronicling work at a liberal arts college to provide a more meaningful entry into mathematics. The author worked with stakeholders across STEM to design precalculus in such a way that it respects inclusivity of persons and their disciplinary identities. In the paper, the author describes the collaboration with stakeholders and provides a helpful table of resulting connection.

The next four articles address using interdisciplinary collaboration to improve traditional mathematics courses. In “Revising General Education

Math Courses with Partner Discipline Input,” Hirst and Palmer describe working with partner disciplines to revise their business calculus, college algebra, and other mathematics courses that satisfy their institution’s general education quantitative literacy requirement. Although their collaboration led to the development of rich applications for the mathematics courses, they also found that some trends in the teaching of mathematics (such as the role of technology) have their limitations. Sears, Kersaint, Burgos, and Wooten, the authors of “Collaborative Effort to Develop Middle School Preservice Teachers Mathematical Knowledge” describe a novel collaboration between two mathematicians and a mathematics teacher educator in developing mathematics knowledge in preservice middle school mathematics educators through the mathematics content and methods courses. The collaboration between scholars of mathematics and scholars of mathematical education is particularly noteworthy. In “Linking Mathematics and Psychological Science,” Pinter and Jones describe a collaboration between a mathematician and psychologist to connect a quantitative reasoning course and a psychology course. Their goal of connecting the two courses was accomplished through assignments, reading and projects. White, in “A Project-Based Approach to Statistics and Data Science,” describes the development of real-life examples and problems for a two semester applied statistic course. Unlike many of the other papers in this volume where mathematicians worked with a specific partner discipline, the author of this paper reached out to a wide variety of partner disciplines for novel and realistic contexts.

The special issue concludes with “Cryptography in Context: Co-teaching Ethics and Mathematics.” In this paper, Karst and Slegers describe a partnership between a mathematician and a philosopher in teaching an ethics module in a cryptography course. Scandals involving companies such as Cambridge Analytica and organizations such as the National Security Agency show the centrality of mathematicians (and cryptography specifically) in twenty-first century ethics problems. As such, this paper is as timely as it is intrinsically interesting. In terms of the collaboration, whereas the other papers in this part of the special issue describe team-designed courses or linked courses, this paper discusses a co-taught module in a single course.

Impactful problems are complicated, messy, and interdisciplinary. Since mathematics programs and courses are about problem solving, the collaborative element is critical in preparing students to look beyond their own disciplinary expertise. When faculty collaborate across disciplinary boundaries, they not only model those conversations, but also provide realistic, motivating contexts in which education is enhanced.

The papers in both parts of this special issue provide valuable insights, from specific course materials to frameworks for starting and maintaining interdisciplinary conversations. Collectively, they inspire us

to better our classroom design and practices by talking and collaborating across disciplines.

ACKNOWLEDGEMENTS

We thank the work of all contributing authors. We also thank the institutions in the SUMMIT-P consortium: Appalachian State University, Augsburg University, CUNY LaGuardia Community College, Duke University, Embry-Riddle Aeronautical University, Ferris State University, Lee University, Norfolk State University, Oregon State University, Saint Louis University, San Diego State University, Virginia Commonwealth University, Virginia Tech, and Unity College. Finally, we thank the membership of CRAFTY, including specifically chairs Stuart Boersma and Jennifer Nordstrom.

FUNDING

We acknowledge the funding of NSF DUE IUSE Lead Awards 1625771 and 1822451.

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BIOGRAPHICAL SKETCHES

Dr. Susan L. Ganter is professor of mathematics and dean for the College of Arts & Sciences at Embry-Riddle Aeronautical University-Worldwide. Her work focuses on the evaluation of innovations in post-secondary science and mathematics curricula, also including articulation issues from K–12 to college education. Student access and success at the postsecondary level are natural components of her work, including the implementation and evaluation of programs designed to improve success rates for underrepresented students. Dr. Ganter served as Director (since 1999) for the Curriculum Foundations Project housed at the Mathematical Association of America. Currently, she is Lead PI for the NSF-funded SUMMIT-P consortium.

Dr. Stella Koutroumanes Hofrenning is a professor of economics at Augsburg University. She received her Ph.D. from the University of Illinois-Chicago with research interests in applied microeconomics, econometrics, public policy, and the economics of education. She is a member of the SUMMIT-P management team supporting collaborative efforts in economics, business and the social sciences with mathematics and also serves as a co-PI for SUMMIT-P project at Augsburg.

Dr. Carrie Diaz Eaton is associate professor of digital and computational Studies at Bates College in Maine. When at Unity College, she was one of the SUMMIT-P team members. Since moving to Bates, she has been a “friend” of the SUMMIT-P project, teaching in inter-sectional spaces of mathematics, computer science, biology, and equity and social justice.

Dr. Victor Piercey is the director of general education and an associate professor of mathematics at Ferris State University in Big Rapids, Michigan. In a former life, he worked as an attorney at Weil, Gotshal, and Manges LLP in New York City. He is interested in identifying unexpected connections between mathematics and partner disciplines, especially when he can connect his legal experience with mathematics. He serves on the SUMMIT-P management team and is the PI for the SUMMIT-P project at Ferris.