Scholarship Statement

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This document briefly outlines several projects related to the teaching and learning of mathematics that I have been working on since my lectureship began at UCSB in 2012. My primary focus has been on creating and refining inquiry-based learning (IBL) instructional materials for lower division linear algebra and differential equations courses. At this point there are no widely available materials for these courses and I hope to have them peer reviewed and made publicly available through the Journal of Inquiry-Based Learning in Mathematics (JIBLM). In addition to creating these course materials, I am working to contribute to the body of scholarship on teaching and learning mathematics.

An inquiry-based course centers around a scaffolded sequence of problems that serve as the basis for class discussion, in-class group work and homework. For the past three summers I have been working on creating and revising IBL course materials for linear algebra and differential equations courses offered at UCSB. In the process of writing these materials, I came across a large body of research on how students learn linear algebra and differential equations. Several of these papers also contained instructional materials for linear algebra that support what is known in the mathematics education research community as *Realistic Mathematics Education* or RME. The central tenant of RME is that mathematics is a human activity and "students should be given the opportunity to reinvent mathematics by organizing or mathematizing either real world situations or mathematical relationships and processes that have substance for them" [2]. This approach to instructional design resonated with me because it is very similar in spirit to the most successful problem sequences I had already been using in our IBL courses; now I had research to clarify and support the approach, as well as access to instructional task sequences that had been classroom tested and refined over the course of years. Not surprisingly, these task sequences were extremely effective for my students' learning, so I have incorporated and expanded on several of them in my own course materials. Moreover, much of the research I came across made me aware of instructional challenges specific to lower division linear algebra and differential equations [1, 3, 6 and 7]. As a result I have written new materials for both courses with the goal of addressing these challenges. The linear algebra notes were particularly successful this past fall, and after some minor revisions, I plan to submit them to JIBLM for peer review and online publication. This summer I was able to gain access to a new collection of task sequences for differential equations based in RME design theory and I plan to incorporate several of them into my materials for that course. If the materials work well in my differential equations course this winter I plan to polish them and beta test revisions for later submission to JIBLM.

In addition to creating course materials, I have been working to contribute to the body of scholarship on the teaching and learning of mathematics. Brian Katz at Augustana University and I co-authored an article titled *WikiTextbooks: designing your course around a collaborative writing project* that appeared in the journal PRIMUS: Problems Resources and Issues in Mathematics Undergraduate Studies. The article focuses on our experiences implementing large scale, long-term collaborative writing projects in our classes using wiki technology. The purpose of the article is to help other college educators adopt these methods for their own courses. Katz and I are continuing our work with PRIMUS over the coming year as guest editors for a special issue on *Teaching Inquiry*. Our goal is to promote teaching methods that support students learning to ask and explore *their own* mathematical questions. For example, my students used a wiki to support generating and refining their own conjectures in lower division linear algebra course and my colleague has had students explore questions of personal interest in a project-based mathematics course. This skill goes beyond procedural fluency and conceptual understanding of a subject, and as such we recognize that new methods and supports are required to make this type of inquiry happen. We are currently soliciting papers from educators and education researchers describing successful pedagogies, assignments, or structures designed to support students through this process.

References

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