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MATHEMATICAL INSTRUCTION AND TEXTBOOK USE IN POST-SECONDARY AND TERTIARY CONTEXTS: A DISCUSSION OF METHODS

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In this presentation I focus on methodological issues that I have faced in my studies of interactions between instructors, students, and resources both inside and outside of the classroom. I seek to understand how such interactions create opportunities for mathematics learning in post-secondary settings. I showcase the evolution of two inter-dependent research strands that together have helped me understand the centrality of resource use by instructors and students and its implications for student learning.

I conceptualize instruction as the interactions between the instructor, the students, and the content as shaped by particular environments (Cohen, Raudenbush, & Ball, 2003). This conceptualization has allowed me to focus on particular interactions using various grain-size approaches to report their quantity and quality. From counting how many questions and answers are given in any given period of time, to the average length of the utterances made by instructors and students, to the cognitive demand implicit and enacted from questions and tasks, these measures are useful to showcase typical patterns in post-secondary and university mathematics classrooms: instructors do most of the talking; students' contributions are short and usually on low cognitive demand work; there are exceptions, and these occur when the classes are organized around inquiry (Mali, Gerami, Ullah, & Mesa, 2019; Mesa, 2011; Mesa, Celis, & Lande, 2014; Mesa & Chang, 2010; Mesa & Megginson, 2011).

Resources, both material and personal shape these interactions (Rezat & Sträßer, 2012). In my work about how instructors use textbooks for teaching, I have discussed how the textbook mediates the instructors' interactions with content as they plan and enact instruction: The textbook is used differently depending on the instructors' views of their students (Mesa & Griffiths, 2012). In our current work, we are also studying how dynamic textbooks (open source, open access textbooks authored in PreTeXt that embed computational cells in Sage and other interactive features, Mesa, Liakos, & Zhang, 2019, September) can be vehicles for influencing teaching and learning in university contexts. Because the textbooks are authored in PreTeXt (https://pretextbook.org/) it is possible to (1) capture all user interactions at the minute resolution (Mesa, Mali, & Castro, 2019, February) and (2) analyze textbook content in a systematic way (O'Halloran, Beezer, & Farmer, 2018). However, viewing data are not sufficient to understand users' interactions. We collect data in other ways (surveys, logs, tests) from numerous users who are in many locations. These advantages result in challenges to our current approaches to data management and data analysis as the goal is to distill information that can result in modifications of the textbooks so that instruction can be more engaging (Mesa & Gerami, 2021). In this talk I will describe some of these issues and their connections to both research, practice, and textbook design.

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