TRANSFORMATIVE INFLUENCE OF PRIMARY HISTORICAL SOURCES ON TEACHING PRACTICES: A CASE STUDY

A POSTER PRESENTATION

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EXTENDED ABSTRACT

Incorporating primary historical sources into teaching can have fruitful benefits for teaching and learning in undergraduate mathematics (Fauvel, 2002; Barnett, 2014). To list a few, as they engage with original sources, students will be able to see the formation of mathematical thinking, and will be able to understand that theorems are products of human endeavor. Under the lights of these benefits, we seek an answer to the following question: Can primary historical sources be employed to improve the transformative learning of higher education in collegiate mathematics courses? To find out an answer to this question, we conducted research on an instructor's teaching of the derivative in a first-year calculus course, which is required for all STEM majors.

Derivative is one of the three core concepts in calculus courses (besides limits and integrals), yet, is considered a difficult concept due to the complexity in its formal definition (Zandieh, 2000). Although derivative is originally defined by using the differential concept by Leibniz in 1684, the textbooks in the last 100 years are using another approach to define it: Limit definition. Despite many studies arguing for alternative approaches for introducing derivative to students, the tradition of using limit definition has remained unchanged in the textbooks in the last 100 years. Therefore, it is not a straightforward task for an instructor to tackle this hundred-year-old tradition.

The research that inspired this proposal is a result of our interest in experiences of a mathematics instructor who transformed his teaching of the derivative. The participant of our study was a male mathematics instructor at a university located at a Central region in the US, who also had concerns about teaching the derivative concept. As he says in his interview, students rather tend to memorize the derivative definition but not to learn the concept itself as it is also observed in Bezuidenhout (1998). When he became a part of a larger effort to incorporate primary sources into the teaching of standard mathematics topics, he encountered Leonhard Euler's text, Foundations of Differential Calculus (Euler, 1755). After reading Euler's approach to building the derivative concept, he decided to make significant changes in his calculus teaching and utilized some parts of Euler's book for this. With our analysis of instructor interviews and video-recordings of classroom sessions, we documented how primary sources transformed his pedagogy of mathematics and students' learning experience.

In our presentation, we discuss the transformative influence of primary historical sources on teaching practices by using Speer, Smith, and Horvath's (2010) framework on teaching practices. According to Speer et al., there are seven dimensions of teaching practice (a) Allocating time within lessons, *(b) Selecting and sequencing content (e.g., examples) within lessons, (c) Motivating specific content*, (d) Posing questions, using wait time, and reacting to student responses, (e) Representing mathematical concepts and relationships, (f) Evaluating and preparing for the next lesson, and (g) Designing assessment problems and evaluating student work. Our study shows how using primary historical sources can transform the teaching practices (b) and (c), the italicized ones, in undergraduate mathematics education.

Furthermore, we also argue that personal characteristics such as risk-taking and being open to changes are as important as, for instance, the quality of curriculum materials for transforming teaching practices in undergraduate mathematics.

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