

Public Abstract

First Name: Ruthmae

Middle Name:

Last Name: Sears

Adviser's First Name: Oscar

Adviser's Last Name: Chavez

Co-Adviser's First Name:

Co-Adviser's Last Name:

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Title: An Examination of How Teachers Use Curriculum Materials for the Teaching of Proof in High School Geometry

This case study examined how three high school geometry teachers used their geometry textbooks (Prentice Hall Geometry and McDougal Littell Geometry) to teach proof. More specifically, this study examined the following: How subject-specific curriculum materials present proofs related to parallel and perpendicular lines, angles, and congruent triangles? How do geometry teachers use curriculum materials to facilitate students learning to prove? What factors influences teachers decision to deviate or not from curriculum materials? Data were collected via a classroom observation protocol, teacher artifacts, audio and video classroom recording, and teacher interviews. A conceptual analytical framework, which consisted of three dimensions, comprised of the Mathematical Tasks Framework (Henningesen & Stein, 1997) and proof schemes framework (Harel & Sowder, 1998) was used to analyzed the data. The first dimension focused on task features, the second on levels of cognitive demands and the third considered the proof schemes utilized.

To inform the classroom observations and the data analysis, a textbook analysis was conducted of proof and proof-related tasks. This analysis considered the frequency of proof and proof-related tasks, types of proof representations used, real world or abstract context of proofs, use of figures, occurrences of fill-in-the-blank and multiple choice tasks, and the extent to which tasks were composed of multiple parts. Additionally, the levels of cognitive demand of tasks were evaluated. During classroom observations, attention was given to what constitutes convincing proof arguments, and how curriculum materials were utilized.

The data analysis showed that the geometry curriculum materials used by the teachers in this study provided few opportunities to prove, and that there were differences between textbook series in the tasks features and the levels of cognitive demand of the proof tasks included. Additionally, the teachers in this study enacted proof tasks generally by promoting memorization or procedures without connections. Moreover, whenever lower levels cognitive demand tasks were posed external conviction proof schemes were more evident; while analytical proof schemes appeared more frequently when higher-level cognitive demand tasks were posed. Furthermore, teachers beliefs, experience, desire to make mathematics easy, community, and assessment were factors that contributed to how proof was taught.