Playing with Perpendicular Lines: The Case of Laura

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EXECUTIVE SUMMARY

This chapter has been designed to examine both the teaching and learning of algebraic concepts as well as the way in which representations play a role in the development of these concepts. The framework for the discussion of representational use is based on the Kaput, Blanton, and Moreno (2008) model for the development of symbolic meaning. The specifics of this model are elaborated toward the end of the chapter.

INTRODUCTION

As you read the case, we encourage you to think about the interactions between the students and teacher along two dimensions: (1) what are the relevant mathematical ideas involved and (2) what did the teacher do or not do to facilitate the development of these ideas? Keep in mind that mathematical ideas are not limited to specific concepts such as slope, but also include mathematical processes. The Common Core State Standards (CCSS) lay out *Standards for Mathematical Practice* such as "Construct viable arguments and critique the reasoning of others" that go beyond the mere teaching of concepts to include habits of the mind for thinking mathemati-

cally. The development of these practices is crucial for preparing students that are capable of adapting in a constantly changing world where the mathematics we teach is mediated by technological changes that are happening at ever increasing rates.

THE CASE

Background

Preparation

Laura is a beginning teacher (less than 3 years of experience) in a secondary mathematics class. Her certifications are in social studies and mathematics and she teaches three preps of Algebra 1 and two preps of American History. During her undergraduate teacher preparation program she began as a major in mathematics and minor in history; however, she later switched these to a major in history and minor in mathematics. In her state, secondary teachers must be certified in at least two subjects with either a "teachable" major and a minor or a double major. When asked about her decision to swap her major and minor, Laura said, "I was doing OK in math through Calculus and even into Linear Algebra since most of the time I could follow what the professors did and could also do it. Then I had a course called 'Intro to Proof'. For the most part, I did OK since a lot of the course was on different types of ways to prove things and all we needed to do was repeat them. But when I took the Abstract Algebra course, that's when the wheels came off. The problem was that we needed to figure out how to use the theorems to prove different things and they didn't tell us what theorems to use. I really struggled with the class and had to drop it. Since the minor didn't require the Abstract Algebra course, I decided to switch to the minor." Laura stated that she enjoyed her upper-level history courses much more than the upper-level math courses since she was better at connecting ideas and history was all about making connections. She was ultimately happy that she made the switch to the history major.

Classroom Approaches

Laura's view of her mathematics preps is that they take less time and are easier to teach since she can more easily demonstrate the procedures and allow the students time to practice while she circulates and helps with any difficulties the students may have. Laura has been feeling particularly challenged recently since reforms at both the state and national levels have resulted in legislative changes requiring teachers to be held accountable for their students achieving a certain level of mathematical