CHAPTER 8

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MATHEMATICS TEACHER CHANGE AND DEVELOPMENT

The Role of Beliefs

Abstract. The chapter focuses on impacts of mathematics teachers’ beliefs on their ability and tendency to change. A discussion of common definitions of belief precedes a review of reports about elementary, middle, and high school mathematics teachers’ beliefs from three international research journals (1995-1999). Implications of the reports’ often implicit definitions of beliefs are considered, as well as other implications for teacher change. For example, an assumption that beliefs are dispositions to act in certain ways, rather than simply verbal proclamations, leads to data collection methods that involve both discussions with and observations of teachers. The reports also point out the need to reconsider a tendency to separate teachers’ mathematical and pedagogical beliefs.

1. INTRODUCTION

Research on the teaching and learning of mathematics has taken many twists and turns throughout the years. During the late 1960s and early 1970s the primary emphasis of research was on students’ learning, particularly that of young children, and often evoked a strong Piagetian flavor. Little emphasis was given to how teachers influence learning through their instructional programs or to how instructional programs were influenced by what teachers believed about mathematics or its teaching. Most research on teaching mathematics that was conducted in the 1970s used a behavioristic framework that shaped both questions and methodologies. In general, various characteristics of teaching were quantified and correlated with specific learning outcomes. Although this line of research led to a few interesting results in terms of revealing high inference variables that were significantly correlated to learning, e.g., clarity and flexibility, in general, this line of research was limited. There was concern that the mathematics being assessed was too narrow and that the notions of clarity, flexibility, and the like defied definition in a mathematics classroom.

In the late 1970s there was an emerging methodological crisis that suggested researchers were not focusing on what was really significant about the teaching of mathematics. There was, for example, a brief foray into investigations about teachers’ attitudes toward mathematics and teaching. This research was generally

well received but it lacked a cognitive component and ultimately failed to be free of the shackles of the dominant behaviorist paradigm. Still, there was a sense that in order to understand the teaching and learning of mathematics one must contend with something other than well-defined variables and a tightly quantifiable notion of teaching behavior.

Perhaps spurred by Kuhn’s (1962) classic work *The Structure of Scientific Revolution*, combined with the movement toward teaching experiments borne out of Russian methodologies in mathematics education, sense-making became a central theme for much of the research during the 1980s. Some researchers shifted away from viewing teaching and learning from an ontological perspective toward one in which an individual’s construction of meaning was paramount. Given the diverse forces that were influencing research in mathematics education, there evolved a greater sense that the context in which teaching occurred influenced what was being taught and learned in the classroom. The notion of context became recognized not just as the physical arrangement of classrooms but also of the teachers’ beliefs about mathematics and its teaching. Over the past 15 years, there has been a considerable amount of research on teachers’ beliefs based on the assumption that what teachers believe is a significant determinant of what gets taught, how it gets taught, and what gets learned in the classroom.

Thompson (1992) provided an extensive review of research on teachers’ beliefs and conceptions. One thrust of her review was about the impact of teachers’ beliefs on change. Thompson understood, as many authors point out in this volume, that understanding teachers’ beliefs is vital to reform. However, Thompson’s review was a decade ago and a considerable amount of research has occurred since that review. Additionally, recent research has focused even more extensively on the implications of teachers’ beliefs for change. Like many of the chapters in this section, we focus on the impact of teachers’ beliefs on their ability to grow, change, and develop teaching practices consistent with reform recommendations (e.g., National Council of Teachers of Mathematics [NCTM], 1989, 2000).

The review that follows involves articles from three mathematics education journals: *Educational Studies in Mathematics* (ESM), the *Journal for Research in Mathematics Education* (JRME), and the *Journal of Mathematics Teacher Education* (JMTE). Articles about mathematics teachers’ beliefs or teacher change that were published from 1995 through 1999 constituted the data set for our analysis. We have chosen to review articles from these three journals, given their international readership and the fact that they provide important outlets for researchers concerned with teaching or teacher education.

To set a context for our review, we present a characterization of beliefs and link this notion to the concept of teacher change. We then present a summary and analysis of several sets of recent empirical studies that focus on elementary and secondary mathematics teachers’ beliefs or changes in their teaching of mathematics. We conclude our discussion with an analysis of how this research can impact future research in mathematics teacher education.

Previous research on teachers’ beliefs has focused primarily on the empirical question of what teachers believe about mathematics, the teaching of mathematics, and the learning of mathematics. Often unnoticed in this research, however, is what