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An "inverse" relationship between mathematics identities and classroom practices among early career elementary teachers: The impact of accountability

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ABSTRACT

This qualitative case study guided by portraiture examines the relationships between three early career elementary teachers' beliefs about themselves in relation to mathematics (mathematics identities) and their classroom practices. Through autobiographical inquiry, reflective practice, classroom observations, interviews, and artifacts, findings show that all three second grade teachers appeared to have an "inverse" relationship between their mathematics identities and their classroom practices. In this relationship, as negative as they felt about themselves with regards to mathematics, they expended that much more effort to ensure that their students would have positive experiences with it and not be stigmatized by it as they had been. Accountability to schools, students, and parents, to increase student achievement appeared to play an important role in this relationship. Implications for preservice teacher education, inservice professional development, and research on beliefs and practices are discussed.

1. Introduction

The contemporary mathematics reform movement in the United States evolved from the publication of the *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989). As a result of those Standards, mathematics began to shift from a traditional orientation that focuses on skill efficiency, fixed answers, and drill and practice to a constructivist nature that emphasizes more active student engagement with mathematical ideas through collaborative investigations, hands-on explorations, and multiple representations (Goldsmith & Mark, 1999). This shift has resulted in the development of standards-based curricula [e.g., *Everyday Mathematics* (UCSMP, 2007) and *Investigations in Number, Data, and Space* (TERC, 2008)] which have permeated many school systems across the United States and have subsequently changed the way mathematics is currently taught and learned. Standards-based curricula emphasize the development of conceptual understanding and reasoning of important mathematics to meet Standards as opposed to memorization and rote learning of facts and procedures (Nie, Cai, & Moyer, 2009). Mathematics reform continues to take shape as states and school districts work toward aligning curriculum with the recent Common Core State Standards which aim to provide consistent and focused understanding of the knowledge and skills relevant to the real world which young people need for success in college and careers (CCSSO, 2010). All of these reform efforts to move from procedural skills to greater conceptual understanding have resulted in heightened expectations for teachers in the content they are expected to teach, the methods they are encouraged to use,

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and in increased accountability measures to ensure greater student achievement (outcomes) through a variety of evaluation tools.

Early career elementary teachers represent a new generation of teachers who are responsible for teaching toward the high expectations of the mathematics reforms. Most elementary teachers do not have a choice in the array of subjects they teach, which can impact their teaching practices as teaching identities are subject matter specific (Beijaard, Verloop, & Vermunt, 2000; Drake & Sherin, 2006; Spillane, 2000). Teachers' personal beliefs about a subject and their beliefs about who they are in relation to that subject (teacher identity) affect the entire classroom climate and the numerous decisions they routinely make (Leatham & Hill, 2010; Spillane, 2000). Although elementary teachers do have strong identities in a range of subject areas, often mathematics is not one of the favored ones (Gujarati, 2010; Philippou & Christou, 2002; Schuck, 1997). These beliefs are created early in one's life through a process of enculturation, social construction, and cultural transmission (Pajares, 1992; Seaman, Szydlik, Szydlik, & Beam, 2005). They are the product of upbringing, reflection of life experiences, and the result of socialization processes in schools (Raths, 2001). Through relationships and experiences with peers, teachers, family, and community, people come to know who they are relative to a subject area (Anderson, 2007; Gee, 2001; Wenger, 1998). In mathematics, often these beliefs about the subject area itself and one's identity are negative and there is then the risk of teachers perpetuating a cycle of negative affect. Mathematically anxious teachers, for example, tend to pass their anxiety on to their students (Trujillo & Hadfield, 1999). In addition, mathematically anxious teachers tend to use more traditional teaching methods such as lecturing and teaching basic skills which showcase procedural knowledge rather than emphasizing conceptual knowledge which run contrary to expectations in the current reform movement. Teachers are now expected to model problem-solving, explore real-world mathematical contexts, value multiple solution strategies, and give students the time to create, discuss, hypothesize, and investigate (Frykholm, 2004) sometimes beyond both their cognitive comfort zone and affective capabilities.

Prior research has focused on illuminating elementary teachers' beliefs about mathematics and belief changes predominantly in redesigned mathematics methods courses at the preservice level (Raymond & Santos, 1995; Stuart & Thurlow, 2000). However, there has been a paucity of research which examines early career elementary teachers' beliefs about mathematics in the midst of *actual* teaching practices and the affective side to mathematics teaching and learning, notably mathematics identities. Although few researchers have examined the relationship between mathematics teachers' affective traits and their instruction, the existing research shows that what teachers experienced as learners carries forward to their adult lives and is an important factor in the ways teachers interpret their mathematical worlds (Philipp, 2007). There is a growing awareness among mathematics educators of the central role of affect in mathematics teaching and learning (Tsamir & Tirosh, 2009). Therefore, more research that examines teachers' beliefs beyond the methods course(s) into their practice would be beneficial (Pajares, 1993). After all, teachers are responsible for enacting expectations of reform and can either facilitate or hinder change. Reform efforts are destined for failure unless teachers are viewed as active learners and reorganizers of their experiences, and not as empty vessels waiting to be filled (Feikes, 1995).

Due to the importance of teachers and their beliefs in enacting expectations of reform, this article examines the relationship between three early career elementary teachers' beliefs about mathematics and their classroom practices in order to have a more holistic understanding of what drives these teachers in their classrooms and why. This article stems from a larger study (Gujarati, 2010) and addresses two major questions: (1) What are three early career elementary teachers' beliefs about mathematics and teaching mathematics? This question is broken down into three parts: beliefs about their sense of self in relation to mathematics (mathematics identities), beliefs about the nature of mathematics, and beliefs about best practices in mathematics teaching; and (2) What is the relationship between these three early career elementary teachers' beliefs about mathematics and their teaching practices? This article highlights the specific relationship between beliefs about the early career elementary teachers' sense of self in relation to mathematics (mathematics identities) and classroom practices, and the role of accountability to classrooms, schools, and parents to increase student achievement in shaping this unique relationship. Implications for preservice teacher education, inservice professional development, and future research are also discussed.

2. Theoretical and conceptual frameworks

This qualitative study was grounded in Ernest's (1988) social constructivist theory of mathematics, social theories of identity (Gee, 2001; Sfard & Prusak, 2005; Wenger, 1998), and reflective practice (Dewey, 1933; Schön, 1983). Ernest (1988) posits that both social processes and individual sense making have central and essential parts to play in the learning and teaching of mathematics. In his view, the practice of teaching mathematics depends on: (1) the teacher's mental contents or schemas, particularly the system of beliefs concerning mathematics and its teaching and learning; (2) the social context of the teaching situation, particularly the constraints and opportunities it provides; and (3) the teacher's level of thought processes and reflection. It is necessary to consider all three factors to do justice to the complex notion of the autonomous mathematics teacher.

Building upon the idea that both the individual and social contexts impact mathematics teaching and learning, social theories of identity formation were utilized to understand the construct of identity as it pertains to this study. Since beliefs are an individual's subjective knowledge and because there is an absence of a universal acceptance by mathematics researchers and educators of a definition of beliefs (Goldin, Rösken, & Törner, 2009), it is up to the individual to conceptualize it themselves (Pehkonen, 2008 cited in Kislenko, 2009). As such, in this study, beliefs are peculiar to each individual because they are