



Teachers' self-efficacy in Belize and experimentation with teacher-led math inquiry[☆]



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HIGHLIGHTS

- Teachers' self-efficacy is significantly predicted by Openness to Experience.
- Teacher-led math inquiry increased teacher self-efficacy in student engagement.
- Teacher-led math inquiry increased teacher self-efficacy in instructional practices.
- Student-centered instruction was inexpensively implemented in a developing country.

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ABSTRACT

The present study first examined teacher characteristics in the nation of Belize hypothesized to correlate with teacher self-efficacy, then after controlling for those variables examines increases in teacher self-efficacy following exposure to “teacher-led mathematics inquiry” using a randomized trial ($N = 332$). Pre-service teacher preparation and Openness to Experience from the Big Five measure of personality contribute to teachers' self-efficacy within the context of Belize. Statistical and practical significance is discussed for teachers' self-efficacy when professional development was provided to enhance teacher content knowledge in combination with inquiry-based student centered instruction with manipulatives.

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1. Introduction

Globally, teachers' self-efficacy for teaching is a perception about one's own ability to foster learning and engagement (Shaughnessy, 2004), but teachers' self-efficacy is likely to be culturally embedded in acceptable/common practices, endemic personality characteristics of a region, and the affordance of

training opportunities, either practical or pedagogical. Consequently, despite the universality of self-efficacy as an instructional construct of interest, how one teaches is not necessarily universal, nor universally valued (Hamilton & Clandinin, 2011).

Teacher self-efficacy has increasingly captured the attention of researchers with international samples over the last decade, as the construct appears to predict a variety of school-related outcomes (Ashton, 1984). International investigations extend to psychometric and construct validity (Chan, 2008a; Klassen et al., 2009; Klassen & Chiu, 2010; Vieluf, Kunter, & van de Vijver, 2013), and cross-sectional relationships with other variables or criterion validity (Bogler & Somech, 2004; Chan, 2008a; 2008b; Gür, Çakiroglu, & Aydin, 2012; Smolleck, Zembal-Saul, & Yoder, 2006), but also include teacher job satisfaction and persistence (Brouwers & Tomic, 2000; Bümen, 2010; Chan, 2007; Evers, Brouwers, & Tomic, 2002; Klassen & Chiu, 2010; Öztaş & Dilmac, 2009; Schwarzer & Hallum, 2008), gender (Karimvand, 2011), and specific content

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knowledge (Çakiroglu, Çakiroglu, & Boone, 2005).

Other investigations have examined changes in perceived teacher self-efficacy in combination with alterations in instructional practice, connoting those teachers utilizing practices that are more student-centered expand their sense of locus of control when providing instruction they believe matters (Abu-Tineh, Khasawneh, & Khalaileh, 2011; Brown, 2005; Eslami & Fatahi, 2008; Friedman & Kass, 2002; Klassen et al., 2009; Mohamadi & Asadzadeh, 2012; Skaalvik & Skaalvik, 2010). Instructional effects from altering instructional strategies can be significant for student outcomes in developing countries since teachers largely use highly structured daily routines where seatwork is strictly monitored and enforced. In Jamaica's primary schools, for instance, the mean teacher rating of whole class lecture frequency is 4.19 (SD = 0.62; 0 = never; 5 = almost every lesson; Glewwe, Grosh, Jacoby, & Lockheed, 1995). Yet, outside of highly select and completely private schools, little attention is given to alternative instructional approaches that emphasize student engagement in developing countries throughout Latin America and the Caribbean since larger effects on learning occur through repair of leaky classrooms (2.2 standard deviation increase in mathematics performance), the addition of usable blackboards or writing materials (1.8 standard deviation increase in math performance), or addition of a library (Glewwe & Kremer, 2006). Teachers from this region are similar to teachers elsewhere, they would prefer to utilize instructional strategies that make a difference in learning outcomes, but few teachers are provided with training in methodologies where techniques involve the teacher as a 'facilitator of learning' (Jennings, 2001).

When teachers around the world implement activities to develop deep understanding through inquiry of material in contrast to data manipulation or working toward conclusions, teacher self-efficacy increases (Duran, Ballone-Duran, Haney, & Beltyukova, 2009; Lucero, Valcke, & Schellens, 2013). This increase in self-efficacy results partly because when teachers use inquiry-based approaches to teaching, their content knowledge improves (Avery & Meyer, 2012), but also because teacher self-efficacy is related to level of effort, aspirations for student performance, planning for and organization of instruction, and persistence or resilience in the face of challenges.

Personality characteristics have been investigated as a possible predictor of personal teacher efficacy (Henson & Chambers, 2003) and teacher effectiveness (Teachout, 2001). While the investigation of personality characteristics has been diverse across the literature with respect to teacher self-efficacy, many investigators have utilized the Myers-Briggs Type Indicator with teachers (Grant & Cambre, 1990; Grindler & Stratton, 1990; Henson & Chambers, 2003; Katz, 1992), which personality researchers for several decades have not supported (Stricker & Ross, 1964a; 1964b), as it contains distorted concepts of Jung's theory (Coan, 1978; Comrey, 1983), and produces spurious psychometric properties (Mendelsohn, Weiss, & Feimer, 1982). Personality, as defined by the Myers-Briggs Type Indicator, was found to be a predictor for both teacher efficacy and teacher effectiveness but the inverse relationship was not supported (Henson & Chambers, 2003).

Magno and Sembrano's (2007) study utilized the Osgood's Personality Characteristics Scale (OPCS) and investigated how personality influenced teaching efficacy, teacher effectiveness, and teacher performance. In their study, personality, as defined by the OPCS, affected teacher performance, teacher effectiveness, and teacher efficacy. Yeh (2006), however, found teacher efficacy to be a relevant predictor of improvements in personality traits. Others have found that teacher efficacy mediated the relationship between pedagogical modifications and teacher learning (Fisler & Firestone, 2006).

Content-specific teacher self-efficacy investigations are less

frequent, but self-efficacy in teaching is positively associated with individuals' perceived capabilities in a given context (Tella, 2011) and has been defined as "the teacher's beliefs in his/her capability to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context" (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998, p. 233). Domain-specific teacher self-efficacy has been infrequently examined in science (Mulholland & Wallace, 2001; Yalçın, 2011) and mathematics (Bagaka, 2011; Brown, 2005). In mathematics (Bagaka, 2011), teachers' ability and perceived competence is negatively associated with a gender gap in student competence and self-confidence in mathematics. Moreover, teacher interest and enjoyment of mathematics is positively associated with students' performance, self-confidence, interest in, and perception of the importance of mathematics, as well as reduced anxiety about mathematics. Particularly in international contexts, the relationship of teacher background variables, for example the college school major of teachers (Bursal, 2010), predicts teacher self-efficacy within math and science education and it has been postulated that culture, age, and other individual differences characteristics are responsible for teachers' self-efficacy (Ly & Brew, 2010).

1.1. Purpose of the present study

The present study seeks to better understand in-service teacher efficacy in Belize, which we hypothesize to be related to several predictor variables (i.e. personality characteristics, education/training, experience as a teacher, and math content knowledge) that should theoretically and empirically correlate with teacher self-efficacy. Second, the current study seeks to extend the literature in international teacher self-efficacy research using an experiment; where we hypothesize that a student-centered math instruction intervention supporting student inquiry and delivered to teachers through ongoing professional development and mentorship would have an effect on teachers' self-efficacy. Hypotheses and research questions related to these two points are explicated in Section 3.0.

2. Theoretical framework

The theoretical perspective guiding the present study is teacher self-efficacy, which we hypothesized to be altered by a treatment program that we refer to as teacher-led math inquiry (TLMI). While the teacher-led math inquiry instructional approach ensconces within it a supportive mechanism for change in how teachers' self-efficacy improves with the introduction of math manipulatives and facilitated instruction, we believe that the successful implementation of the approach is dependent on individual differences in personality. Thus, two theoretical perspectives (self-efficacy and individual differences in personality) coalesce to explain the observed phenomena in teachers' self-efficacy outcomes through exposure to the TLMI approach (more about TLMI is provided in Sections 2.2 and 3.0).

2.1. Teacher self-efficacy

Self-efficacy is a cognitive process in which the perceived competence individuals possess given their performance on particular tasks is a central component of social cognitive theory (Bandura, 1977). Self-efficacy embodies individuals' beliefs and expectations for future performances, resulting in effort dedicated to a task and the duration of the effort spent on a task (Bandura, 1977). With respect to an individual's expectation to perform a given task and the outcomes of an individual's performance, four

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