The Role of Contextual Factors in Understanding Mathematics Teacher Efficacy Beliefs

Jathan Austin, Ph.D. †

Abstract

The purpose of this article is to argue for a more nuanced view of mathematics teacher efficacy beliefs as a construct. I argue that most researchers studying teacher efficacy assert that teachers should display a strong sense of teacher efficacy, even though the ways teacher efficacy beliefs are often measured are not specific to any content area. This belief apparently is based on the assumption that a strong sense of teacher efficacy results in more effective teaching. Other explanatory variables (e.g., teachers' content knowledge for teaching and the content to be taught) are important contextual factors affecting teacher efficacy beliefs. I argue that these too often have been neglected in the existing literature. An understanding of the effects of these contextual factors can help reveal why advocating a strong sense of teacher efficacy is too simple a prescription for improving teaching.

Introduction

Researchers have identified two dimensions of teaching effectiveness beliefs: *personal teacher efficacy beliefs*, "a teacher's beliefs about his or her abilities as a teacher" (Swars, 2005, p. 139) and *general teacher efficacy beliefs*, more general beliefs about teaching or its outcomes that are not specific to a particular teacher. Researchers typically argue that a strong sense of personal teacher efficacy is preferable for any content area, including K-12 mathematics. There are, however, several problems with this claim. I will outline evidence typically cited in support of this claim, discuss complexities in interpreting this evidence, and present several contextual factors neglected in the existing literature that, if considered, would contribute to an understanding of teacher efficacy beliefs as a construct.

Assumption that strong teacher efficacy beliefs result in more effective teaching

Researchers have argued that a strong sense of teacher efficacy is preferable to a weak sense of efficacy. The initial basis for this argument lay in theoretical arguments that a weak sense of efficacy can be debilitating, causing individuals to avoid entirely situations in which they feel ineffective (e.g., see Bandura, 1986; Pintrich & Schunk, 1996). The claim that a strong sense of efficacy is better is now primarily supported with results from empirical studies indicating positive correlations between teacher efficacy beliefs and other factors relevant to teaching.

Correlations between teacher efficacy beliefs and other factors

A common argument that a strong sense of teacher efficacy is better than a weak one stems from a number of studies indicating that teachers with a strong sense of teacher efficacy are more likely to engage in novel teaching practices. In a study of 120 elementary and secondary school teachers, Guskey (1988) found that teachers with a stronger sense of teacher efficacy were more likely to use a new instructional strategy than those with a weaker sense of efficacy. Interpreting results from Guskey's work is challenging, however, as he did not distinguish between personal teacher efficacy beliefs and general teacher efficacy beliefs. In fact, Guskey used a two-item Likert-scale questionnaire that researchers now consider too generally worded to measure teacher efficacy beliefs effectively (Tschannen-Moran & Hoy, 2001).

Ghaith and Yaghi (1997) discovered that personal teacher efficacy beliefs, but not general teacher efficacy beliefs, were positively correlated with teacher willingness to use cooperative learning strategies. In their study of sixteen middle school and nine high school teachers, Ghaith and Yaghi employed a questionnaire containing subscales aimed at measuring, and distinguishing between, personal teacher efficacy beliefs and general teacher efficacy beliefs. It should be noted, however, that personal teacher efficacy beliefs were positively correlated with teacher *willingness* to use cooperative learning strategies when teaching as measured on a Likert-scale questionnaire. No relationship was uncovered between personal teacher efficacy beliefs and teachers' actual teaching practices. Riggs and Enochs (1990) found that elementary-school teachers with a stronger sense of personal teacher efficacy were more likely to use reform-oriented practices when teaching mathematics. Again, however, the relationship uncovered was between personal teacher efficacy beliefs and teachers' self-reported teaching preferences. There are similar problems with other findings, such as the apparent positive correlation between teacher efficacy beliefs and the use of inquiry-based teaching methods (Czernaik, 1990).

Researchers also point to other apparent connections between teacher efficacy beliefs and other factors relevant to teaching. For example, several studies have indicated that teachers with a stronger sense of teacher efficacy are less susceptible to teacher burnout (Brouwers & Tomic, 2000; Betoret, 2006; Skaalvik & Skaalvik, 2007; Skaalvik & Skaalvik, 2010), exhibit lower levels of teaching-related stress (Parkay, Greenwood, Olejnik, & Proller, 1988), and have a greater sense of job satisfaction (Caprara, Barbaranelli, Steca, & Malone, 2006; Trentham, Silvern & Brogdon, 1985). A complication in interpreting the results across these seven studies is the range of instruments used to measure teacher efficacy beliefs. With the exception of the two studies by Skaalvik and Skaalvik (2007, 2010), no two studies utilized the same instrument for measuring teacher efficacy beliefs. In all cases, the instruments used were designed by the authors. This variation in instruments makes synthesizing results across studies difficult. This is especially true given that scores on different measures of teacher efficacy beliefs have been found to be at best moderately positively correlated (Tschannen-Moran & Hoy, 2001). Hence, it is unclear whether these instruments really measured the same construct.

There are also a few studies in which the relationship between teacher efficacy beliefs and student achievement has been examined. Ross (1992) found that personal teacher efficacy beliefs and student achievement on written history assessments were positively correlated. In a study of 1082 second- and fifth-grade teachers, Moore and Esselman (1992) found that although teacher efficacy beliefs and reading achievement were not correlated, personal teacher efficacy beliefs and mathematics achievement were positively correlated. Anderson, Greene, and Loewen (1988) and Caprara et. al (2006) also uncovered positive correlations between teacher efficacy beliefs and student achievement.

Interpreting studies linking teacher efficacy beliefs and student achievement is also difficult, as these studies not only utilize different instruments for measuring teacher efficacy beliefs, but also measure student achievement in different ways. For example, Caprara et al. (2006) used students' final examination grades as a measure of student academic achievement, whereas Moore and Esselman (1992) used student scores on standardized tests. Some researchers have concluded that there is only weak evidence linking teacher efficacy beliefs and student achievement simply because there is a lack of literature establishing clear connections between the two variables. In a recent review of 286 peer-reviewed articles on teacher efficacy beliefs published between 1998 and 2009, Klassen, Tze, Betts and Gordon (2010) found only "modest" (p. 40) support that teacher efficacy beliefs and student achievement are positively correlated. Their review suggests that relationships between teacher efficacy beliefs and other variables, like engagement in novel teaching practices and job satisfaction, have yet to be clearly established. Moreover, given that studies linking teacher efficacy beliefs and student achievement focus on a variety of content areas, it is difficult to determine the extent to which results from such studies apply to the teaching and learning of mathematics.

Complexities in interpreting teacher efficacy beliefs research

Although studies such as those presented above are routinely presented as evidence for the upside of a strong sense of teacher efficacy, I have identified a number of problems involved in interpreting such research. Additional complexities in interpreting such literature are also evident. First, it is still unclear what role teacher efficacy beliefs actually play in supporting effective teaching, as the role of explanatory variables has not yet been fully explored.

Role of explanatory variables. The studies cited above investigated the correlation between teacher efficacy beliefs and other variables hypothetically related to teaching quality. Failure to consider potential explanatory variables is a classic problem in over-interpreting correlations. It is possible that correlations between teacher efficacy and other variables from previous research can be explained by a third variable.

Consider the apparent connection between teacher efficacy beliefs and student achievement. Teachers' mathematical knowledge for teaching, as defined by Ball and colleagues (2008), and teachers' beliefs about their mathematical knowledge for teaching are potential explanatory factors. Teachers with higher levels of mathematical knowledge for teaching might also exhibit a strong sense of teacher efficacy beliefs, as teachers with more mathematical knowledge might feel more equipped for teaching effectively. Moreover, if a teacher has more mathematical knowledge for teaching, she might teach more effectively and her students might perform more successfully on assessments. There is, in fact, empirical evidence that a teacher's content knowledge affects the way she teaches. Hill et al. (2008) discovered that teachers with low levels of mathematical knowledge for teaching treated mathematical topics superficially and did not provide enough opportunities to engage in rich mathematical ideas. Teachers with high levels of mathematical knowledge for teaching performed better in these areas, and also displayed more skill in responding to students' questions.

Hill, Rowan, and Ball (2005) actually found that teachers' mathematical knowledge for teaching was a predictor of student achievement. In a study involving 115 elementary schools, the authors discovered that "teachers' mathematical knowledge for teaching positively predicted student gains in mathematics achievement during the first and third grades" (p. 399).

Thus, if a teacher has a high level of mathematical knowledge for teaching, she might teach more effectively than a teacher with a lower level. More effective teaching means better student achievement. A teacher with high mathematical knowledge might also have a strong sense of teacher efficacy simply because her students perform better than the students of teachers with less knowledge. Hence, teachers with higher levels of knowledge for teaching might feel like effective teachers because they are effective teachers. On the other hand, teachers with low levels of content knowledge for teaching might be less effective teachers and consequently also feel less effective because.

Similarly, teachers' beliefs about their mathematical knowledge for teaching could be a potential explanatory variable. Consider the apparent positive correlation between teacher efficacy beliefs and the use of inquiry-based methods. A strong belief in one's mathematical knowledge for teaching might lead to a strong sense of teacher efficacy, as a teacher might believe that this knowledge is a crucial ingredient in teaching well. Moreover, such a teacher might display more willingness to use inquiry-based approaches in teaching; teachers who feel their mathematical knowledge is strong might feel more willing to engage students in discussions because they are more confident in their abilities to deal with unexpected questions. Thus, a teacher's belief in her mathematical knowledge for teaching could explain both why the teacher feels highly efficacious and why she is willing to use inquiry-based teaching methods.

Some researchers have taken a more careful view of teacher efficacy beliefs, indicating that teacher efficacy beliefs are only one of many factors that might contribute to particular teaching outcomes, in particular student achievement. Muijs and Reynolds (2002) constructed a path analysis to explore factors that might predict student achievement. They concluded that teachers with a stronger sense of teacher efficacy favored a constructivist view of learning over other perspectives. In turn, holding a constructivist view of learning was positively correlated with student learning. However, Muijs and Reynolds do not argue that only two factors explain student achievement, but rather a collection of other inter-related factors, notably the nature of teachers' actual teaching practices and teachers' content knowledge, might also influence student achievement. Therefore, Muijs and Reynolds' analysis supports the view that teacher efficacy beliefs must be understood in the context of other variables.

Bruce et al. (2010) provide a helpful interpretation of how teacher efficacy beliefs matter for student achievement in mathematics, arguing that stronger teacher efficacy beliefs co-occur with improved instruction; improved instruction in turn leads to higher student achievement. Bruce and colleagues found some empirical evidence for their model in a study of two Canadian school districts. For teachers in "District A," strengthening of teacher efficacy beliefs co-occurred with improved instruction and improved student achievement. It should be noted, however, that such a pattern does not always occur. Bruce et al. found that for teachers in "District B," a stronger sense of teacher efficacy did not correspond to gains in student achievement. Such findings imply that correlations between teacher efficacy beliefs and other factors should be interpreted with care, and strengthen the claim that it is essential to consider the role that explanatory variables might play.

Role of content to be taught. Efficacy beliefs are task- and context-specific constructs (Bandura, 1986), so one would expect the content to be taught to influence what efficacy beliefs look like. Indeed, Raudenbush, Rowan, and Cheong (1992) found in a study of 315 teachers from 16 different high schools that the "particular content to be taught in any given class" is a factor that shapes a teacher's efficacy beliefs (p. 165). Again, given that teachers' content knowledge affects the nature of their actual instruction, the role that content plays in affecting teacher efficacy beliefs should be considered.

One way in which researchers have tried to account for the role that mathematics plays in shaping mathematics teacher efficacy beliefs is measuring these beliefs with assessments that specifically reference teaching mathematics, rather than just teaching in general. Huinker and Madison (1997) designed the MTEBI (Mathematics Teaching Efficacy Beliefs Instrument) to be such an instrument. Items on the MTEBI do refer to mathematics teaching with items like, "I know how to teach mathematics concepts effectively" and "I understand mathematics concepts well enough to be effective in teaching elementary mathematics" (Enochs, Smith, & Huinker, 2000, p. 200-201). Wenner (1993, 1995) utilized a similar assessment for measuring efficacy beliefs about teaching science.

Although instruments such as the MTEBI restrict the measure of teacher efficacy beliefs to beliefs about teaching mathematics, they do not reference any particular mathematical content. That is, such instruments ask questions about "mathematics," even though "mathematics" is an extremely broad term. Teachers' efficacy beliefs might vary according to particular subdomains of mathematics (fractions versus geometry for example) or according to individual subtopics within a subdomain (division of fractions versus addition of fractions, for example). It is likely that teacher efficacy beliefs are not uniform across all mathematical subdomains, especially given Bandura's assertion that that "people may judge themselves efficacious only in certain domains of functioning or across a wide range of activities and situations" (Bandura, 1986, p. 396).

Thus, since teacher efficacy beliefs are likely to be more varied with respect to content areas than current measures can detect, it is unclear what current measures of teacher efficacy beliefs actually measure. The beliefs that such measures elicit are not necessarily relevant to the teaching of specific content, and thus current measures might not reveal teachers' beliefs about teaching specific content.

This claim is supported by the fact that studies examining the relationship between teacher efficacy beliefs and teachers' content knowledge for teaching particular content have yielded inconsistent results. Wenner (1993) initially found a significant negative correlation between pre-service teachers' science knowledge and efficacy beliefs, but then found science knowledge and efficacy beliefs to be uncorrelated in a different sample of pre-service teachers (Wenner, 1995). More recently, Bates, Latham and Kim (2011) examined two groups of pre-service teachers. In the first group, pre-service teachers with strong teacher efficacy beliefs tended to have higher levels of mathematical knowledge as measured on a test of basic skills. However, in the second group, pre-service teachers with both high and low content scores exhibited a strong sense of teacher efficacy.

Studies with a specific focus on personal mathematics teacher efficacy beliefs and mathematical knowledge for teaching have produced similar inconsistencies. Swars et al. (2007) found that pre-service teachers' personal mathematics teacher efficacy beliefs and mathematical knowledge for teaching remained uncorrelated throughout and after their teacher education program. In a later study, however, Swars, Smith, Smith, and Hart (2009) uncovered a significant positive correlation between pre-service teachers' personal mathematics teacher efficacy beliefs and mathematical knowledge for teaching.

Such inconsistent results might be due to apparent incongruities between assessments of mathematical knowledge for teaching and assessments of mathematics teacher efficacy beliefs. Measures of mathematical knowledge for teaching are designed to reflect what teachers actually do in mathematics classrooms, tasks such as "giving or evaluating mathematical explanations" (Ball et al., 2008, p. 400). These measures assess teacher skill with respect to these tasks in the context of specific mathematics. On the other hand, measures of personal mathematics teacher efficacy beliefs are typically more distant from the tasks of actual teaching and do not reference specific mathematics.

Therefore, more content-specificity in teacher efficacy beliefs measures is likely needed. This suggestion is in keeping with Pajares' (1996) assertion that "self-efficacy beliefs should be assessed at the optimal level of specificity that corresponds to the criterial task being assessed and the domain of functioning being analyzed" (p. 547). In other words, a measure of teacher efficacy beliefs should actually assess beliefs about the specific task involved. For mathematics teacher efficacy beliefs, this means accounting for the mathematics to be taught when measuring beliefs about teaching effectiveness.

Potential downside of a strong sense of teacher efficacy

In light of the apparent measurement problems discussed previously, the assertion that a strong sense of teacher efficacy is preferable seems to have incomplete empirical support. Moreover, some research contradicts the notion that a strong sense of teacher efficacy is always preferable. Bruce et al. found that teachers can demonstrate "high teacher efficacy beliefs that [are] based on untested self-appraisals" (pp. 9-10). The teachers in this study "did not realize that their professional practice was at a fairly low level" (pp. 9-10). In other words, such teachers had strong teacher efficacy beliefs that were perhaps unwarranted. "District B" teachers still felt highly effective despite their apparent need for professional development in teaching mathematics.

Other efficacy beliefs research also indicates the potential benefits of a *weaker* sense of teacher efficacy. Wheatley (2000) concluded that positive teacher efficacy beliefs can be "poorly grounded," partially because teachers might not be aware of "their own lack of knowledge" (p. 19). In a study of teacher learning conducted with ten in-service secondary teachers, Brodkey (1993) found the perception that one is already a good teacher can be a "powerful barrier to change" (p. 70). Wheatley (2002, 2005) further argued that doubting one's teaching abilities can actually help facilitate learning because doubt can promote both teacher reflection on practice and motivation to learn.

Hawkes (2001) found that reflection on practice was negatively related to teacher efficacy beliefs among elementary-school teachers. Teachers who felt more effective were less likely to engage in reflective discourse on their teaching practices than teachers who felt less effective. Since reflection is an important part of improving one's teaching (e.g., see Hiebert, Morris, Berk, & Jansen, 2007), Hawkes' study also suggests the downside of feeling highly efficacious.

Research in which participants assess their performance in academic settings also demonstrates why a strong sense of teacher efficacy is not necessarily preferable. Hacker, Bol, Horgan, and Rakow (2000) measured both college students' self-assessment and actual performance on a series of psychology exams. They found that tendency to rate academic performance accurately depends on students' actual academic performance. The highest-performing students consistently rated their academic performance accurately, whereas the lowest-performing students consistently over-rated their performance. Thus, how a student assesses his or her knowledge depends on the knowledge the student actually has. Similarly, Hackett and Betz (1989) found that students overestimated their performance on a set of 18 mathematics items. Panaoura (2007) found overestimation of mathematical knowledge prevalent among pre-service teachers, "especially in the case of the students with low [mathematical] performance" (p. 336).

Such results corroborate the findings of Kruger and Dunning (1999) who found that not only can individuals overestimate their abilities in given situations, but that lack of knowledge can interfere with one's ability to self-evaluate his or her skills. That is, individuals who know less about a given topic give less accurate assessments of their performance with respect to that topic. This was the case in the authors' investigations of individuals' knowledge in multiple areas including logic and grammar.

Therefore, teachers who exhibit a strong sense of mathematics teacher efficacy might actually do so inaccurately as a result of their own incomplete mathematical knowledge for teaching. That is, teachers with a strong sense of teacher efficacy who have overestimated their teaching effectiveness possibly have a real need to improve their teaching and their mathematical knowledge. Unfortunately, such teachers might also conclude that they "have nothing new to learn" (Bruce et al., 2010, p. 10). A strong sense of teacher efficacy, therefore, is not necessarily a positive indicator as an unwarranted sense of effectiveness has the potential to interfere with the professional development needed to improve one's teaching.

Contextual factors affecting teacher efficacy beliefs

The need for new perspectives on teacher efficacy beliefs has been recognized by some researchers. Labone (2004) discusses the fact that teacher efficacy beliefs cannot be fully understood in light of the existing notions of the construct, noting a "need to extend efficacy research in order to both broaden and deepen our understanding" of the construct (p. 357). Much of the recent research aimed at broadening teacher efficacy beliefs as a construct has focused on collective efficacy beliefs, beliefs about how groups of teachers can function together to help students learn (e.g., see Bandura, 2000; Goddard, Hoy, & Hoy, 2004; Klassen, Usher, & Bong, 2010; Skaalvik & Skaalvik, 2007; Skaalvik & Skaalvik, 2010).

Some researchers have also begun to pay more explicit attention to contextual factors that might affect teacher efficacy beliefs. Stipek (2012) suggested administrative support as one such contextual factor, finding that found that when teachers feel supported by administration, they exhibit a stronger sense of teacher efficacy. School setting (rural, urban, or suburban) also has the potential to affect teacher efficacy beliefs, as discovered by Knoblauch and Hoy (2008). Raudenbush et al. (1992) found that teacher efficacy beliefs vary according to the student populations to be taught, with the high school teachers in their study feeling most efficacious when teaching honors courses and least efficacious when teaching courses for a general student audience.

Bandura (1977) asserted that "a number of contextual factors, including the social, situational, and temporal circumstances under which events occur" (p. 200) shape the nature of one's efficacy beliefs. Thus, exploring additional contextual factors that have the potential to affect teacher efficacy beliefs is essential for understanding these beliefs. Several contextual factors that have been neglected in the existing literature are important for understanding why advocating a strong sense of teacher efficacy is too simple a prescription for improving teaching. A discussion of these factors helps us understand teacher efficacy beliefs as a more complex construct.

Content to be taught

As mentioned previously, the content to be taught is likely to be an important variable that affects the nature of teachers' efficacy beliefs. A more careful analysis of how this content affects teacher efficacy beliefs is needed to understand how teacher efficacy beliefs vary within and across content areas. Teachers' content knowledge for teaching is likely to vary with the content to be taught, and hence it is appropriate that their teacher efficacy beliefs vary as well. Moreover, teachers' perceptions of their content knowledge for teaching are likely to affect their sense of teacher efficacy.

There is some empirical data that both of these variables are useful for understanding teacher efficacy beliefs as a construct. In a study of 42 pre-service teachers, Austin (2012) measured personal teacher efficacy beliefs in the context of four specific mathematical teaching scenarios. Personal teacher efficacy beliefs were measured but in the context of teaching tasks containing specific mathematics. Pre-service teachers were given written scenarios in which children posed specific mathematical questions. For each scenario, pre-service teachers were asked to give a mathematical explanation and to rate their sense of teacher effectiveness in responding to the student's question. Pre-service teachers with a high level of mathematical knowledge for teaching were more likely to have a sense of teacher efficacy that matched their level of mathematical knowledge for than pre-service teachers with low mathematical knowledge for teaching. Thus, how teacher efficacy beliefs and mathematical knowledge for teaching are related might depend on the level of mathematical knowledge that a teacher has.

Austin (2012) also found that when pre-service teachers rating their mathematical understanding of a task as low, they also exhibited a weaker sense of teacher efficacy. Additionally, Austin found a tendency for pre-service teachers to exhibit a strong sense of teacher efficacy and a high self-evaluation of their mathematical knowledge for teaching even when their actual mathematical knowledge for teaching on a particular task was low. Hence, a teacher's teacher efficacy beliefs potentially vary with her perception of her mathematical knowledge, but do not necessarily vary with her actual mathematical knowledge.

An understanding that a unilaterally strong sense of teacher efficacy is not necessarily preferable, therefore, would be aided by a view of teacher efficacy beliefs as varying according to content. As previously mentioned, existing studies in which teacher efficacy beliefs and content area have been examined together have yielded inconsistent results. Therefore, more studies are needed using measures that are more sensitive to how teacher efficacy beliefs vary according to the mathematics to be taught.

Difficulty of teaching task

Teachers are not likely to perceive all teaching tasks within a particular content area to be of equal difficulty. One's sense of teacher efficacy is likely to be affected by how difficult one perceives a teaching task to be. Again, there is some empirical evidence that perceived task difficulty affects teacher efficacy beliefs. Austin (2012) found that within the mathematical subdomain of fractions, teacher efficacy ratings were lowest on the task that participants rated most difficult, and were highest on the task rated least difficult. This finding might not be surprising, especially given Bandura's (1977) suggestion that difficulty of task can affect efficacy beliefs. However, difficulty of task is not often considered in existing empirical research on teacher efficacy beliefs. If teacher efficacy beliefs vary according to the difficulty level of the teaching task involved, these beliefs are much more contextual than the existing teacher efficacy research has suggested. It would seem that having a sense of efficacy that varies depending on the difficulty of the task involved is appropriate, as actual teaching effectiveness is also likely to vary with task difficulty. Hence, a sense of teacher efficacy that is tied to the difficulty of the task involved seems more reasonable than a unilaterally strong sense of teacher efficacy across all tasks. More studies in which task difficulty is considered as a variable affecting teacher efficacy are needed to examine how this variable shapes teacher efficacy beliefs.

Conclusion

Understanding the effects of these contextual factors is important for understanding why advocating a strong sense of teacher efficacy is too simple a prescription for improving teaching. Studies in which such contextual factors are examined more carefully are needed to unpack teacher efficacy beliefs as a construct.

In particular, researchers should examine how teachers' personal teacher efficacy beliefs and mathematical knowledge for teaching are related. There is empirical evidence that the effectiveness of a teacher's instruction depends in part on the teacher's mathematical knowledge for teaching (Ball, Thames, & Phelps, 2008; Hill, Rowan, & Ball, 2005). Thus, the level of a teacher's mathematical knowledge for teaching should be a factor that affects the teacher's personal teacher efficacy beliefs for teaching. In other words, conceptions of teaching effectiveness and mathematical knowledge should not develop independently. This notion is similar to Pajares' (1996) suggestion that the degree of accuracy or "calibration" (p. 565) of students' beliefs is related to their degree of academic success. Reaching such "calibration" is a non-trivial task for future mathematics teachers. Since students often struggle with assessing their own understanding of mathematical concepts, assessing one's effectiveness for teaching such concepts is presumably of equal or greater difficulty. Examining the extent to which conceptions of teacher efficacy beliefs and mathematical knowledge for teaching are related is therefore one essential avenue for future research.

The existing literature on teacher efficacy beliefs perhaps over-emphasizes the helpfulness of a strong sense of teacher efficacy. This emphasis is largely based on positive correlations found between teacher efficacy beliefs and desirable teaching practices or outcomes. There is insufficient evidence, however, to suggest that such correlations warrant the claim that stronger teacher efficacy beliefs lead to better teaching. The inattention to explanatory variables such as teachers' content knowledge for teaching and task difficulty, and inattention to the content- and task-specificity of teacher efficacy beliefs imply that the results from teacher efficacy beliefs literature should be interpreted with caution.

To be clear, it is certainly not the case that previous studies on teacher efficacy beliefs should be disregarded. Previous studies shed light on teacher efficacy beliefs as a construct and are essential for pointing to further areas of study. An examination of previous research reveals that teacher efficacy beliefs are not yet fully understood, and research on these beliefs, particularly to beliefs that are specific to the teaching of mathematics, is a rich field.

Thus, caution should be exercised in applying the results of previous teacher efficacy beliefs studies to teacher education. If the benefits of a strong sense of teacher efficacy have been misunderstood, it is unclear whether increasing teachers' sense of efficacy is a sensible prescription. A large number of studies have asserted that helping teachers develop a stronger sense of teacher efficacy should be a goal of teacher preparation programs and professional development (e.g., see Ghaith and Shaaban, 1999; Huinker & Madison, 1997; Palmer, 2006; Swars, 2005; Tschannen-Moran & McMaster, 2007; Utley, Bryant, & Moseley, 2005). Since it is unclear whether a strong sense of teacher efficacy actually leads to better teaching, it is premature to assert that helping teachers increase their sense of efficacy is a positive thing. This is especially true with respect to the teaching of mathematics where assessing one's effectiveness has the potential to be extremely complex. Understanding what types of teacher efficacy beliefs would best support student learning can potentially be furthered by research in which the neglected contextual factors discussed in this article are examined more carefully.

† *Jathan Austin, Ph.D.,* Salisbury University, USA

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