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REVIEW ARTICLE

Reconceptualizing the Sources of Teaching Self-Efficacy: a Critical Review of Emerging Literature

David B. Morris[1] · Ellen L. Usher[2] · Jason A. Chen[3]

Abstract Teachers' efficacy beliefs are thought to influence not only their motivation and performance but also the achievement of their students. Scholars have therefore turned their attention toward the sources underlying these important teacher beliefs. This review seeks to evaluate the ways in which researchers have measured and conceptualized the sources of teaching self-efficacy across 82 empirical studies. Specifically, it aims to identify what can be inferred from these studies and what important questions still remain about the origins of teachers' efficacy beliefs. Results indicate that a number of methodological shortcomings in the literature have prevented a clear understanding of how teachers develop a sense of efficacy. Nonetheless, insights gleaned from existing research help to refine, and to expand, theoretical understandings of the sources of self-efficacy and their influence in the unique context of teaching. Implications for future research and practice are addressed.

Keywords Teachers · Self-efficacy · Sources of self-efficacy · Social cognitive theory

As part of his social cognitive theory, Albert Bandura (1997) argued that *self-efficacy*, defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3), is central to the exercise of human agency. Efficacy beliefs have been found to predict the effort people put forth, how well they persevere when faced with obstacles, how effectively they monitor and motivate themselves, what they achieve, and the choices they make in life (Bandura 1997). For this reason, researchers have devoted

✉ David B. Morris
   dbmorris@smcm.edu

[1] Department of Educational Studies, St. Mary's College of Maryland, 47645 College Drive, St. Mary's City, MD 20686-3001, USA

[2] Department of Educational, School, and Counseling Psychology, University of Kentucky, Lexington, USA

[3] School of Education, The College of William and Mary, Williamsburg, USA

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considerable attention to how self-efficacy influences the motivation and behaviors of individuals in academic settings (Pajares 2006).

Although much of this work has explored the self-efficacy of students, researchers have documented that teachers' sense of efficacy also plays a critical role in how classrooms function. Teachers' self-efficacy beliefs (i.e., *teaching self-efficacy*) are the beliefs teachers hold about their capabilities to carry out their professional tasks. Compared to those who doubt themselves, teachers with a strong sense of efficacy typically utilize more effective teaching strategies, are less susceptible to burnout, and are more committed to the profession (see Woolfolk Hoy and Davis 2006; Zee and Kooman 2016). In a recent meta-analysis, teachers' self-efficacy was found to be strongly associated with evaluations of their effectiveness by fellow teachers, supervisors, and administrators (Klassen and Tze 2014). Teachers' beliefs about their capabilities may also influence what students experience. For example, modest but significant associations have been found between teachers' self-efficacy and their students' achievement (Klassen and Tze 2014; Klassen et al. 2011).

Given the benefits that accompany a high sense of teaching efficacy, researchers have turned their attention toward the sources underlying these important teacher beliefs. What experiences and psychological processes lead some teachers to believe themselves capable and others to struggle with self-doubt? Despite attempts by researchers to answer this question, inconsistencies in the ways the hypothesized sources of self-efficacy have been conceptualized and measured have prevented a clear understanding of how teachers form and refine their efficacy beliefs. In their review of over 10 years of research on teaching self-efficacy, Klassen et al. (2011) concluded that:

> Insufficient attention has been paid to the sources of teachers' self- and collective efficacy, and progress in teacher efficacy research has suffered as a result. A scientific understanding of teachers' self- and collective efficacy can only be fostered if reliable and valid measurements of the sources of teacher efficacy—the very foundation of the construct—are designed. (pp. 31–32)

The purpose of this literature review is to address these limitations. To date, reviews and meta-analyses of research on teaching self-efficacy have focused primarily on the conceptualization, measurement, and effects of teachers' self-efficacy (e.g., Aloe et al. 2014; Henson 2002; Klassen and Tze 2014; Kleinsasser 2014; Wyatt 2014; Zee and Kooman 2016). When the sources of teaching self-efficacy have been described in reviews, the discussion has often been theoretical in nature (e.g., Tschannen-Moran et al. 1998) or beyond the scope of the review (e.g., Haverback and Parault 2008). In only two recent reviews have scholars summarized the empirical work on the sources of teaching self-efficacy, but in each case the exploration of the sources was limited in scope. Klassen et al. (2011) reviewed studies of the sources as part of a broader review of teaching self-efficacy research published from 1998 to 2009. Similarly, Wyatt (2014) integrated some discussion of the sources of self-efficacy in a general review of teacher self-efficacy research, focusing primarily on quantitative studies published from 2005 to 2012. Relevant findings from these reviews were that (a) some measures of the sources are inconsistent with social cognitive theory, (b) few quantitative studies have addressed how teachers' self-efficacy beliefs are formed, and (c) there is a need to better understand the role of knowledge in the development of teaching self-efficacy (Klassen et al. 2011; Wyatt 2014).

We further explore these and other concerns in the present review, which is the first to focus exclusively on the sources of teaching self-efficacy. Drawing on peer-reviewed studies

published from 1977 to 2015, we provide a comprehensive analysis of the measure and influence of the sources of self-efficacy relevant to teachers, as well as factors that may mediate and moderate the relationship between the sources and self-efficacy. First, we return to the social cognitive theoretical framework proposed by Bandura (1986, 1997) in which the four hypothesized sources of self-efficacy are described. We then identify empirical studies that have attempted to assess the sources of teaching self-efficacy and examine the methods by which researchers have operationalized and measured these sources. We describe key findings from this body of research and discuss the implications for research and practice.

Theoretical Framework: Sources of Self-Efficacy in the Teaching Context

Bandura's (1986) social cognitive theory provides a view of human functioning in which individuals are neither unwillingly shaped by environmental forces nor automatically determined by their genetic endowments. Instead, one's behavior, environment, and personal factors (e.g., cognitive, biological, and affective processes) are reciprocally influential. According to Bandura, at the heart of social cognition are five interrelated human capabilities. These include symbolizing capability, forethought, vicarious capability, self-regulatory capability, and self-reflective capability. This latter capacity allows humans to reflect on what they have done and on what they can do. Such self-reflections can have a profound influence on one's subsequent behavior; beliefs about one's personal efficacy are often more predictive of behavior, motivation, and feelings than are previous levels of performance (Bandura 1997). Bandura posited that individuals reflect on and evaluate their efficacy by interpreting information from four primary sources: mastery experience, vicarious experience, social persuasions, and physiological and affective states.

Enactive mastery experiences refer to past performance attainments and are thought to be the most influential source of self-efficacy (Bandura 1997; Usher and Pajares 2008). Bandura has also described this source in terms of "performance accomplishments" (e.g., Bandura 1977) and "enactive attainments" (e.g., Bandura 1986). Thus, mastery experiences involve the achievement of goals (i.e., accomplishment/attainment) through direct, personal action (i.e., enactive). People who view their past efforts as successes are more likely to approach similar tasks with confidence, whereas those who believe they have failed may doubt their capabilities (Bandura 1997). According to Bandura (1997), mastery experiences may be especially powerful when one succeeds on a task that is thought to be particularly demanding. Other factors, such as the need for extensive effort or overreliance on help from others, can nevertheless dampen this influence. Therefore, an accomplishment may do little to alter an individual's self-efficacy if it is attributed to something other than one's own ability or effort.

A *vicarious experience* is derived from observing a social model, or even oneself, perform a task. Bandura (1997) noted that the effect of a vicarious experience on the development of self-efficacy may be profound when the task is relatively novel. Vicarious experiences are also particularly potent when the model or comparison group is perceived as similar to the individual. Models who openly struggle to overcome obstacles (i.e., coping models) are more likely to enhance an observer's self-efficacy than are those who appear to make few mistakes (Kitsantas et al. 2000; Schunk and Hanson 1989). Vicarious experiences can also lead to referential comparisons in which one's capabilities are evaluated by comparing one's performance (i.e., enactive mastery experiences) to the observed performances of others (Bandura 1986, 1991).

Evaluative feedback in the form of *social persuasions* can also influence efficacy beliefs. According to Bandura (1997), the power of social persuasions to change one's self-efficacy is often mediated by the perceived knowledge or credibility of the person providing the feedback. The effectiveness of praise depends not only on who delivers it but also on the way that a message is framed. Encouragements that are little more than "knee-jerk praise or empty inspirational homilies" (Pajares 2006, p. 349) are unlikely to wield much influence. On the other hand, messages that are specific and sincere can have a powerful effect on the development of one's self-efficacy (Schunk 1984; and see Hattie and Timperley 2007). One's self-beliefs may be more easily damaged by discouraging messages than enhanced by positive persuasions (Bandura 1997). Social messages are particularly powerful when an individual has little experience in a domain.

Individuals also rely on their own *physiological and affective states* when assessing what they can do in a given situation. Such states include stress, fatigue, anxiety, and mood. The intensity of these states may also influence one's interpretation. Bandura (1997) maintained that moderate levels of arousal lead to optimal performance, a contention supported by various empirical findings (Cassady and Johnson 2002; Keeley et al. 2008).

Interpreting the Sources of Teaching Self-Efficacy

These four hypothesized sources do not affect one's self-efficacy directly; their influence is instead moderated by how individuals interpret their experiences (Bandura 1997). At the heart of social cognitive theory is the notion of the dynamic influence among environmental, behavioral, and personal factors. Being recognized as "teacher of the year" may make some teachers more confident in their capabilities. However, those who feel that such an accomplishment was undeserved may not experience any change in their self-beliefs (Clance and Imes 1978). Moreover, individuals' efficacy beliefs influence their interpretations of new information, including the factors to which they attribute recent successes and failures (Bandura 1997). In other words, self-efficacy is not the simple product or sum of one's experiences; the effect of an experience on one's sense of efficacy depends on how a particular event is cognitively processed.

Drawing from Bandura's (1997) description of the sources of self-efficacy, Tschannen-Moran et al. (1998) provided suggestions as to how teachers develop and maintain a sense of efficacy. They proposed that the relationship between teaching self-efficacy and its sources is cyclical: one's interpretation of efficacy-relevant information influences self-efficacy, which in turn affects the quality of instructional performance. The success or failure of a given performance results in new ability-related information. Some scholars have noted, however, that high teaching self-efficacy may not always lead to better performance, particularly when some level of doubt may be necessary to improve (Wheatley 2002; Wyatt 2014, 2016). On the other hand, Bandura (1997) maintained that self-assured individuals are better equipped to profit from their mistakes, whereas "the failures of those who suffer from self-doubts are unlikely to serve as a fertile source of promising strategies" (p. 94).

Other scholars have described a similar cyclical process whereby the sources, self-efficacy, and teaching practices dynamically influence one another (Burton et al. 2005; Ross et al. 1999). For example, in one two-wave longitudinal study of 274 teachers, higher teaching self-efficacy at Time 1 led to greater work engagement in Time 2 (Salanova et al. 2011). Greater work engagement at Time 1, in turn, led to more positive affective states (i.e., enthusiasm, satisfaction, and comfort) and higher teaching self-efficacy at Time 2. Bandura (1997)

described such reciprocal processes and indicated that the sources of self-efficacy may be particularly powerful when individuals are new to a task and have yet to develop a stable sense of competence.

Empirical Studies Investigating the Sources of Teaching Self-Efficacy

Scope of the Review

In this section, we provide a critical review of the emerging body of literature on the sources of teaching self-efficacy. The review was guided by two main objectives. The first was to identify and evaluate survey items and interview prompts used in quantitative and qualitative studies to gauge the sources of teaching self-efficacy. We explored the extent to which these items and prompts resemble clear, meaningful constructs that are consistent with Bandura's (1997) descriptions of the sources. We also identified ways in which researchers might design measures to provide a more accurate and complete representation of the sources of teaching self-efficacy.

Our second objective was to examine key findings gleaned from research regarding the role and relative influence of the sources of teachers' self-efficacy. We reviewed research relevant to the development of teaching self-efficacy, including studies that did not refer explicitly to Bandura's (1997) hypothesized sources. This approach also helped us to consider factors known to influence teachers' efficacy beliefs other than those described by Bandura.

Method

This review focuses on studies published between 1977, when Bandura first described the sources of self-efficacy, and 2015. We first identified research relevant to teaching self-efficacy using electronic databases such as Education Full Text, ERIC, and PsychInfo. All searches included the truncated terms "teach*" and "efficac*" to capture possible labels used for the construct (e.g., teaching self-efficacy, self-efficacious teachers, teacher efficacy). Terms used to refine the research so as to focus on the sources of self-efficacy included both general terms (i.e., source*, antecedent*, develop*) and specific phrasing used to describe the hypothesized sources (e.g., mastery experience*, enactive attainment*, performance accomplishment*). The initial search resulted in approximately 600 publications. We next applied the following inclusion criteria for identifying the relevant literature:

1. The article was written in English.
2. The authors focused specifically on teachers' self-efficacy as defined by Bandura (1997) rather than teachers' confidence or teachers' efficacy (i.e., their actual, rather than perceived, competence). Although the term "teacher efficacy" was originally conceived of as an outgrowth of Rotter's (1966) locus of control (see Tschannen-Moran et al. 1998, for a review), we were careful to include any studies that defined the construct in a manner consistent with Bandura's description of self-efficacy (i.e., beliefs about one's efficacy). Other studies were eliminated because they pertained to other variables, such as student variables, other teacher variables, or the efficacy (i.e., effectiveness) of a strategy or program. Although Bandura (1997) suggested that collective and personal efficacy beliefs

are derived from similar sources, we eliminated studies of collective teacher efficacy as these were beyond the scope of the review.

3. The article was an empirical study, rather than a review, meta-analysis, or conceptual piece.

4. With the exception of scale validation studies, the article must have been published in a peer-reviewed journal. We retained unpublished conference papers and dissertations only for studies that involved the use of new scales that we felt could be instructive if only for identifying challenges to instrument design and analysis. As we note later, some of these unpublished scales have been used in subsequent published studies.

Seventy-four empirical studies met the inclusion criteria described above. We once again widened our search by examining these 74 studies for cross-references to other relevant research that may have been overlooked due to terminology inconsistent with our search terms or limitations in the databases. This resulted in a final selection of 82 studies that met our search criteria.

In addition to the 82 studies that focused on the sources of teaching self-efficacy, we identified 55 studies that featured variables associated with changes in teachers' self-efficacy (e.g., stress, Shen 2009). Although we do not provide in-depth analyses of these studies (i.e., they were not explicitly designed as investigations of the sources of self-efficacy), we have made occasional reference to their findings as appropriate to the objectives of this review. We next provide a general overview of the 82 empirical studies central to this review.

General Overview of Retained Studies of the Hypothesized Sources

The goals driving the 82 investigations of the sources of teacher self-efficacy varied greatly. Whereas much research has been exploratory in nature (e.g., Mills 2011), other efforts have been designed for the purpose of scale construction (e.g., Poulou 2007) or assessment of a teacher education or professional development programs (e.g., Palmer 2006b). Methodologies have also varied; 36 of the studies selected were purely quantitative, 31 employed mixed methods, and 15 were purely qualitative. Over half ($n = 49$) of the 82 studies that met the criteria for review were published between 2010 and 2015.

The median sample size in the purely quantitative studies we reviewed was 139, with an interquartile range of 57.75 to 271.50. Data from 19 of the 36 quantitative investigations, including the scale validation studies, were cross-sectional in nature. Other quantitative studies were designed to measure changes in self-efficacy at two or more points of a professional development ($n = 8$) or teacher education ($n = 9$) program. In five of these studies, self-efficacy growth was compared between groups of students exposed to different experiences (e.g., laboratory-based teaching experiences versus field experiences; Gurvitch and Metzler 2009). In only 19 studies were the sources of self-efficacy measured through the use of survey items. In the other 17 cases, Bandura's (1997) descriptions of the sources were used to inform or describe the design of the professional development or teacher education experience; as such, there was no way to evaluate the independent influence of these multifaceted experiences on teachers' self-efficacy.

The majority of mixed-methods studies ($n = 22$) supplemented repeated-measures data with qualitative data to better understand the particular sources that influenced participants' self-efficacy during either professional development ($n = 6$) or teacher education ($n = 16$). Other

mixed-methods designs involved cross-sectional research ($n = 9$), often used to identify potential interviewees who fit a particular self-efficacy profile (e.g., Tosun 2000). The median sample size of mixed-methods studies was 55, with an interquartile range of 24.50 to 120.50. The median qualitative subsample size was 21. Qualitative data used in mixed-methods studies were collected in the form of interviews ($n = 16$), open-ended questionnaires ($n = 9$), participant documents such as teaching journals ($n = 3$), and observations ($n = 1$). In only three studies were participants given interview or questionnaire prompts specific to particular sources of efficacy information. Elsewhere, participants responded to general prompts about their experiences (e.g., "Based on your experiences in this course, list and discuss two ideas that you feel have had the greatest impact on your beliefs about your ability to teach science/mathematics"; Brand and Wilkins 2007, p. 302). Responses were then coded according to the relevant sources of teaching self-efficacy.

Qualitative studies of the sources of self-efficacy have tended to focus on a small number of individuals; the median sample size of retained studies was 8, with an interquartile range of 3.50 to 12.00. These investigations offer more detail into how individuals develop a sense of efficacy, whether through one-on-one interviews ($n = 13$), observations ($n = 5$), focus group interviews ($n = 3$), open-ended questionnaires ($n = 1$), or participant documents ($n = 2$). Of the 13 qualitative studies that included interviews, in only five was it clear that participants were directly asked to assess the influence of certain experiences on their teaching self-efficacy (e.g., Chong and Kong 2012). In five other studies, participants were asked more generally about their teaching experiences; findings were based on responses to follow-up questions that arose organically (e.g., Brand and Wilkins 2007). In the remaining three studies, it was unclear which approach the researchers took.

Teachers' mastery experiences ($n = 73$) were the most commonly assessed source of self-efficacy across the 82 studies, although many researchers also assessed vicarious experiences ($n = 58$), social persuasions ($n = 56$), and physiological and affective states ($n = 43$). Teaching self-efficacy was also assessed differently across the selected investigations. In 34 studies, teaching self-efficacy was assessed in a domain-general manner, whereas 29 studies pertained to science teaching self-efficacy and another 19 pertained to another subdomain, or combination of subdomains (e.g., self-efficacy for teaching English as a foreign language; Chacon 2005). In quantitative and mixed-methods studies, the most commonly used teaching self-efficacy scales were Tschannen-Moran and Woolfolk-Hoy's (2001) Teachers' Sense of Efficacy Scale ($n = 20$), Enochs and Riggs' (1990) Science Teaching Efficacy Belief Instrument—Preservice ($n = 19$), Gibson and Dembo's (1984) Teacher Efficacy Scale ($n = 6$), and Riggs and Enochs' (1990) Science Teaching Efficacy Belief Instrument ($n = 5$).

The majority of studies reviewed had been conducted in the USA ($n = 51$), with others conducted elsewhere in the world, including Australia ($n = 9$), Canada ($n = 6$), and Turkey ($n = 3$). Participants' gender (reported in 58 studies) was 75 % female and 25 % male. Twenty-four studies (largely North American) reported teachers' race and/or ethnicity as 88 % White or of Anglo-European descent; 4 % as Black or of African descent; 2 % as Asian, Pacific Islander, or of Asian descent; 1 % as Hispanic or Latino; and <1 % as Aboriginal (e.g., American Indian, First Nations).

Samples in the reviewed studies were more often composed of preservice ($n = 43$) than practicing ($n = 35$) teachers. In four studies, the sample included both preservice and practicing teachers, or teachers who were followed beyond their preservice years. Most often, participants taught, or were preparing to teach, in elementary or early childhood ($n = 40$) settings, followed by higher education ($n = 9$), high school ($n = 5$), and middle school ($n = 2$) settings. In 23

studies, the sample included participants in multiple settings from preschool to grade 12. Grade level was not clearly reported in three studies. Samples were typically composed of participants who taught, or who planned to teach, in diverse academic subject areas ($n = 65$). In the remaining 13 studies in which teachers' subject area was described, teaching domains included science, mathematics, English, foreign language, health and physical education, and college-level psychology. As noted above, self-efficacy measures were often domain general (i.e., pertaining to teaching in general).

Measuring the Sources of Teaching Self-Efficacy

The sources of teaching self-efficacy have been assessed in inconsistent and often problematic ways. In this section, we address the diverse ways in which the sources of teaching self-efficacy have been measured. First, we consider the merits of scales developed for the assessment of all four hypothesized sources. We then describe and evaluate the ways in which each hypothesized source of teaching self-efficacy has been operationalized and assessed. We accompany these descriptions with a list of sample items and prompts used in the assessment of each particular source.

Scales Designed to Assess All Four Sources of Self-Efficacy

To date, only two published scales have been developed to assess all four sources of self-efficacy hypothesized by Bandura (1997) as they pertain to the domain of teaching. The first of these was a four-item measure designed by Heppner (1994) to evaluate the influence of a teaching practicum on five graduate instructors' self-efficacy. No evidence of validity was provided for this measure.

The second measure, designed by Poulou (2007), comprised a 30-item scale to assess the sources of teaching self-efficacy among 198 preservice elementary teachers in Greece. The sources inventory included subscales for sources identified by Bandura (1997), as well as other variables not included in Bandura's descriptions (i.e., motivation, personality characteristics, capabilities/skills, and teacher training). Factor analysis results led the researcher to combine mastery experience and social persuasion items into a single subscale entitled "enactive mastery with social/verbal persuasion" (p. 197). Combining items may not be ideal, however. As Usher and Pajares (2008) cautioned, "results from studies that have used an aggregate score from two or more sources yield little practical information, as combining sources prevents an understanding of how [individuals] interpret each source independently" (p. 762).

Reliabilities (i.e., Cronbach's α) of the three subscales associated with Bandura's hypothesized sources (i.e., vicarious experiences, physiological/affective state, and enactive mastery combined with social/verbal persuasion) somewhat low in Poulou's (2007) original study ($.72 \leq \alpha \leq .79$). These values were slightly higher in a shorter version of the scales adapted by O'Neil and Stephenson (2012; $.75 \leq \alpha \leq .82$). Participants were directed to respond to items by assessing how a given experience influenced their self-efficacy (e.g., "I attribute my confidence in my classroom behavior management capabilities to [my teaching experience during practicum]"; O'Neil and Stephenson 2012, p. 538). Consequently, results reflected an evaluation of the relationship between the sources and self-efficacy rather than the frequency or quality of the efficacy-relevant experience itself. It is therefore not surprising that Poulou found weak or nonsignificant correlations between the sources subscales and teaching self-efficacy,

and researchers who have used or adapted the scale have reported similar findings (Oh 2011; O'Neil and Stephenson 2012).

Three unpublished scales also assessed all four hypothesized sources of self-efficacy. These included (a) a 35-item scale designed by Kieffer and Henson (2000), who surveyed 252 undergraduates enrolled in an educational psychology class; (b) a 16-item scale developed by Weaver Shearn (2008), who surveyed 252 first-year elementary and secondary teachers; and (c) a 21-item scale designed by Morris and Usher (2013) with data from 144 elementary and middle school teachers. The authors of all three validation studies encountered problems similar to those reported by Poulou (2007). In particular, they found that responses to the items did not separate psychometrically in factor analyses as expected (Kieffer and Henson 2000; Morris and Usher 2013; Weaver Shearn 2008). Mohamadi and Asadzadeh (2012) found that a Persian adaptation of Keiffer and Henson's (2000) scale had a four-factor solution representing each hypothesized source; however, reliabilities of the subscales were low ($.63 \leq \alpha \leq .80$). Similarly, Morris and Usher (2013) reported that a theoretically consistent four-factor solution emerged only after the sources of self-efficacy scale was reduced from 40 to 20 items; reliabilities remained low ($.63 \leq \alpha \leq .82$). As we will later discuss, these shortcomings point to the unique nature of efficacy-relevant experiences related to teaching and underscore the need for a psychometrically sound scale of the sources of teaching self-efficacy. Next, we offer a closer look at how each source of self-efficacy has been assessed.

Measures Used to Assess Mastery Experience

How does a teacher measure a "success"? Researchers have grappled with this question as they attempt to assess teachers' perceived mastery (and failure) experiences. The instructional task is inherently complex. The excellent teacher must be competent or "efficacious" in many ways, and therefore, many types of successes or failures could alter one's teaching self-efficacy. This likely explains why the manner in which mastery experience has been assessed has varied considerably. Sample survey items, variables, and open-ended prompts used to assess mastery experiences can be found in Table 1.

General prompts have typically been used in qualitative studies to identify teachers' mastery experiences (e.g., "Have you had experiences teaching literature, or teaching reading texts in your language classes? Can you describe these experiences?"; Mills 2011, p. 80). Because participants are able to talk in depth about their experiences during interviews, the use of such general questions has led to more nuanced understandings of mastery experiences. In quantitative studies, however, operationalizing mastery experiences as teachers' general experiences has done little to advance understandings of how teachers' performances influence their self-efficacy.

One such approach has been to examine the potential influence of teaching experience itself, either by measuring self-efficacy before and after a novel teaching experience (e.g., Cantrell et al. 2003) or by correlating experience with self-efficacy (e.g., DeChenne et al. 2015). For example, some researchers have drawn conclusions about preservice teachers' mastery experiences based solely on the amount of time participants reported having spent teaching in local schools (e.g., Cantrell et al. 2003; Capa Aydin and Woolfolk Hoy 2005; Gurvitch and Metzler 2009). In many cases, the rationale for doing so was that such experiences provide *opportunities* for enactive attainments in an authentic environment. Researchers have also measured mastery experiences as years of experience (e.g., Ruble et al. 2011) or opportunities to practice in certain types of classroom environments (e.g.,

Table 1 Sample survey items, variables, and open-ended prompts used to assess mastery experiences

Survey items	Variables	Open-ended prompts
Rate your satisfaction with your professional performance this year. (Tschannen-Moran and Woolfolk Hoy 2007)	Level of student engagement, ranked by observers (Guo et al. 2011)	What experiences affected your choice and decision to integrate technology in your teaching? (Al-Awidi and Alghazo 2012)
Rate your success during the first year compared to other first year teachers in similar situations. (Woolfolk Hoy and Burke-Spero 2005)	Student teachers' hours of teaching experience (Capa Aydin and Woolfolk Hoy 2005)	What experiences contributed to your confidence in working on the lesson plans (or to provide a positive learning experience? (Chong and Kong 2012)
I have had many positive opportunities to teach. (Kieffer and Henson 2000)	Academic performance in teacher preparation courses (Moulding et al. 2014)	What experiences in your professional life as a teacher have made you more confident as a teacher of undergraduates? What experiences in your life as a teacher have lowered your confidence as an instructor? How do you know that a given lesson has gone well/not gone well? Does that influence your confidence as an instructor? (Morris and Usher 2011)
Please rate the degree to which your teaching efficacy stems from teaching experience in difficult classes or schools during teaching practice (minority, multicultural, special schools, etc.). (Poulou 2007)	Years of teaching experience (Ruble et al. 2011)	
	Number of quarters and/or semesters of graduate teaching experience (DeChenne et al. 2015)	

Poulou 2007). Such measures reflect exposure to, or quantity of, teachers' experience rather than teachers' own appraisals of their teaching experiences. Without an evaluation of whether these experiences were successful or unsuccessful, little can be known about how they might influence self-efficacy (Bandura 1997).

Scholars who have examined teachers' interpretations of their past teaching performances have tended to focus on teachers' general appraisals. Some have asked teachers to rate their level of "satisfaction" with their past professional performance (e.g., Tschannen-Moran and Woolfolk Hoy 2007; Weaver Shearn 2008; Woolfolk Hoy and Burke-Spero 2005). Such items may not be best suited to represent an efficacy-related experience as conceptualized by Bandura (1997) because using the term "satisfaction" may encourage participants to provide an affective appraisal of their performance rather than a judgment of the degree to which their efforts were successful. Other scholars have instead asked teachers to rate the degree to which their teaching experiences were successful or positive (e.g., Kieffer and Henson 2000; Poulou 2007).

Conceptualizing mastery experience as a general appraisal of past performance is both limiting and vague. It is true that Bandura (1997) often used the word "successes" to describe mastery experiences, but as previously noted, these successes necessarily reflect the achievement of "certain goals or levels of performance" (p. 107) through direct action. As Zimmerman (2000) explained, mastery experiences are "predicated on the outcomes of personal experiences" (p. 88). Framing mastery experience items as appraisals of one's overall experience serves as a global self-appraisal more consistent with measures of self-concept (e.g., "I have always done well in mathematics"; Bong and Skaalvik 2003, p. 21). Such items fail to capture the actual outcomes of teachers' direct actions. As such, they are not original sources of information but mere appraisals of existing information. Moreover, there is likely greater practical utility in identifying not only that teaching experiences were successful, but *why* teachers deemed those experiences successful.

Scholars who seek to measure mastery experience should instead ask teachers to focus on the outcomes of their performances—the direct experiences that teachers reflect on in evaluating the extent to which they have achieved their goals. To date, only a handful of studies have addressed how direct instructional outcomes function as mastery experiences. In these studies, mastery experiences typically take the form of student behaviors presumably associated with effective teaching, such as the degree to which students behave appropriately, are engaged in the lessons, or demonstrate an understanding of the material (e.g., Gabriele and Joram 2007; Guo et al. 2011; Phan and Locke 2015). As noted by Guskey (2002), most teachers define their success in terms of student learning and behavior. For the most part, however, researchers have overlooked these mastery experiences in favor of broader appraisals, which has obscured what is known about the source and its influence on the development of teaching self-efficacy.

Mastery of Knowledge: a Form of Mastery experience?

Some scholars have argued that teachers' achievement of certain learning goals functions an additional source of self-efficacy. These learning goals may be associated with gaining knowledge in particular areas (e.g., technological, pedagogical, content) thought to be necessary for effective teaching (Mishra and Koehler 2006). For example, Garvis and Pendergast (2011) measured teachers' ratings of their content knowledge, which they described as "an important source of self-efficacy" (p. 10). Other researchers have identified teachers' sense of knowledge as a source of self-efficacy only after coding patterns that emerged from qualitative data (e.g., Bautista and Boone 2015; Palmer 2006b; Phan and Locke 2015).

Palmer (2006b, 2011) used the term "cognitive mastery" to refer to teachers' successes in their understanding of subject-matter content and pedagogical strategies. This he distinguished from enactive mastery by arguing that it involves "success in understanding something rather than success in doing something" (Palmer 2006b, p. 339). The term has since been adopted by other scholars (e.g., Bautista 2011; Bautista and Boone 2015; Phan and Locke 2015). Palmer (2006b) described cognitive mastery as a form of mastery experience and a prerequisite for enactive mastery. He thus sought to expand Bandura's (1997) characterization of this source, which had always been described in the context of enactive attainments. Other researchers have used this model, describing both enactive mastery and cognitive mastery as forms of mastery experience (e.g., Bautista and Boone 2015; Phan and Locke 2015).

Bandura (1997) acknowledged that "self-development of personal efficacy requires mastery of knowledge and skills" (p. 16), but he saw knowledge as something derived from the previously identified sources of self-efficacy rather than an original source of information. He argued that, like expectations and beliefs, "cognitive competencies are developed and modified by social influences that convey information and activate emotional reactions through modeling, instruction, and social persuasion" (Bandura 1989, p. 3). For example, preservice teachers' sense of pedagogical knowledge, and subsequent efficacy beliefs, may improve after their completion of a teaching methods course. However, this improvement might be attributed to the grades they received (i.e., mastery experiences) and the strategies that were conveyed by the professor and other live, verbal, or symbolic models (i.e., vicarious experiences). Knowledge is not, in itself, a source of self-efficacy; it is necessarily derived from previous experiences. Wyatt (2014) noted this in his review of teaching self-efficacy research and argued that poor conceptualizations of the role of knowledge have obscured understandings of how teachers' self-efficacy beliefs are formed. But the question that remains,

and that we will later address, is whether all sources of teachers' efficacy-relevant knowledge can be categorized as mastery experiences, vicarious experiences, social persuasions, and physiological and affective states.

Measures Used to Assess Vicarious Experience

The ways in which researchers have assessed vicarious experience have varied greatly (see Table 2). Quantitative studies have relied largely on items from the aforementioned scales designed to measure all four sources. Some of these items assess the general quality of opportunities to observe others teach, such as the extent to which they were "meaningful" or "valuable" (e.g., Kieffer and Henson 2000; Mohamadi and Asadzadeh 2012). Another approach has been to ask individuals to rate the effectiveness of potential models, such as mentor teachers (e.g., Capa Aydin and Woolfolk Hoy 2005). Still another approach has been to ask participants to rate the extent to which they *learned* from watching effective teachers, thus providing an evaluation of how these observations influenced their pedagogical knowledge (e.g., Kieffer and Henson 2000; Morris and Usher 2013). It may be important for researchers to also account for the extent to which models were perceived as being similar to the respondent, as the influence of vicarious experiences is thought to be informed by the respondents' perceived similarity to a model (Bandura 1997). Heppner (1994), for example, asked graduate instructors to rate the influence of "watching people similar to oneself succeed at teaching" (p. 502).

Vicarious experiences can also include observations of the self rather than others (Bandura 1997). For example, Palmer (2006b) created a code for cognitive self-modeling to identify instances in which preservice teachers imagined themselves teaching in the future. However, few scholars have assessed the potential influence of self-modeling.

All of these elements are related to, and consistent with, vicarious experiences as described by Bandura (1997). And because vicarious experiences can include a wide range of events, interview prompts used to explore the source have tended to be vague. For example, Al-Awidi

Table 2 Sample survey items and open-ended prompts used to assess vicarious experiences

Survey items	Open-ended prompts
My classroom observations are valuable to me. (Kieffer and Henson 2000)	Was there anyone who had an effect on your beliefs to integrate technology in your teaching? How did those people affect you? (Al-Awidi and Alghazo 2012)
[To what extent does your mentor teacher] demonstrate effective classroom management practices? (Capa Aydin and Woolfolk Hoy 2005)	How do your colleagues influence your confidence to work out these lesson plans? (Chong and Kong 2012)
I have learned about how to be a teacher by watching other skillful teachers. (Kieffer and Henson 2000)	How are you influenced by others, or how would you imagine yourself influenced by others, in your teaching… (i.e., observing others teach, media/society images, mentors of successful teachers, comparisons to others)? (Mills 2011)
[Rate the influence on your self-efficacy beliefs of] watching people similar to oneself succeed at teaching. (Heppner 1994)	
Please rate the degree to which your teaching efficacy stems from comparison of your teaching with that of your colleagues. (Poulou 2007)	According to the theory I am exploring in this study, there are many vicarious influences on the confidence we have in our teaching. These may include things we've seen, things we've read, or others we have observed. Can you pinpoint some powerful vicarious influences on your teaching confidence? (Morris and Usher 2011)

and Alghazo (2012) asked preservice teachers, "Was there anyone who had an effect on your beliefs to integrate technology in your teaching?" and "How did those people affect you?" (p. 934). Some researchers had respondents evaluate specific vicarious experiences such as observing others teach, comparing oneself to others, and being exposed to media images (Mills 2011; Morris and Usher 2011). Although such an approach may encourage participants to think of specific experiences they might not have otherwise considered, offering examples of vicarious experience may bias participants to report certain types of experiences and underreport others. For example, participants in these studies were not asked to consider the influence of self-modeling, despite Bandura's (1997) emphasis on this form of vicarious experience.

Finally, it is important to distinguish between vicarious experiences, which involve the observation of models, and what Bandura (1991, 1997) termed *referential comparisons*, or self-comparisons to others in a group. Some researchers have assessed vicarious experiences by asking participants to rate their teaching in comparison to that of particular groups or individuals, such as other in-service teachers (e.g., Oh 2011; O'Neil and Stephenson 2012; Poulou 2007). Woolfolk Hoy and Burke-Spero (2005) used a similar item to instead measure mastery experiences, asking teachers to rate to "their own success during the first year compared to other first year teachers in similar situations" (p. 350).

The reason for this confusion is that referential comparisons are based on both direct and vicarious influences (Bandura 1991). Vicarious experiences are an essential ingredient of referential comparisons; individuals must be aware of others' performance to make judgments about their relative standing. However, such comparisons are necessarily influenced by other sources of information, including one's own attainments and personal standards (Bandura 1997; Marsh 1990, 1993). As Bandura (1986) explained, referential comparisons rely on "three major information sources: performance level, internal standards, and the performance of others" (p. 346). That is, they involve viewing one's own performance accomplishments (i.e., mastery experiences) in the context of others' accomplishments (i.e., vicarious experiences). It is therefore problematic to use referential comparison items to measure vicarious experience.

Moreover, referential comparison items are likely to operate differently from vicarious experience items in their prediction of teaching self-efficacy. Vicarious experiences (e.g., watching similar others succeed, self-modeling, learning new teaching strategies) provide teachers with new skills and information about their capabilities. In these cases, observing effective instruction typically enhances beliefs in one's capabilities (Bandura 1997). When one uses vicarious experiences to make referential comparisons, however, one's perceived superiority to a group of similar individuals usually increases self-efficacy (Bandura 1997). The observation of proficient models typically increases self-efficacy when others are viewed in a positive light; however, referential comparisons typically increase self-efficacy when others are viewed in a negative light, relative to oneself (i.e., a downward comparison).

Measures Used to Assess Social Persuasions

The evaluative messages that teachers receive from their social environment take many forms, and come from a variety of sources (see Table 3). Researchers have often assessed social persuasions in terms of interpersonal support. For example, individuals have been asked to rate the quality or type of *support* they have received from members of the school community, such as students, colleagues, administrators, and parents (Capa Aydin and Woolfolk Hoy 2005; Tschannen-Moran and Woolfolk Hoy 2007; Woolfolk Hoy and Burke-Spero 2005). Capa Aydin and Woolfolk Hoy (2005) were the first to assess social persuasions in terms of support,

using items from Reiman and Edelfelt's (1991) Questionnaire for Beginning Teachers and Mentors. Many researchers have followed their example. Conceiving of social persuasions in terms of support may in fact be too encompassing. The manner in which support has been described is also distant from Bandura's (1997) description of persuasions as "social evaluations of capability" (p. 102). For example, scholars have used items such as, "My supervisor gets me to look at problems from many different angles" (Ruble et al. 2011, p. 70; original item from Avolio et al. 1999), and "My cooperating teacher frequently helped me solve problems" (Moulding et al. 2014, p. 63). Such items address mentoring and helping behaviors that may be important for teachers, but they do not provide direct evidence that the participants received evaluative feedback. In these cases, researchers have perhaps incorrectly inferred that these experiences were interpreted as indicators of one's capability.

Items that assess *messages that convey capability-related information* can be found primarily in the existing published and unpublished scales of the four hypothesized sources (e.g., Heppner 1994; Kieffer and Henson 2000; Poulou 2007). Items like "I often get important feedback from my professors about my teaching ability" (Kieffer and Henson 2000, p. 18) or "My students have told me that I have taught them a great deal" (Morris and Usher 2013, p. 7) capture ways in which teachers may be encouraged by others, and thus may be more appropriate measures of social persuasion as conceptualized by Bandura (1997).

Researchers using qualitative methods have typically asked teachers to recall what others have told them about their teaching abilities (e.g., Al-Awidi and Alghazo 2012; Mills 2011). A more complete measure of social persuasions might also incorporate the less explicit messages individuals receive (Bandura 1997; Pajares 1994). For example, instructors who are sought out by others for their teaching advice may receive the message that they are competent, whether or not that message is directly stated. One way to accomplish this is to prompt interviewees, as Chong and Kong (2012) did, to consider not only what they were explicitly told, but also what "messages" they received from others.

Table 3 Sample survey items and open-ended prompts used to assess social persuasions

Survey items	Open-ended prompts
Rate the interpersonal support provided by your colleagues at your school. (Tschannen-Moran and Woolfolk Hoy 2007)	How did people around you encourage you to integrate technology in teaching? (Al-Awidi and Alghazo 2012)
I got enough clerical support from the school. (Capa Aydin and Woolfolk Hoy 2005)	How have people around you encouraged you to utilize technology? (Al-Awidi and Alghazo 2012)
My supervisor gets me to look at problems from many different angles. (Ruble et al. 2011; original item from Avolio et al. 1999)	What did people (colleagues, senior colleagues, students) say to you as you worked on developing the lesson plans? What sort of messages did you get from these people? (Chong and Kong 2012)
My cooperating teacher frequently helped me solve problems (Moulding et al. 2014, p. 63).	Have you received feedback from others about your teaching of literature or reading? What types of feedback have you received from others about your teaching? What obstacles do you foresee in teaching literature? Who, if anyone, has provided you encouragement/and or strategies for overcoming obstacles in teaching literature? (Mills 2011)
[Rate the influence on your self-efficacy beliefs of] significant people in your life persuading you about your skillfulness as a teacher. (Heppner 1994)	
I often get important feedback from my professors about my teaching ability. (Kieffer and Henson 2000)	Have you ever been complimented or rewarded for what you have done as an EFL teacher at the faculty? (Phan and Locke 2015)

Measures Used to Assess Physiological and Affective States

Scholars who have measured physiological and affective states have tended to focus on negative physiological and affective states, such as stress, fear, anxiety, and fatigue (e.g., Heppner 1994; Kieffer and Henson 2000; O'Neil and Stephenson 2012; Poulou 2007; see Table 4). For example, Klassen and Durksen (2014) asked preservice teachers to rate, each week, how stressful a teaching practicum was. Palmer (2006b) characterized preservice teachers' self-efficacy-building events as physiological states when those events involved "coping with stress, fear, and anxiety" (p. 345). More work is needed to address teachers' positive physiological and emotional states, which may have differential influences on teachers' sense of efficacy.

Ruble et al. (2011) measured physiological and affective states using the 22-item Maslach Burnout Inventory, composed of three subscales to measure emotional exhaustion (i.e., depletion of emotional resources), depersonalization (i.e. negative, cynical attitudes and/or feelings about students), and personal accomplishments (i.e., evaluation of professional performance; Maslach et al. 1997). However, many of the items, particularly those used to measure personal accomplishments, are inconsistent with Bandura's description of the source. Moreover, burnout is typically conceptualized as an outcome, rather than a predictor, of self-efficacy (Bandura 1997; Schwarzer and Hallum 2008).

In qualitative studies, physiological and affective states have often been evaluated by asking participants to identify prominent feelings and emotions they experienced while teaching or preparing to teach (e.g., Chong and Kong 2012; Mills 2011). Such prompts improve upon most quantitative items in that respondents may consider both positive and negative events. However, they may not capture physiological and affective states that emerge at the completion of a teaching exercise, when teachers reflect on the effectiveness of the lesson.

Research Findings on the Sources of Teaching Self-Efficacy

We have now described several threats to the validity of measures used to assess the sources of teaching self-efficacy. Namely, (a) existing scales of the four hypothesized sources are not

Table 4 Sample survey items and open-ended prompts used to assess physiological and affective states

Survey items	Open-ended prompts
Rate the degree to which your teaching efficacy stems from feelings of stress or anxiety during your teaching sessions. (Poulou 2007)	How do you feel when you integrate technology in your teaching? (Al-Awidi and Alghazo 2012)
When I say the wrong things to a class, I become anxious. (Kieffer and Henson 2000)	How would you describe your feelings and beliefs as you worked on the lesson plans? (Chong and Kong 2012)
[Rate the influence on your self-efficacy beliefs of] information you obtain from your body that might include nervousness, tension, or calm while teaching. (Heppner 1994)	How do you feel while you are teaching a literary text or a reading text? (Mills 2011)
How stressful was your practicum this week? (Klassen and Durksen 2014)	Identify some of the most prominent feelings and emotions that you experience when you are teaching and when you are preparing to teach. Which of these feelings or emotions would you say have raised/decreased your confidence for teaching undergraduates? (Morris and Usher 2011)
I feel burned out from my work. (Ruble et al. 2011; original item from Maslach et al. 1997)	

psychometrically strong, and (b) items and prompts used in studies of the sources have often been written too narrowly, too broadly, or in ways inconsistent with Bandura's (1997) theoretical tenets. In this section, we examine findings from studies of the hypothesized sources and explain how some of these findings might be interpreted cautiously given the aforementioned measurement problems. We also incorporate results from studies that did not explicitly address Bandura's (1997) hypothesized sources but may nonetheless be pertinent to continued research in this area. Because few of these studies were experimental in nature, causal inferences must be made with caution.

Research Findings: Mastery Experiences

Mastery experiences have received the most attention of the hypothesized sources, likely because Bandura (1997) viewed them as being particularly potent in the development of self-efficacy. Unfortunately, the influence of the source continues to be poorly understood due to the problematic ways in which it has been measured. As previously noted, one such approach was to evaluate the mere influence of teachers' exposure to, or amount of, teaching experience (e.g., Capa Aydin and Woolfolk Hoy 2005; DeChenne et al. 2015; Ruble et al. 2011). The relationship between opportunities to teach and teaching self-efficacy is more nuanced than one would expect if such opportunities, in themselves, constituted mastery experiences.

For the most part, researchers have found that preservice teachers become more self-efficacious after completing early student teaching experiences (e.g., Cantrell et al. 2003; Fives et al. 2007; Knoblauch and Woolfolk Hoy 2007). When interviewed, preservice teachers have indicated that having the opportunity to practice particular forms of pedagogy bolstered their beliefs in their teaching competencies (Siwatu 2011a; Smolleck and Mongan 2011). And in one study, 62 preservice early childhood teachers became significantly more self-efficacious after practicing science methods in a virtual classroom (Bautista and Boone 2015). But the relationship between teaching experience and self-efficacy becomes less clear when looking beyond preservice teachers' initial field experiences. Preservice teachers ($N = 53$) in one study became more self-efficacious during their student teaching, but those who returned surveys after their first year as a classroom teacher ($n = 29$) reported a subsequent decrease in their self-efficacy (Woolfolk Hoy and Burke-Spero 2005).

The relationship between practicing teachers' years of experience and their self-efficacy is ambiguous, even when considering large-scale studies. For example, Wolters and Daugherty (2007) found that teachers' ($N = 1024$) experience was positively correlated with their self-efficacy; however, Tschannen-Moran and Johnson (2011) found no such relationship ($N = 648$). Klassen and Chiu (2010) suggested that the relationship between teachers' ($N = 1430$) experience and their self-efficacy was nonlinear. They couched their findings in Huberman's (1989) characterization of the life cycle of a teacher, in which teachers undergo self-doubts in early career stages and disengagement toward the end of their careers.

These findings collectively illustrate that teaching experience does not, in itself, persuade teachers of their capabilities. As Capa Aydin and Woolfolk Hoy (2005) acknowledged, researchers must at least account for whether or not participants believed their experiences were successful, or indeed *mastery* experiences. And there may be many reasons why preservice teachers tend to become more self-efficacious with experience. Woolfolk Hoy and Burke-Spero (2005) noted that whereas those enrolled in a teacher education program typically have a built-in support system, the support and resources available to practicing teachers may vary greatly, with implications for their self-efficacy. This support, along with the

various other events in the lives of teachers, may influence teachers' beliefs through enactive, vicarious, persuasive, or physiological and affective means. A focus on the influence of the quantity of one's experiences, and not on more particular events and their quality, does little to advance understandings of how teachers' efficacy beliefs evolve.

We have previously described why it is also conceptually problematic to measure mastery experiences in terms of general appraisals of past performance divorced from specific performance outcomes. However, researchers who have assessed mastery experience in this manner have consistently reported positive relationships between general perceptions of past success and self-efficacy. For example, correlations between teachers' self-efficacy and their satisfaction with their professional performance have ranged from .36 to .50 (Tschannen-Moran and Woolfolk Hoy 2007; Weaver Shearn 2008; Woolfolk Hoy and Burke-Spero 2005). At first blush, it would seem that asking teachers to evaluate their past performances provides a theoretically sound measure of mastery experience.

However, a closer examination of the research reveals that teachers reflect on many different sources when they provide such general appraisals of their past teaching performances. This is particularly salient when instructors are interviewed, as in Morris and Usher's (2011) study of 12 professors who had won multiple university-wide teaching awards at research-intensive institutions. When one professor was asked how he developed a sense of teaching efficacy, he explained, "I did it. Experience. I had never had the experience before. I did it and I learned that I did it well" (Morris and Usher 2011, p. 243). However, when pressed to elaborate on *how* he knew he had done well, he added, "They told me I did it well. Students told me. Those who observed me told me that I did it well." That is, his teaching self-efficacy was informed by social persuasions rather than a mastery experience. Phan and Locke (2015) described the same phenomenon in their qualitative study of eight Vietnamese university instructors; once interviewees were asked how they knew their past performances had been successful, they reflected on the social persuasions they had received.

Thus, general perceptions of one's past teaching are not based solely on the direct outcomes of one's teaching performances but may be derived from a variety of sources. This may help to explain why, in the four attempts made by researchers to validate an original scale of the sources of teaching self-efficacy, mastery experience items that involved a general appraisal of past performance did not perform as expected in factor analysis. Even after Morris and Usher (2013) substantially reduced their initial pool of items to arrive at a theoretically consistent four-factor solution, the item "I have always been good at teaching" (p. 7) had the weakest loading on the factor associated with mastery experience (.45). Similarly, Weaver Shearn's (2008) item, "Rate your satisfaction with your professional performance this year" (p. 81), which was designed to measure mastery experience, loaded on the same factor as an item intended to assess affective states. Kieffer and Henson's (2000) item, "I have had many positive opportunities to teach" (p. 16), loaded on the same factor as a physiological state item. And Poulou's (2007) mastery experience subscale, which included an item to assess "successful teaching sessions during teaching practice" (p. 197), was combined with a social persuasions subscale due to high shared variability. Thus, it appears difficult to tease apart the effects of teachers' general appraisals from those of items designed to measure other sources of information.

Clearly, teachers' general appraisals of their past performance are important in the development of their teaching self-efficacy. However, these appraisals are not in themselves sources of self-efficacy. They do not provide original information; they function only as an

interpretation of existing information. As we later discuss, it is more likely that these appraisals mediate the relationship between particular sources (e.g., enactive attainments, social persuasions, physiological and affective states) and self-efficacy.

As previously described, mastery experiences items are more appropriately conceptualized as the achievement of goals through direct action. Although few scholars have explored mastery experiences in this manner, there is good reason to believe that teachers' sense of efficacy is informed by their instructional accomplishments. For example, in his cross-sectional study, Guskey (1987) found that elementary and secondary teachers who tended to take more responsibility for positive student outcomes also reported higher self-efficacy.

Student behaviors (e.g., being on-task, responsive, and engaged) can also inform teachers' efficacy beliefs and are likely related to inferences teachers make about their own performances. In one qualitative study, elementary teachers described their self-efficacy being influenced not only by their achievement of lesson objectives but also by evidence of their students' comprehension and strategy use, affect (i.e., enjoyment vs. frustration during lessons), and conduct (Gabriele and Joram 2007). Similarly, university teachers reported that their teaching self-efficacy could be influenced by the extent to which students successfully completed tasks and exhibited appropriate behaviors (Phan and Locke 2015).

In cross-sectional studies, student engagement (rated by teachers and external observers) has been found to be positively correlated with teaching self-efficacy (Guo et al. 2011; Ross et al. 1996). In one experimental study, 112 university instructors were assigned to one of four treatments in which they watched 10-minute simulated classroom videos (Mottet et al. 2004). Students in the videos displayed either high verbal (e.g., asking questions), high nonverbal (e.g., head nodding), low verbal (e.g., not responding to teacher questions), or low nonverbal (e.g., slouched posture) responsiveness to the teacher. When asked how they would feel as the teacher in the video, instructors rated their self-efficacy highest in both high verbal and nonverbal treatment conditions, significantly lower in the low verbal condition, and the lowest in the low nonverbal condition. These findings further suggest a relationship between students' behaviors and teachers' self-efficacy. The manner in which student behaviors serve as an experiential source of teaching self-efficacy has not been extensively explored and warrants further investigation in diverse contexts.

Research Findings: Vicarious Experiences

Many teachers who have been interviewed have attested to the importance of early modeling experiences, often claiming that early experiences with masterful mentors were foundational in their development of confidence because those experiences armed them with content knowledge and pedagogical strategies (Gunning and Mensah 2011; Mills 2011; Siwatu 2011a). When learning new strategies, some preservice teachers have reported that merely watching video case studies of experienced teachers improved their self-efficacy because it provided them with pedagogical tools they could see themselves using (Bautista 2011; Martinussen et al. 2015). Posnanski (2002) found that practicing elementary science teachers became more self-efficacious after participating in a professional development program that included videotaped teaching models. In these cases, as Palmer (2011) noted, vicarious experiences may exert their influence on teachers' self-efficacy by enhancing their pedagogical knowledge. Bautista and Boone (2015) reported

that preservice early childhood teachers became more self-efficacious after teaching in a virtual classroom. So rather than watching a model, these preservice teachers engaged in self-modeling that provided them with information about not only effective pedagogical skills but also their own capability to employ them.

Cross-sectional research has failed to capture the vicarious influence of mentor teachers on their interns' sense of efficacy. In two studies, preservice and novice teachers who rated their mentors as effective were no more likely to be self-efficacious (Capa Aydin and Woolfolk Hoy 2005; Rots et al. 2007). However, Knoblauch and Woolfolk Hoy (2007) found that education majors who perceived their mentors to be highly self-efficacious were themselves more confident after completing their student teaching.

These discrepancies illustrate that asking preservice teachers to assess a mentor's effectiveness, or a mentor's *perceptions* of effectiveness, neglects the more important question of how they attended to and interpreted their observations of that mentor. The nature of information conveyed vicariously can take different forms. For example, when French literature teaching assistants were interviewed, some indicated that they would take note of the teaching strategies used by experienced professors during an observation; others appeared to focus almost exclusively on the content presented (Mills 2011). Researchers should also take into account the extent to which preservice teachers view their mentors as similar to themselves, as perceived model similarity is theorized to influence the potency of vicarious experiences (Bandura 1997). For instance, Capa Aydin and Woolfolk Hoy (2005) concluded that the mentor teachers in their study may not have provided powerful vicarious experiences for student teachers due to differences in teaching styles and years of experience. In interviews and open-ended responses, instructors have indicated that they became more self-efficacious after watching their peers teach, perhaps because they viewed them as similar (Bruce et al. 2010; Heppner 1994).

As previously noted, some researchers have assessed vicarious experiences in terms of referential comparisons with others, which is problematic in that these comparisons are necessarily derived from multiple sources. The influence of these comparisons on teachers' self-efficacy is unclear. Researchers who have used Poulou's (2007) scale have found weak or nonsignificant correlations between self-comparisons with different types of models (e.g., colleagues, tutors at university) and teaching self-efficacy (Oh 2011; O'Neil and Stephenson 2012; Poulou 2007). Woolfolk Hoy and Burke-Spero (2005) used a single item to assess first-year teachers' self-comparisons with "other first-year teachers in similar situations" (p. 350). Bandura (1997) suggested that such referential comparisons are most powerful because they focus on models similar to the individual. Yet the researchers, working with a small subsample ($n = 29$), found no significant correlation between the degree to which participants believed they were superior and increases in their self-efficacy over their first year.

Assessing vicarious experience has proven difficult in studies focused on the sources of students' self-efficacy due in part to the fact that much social learning occurs implicitly (Usher and Pajares 2008). The influence of vicarious experience on teachers' self-efficacy may be similarly subtle. For example, teachers might not readily consider the impact of overhearing other instructors express their self-doubts in the workroom. Research findings on this source have also been limited because scholars have tended to focus on live models and have devoted less attention to other forms of vicarious influence identified by Bandura (1997). In particular, more work is needed to address how symbolic models (e.g., Internet, articles, films) and cognitive self-modeling influence teaching self-efficacy.

Research Findings: Social Persuasions

Consistent with Bandura (1986) social cognitive theory, instructors asked to describe the sources of their teaching self-efficacy have indicated that social evaluations were particularly important earlier in their careers and before they had many direct teaching experiences (Milner and Woolfolk Hoy 2003; Morris and Usher 2011). Self-efficacy researchers have noted that social persuasions are most potent when they are specific, sincere, and provided by a credible observer (Bandura 1997; Pajares 2006; Schunk 1984). In interviews and surveys, instructors have indicated that their teaching self-efficacy was powerfully influenced by the feedback they received from experts following an observation (Cone 2009; Heppner 1994; Palmer 2011). Tschannen-Moran and McMaster (2009) found that, of four different professional development formats in their quasi-experiment, the most effective was one in which elementary teachers were "coached" as they implemented a new reading instruction strategy in their classrooms. Teachers in this treatment group, which was unique from others only in that it incorporated coaching, showed the greatest increase in teaching self-efficacy for reading instruction and indicated more willingness to use the strategy in the future. As Klassen and Durksen (2014) noted, however, sincere feedback from a credible observer can play a "double-edged role" (p. 167); whereas positive messages can enhance efficacy beliefs, negative messages can make it difficult to maintain a healthy sense of efficacy.

Tschannen-Moran et al. (1998) posited that evaluative feedback from students may also influence teachers' self-efficacy. This form of social persuasion has received little attention in studies of K-12 teachers, although student feedback did emerge as a source in Milner's (2002) case study of a high school English teacher. In qualitative studies of university instructors, participants have frequently described the importance of the feedback they receive from students, sometimes giving it more credence than feedback from supervisors who rarely saw them teach (Heppner 1994; Morris and Usher 2011; Phan and Locke 2015). Student feedback in the form of end-of-course evaluations might be less influential to some instructors because it has been shown to be a poor indicator of instructional quality (Braga et al. 2014; Carrell and West 2010). However, in the absence of consistent supervision and standardized measures of student achievement, university instructors may rely more on student feedback than do K-12 teachers. Future researchers may examine the various ways in which student feedback is conveyed and assess the relative effects of these persuasions on teachers' self-efficacy.

It is unclear how beliefs about interpersonal support, used by some researchers to assess social persuasions, influence teaching self-efficacy. Scholars who have measured social persuasions by combining ratings of perceived support from various members of the school community (e.g., administration, colleagues, parents) have found them to be positively correlated with self-efficacy (Capa Aydin and Woolfolk Hoy 2005; Woolfolk Hoy and Burke-Spero 2005). However, one can only draw limited inferences from such findings when the social persuasion variable is composed of items to evaluate disparate sources of information. When researchers have focused on the independent contribution of individual sources of support, they have found only weak or nonsignificant correlations between those sources and teaching self-efficacy (Moulding et al. 2014; Ruble et al. 2011; Tschannen-Moran and Woolfolk Hoy 2007). This suggests that perceptions of support are not a useful proxy for social persuasions.

Research Findings: Physiological and Affective States

In teaching self-efficacy research, physiological and affective states have received the least attention of the four sources hypothesized by Bandura (1997). Perhaps this omission reflects the view of some researchers that these states are "most relevant to clinical research" (Labone 2004, p. 343). A possible misconception is that physiological and emotional events inform self-efficacy directly, as when teachers who exhibit physical manifestations of stress (e.g., elevated heart rate) report lower self-efficacy (Schwerdtfeger et al. 2008). In fact, it is the meaning that individuals assign to these states and events that informs their self-efficacy (Bandura 1997; Klassen and Durksen 2014). Whereas some teachers may interpret an elevated heart rate before a class as a sign that they are not well-prepared, others may interpret the physiological event as excitement.

At first glance, it may also seem that physiological and affective states provide little ability-related information. Variables designed to assess multiple physiological and affective states tend to be weakly correlated with teaching self-efficacy (Mohamadi and Asadzadeh 2012; Morris and Usher 2013; Poulou 2007). In interviews, teachers have been less likely to mention physiological and affective states than other sources in describing the development of their self-efficacy (Palmer 2006b, 2011; Mulholland and Wallace 2001). But it is also possible that individuals underestimate the importance of these experiences because their influence tends to be ongoing rather than episodic.

It may be valuable to focus on particular states and their effect on different facets of teaching self-efficacy. For example, researchers have found that preservice and practicing teachers who report higher classroom stress due to unwanted student behaviors tend to have lower self-efficacy for classroom management (Klassen and Chiu 2010, 2011). Ross and Bruce (2007) randomly assigned grade 6 mathematics teachers to a professional development opportunity designed, in part, to minimize their stress and anxiety about teaching standards-based mathematics. They found that teachers in the treatment condition had higher classroom management self-efficacy than did teachers who did not receive the professional development, but it is difficult to discern if this was due to reduction of teachers' stress levels or some other aspect of the professional development.

As we have noted, much of the quantitative research on physiological and affective states has focused on negative states. But when interviewees have been questioned specifically about their feelings while teaching, many have attested to the facilitative role of positive physiological and emotional states. Award-winning professors reported feeling more energized after teaching a class, which supported their perceived efficacy for teaching (Morris and Usher 2011). Teaching assistants described feelings of excitement during teaching that boosted their self-efficacy and reinforced their professional aspirations (Mills 2011). And elementary and secondary teachers have described feelings of happiness when students show signs of understanding the material (Akkuzu 2014; Mansfield and Woods-McConney 2012). In one study of 274 secondary teachers, participants' positive affective states (i.e., enthusiasm, satisfaction, and comfort) were positively correlated with their teaching self-efficacy (Salanova et al. 2011). Further research is needed to explore the influence of these positive states.

Although Bandura (1997) identified physiological and affective states as a source of self-efficacy, the relationship between these states and efficacy beliefs may not always follow a clear causal trajectory. For example, Schwarzer and Hallum (2008) suggested that teachers' self-efficacy predicts their job stress, which in turn predicts teacher burnout. It seems clear that teachers who believe they are capable are less susceptible to work-related stresses. However, it

also seems clear that individuals who feel overwhelmed at work are consequently less likely to believe they can be effective. Klassen and Durksen (2014) found that although preservice teachers tended to become more self-efficacious and experience less work stress over the course of a practicum, gains in self-efficacy were not significantly related to decreases in stress. Qualitative analysis revealed that how participants coped with work stress may have played a role in how changes in their stress were associated with changes in their self-efficacy. Individuals who used adaptive, rather than avoidant or unhealthy, coping strategies were most likely to report decreases in stress and increases in teaching self-efficacy. In a cross-sectional study of 530 primary and secondary teachers, Shen (2009) similarly reported that teachers with higher teaching self-efficacy were more likely to engage in adaptive stress-coping strategies.

Other studies provide additional evidence that the influence of physiological and affective states on teaching self-efficacy may be moderated by how individuals manage those states. When interviewed, teachers have reported that engaging in emotional regulation helped them to be more effective in managing their classrooms and interacting with students (Sutton 2004; Sutton et al. 2009). Morris and Usher (2011) similarly found that award-winning professors had developed a variety of adaptive ways to manage their physiological and affective arousal in their professional tasks. Many blocked out negative emotions before entering a classroom, and some mentioned that actions as simple as eating a full meal or dressing professionally helped them to feel more confident. Such self-regulation likely requires teachers to first become aware of their emotions. But self-efficacious teachers are typically higher in intraper-sonal emotional intelligence than are their less confident colleagues (Di Fabio and Palazzeschi 2008).

The Role of Teacher Knowledge

As previously noted, some researchers have viewed teachers' mastery of content or pedagogical knowledge as a form of mastery experience (e.g., Bautista and Boone 2015; Palmer 2006b; Phan and Locke 2015). The attainment of knowledge should not be viewed as a source of self-efficacy; instead, it is necessarily derived from experiences. However, it is clear from the research reviewed that teachers' knowledge, and their beliefs about that knowledge, can play an important role in their development of self-efficacy. The influence of pedagogical and content knowledge on teachers' beliefs has been explored in studies of the hypothesized sources as well as studies that have not been guided by Bandura's (1997) descriptions of the sources.

In cross-sectional studies, teachers who indicated that they were generally well-prepared to enter the classroom were more likely to have a positive appraisal of their capabilities (Darling-Hammond et al. 2002; Ross et al. 1996; Tschannen-Moran and Johnson 2011). Those who had taken more pedagogical courses or classes that armed them with particular teaching strategies were also more confident than are those who had not (Postareff et al. 2008; Siwatu 2011a). And in studies with a one-group pretest-posttest design, preservice teachers enrolled in college methods courses have typically reported higher self-efficacy at the conclusion of the class than at the beginning (Bautista 2011; Bleicher and Lindgren 2005; Palmer 2006a; Swars and Dooley 2010).

Practicing teachers may similarly become more self-efficacious with increased pedagogical knowledge. In one study, 12 elementary teachers engaged in an 8-week professional devel-opment program in which they learned about hands-on science inquiry methods, saw those methods modeled and taught inquiry-based lessons in their classrooms (Palmer 2011). In

surveys and interviews, they reported higher science teaching self-efficacy immediately following the intervention and continued to maintain their self-efficacy 2 years after the intervention. And in one quasi-experiment, Tschannen-Moran and McMaster (2009) found that a professional development format in which teachers were merely lectured about a teaching strategy led to significant improvements in teachers' self-efficacy for reading instruction. Knowledge of instructional technologies, which may serve as additional pedagogical tools, may also inform teachers' self-efficacy beliefs. For example, elementary science teachers who were confident in their ability to use Internet-based instruction had higher science teaching self-efficacy (Wang et al. 2015).

In addition to pedagogical and technological knowledge, subject-matter knowledge also appears to inform teachers' self-efficacy, whether one is teaching at the early childhood (Bates et al. 2011), secondary (Chacon 2005; Swackhamer et al. 2009), or college level (Morris and Usher 2011). For example, preservice elementary teachers' self-efficacy for science instruction tends to be positively correlated with the number of science classes they took in high school and college (Bleicher 2004; Cantrell et al. 2003; Mulholland et al. 2004). Teacher education and professional development programs designed to improve content knowledge have improved teachers' beliefs in their teaching capabilities. Elementary teachers who participated in professional development programs that emphasized understandings of science were subsequently more self-efficacious and performed better on tests of content knowledge (Sandholtz and Ringstaff 2011; Sinclair et al. 2011). Similarly, preservice elementary teachers who enrolled in methods classes designed to support understandings of earth science demonstrated improved conceptual understanding and had higher science teaching self-efficacy (Bleicher 2007; Bleicher and Lindgren 2005). Taken together with the aforementioned findings, it appears that knowing the material, and knowing how to teach it well, can improve teachers' sense of efficacy.

Key Findings

The purpose of this review was to provide a critical examination of empirical studies that have investigated the sources of teachers' self-efficacy. Several key findings emerged from the literature. First, we found that a number of methodological shortcomings have prevented a clear understanding of how teachers form their efficacy beliefs. Items used to gauge information relevant to one's teaching self-efficacy have often been limited in scope, inconsistent with social cognitive theory, or problematically worded. Such measures have thus obscured what is known about how the sources of self-efficacy function in the teaching domain.

Second, the relationship between the sources and teaching self-efficacy is unclear given how few investigations have tested the independent effect of each of the four hypothesized sources on teaching self-efficacy. Some researchers have chosen to focus on only one or two of the hypothesized sources in their correlation analyses. Others have taken the approach of combining different sources in their subscales. Including all four hypothesized sources in one model could lead researchers to a more complete understanding of the sources and their influence.

It is also difficult to make generalizations about the relationships between the hypothesized sources and self-efficacy when the dependent variable (i.e., teaching self-efficacy) is not measured in a consistent manner. Indeed, Woolfolk Hoy and Burke-Spero (2005) reported that the significance of correlations between hypothesized sources and teaching self-efficacy

vary as a function of the self-efficacy scale used. Problems with the measure of teaching self-efficacy have been well-documented in previous reviews (e.g., Henson 2002; Klassen et al. 2011; Wyatt 2014). For well over a decade, the most commonly used scale to measure teaching self-efficacy was Gibson and Dembo's (1984) Teacher Efficacy Scale, but criticisms of the scale's reliability, validity, and consistency with social cognitive theory have led researchers to consider alternative scales (see Guskey and Passaro 1994; Henson 2002; Tschannen-Moran et al. 1998). Tschannen-Moran and Woolfolk Hoy's (2001) Teachers' Sense of Efficacy Scale has since gained increasing acceptance by researchers due to its psychometric and conceptual superiority to the Gibson and Dembo's (1984) scale. Nevertheless, the Teacher Efficacy Scale and related scales (e.g., Science Teaching Efficacy Belief Instrument, Enochs and Riggs 1990) continue to be widely used in studies of teaching self-efficacy (e.g., Gencer and Cakıroglu 2007; Gurvitch and Metzler 2009; Lumpe et al. 2012). Researchers who have been unsatisfied with these scales have offered still other scales of teaching self-efficacy (e.g., Brouwers and Tomic 2001; Dellinger et al. 2008; Friedman and Kass 2002).

The scales most commonly used in studies of the sources of teaching self-efficacy were Tschannen-Moran and Woolfolk Hoy's (2001) Teachers' Sense of Efficacy Scale and Enochs and Riggs' (1990) Science Teaching Efficacy Belief Instrument—Preservice. Most researchers have used Tschannen-Moran and Woolfolk Hoy's (2001) scale in its original form, which is domain general (i.e., not specific to any academic content area), although some have adapted it to assess teaching self-efficacy in particular content areas (e.g., Chacon 2005; Tschannen-Moran and Johnson 2011). The use of a domain-general teaching self-efficacy scale could introduce unnecessary noise into statistical models. Many teachers likely respond to generally worded items with their own teaching content area in mind. Teachers who teach multiple subjects (e.g., elementary teachers) might rate their teaching efficacy in some aggregate form. Still other respondents might rate their teaching efficacy in general and without thinking of a particular academic subject. Bandura (1997) maintained that teaching self-efficacy measures should be tailored to specific content areas so that they are more predictive of outcomes. The same logic should apply to studies of teaching self-efficacy and its antecedents; as Tschannen-Moran and McMaster (2009) found, the influence of the sources on teaching self-efficacy varied greatly according to whether the generic or content-specific form of the scale was used in analysis.

Enochs and Riggs' (1990) scale, on the other hand, is content-specific but fails to measure teaching self-efficacy in the multifaceted ways that Bandura (1997, 2006) recommended (e.g., classroom management self-efficacy, instructional self-efficacy). Moreover, even Bleicher's (2004) updated version of the scale contains items with "I will" statements (e.g., "I will typically be able to answer students' science questions"; p. 391). Bandura (2006) clarified that "I will" statements are statements of intentionality, a related but distinct construct.

The 67 quantitative and mixed-methods studies reviewed herein contained 19 different measures of teaching self-efficacy that ranged in specificity. Tschannen-Moran and Woolfolk Hoy's (2001) scale centers on three competencies: the ability to utilize different instructional strategies, the ability to manage a class effectively, and the ability to engage students. However, there may be additional competencies that teachers consider in evaluating their capabilities (e.g., teachers' perceived capability to enact culturally responsive pedagogy, Siwatu 2007). Given the complex set of competencies that undergird effective teaching, teaching self-efficacy cannot be considered monolithic; teachers no doubt form not one but many types of judgments of their own capabilities in diverse areas and with diverse students. The particular experiences that influence those contextualized efficacy judgments are likely also diverse and require sensitive measures.

The Development of Teaching Self-Efficacy

In this section, we propose a model of the development of teaching self-efficacy that emphasizes the role of personal cognition in the formation of self-efficacy (see Fig. 1). This model identifies factors involved in the integration and evaluation of this information that may mediate or moderate the relationship between the sources and self-efficacy. Proposed relationships between these factors are informed by social cognitive theory, empirical research, and previous models of the sources of teaching self-efficacy (e.g., Tschannen-Moran et al. 1998). The model pertains specifically to the domain of teaching; we do not intend to speculate about how the sources might inform self-efficacy beliefs in other domains.

We will first briefly describe the sources of self-efficacy, including those sources of teaching self-efficacy that may not fall neatly into Bandura's (1997) descriptions. Next, we identify general, secondary appraisals (e.g., of knowledge or past success) that may mediate the relationship between the sources and teaching self-efficacy. Finally, we explain how interpretation and attention moderates relationships between the sources, these secondary appraisals, and teaching self-efficacy.

Sources of Teaching Self-Efficacy

Because Bandura (1997) described the sources of self-efficacy in such broad terms, we did not find many examples of efficacy-relevant experiences that could not be described as a mastery experience, vicarious experience, social persuasion, or physiological and affective state. Palmer (2006b, 2011) identified cognitive mastery, which pertains to the accomplishment of learning goals relevant to teaching, as a previously undescribed source of teachers' self-efficacy. We have shown that teachers' knowledge (e.g., of technology, pedagogy, and content), and their appraisals of that knowledge, can indeed inform their efficacy beliefs. The role of knowledge in the development of teaching self-efficacy has been described in studies of the hypothesized sources (e.g., Palmer 2006b) as well as studies that do not focus explicitly on the sources (e.g., Sandholtz and Ringstaff 2011). However, as we have argued,
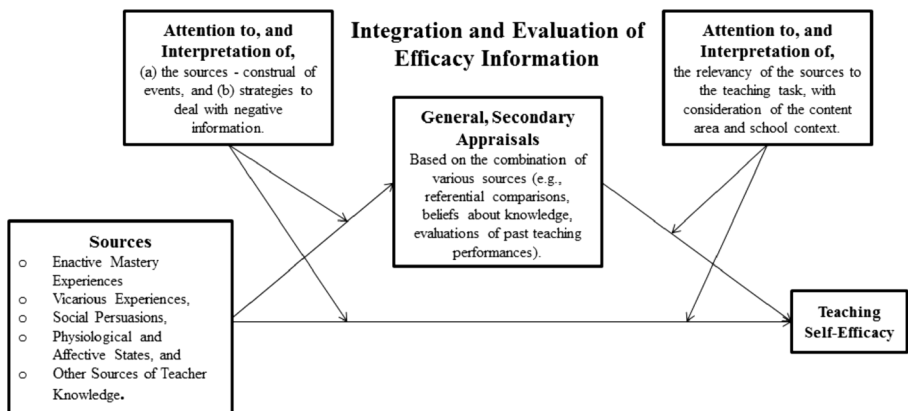

Fig. 1 Proposed model of the relationship between the sources, integrative and evaluative factors, and teaching self-efficacy. Capability-related information is derived from the four hypothesized sources and other sources of teacher knowledge. The relationship between the sources and teaching self-efficacy is mediated by secondary appraisals and moderated by attention and interpretive processes

one's sense of knowledge does not serve as a new source of information; it is necessarily informed by previous experiences. For example, novice teachers who believe they have a solid understanding of inquiry-based methods may reflect on the grades they received in science methods courses (i.e., mastery experiences), or seeing professors demonstrate how to use the methods (i.e., vicarious experiences).

However, it would be premature to conclude that all appraisals of teacher knowledge are derived from the sources of self-efficacy identified by Bandura (1997). Buehl and Fives (2009) explored the sources of teachers' beliefs about their knowledge by analyzing open-ended responses from 110 preservice and practicing teachers. Some of these knowledge sources could indeed be categorized as enactive or vicarious experiences. Others did not neatly fit into Bandura's (1997) descriptions. For example, many teachers described gaining knowledge from books, research articles, or the Internet. If the type of knowledge obtained was pedagogical in nature, these sources could be described as symbolic models in that they model effective teaching behaviors (Bandura 1977, 1997). Like live models, "symbolic models who exhibit useful skills and strategies raise observers' beliefs in their own capabilities" (Bandura 1997, p. 93). But teachers who are asked to teach a new subject might also engage in such independent reading to improve their content knowledge. Presumably, this could then improve their teaching self-efficacy in a given domain (e.g., trigonometry teaching self-efficacy).

This form of independent reading does not clearly fit any existing source. It does not seem to be a mastery experience, because there is no external outcome/attainment on which to judge one's success. Nor does it seem to be a vicarious experience; Bandura (1997) explained that all modes of vicarious influence involve modeling, but in reading about the subject one will teach, no behavior or strategy is being modeled. It is also not a social persuasion, because the reading material itself does not convey information about the readers' competencies. So although reading can be a vicarious experience when it symbolically models a behavior or strategy, it may not in all cases serve as a vicarious experience. As Buehl and Fives (2009) noted, more work is needed to identify the sources of *knowledge* beliefs and evaluate their potential influence on efficacy beliefs. It is for this reason that we include "other sources of teacher knowledge" as potential additional sources of teaching self-efficacy in the model.

Mediating Factors: General, Secondary Appraisals

Bandura (1997) described how individuals combine information from various sources as they evaluate their capabilities. These sources lead to efficacy appraisals. In this review, we have described how teachers combine information to form other general appraisals (e.g., of past success, of knowledge, of comparisons with others) that may, in turn, inform self-efficacy. These appraisals are not themselves new sources of information; they depend on the integration of existing information. For example, we have reviewed evidence from both qualitative and quantitative studies that teachers' general appraisals of their past effectiveness may be based on a variety of source, rather than solely on mastery experience. Similarly, we have shown that teachers' perceptions of their knowledge are derived from many types of experiences. In addition, Bandura (1986, 1991) wrote that self-comparisons with others, or referential comparisons, are based on multiple sources, including vicarious experiences and one's own performance accomplishments. Referential comparisons may also include information from other sources, such as social persuasions in which students compare teachers to their colleagues.

These general appraisals, in turn, may influence teachers' self-efficacy. As previously described, teachers' general perceptions of their past effectiveness are significantly correlated with their self-efficacy. And teachers who believe they have obtained necessary knowledge are more likely to be self-efficacious as a result. The relationship between referential comparisons and efficacy beliefs is not as clearly established in teaching self-efficacy research, but Bandura (1982, 1997) has described referential comparisons as a mechanism through which the sources exert their influence on self-efficacy. It therefore seems clear that these appraisals can be based on multiple sources of information and that they can affect how teachers evaluate their capabilities.

Moderating Factors: Interpretation and Attention

Bandura (1997) described not only how individuals integrate information from various sources but also how they evaluate information. He emphasized that attention and interpretation play a critical role in how efficacy-relevant sources influence one's beliefs. For example, being told that one's lessons are "always interesting" becomes a social persuasion only when interpreted as a compliment rather than a neutral or even negative statement about the peculiarity of one's approach. If one decides that this is indeed a positive experience, one must still evaluate the extent to which the source can be trusted (Bandura 1997). Interpretation of the sources is ultimately a personal process, but teachers may also seek out others to help them make sense of their experiences (Klassen and Durksen 2014). As information from various sources is combined, individuals must also interpret its relative value or weight (Bandura 1997). Another moderating factor is one's use of adaptive strategies to cope with negative information, such as negative physiological and affective states, which can lessen or neutralize their detrimental effects on self-efficacy (Shen 2009). For any of these strategies to be effective, teachers must first be aware of them and perceive them to be useful.

Individuals may also evaluate the relevance of the sources to the teaching task. Recall that teaching self-efficacy is conceived as "both context and subject-matter specific" (Tschannen-Moran et al. 1998, p. 215). When teachers define the task at hand, they may reflect on (a) the subject they teach and (b) the context in which they teach, which includes an assessment of the resources available to them. It is likely for this reason that teachers report lower teaching self-efficacy when asked to teach outside of their content area (Ross et al. 1999). Teachers' self-efficacy has also been found to vary as a function of contextual factors, such as the school's geographic setting (urban, suburban, or rural) and students' race, socioeconomic status, and "tracking" levels (Auwarter and Aruguete 2008; Moseley and Taylor 2011; Raudenbush et al. 1992; Tschannen-Moran and Johnson 2011). Another important contextual factor is the adequacy of teaching resources at the school, as teachers who feel they have access to helpful resources tend to have higher self-efficacy (Lumpe et al. 2000; Tschannen-Moran and Woolfolk Hoy 2007).

The sources inform teaching self-efficacy only to the degree to which teachers perceive them to be aligned with the task at hand. For example, the fact that one's students typically did well on formal assessments (i.e., mastery experience) in one subject area may have little influence on a teacher's self-efficacy when the teacher is charged with teaching another subject. In one experimental study, Siwatu (2011b) found that preservice teachers had lower culturally responsive teaching self-efficacy after reading descriptions of typical urban schools than they did after learning about suburban schools. He suggested that their previous mastery and vicarious experiences may have occurred in educational settings that were not as culturally

and linguistically diverse as urban schools. Similarly, when teaching self-efficacy is measured according to certain subtasks (e.g., managing student behavior), the sources may inform these self-efficacy beliefs only to the degree that they are well-aligned with the subtasks. For example, Klassen and Chiu (2010, 2011) found that stress due to student misbehaviors was more highly correlated with teachers' self-efficacy for classroom management than for instructional strategies or student engagement.

In sum, teachers' attentional and interpretive processes are proposed to moderate relationships between the sources, secondary appraisals, and teaching self-efficacy because they may influence the strength of these relationships. We base these suppositions on the aforementioned theoretical claims and empirical evidence. First, informational sources have a greater influence on secondary appraisals and on self-efficacy when teachers believe they provide reliable information. Second, the potentially detrimental effects of negative sources (e.g., criticism, stress) on teachers' self-appraisals could be minimized when teachers are aware of, and engage in, adaptive coping strategies. Finally, the influence of the sources and secondary appraisals on teaching self-efficacy may be moderated by the extent to which teachers believe their past experiences, and self-appraisals based on those experiences, provide information that is relevant to the current teaching task and context.

Directions for Future Research

In this review, we have argued for a reconceptualization of the hypothesized sources of self-efficacy in research on teaching. Some scholars have operationalized the sources as teachers' general appraisals of their knowledge, past performances, and comparisons with other teachers (e.g., Palmer 2006b; Poulou 2007; Tschannen-Moran and Woolfolk Hoy 2007). However, theory and empirical findings suggest that these variables are not sources in themselves but rather secondary appraisals that necessarily draw on previous experience. It is more likely that these appraisals mediate the relationship between the sources and teaching self-efficacy. In addition, we propose that attentional and interpretive processes moderate relationships between the sources, secondary appraisals, and teaching self-efficacy. These include interpretation of the sources, awareness of strategies to cope with negative information, and consideration of the relevancy of the sources to the given teaching task.

We recommend that researchers conceptualize enactive mastery experiences in terms of the outcomes of teachers' direct actions rather than their mere exposure to teaching experiences. Vicarious experiences should be measured in ways that capture the influence of live, verbal, or symbolic models, rather than the referential comparisons they may lead to. Vicarious experiences may also involve videotaped or cognitive self-modeling. Social persuasions should be operationalized in terms of social messages that convey capability-related information rather than perceived support. And researchers should explore the influence of both negative and positive physiological and affective states.

We believe that there may be additional sources of teacher knowledge beyond Bandura's (1997) four hypothesized sources and invite researchers to examine their influence on teaching self-efficacy. Future research could involve exploratory studies, much like Buehl and Fives (2009), in which teachers from diverse backgrounds are asked to identify the roots of their beliefs in their pedagogical, content, and technological knowledge. Data could be coded according to the sources described by Bandura (1997) as well as any new categories that emerge. Relationships between these sources and teachers' self-efficacy could then be assessed

qualitatively and quantitatively. Results from these studies could inform teacher education and professional development programs by identifying ways to most effectively build teachers' knowledge and sense of efficacy.

This review also points to the need for a psychometrically sound and theoretically based measure of the sources of teaching self-efficacy. Such a measure would provide valuable information for subsequent research efforts. As interest in the sources of teaching self-efficacy increases, so too will the demand for a scale that offers a more complete and accurate picture of how teachers' self-efficacy can be supported. The measure may also help to evaluate professional development programs, as scholars who have imposed interventions that emphasize positive capability-related information have generally reported improvements in participants' self-efficacy (e.g., Henson 2001; Liaw 2009; Ross and Bruce 2007). A valid tool to assess the different sources of teachers' self-efficacy may moreover enable researchers to conduct longitudinal studies that document the ways in which training experiences influence teachers' sense of efficacy.

Researchers might also consider measures that can tap diverse efficacy-relevant experiences within each broader category described above. For example, it may be helpful for teacher educators to know whether vicarious experiences with peers or with expert models have a greater influence on preservice teachers' efficacy beliefs. Assessing the relative influence of each type of social modeling could be beneficial. If peers are indeed an important factor in the budding confidence of prospective teachers, professional learning efforts might create more opportunities for these teachers to observe one another.

Researchers who wish to explore the sources of teaching self-efficacy must consider both the *quality* and the *quantity* of individuals' experiences. Bandura (1997) posited that self-efficacy is influenced not only by quality of events (e.g., positive or negative, profound or mild) but also by the number of times an individual experiences such an event. For example, teachers may become more confident from their observations of other teachers, but if opportunities to watch their colleagues are limited, so too may be the influence of these vicarious experiences on teaching self-efficacy. In some studies, the sources have been assessed only in terms of the frequency (i.e., quantity) of an event, as in measuring mastery experiences merely as the amount of teaching experience one has (e.g., Ruble et al. 2011). More often, researchers have focused exclusively on the quality of an experience, as in measuring mastery experiences as teachers' satisfaction with their professional performances (e.g., Woolfolk Hoy and Burke-Spero 2005). When it is unclear if an item pertains to the quantity or quality of an experience, participants can potentially interpret the item in different ways. For example, when asked to rate the interpersonal support they receive (e.g., Tschannen-Moran and Woolfolk Hoy 2007), some teachers may consider how much support they have received, and others may consider the extent to which support was positive. An item crafted to measure how often one receives positive feedback from colleagues, on the other hand, would lead participants to reflect on both the quantity and quality of these social persuasions without a double-barreled effect.

To understand the factors that contribute to self-efficacy development, researchers must identify not only important events in individuals' lives (i.e., the sources) but also the ways that individuals reflect on their experiences. In other words, *construal biases* can influence the relationship between capability-related events and self-efficacy (Bandura 1997). Whereas quality and quantity serve as characteristics of a source, construal refers to the way the actor makes meaning and assigns importance to that source. Items crafted to assess construal relate a general interpretive bias to a given source, as in the item, "When people I respect tell me I will be a good teacher, I tend to believe them" (Kieffer and Henson 2000, p. 17). Items used to

assess construal biases should be distinct from items used to measure efficacy-relevant experiences and thus should include no presuppositions about the frequency or quality of an experience. To date, no researchers have quantitatively explored how construal biases or other preconceptions might moderate the relationship between the sources and teachers' self-efficacy.

Research on the sources of teaching self-efficacy may also benefit from the use of more diverse quantitative analyses. Item response theory approaches such as Rasch analysis can be helpful for examining how respondents make use of Likert-scale categories in self-efficacy scales and related measures (e.g., Toland and Usher 2015). For example, Alviar-Martin et al. (2008) found that teachers from four countries used differential item response patterns when reporting their confidence to teach various topics related to civics education. Findings from teaching self-efficacy research that are obtained from such methods might present a more nuanced, and potentially more reliable, picture of how self-efficacy develops than findings based on classical test theory approaches that have been used more widely (e.g., factor analysis). Another possibility is to study the sources of teaching self-efficacy using person-centered approaches. For example, Chen and Usher (2013) used latent profile analysis to examine how students weigh and integrate multiple sources of self-efficacy in science. Using different design and analytic approaches can similarly help elucidate the various ways teachers come to believe in their capabilities. Intervention studies will continue to be useful for illuminating how teachers' self-efficacy can be changed.

Of course, measures of the sources of teachers' self-efficacy need not be limited to Likert-type scales. Likert-type measures might be prone to problems such as social desirability effect, ceiling effects, or overdependence on certain categories rather than a full range of responses. Moreover, different referential biases, such as school setting, can make it difficult to compare ratings across contexts (see Duckworth and Yeager 2015). One possibility is to measure the sources using a ranking system; instructors could rank the relative import of their efficacy-relevant experiences or a set of experiences typically reported and theoretically aligned. Results could then be correlated with teaching self-efficacy to identify the most significant efficacy-building experiences. Such approaches bring with them unique measurement challenges.

In qualitative studies, think-aloud (or talk-aloud) methods may be useful in identifying the kinds of information that teachers rely on in judging how well they taught a certain lesson. Gabriele and Joram (2007), for example, asked teachers to verbalize their reflective thought processes immediately after teaching a class. A similar approach could be to offer a playback session of a teaching segment and ask teachers to describe even minor changes in their sense of efficacy on a moment-to-moment basis. From there, researchers could further explore the sources of that particular efficacy judgment. This approach, which is similar to training approaches used in counseling and health professions, could lead to more detailed and contextually situated understandings of the sources than studies that rely on delayed retrospection.

Researchers can more directly assess the influence of teachers' experiences on their teaching self-efficacy by recording observations of classroom events (e.g., Jamil et al. 2012) or implementing particular elements of an intervention (e.g., Tschannen-Moran and McMaster 2009) and collecting self-efficacy data at multiple time points. Such methodological approaches help to capture the events themselves rather than the degree to which teachers attend to those events. Both self-report and direct measures could potentially offer valuable insights into the development of teaching self-efficacy. Such approaches must remain sensitive to the fact that experiences influence self-efficacy only to the extent that individuals attend to them (Bandura

1997). For example, external observers may note that a teacher's students are on-task, but these on-task behaviors may only influence the teacher's self-efficacy if the teacher is first aware of them. Self-report helps to clarify the extent to which individuals attend to such experiences. However, objective measures of experience may also be valuable to researchers, in that they provide information that is directly relevant to professional development and teacher education. Researchers have tended to use either self-report or objective measures exclusively, but much can be learned from studies in which the sources are assessed from both perspectives.

Finally, research on the sources of teaching self-efficacy has overwhelmingly relied on designs that do not convincingly establish causality. Only 7 of the 82 studies we reviewed could be described as experimental or quasi-experimental. Many of the presumed sources (e.g., stress, student achievement) may as easily be an effect as a cause of teaching self-efficacy. Cross-sectional designs do not help to clarify these relationships, and only limited causal inferences can be drawn from longitudinal or one-group pretest-posttest designs. Although exploratory studies of the sources can help to identify possible efficacy-relevant events, only experimental studies can establish whether or not those events are in fact antecedents, or sources, of teaching self-efficacy. Designs that help to isolate the effects of a particular experience on teaching self-efficacy (e.g., Tschannen-Moran and McMaster 2009) better contribute to understandings of the sources than do designs in which differences between groups can be attributed to multiple experiences.

Implications for Teacher Education and Professional Development

Many questions remain about the implications of this work for educational practice. What seems most salient in studies of effective teacher education and professional development programs is a focus on teachers' skill and knowledge development (Guskey 2002; Guskey and Yoon 2009). Furthermore, as this review suggests, teachers are most self-efficacious when their experiences provide them with the tools they need to be effective: pedagogical strategies, an understanding of how to use educational resources, and knowledge of the content they teach. Pajares (2006) argued that it is more important to emphasize skill development than to engage in empty self-enhancement strategies. It may be best to provide individuals with the tools they need and a context in which the use of those tools can be successful (Bandura 1997; Pajares 2006). But this need not be limited to the ways in which mastery experiences are used in professional development; teachers' knowledge can be improved by many other sources. As previously discussed, vicarious experiences can be especially powerful when individuals gain content knowledge and pedagogical tools. Social persuasions can also convey important information related to one's skills and knowledge and thus inform appraisals of knowledge. According to Bandura (1997):

> Social persuasion serves as a useful adjunct to more powerful efficacy-promoting influences.... persuasory mentors must be good diagnosticians of strengths and weaknesses and knowledgeable about how to tailor activities to turn potentiality into actuality. Moreover, to ensure progress in personal development, skilled efficacy builders encourage people to measure their successes in terms of self-improvement rather than in terms of triumphs over others. (p. 106)

That is, social persuasions should be structured such that they (a) provide information designed to improve effectiveness, or (b) lead individuals to engage in adaptive rather than

maladaptive reflection—in this case, focusing on self-modeling rather than referential comparisons. For example, Tschannen-Moran and McMaster (2009) found that professional development interventions designed to provide general social persuasions were not as effective as an intervention that included "coaching sessions" and provided teachers with specific and individualized social persuasions. Coaching is an apt metaphor for the role of teacher education and professional development. Effective coaches are growth-minded; rather than using social persuasions simply to reassure teachers, they "tell [them] the truth, and then give them the tools" (Dweck 2006, p. 199). Of course, there are times when a teacher plagued with self-doubts may need some reassurance, but even in these cases, encouragement can be couched in terms of skills and adaptive ways of thinking.

This is not to say that mere belief in one's knowledge or skills necessarily improves teaching self-efficacy (Bandura 1997). It is possible, for example, that a teacher who feels knowledgeable in a content area may be less self-efficacious because he or she has trouble simplifying the material for students. Moreover, contextual factors like students' level of prior knowledge may influence the degree to which teachers' knowledge of the content informs their self-efficacy.

It should also be noted that professional development and teacher education may most powerfully influence teachers' self-efficacy when they provide opportunities for teachers to apply their newfound knowledge and skills in authentic settings (Bruce et al. 2010; McDonnough and Matkins 2010; Tschannen-Moran and McMaster 2009). For example, Gurvitch and Metzler (2009) found that preservice teachers who had no field experience became more self-efficacious after completing courses designed to improve their pedagogical content knowledge. However, their teaching self-efficacy became even higher when they later taught students in authentic classroom settings. One possibility is to embed methods courses in a teaching practicum supervised by the professor, which McDonnough and Matkins (2010) found to be effective in improving preservice teachers' science teaching self-efficacy. Such experiences may confirm that the knowledge one gained from teacher education or professional development is indeed useful in the "real world" of teaching and learning.

It is important to keep in mind certain limitations and delimitations of the findings we have presented. First, as we have described, many of the studies we reviewed relied on small sample sizes and flawed conceptualizations of the sources. Moreover, few of these studies were experimental in nature, which limits what causal inferences can be made about the influence of particular events on teachers' self-efficacy. Therefore, many of these findings should be viewed as preliminary. Second, because we focused on studies using terminology consistent with Bandura's (1986) social cognitive theory, it is possible that we overlooked additional ways in which teachers' experiences influence their beliefs about their capabilities. Finally, this review focuses on general relationships between the sources of self-efficacy and teaching self-efficacy. Teachers' background factors (e.g., race, ethnicity, or gender) can play a role in the experiences that teachers have, which may in turn influence their sense of efficacy (Basow 1995; Milner and Woolfolk Hoy 2003). The potential influence of such factors is worthy of a lengthy discussion. However, we felt that addressing them in sufficient depth was beyond the scope of this review as they have rarely been explored in studies of the sources of teaching self-efficacy.

It is no easy task to define and measure something as elusive as the origins of individuals' beliefs. The future of research on the sources of teaching self-efficacy is uncertain, but the need for such research has become clear. In learning what events shape teachers' efficacy beliefs, scholars and teacher educators can gain valuable insights into ways to improve a belief that influences the motivation and behaviors of teachers and their students.

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