Culturally Efficacious Mathematics and Science Teacher Preparation for Working with English Learners

By Belinda Bustos Flores, Lorena Claeys, Conra D. Gist, Ellen Riojas Clark, & Abelardo Villarreal

One of the biggest challenges in teacher preparation programs is fostering teachers' abilities to build relationships with students while simultaneously cultivating students' academic potential. This is specifically vital in the case of English learners (ELs). Many secondary teachers feel unprepared to work with and lack preparation to differentiate instruction for ELs (Durgunoğu & Hughes, 2010; Flores, Clark, Claeys, & Villarreal, 2007; Reeves, 2006; Téllez & Waxman, 2006; Yoon, 2008). Moreover, teachers' underpreparedness affects their attitudes and beliefs about ELs (Durgunoğu & Hughes, 2010; Yoon, 2008) and unfortunately hampers ELs' performance (Coady, Harper, & de Jong, 2011; Téllez & Waxman, 2006; Turkan, De Oliveira, Lee, & Phelps, 2014; Yoon, 2008). Furthermore, teacher education

Belinda Bustos Flores is a professor and chair of the Department of Bicultural-Bilingual Education, Lorena Claeys is executive director and research associate with The Academy for Teacher Excellence, and Ellen Riojas Clark is professor emerita in the Department of Bicultural-Bilingual Education, all in the College of Education and Human Development at the University of Texas at San Antonio. Conra D. Gist is an assistant professor in the Department of Curriculum and Instruction in the College of Education at the University of Arkansas, Fayetteville, Arkansas. Abelardo Villarreal is an external evaluator with the Intercultural Development Research Association, San Antonio, Texas. belinda.flores@utsa.edu, lorena.claeys@utsa.edu, gist@uark.edu, ellen.clark@utsa.edu, & abelardo.vallarreal@idra.org

has failed to prepare secondary mathematics and science teachers for working with ELs (Turkan et al., 2014).

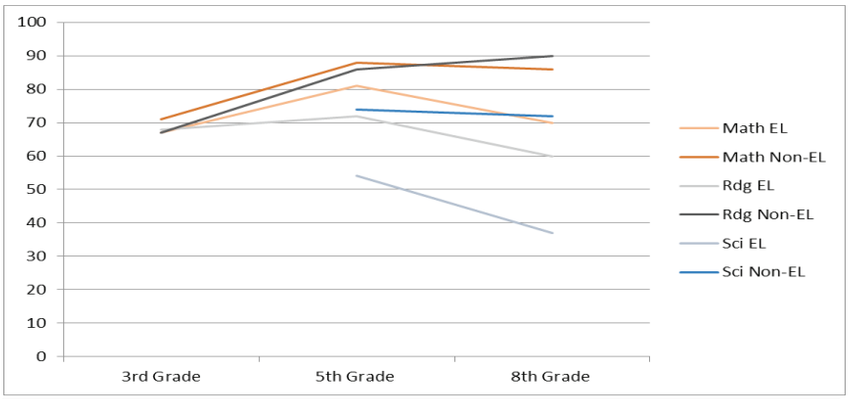
It is our contention that teacher preparation for working with ELs requires the following: (a) specialized content and pedagogical knowledge and skills; (b) specialized knowledge of ELs, including their language acquisition and learning processes (Coady, Harper, & de Jong, 2015; Lucas & Villegas, 2013); (c) specialized disciplinary knowledge for teaching ELs (Turkan et al., 2014); and (d) culturally efficacious praxis (Clark & Flores, 2005; Flores et al., 2007; Siwatu, 2007). Thus teacher education must make a concerted effort to recruit, prepare, and retain individuals pursuing mathematics and science certification who believe they have the capacity to affect ELs' learning outcomes. To ensure the efficiency and efficacy of teacher preparation, we should find ethical and responsive ways to examine program impact (Gist, Flores, & Claeys, 2014; Sleeter, Neal, & Kumashiro, 2014; Zeichner, 2003) and appraise the quality of these teachers in relation to ELs' performance (Téllez & Waxman, 2006).

A case in point is our own state of Texas: Although elementary teacher certification often requires a course for teaching ELs, secondary content teachers do not necessarily take similar course work. The disparity in secondary teacher preparation is evident in Texas State–mandated assessment results (see Figure 1). For example, students transitioning from elementary to middle school on average bring with them

Figure 1

State of Texas Assessment of Academic Readiness (STARR), 2014

Data from TEA (2014)



	Mathematics		Reading		Science	
Grade level	EL	Non-EL	EL	Non-EL	EL	Non-EL
3rd	67%	71%	68%	67%		
5th	81%	88%	72%	86%	54%	74%
8th	70%	86%	60%	90%	37%	72%

test scores that indicate a steady increase in mathematics and reading. In contrast, ELs' passing rates are lower than those of their non-EL peers. When ELs reach middle school (eighth grade), the gap widens in mathematics and reading, with science having the greatest decline (Texas Education Agency [TEA], 2014).

To address the challenge of ensuring the quality of preparation of secondary mathematics and science teachers, this article describes the efforts of the Academy for Teacher Excellence (ATE; Flores et al., 2007), which received Transition to Teaching grants to establish the Accelerated Teacher Education Program (ATEP). ATEP's purpose was to prepare ethnic minority teachers, mid-career professionals, and recent graduates to become highly qualified culturally efficacious mathematics and science teachers of ELs in high-need schools (Moseley, Bilica, Wanless, & Gdovin, 2014). Findings from ATEP are unpacked to (a) analyze mathematics and science teachers' efficacy beliefs, (b) explore the relationship between efficacy sources and the cultivation of mathematics and science teachers' teaching efficacy with ELs, and (c) contemplate practice and research implications for the design of culturally efficacious teacher preparation.

ATE's Accelerated Teacher Education Program

ATEP, in the College of Education and Human Development at the University of Texas at San Antonio (UTSA), was designed to integrate a culturally efficacious model for preparing teachers for success in public schools. *Culturally efficacious* is defined as (Claeys & Muñoz, 2014)

> holding a strong ethnic identity, demonstrating self-determination, employing critical reflection, exhibiting positive efficacy, revealing sociocultural competence, and engaging in transformative practices (Flores et al., 2007), in addition to having strong content, pedagogical, and technological-pedagogical knowledge. (p. 69)

As a community-based research model, ATEP addressed teacher development from the onset of preparation and through the novice years. Preparation included graduate-level course work, online modules, professional development, and a comprehensive induction support system. To address the needs of ELs, two intensive courses and professional development focusing on English as a second language (ESL) methodology and critical pedagogy were required. In preparing teachers, Durgunoğu and Hughes (2010) noted the importance of mentors being able to model effective strategies with ELs. Hence participants' mentors were also in attendance to ensure an alignment between theory and practice. ATEP was specifically conceptualized to prepare mathematics and science teachers who are highly qualified, well prepared to deliver instruction to ELs, and culturally efficacious. Components included (a) a reciprocal collaborative partnership between university and schools (Flores & Claeys, 2010/2011); (b) a redesigned course work program to meet the needs of ELs; and (c) induction support that included coteaching, observation of master

teachers, working with parents and communities, and leadership training (Flores, Hernández, García, & Claeys, 2011).

Culturally Efficacious Teachers and English Learners

The implementation of a standards-based curriculum and instruction that is culturally relevant is a challenge confronting teachers (Rodriguez, 2005). However, extensive research has been conducted for educators and researchers on the importance of culturally responsive and critical pedagogy for ensuring student achievement (Gay, 2010; Gist, 2014a; Gist et al., 2014; Nieto, 2004; Villegas & Lucas, 2002). Several discipline-specific national organizations have developed standards for teachers to teach in a more culturally responsive manner (National Association for Research in Science Teaching, 2014; National Council of Teachers of Mathematics, 2000; National Science Teachers Association, 1996). Specifically, these standards call for the equitable accessibility of science and mathematics for all students, including ELs. Zapata (2013) suggested that efforts for reform would only occur if teachers are prepared from a sociocultural constructivist framework, in which "the complex layers of understanding gender, ethnicity, and social-status, utilized to frame science education, must include factors such as language and cultural norms" (p. 799). The same notion has been iterated about mathematics education teacher preparation (Celedón-Pattichis, 2008; Civil, 2007; Rodriguez, 2005).

To address these issues, ATEP employed the Culturally Efficacious Evolution Model (CEEM), which is situated in a socioconstructivist transformative framework. Flores et al. (2007) built and extended the work of Ladson-Billings (1994), Gay (2000, 2010), Darder (2011a, 2011b), Sheets (2005), and Sleeter et al. (2014) in constructing the model. They suggested that teachers must demonstrate content, pedagogical, sociocultural, and theoretical knowledge but also contended that personal knowledge of self is important (Clark & Flores, 2005; Flores et al., 2007). In becoming a culturally efficacious teacher, a teacher must recognize his or her own stance in terms of his or her ethnicity, culture, gender, and multiple forms of self (e.g., an educator, a scientist, a professor); this will help in understanding others and developing critical consciousness (Clark & Flores, 2014; Flores, Clark, Guerra, & Sánchez, 2008; Flores, Ek, & Sánchez, 2011). Becoming a culturally efficacious teacher is an iterative journey that begins with critical consciousness and cultural competency. For a teacher, cultural competency requires an understanding of the community in which the teacher is working and its resources as well as an understanding of the students the teacher is serving. In contrast to being culturally competent, cultural proficiency requires the teacher to have a much deeper knowledge about the community's social, cultural, political, and historical status (Celedón-Pattichis, 2008; Civil, 2007; Darder, 2011a, 2011b; Salazar, 2013; Zapata, 2013). Cultural proficiency is the recognition that knowledge and reasoning within different communities are derived distinctly and that people have unique ways of being and

understanding. In addition, a culturally proficient educator realizes that there are power relations within all classrooms, so if the instructor is trying to control the setting, this may be in opposition to how the students' perceive their role within the classroom. A culturally proficient instructor understands the multiple dimensions that exist in classrooms, culturally, cognitively, emotionally, linguistically, and also considers the physical environment.

To move beyond understanding requires the educator to engage in critical pedagogical practices. In the case of mathematics and science teachers, culturally responsive lessons would not solely approach the presentation of concepts from a Western stance but would encourage other points of view, provide readings from various lenses (considering, e.g., gender, ethnicity), and examine how scientific communities (including indigenous groups) across the globe approach or resolve issues. In addition, lessons would engage students in active learning and real-world problem-solving approaches that may have direct impact on their communities. As prior research has demonstrated, there is a relationship between self-conceptualization and efficacy (Flores & Clark, 2004) as well as interconnectedness between personal ideology (identity, motives, beliefs) and cultural-responsive teaching (Flores et al., 2011). Hence, to be culturally efficacious means that one has confidence in oneself as an instructor and signifies one's belief that one can impact learning regardless of what external factors exist beyond one's control. As a culturally efficacious teacher, one employs various knowledges as cultural responsivity—critical pedagogical practices. The teacher considers what students bring to the classroom and use what they know (the tools and skills they have) to be able to effectively impact students' development, learning, and achievement.

In an iterative process, a teacher is constantly in a state of being, becoming, and transforming throughout the lifetime as the teacher continuously engages in critical reflection and attains new understandings. This process is illustrated through the CEEM that was developed and deployed in the ATE program (see Figure 2):

1. *awakening cultural consciousness*: examining and recognizing unexplored own identities and multiple selves

2. *acquiring cultural competence*: exploring the sociocultural learning context and acknowledging cultural displays in understanding of others; being able to function within another cultural system

3. *developing cultural proficiency*: acquiring a deeper understanding of cultural knowledge and others' ways of being and beginning to recognize and apply cultural connections in practice

4. *actualizing cultural and critical responsivity*: enacting in transformative and critical practices and advocating for social justice; promoting empowerment and self-determination

5. *realizing cultural efficacy*: becoming a transformative guide, having agency and assuming responsibility, and ensuring that practice impacts outcome

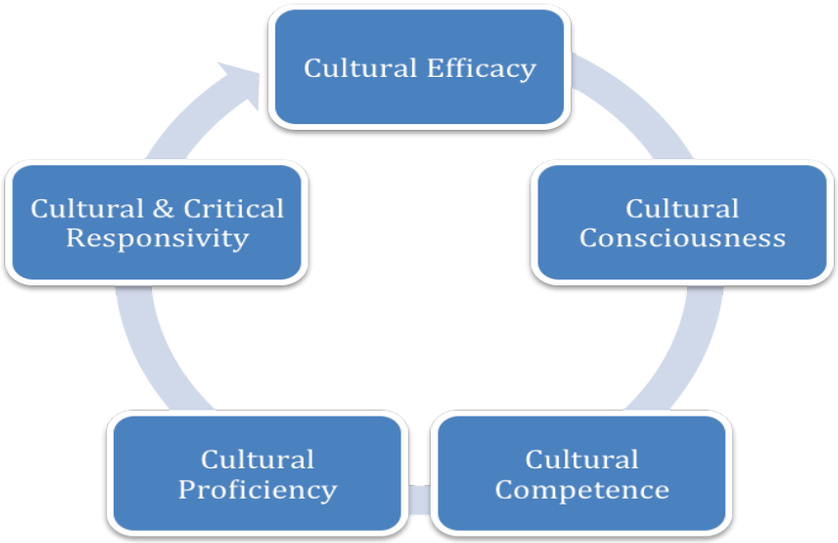
For mathematics and science teachers working with ELs, to be culturally efficacious requires the intersection of content knowledge (Swackhamer, Koellner, Basile, & Kimbrough, 2009); personal knowledge (Flores et al., 2007); knowledge about ELs, including second language acquisition (Turkan et al., 2014); and cultural and critical responsive practices. However, we contend that teaching efficacy beliefs is a key lever for ensuring culturally efficacious practices (Flores et al., 2007). In other words, it is important for mathematics and science secondary teachers to have personal, content, cultural, and linguistic knowledge, but their belief systems are also critical for applying this knowledge in their work with ELs. Therefore the following section focuses on literature concerning teachers' teaching efficacy and sources of efficacy development.

Teaching Efficacy

Several researchers (Bandura, 1993, 1997; Pajares, 1996; Zimmerman, Bandura, & Martinez-Pons, 1992) have proposed that an understanding of self is a critical aspect in the formation of positive self-efficacy beliefs. According to Bandura (2002),

> self-efficacy beliefs regulate human functioning through cognitive, motivational, affective, and decisional processes. They affect whether individuals think in self-enhancing or self-debilitating ways; how well they motivate themselves and persevere in the face of difficulties; the quality of their emotional life, and the

Figure 2
Culturally Efficacious Evolution Model and Dimensions



> choices they make at important decisional points which set the course of life path. (pp. 270–271)

In the case of teachers, understanding of self leads to competence, persistence, and perseverance for teaching in specific content areas (Brownell & Pajares, 1999; Pajares, 1997). Initially, researchers (Ashton & Webb, 1986; Woolfolk & Hoy, 1990) identified the construct of teaching efficacy as general teaching efficacy (GTE) and personal teaching efficacy (PTE). Originally, GTE was defined as a teacher's belief about teaching ability contingent on internal and external factors, whereas PTE was described as the degree of confidence that teaching will make a difference in students' lives. Over time, researchers moved toward Bandura's (1993) definition of the self-efficacy construct, which operationalizes PTE and outcome expectancy beliefs (OEB) in teaching efficacy. Hence PTE is a teacher's beliefs about being able to teach in situations wrought with variability and uncertainty, and OEB reflects a teacher's beliefs that practices will result in outcomes or differences (Bandura, 1997). Various factors may modulate the development of teaching efficacy beliefs, for example, (a) cultural values (Lin, Gorrell, & Taylor, 2002), (b) teacher preparation routes (Flores, Desjean-Perrotta, & Steinmetz, 2004), and (c) induction support (Flores et al., 2011; Woolfolk Hoy & Spero, 2005).

Teachers' approaches to classroom problem solving, strategy usage, and goal setting are likely mediated by their teaching efficacy (Zimmerman, 2000). Apparently, teachers with strong teaching efficacy are prone to engage in innovative practices (Tschannen-Moran & Woolfolk Hoy, 2001). Teacher efficacy has also been linked to students' achievement, motivation, and self-efficacy (Woolfolk Hoy & Spero, 2005). Going beyond teacher efficacy, cultural competence, and culturally responsive teaching, researchers have begun emphasizing cultural teaching efficacy (Clark & Flores, 2005; Flores et al., 2007; Siwatu, 2007). For example, establishing positive student relationships, developing a sense of trust, and engaging students as members of the classroom reflect culturally responsive efficacy (Siwatu, 2007). Siwatu proposed that the capacity to engage in culturally responsive teaching will likely influence teacher candidates' OEB. The inability to communicate with ELs and the failure to see the link between the native language and cultural identity are considered indicators of teachers' lack of teaching efficacy (Siwatu, 2007). McKinnon, Moussa-Inaty, and Barza (2014) found a low teaching efficacy for science teachers working in a foreign context and contended that the efficacy of these science teachers may have been dependent on their cultural adaptability.

Sources of Efficacy Development

Research has explored the development or "antecedents of self-efficacy beliefs of novice and experienced teachers" (Tschannen-Moran & Woolfolk Hoy, 2007, p. 944). Researchers have suggested that further research is needed to explore the development and the prior experiences that influence efficacy. To date, we have not

found studies investigating the antecedents of mathematics and science teachers serving ELs or studies exploring culturally efficacious teacher preparation. Given the importance of teaching efficacy, there is a need for extensive research on what type of teacher preparation or professional experiences assist in the development of a teacher's efficacy, specifically in a context in which ELs are present. Bandura (1993, 1997) hypothesized that the development of the individual's efficacy is incumbent on four sources of efficacy in a social context: mastery, vicarious experiences, verbal persuasion, and physiological arousal experiences. Mastery experiences include field- and community-based experiences in which teacher candidates practice their craft and that lead to accomplishing the specified tasks, in this case, teaching. Vicarious experiences occur when seeing someone how to model an activity that an individual hopes to accomplish. For example, field observations and service-learning experiences are likely sources of vicarious experience, as is observing mentors modeling teaching practices (Wagler, 2011). Verbal persuasion results when individuals receive feedback about their performance on a specific task, for example, when mentors debrief with the teacher after mentoring and coaching sessions. Physiological arousal occurs when feeling joy, excitement, or contentment as the activity is performed. For example, when teachers witness that students are acquiring a certain concept, they may feel a sense of satisfaction. Karabiyik and Korumaz (2013) noted that an increase in job satisfaction is correlated with higher teaching efficacy.

In the case of mathematics and science teacher candidates, studies have examined efficacy in terms of personal teaching efficacy (PTE) beliefs and teaching outcomes expectancy beliefs (OEB; Riggs & Enochs, 1990). For instance, efficacy differences were observed between prospective and practicing mathematics and science elementary teachers (Wenner, 2001). Practicing teachers had a greater sense of PTE, whereas prospective teachers had more positive OEB. In general, elementary teachers were more positive toward teaching mathematics than toward teaching science. Specific content course work appears to assist mathematics and science elementary teacher candidates' efficacy (Moseley & Utley, 2006). Of note, content courses embedded with pedagogical techniques assisted in increasing practicing mathematics and science teachers' efficacy (Swackhamer et al., 2009).

With the increased awareness that we need to better serve diverse populations, researchers have begun exploring the equity efficacy beliefs of mathematics and science teachers (Cone, 2009; Ritter, Boone, & Rubba, 2001) and have included specific items pertinent to the instruction of ELs (Swackhamer et al., 2009). In exploring teacher candidates' equity efficacy beliefs about science teaching and learning, Cone noted that community-based service learning had a significant impact on teacher candidates' OEB. Also, Swars (2005) observed differences in teacher candidates' mathematics teaching efficacy when teaching diverse learners as compared to self-reported positive teaching efficacy. It appears that providing science and mathematics teacher candidates with opportunities to engage in mastery experiences, such as

community-based service learning and field experiences, assists in their development of equitable teaching efficacy. Coady et al. (2015) argued that teacher education can aim for equity by ensuring teacher candidates are prepared to employ specific EL strategies. They suggested that teacher education "interrogate the terms used to describe effective practices in ESL and mainstream classrooms" and consider "more highly structured field experiences and specialized assignments for teacher candidates that provide models of effective instruction for ELLs" (pp. 23–24).

In other research, we see evidence of physiological arousal as a source of efficacy in which experiences lead to teachers' satisfaction and gratification. Collier (2005) proposed that there is a reciprocal relationship between teacher efficacy and caring:

> The act of caring and being cared for forms a loop which provides needed support to enhance student growth, development and performance while refueling teachers with experiences of gratification and appreciation, increasing satisfaction with teaching and commitment to teaching as a profession. (p. 359)

Noddings (2012) described the caring relation in teaching as the care ethics of "listening, dialogue, critical thinking, reflective response, and making thoughtful connections among the disciplines and to life itself" (p. 771). Bartell (2011) drew a theoretical map of how the caring teacher can negotiate student relationships as related to race, culture, politics/power, and academic achievement and posited a professional development design for caring mathematics teachers that integrates student mathematical thinking and competencies with dilemmas of practice related to issues of race, culture, and power. Specifically, Lewis et al. (2012) verified that there is a direct link between teacher caring and Latino ELs' self-efficacy in mathematics, which emphasizes the importance of fostering caring teacher–student relations.

The contexts in which caring teacher–student relationships are fostered also appear to have an impact on teachers' efficacy. Collective teaching efficacy, which is reflective of the school climate, appears to impact students' success, particularly in reading and mathematics (Hoy, Goddard, & Sweetland, 2000). Communities of practice, in which individuals dialogue about common goals, issues, or interests (Nika, 2014; Wenger, 1998), can serve as a context in which teachers develop positive relationships that value and respect others' views promoting their teaching efficacy (Nika, 2014; Takahashi, 2011). Takahashi observed that in analyzing and discussing student data, teachers' pedagogical practices and efficacy were reaffirmed in communities of practice. In addition, with the proliferation of online technologies, communities of practice have transformed over time, offering teachers participation in a social group, such as an online community of practice, to connect with and support each other engaging in meaningful interactive and reflective practices to continue learning and sharing professional strategies (Murugaiah, Azman, Thang, & Krish, 2012). Essentially teachers' connections, dialogue, and reflective practices as a community of practice serve as a form of verbal persuasion that support teachers' efficacy.

In summary, cultural, personal, situational, and contextual factors intersect in

teachers' lives, ultimately affecting their teaching efficacy. Drawing on this review, we posit that mathematics and science teachers must be culturally efficacious and engage in responsive practices to work effectively with ELs. They must know themselves, their students, and diverse communities, because all of these ways of knowing affect student achievement. We argue that the design of teacher preparation programs plays an integral role in the efficacy development of the teacher and that, collectively, the teacher education program structures and practices create experiences that serve as efficacy sources (i.e., mastery, vicarious, verbal, persuasion, and physiological) supporting teacher development.

Methodology

This study employed a mixed methods design because it allowed the researchers to look at teaching efficacy within a second language context from both macro and micro levels. This design was specifically suited to answering the following research questions:

1. Upon program entry, what are ATEP participants' teaching efficacy beliefs?

2. Are there differences between personal and outcome efficacy beliefs? Are there differences between entry and teaching efficacy and exit equity teaching efficacy?

3. How do ATEP's program structures as a community of practice act as efficacy sources that foster mathematics and science teachers' teaching efficacy with English learners?

Research Setting

Participating school districts. ATE partners with six high-need urban and rural districts experiencing severe shortages of secondary mathematics and science teachers. Legislation defines high-need schools based on (a) low-income families served, (b) low performance, (c) teachers teaching out of field, and (d) teachers with provisional credentialing. All participating school districts initially expressed reservations about ATEP, because for-profit alternative certification programs (ACP) had not met school districts' expectations. However, upon learning about ATEP's goals, district personnel agreed to prescreen and hire potential teachers.

Students receiving instruction. ATEP teachers primarily work with low-income students, students from an ethnic minority, and/or ELs. A high percentage of ELs, comprising mostly low-income Latino students, enrolled in participating schools are not meeting state expectations, not being academically successful, and not advancing to the next grade level. Although the school districts' objective is for students to be college and career ready, students often do not have role models from

underrepresented groups. ATEP's challenge was to ensure that teachers served in this capacity to make a positive difference in students' lives.

Participants

As observed in Table 1, a total of 143 students enrolled in ATEP; of these, 100 became teachers of record (TOR). In this study, 42 secondary mathematics and 58 science teachers participated; most were women (n = 76) as compared to men (n = 24). The majority were Latino (n = 51), followed by White (n = 29), African American (n = 10), Asian/Asian Indian American (n = 2), Native American (n = 1), and other (n = 7).

Data Collection Procedures

Darling-Hammond (2006) suggested that to determine program outcomes, multiple data sources should be garnered. Our data sources included (a) focus groups with 45 teachers, (b) forum responses from all teachers, (c) interviews with school administrators who had hired ATEP teachers, (d) interviews with project staff, (e) project evaluation survey, (f) the Mathematics/Science Teacher Efficacy Belief Inventory (MTEBI/STEBI; Riggs & Enochs, 1990) administered upon program entry, (g) Self-Efficacy Beliefs About Equitable Science/Mathematics Teaching and Learning (SEBEST/SEBEMT; Ritter et al., 2001) inventories administered upon program completion, and (h) archival records of project evaluators' reviews.

Table 1
Cohort Enrollment and Teachers of Record

	Math		Science		Total	
	Enrolled	TOR	Enrolled	TOR	Enrolled	TOR
Cohort 1 (2005)	8	7	19	14	27	21
Cohort 2 (2006)	7	7	7	5	14	12
Cohort 3 (Spring 2007)	11	8	13	9	24	17
Cohort 4 (Spring 2008)	0	0	4	2	4	2
Cohort 5 (Fall 2008)	0	0	2	2	2	2
Cohort 6 (Spring 2009)	3	3	11	6	14	9
Cohort 7 (Summer 2009)	5	4	6	4	11	8
Cohort 8 (Fall 2009)	9	6	7	4	16	10
Cohort 9 (Spring 2010)	3	1	7	5	10	6
Cohort 10 (Fall 2010)	1	1	4	4	5	5
Cohort 11 (Spring 2011)	6	4	2	0	8	4
Cohort 12 (Fall 2011)	2	0	1	1	3	1
Cohort 13 (Spring 2012)	2	1	3	2	5	3
Total	58	42	86	58	143	100

Note. TOR = teachers of record.

Focus groups. Teachers were invited to participate in biannual focus groups. Approximately five novice teachers per year volunteered to participate in the focus groups, which informed ATEP faculty and staff of the quality of support services for working with ELs and other resources available to participants. Other topics discussed were teacher–student relationships, student engagement levels and outcomes, teacher practices, and school context.

Forums. As part of the ATEP project, participants engaged in a hybrid community of practice where online forums provided spaces to dialogue, share ideas, discuss challenges, and support each other. Data related to ELs were extracted from these forums.

Interviews. Interviews were conducted during the first, mid-way, and final years. During each period, five school administrators, including principals and human resources personnel, were interviewed for 45 minutes to 1 hour. The interviews provided information on the quality of services provided by ATEP to participating campuses. Also, administrators reflected on their experiences with ATEP teachers in comparison to other first-year teachers. Specifically, questions were asked about teachers' preparedness in working with ELs.

Project evaluation survey. At the time of the study, two-thirds of all participants had completed their third year as TOR. These teachers (n = 66) were asked to complete a survey with a 4-point Likert-type scale ranging from 1 (*undecided*) to 4 (*very much*) and open-ended questions to indicate job satisfaction, quality and intensity of support, and quality of trusting teacher–student relationships.

Mathematics/Science Content Teaching Efficacy Scales. MTEBI/STEBI use a 5-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) to measure teachers' confidence in teaching mathematics/science and teachers' beliefs in making a difference in their students' academic lives. Upon entry, participants completed the corresponding mathematics or science scale. These scales have demonstrated Cronbach's alpha reliability and validity (Riggs & Enochs, 1990). We used the original STEBI scales and replaced "science" with "mathematics" as appropriate. Our study's Cronbach's alpha results reveal an overall high reliability for the MTEBI scale (α = .962, n = 36) and for the STEBI scale (α = .874, n = 54). MTEBI Cronbach's alpha results demonstrate a high reliability (α = .969) for the Personal Mathematics Teaching Efficacy (PMTE) subscale and a strong reliability (α = .86) for the Mathematics Teaching Outcome Expectancy (MTOE) beliefs subscale. Similarly, STEBI personal science teaching efficacy (PSTE) subscale reliability (α = .872) was high, and reliability for the science teaching outcome expectancy (STOE) beliefs subscale (α = .72) was strong.

Mathematics/Science Equity Efficacy Teaching Beliefs. SEBEST/SEBEMT scales measured participants' equity teaching beliefs on a 5-point Likert scale rang-

ing from 1 (strongly disagree) to 5 (strongly agree). Using the STEBI as a model, the SEBEST was specifically established to measure science teaching equity efficacy teaching beliefs and had specific items concerning ELs. The SEBEST has an established Cronbach's reliability and validity (Ritter et al., 2001). For the purpose of this study, we modified the science scale by replacing the word "science" for "mathematics" where appropriate in the items. Participants completed the SEBEST/SEBEMT upon completion of program requirements. Cronbach's alpha revealed that both scales had high reliability (SEBEST, $\alpha = .965$, $n = 46$; SEBEMT, $\alpha = .966$, $n = 28$). SEBEST PSTE ($\alpha = .892$) and STOE ($\alpha = .958$) subscales also demonstrated high reliability. High reliability was observed on the SEBEMT's PMTE ($\alpha = .915$) and MTOE ($\alpha = .954$) subscales.

While the entry and exit tools are two distinct instruments measuring the latent construct of teaching efficacy, given the one-group design to reduce test familiarity, these measures were used to assess teaching efficacy over time. Moreover, the exit survey had specific items to assess teachers' efficacy about teaching ELs. Nevertheless, we recognize the limitations and threats to the validity of our study findings.

Archival evaluator reviews. Researchers examined the annual evaluators' reviews of project activities used to assess progress on ATEP project goals and objectives. Data were collected annually and shared during staff meetings to assist with program improvement.

Data Analysis

Using Onwuegbuzie and Teddlie's (2002) framework for mixed-method analysis, we followed these steps: data reduction, display, transformation, correlation, consolidation, comparison, and integration. During the first three steps, descriptive statistics (M, SD) were generated from Likert-type data, and qualitative data were analyzed for recurring themes and general patterns. The final steps included t-tests to compare each certification area (mathematics and science teachers, respectively) within-group differences on PTE and OEB subscales. We also examined differences for entry and exit teaching efficacy beliefs for each certification area. Because multiple t-tests were run for the purposes of reducing Type I error, a Bonferroni adjustment was computed, $p < .001$. Lastly, all data were triangulated to examine commonalities across findings as well as trustworthiness and to enrich and broaden the findings (Creswell, 2009).

Findings

To respond to each of the research questions, we first examine the MTEBI/STEBI results, and then we present the results of the entry and exit efficacy subscales to assess the development of efficacy over time. Last, using qualitative methods, we explore the ATEP participants' sources of efficacy and how these support the mathematics and science teachers' teaching efficacy for working with ELs.

Survey Findings: Teaching Efficacy Analysis

Entry teaching efficacy. In examining the entry teaching efficacy, survey data analysis revealed interesting findings for both the science and mathematics teachers. We first compared each scale's subscales by running a paired t-test on the respective mathematics or science PTE beliefs and the teaching OEB.

In the case of the mathematics teachers (see Table 2), we observed that the MTOE ($M = 2.72$, $SD = .70$) is slightly greater than the PMTE ($M = 2.53$, $SD = 1.16$) scores. However, t-test results show no significant difference on entry MTEBI PMTE and MTOE subscales. Somewhat similar trends (see Table 3) were noted for the ATEP science teachers with entry STOE ($M = 2.34$, $SD = .46$) scores significantly greater than PSTE ($M = 1.76$, $SD = .55$), $p < .001$. Initially, as measured by the MTEBI/STEBI, respectively, these ATEP mathematics and science teachers' PTE entry self-reported results revealed that as candidates, they were not necessarily convinced of their teaching capacity given the demands of the classroom.

Outcome efficacy beliefs (MTOE/STOE) entry results indicate that as candidates, they are not totally confident that their teaching would garner the expected outcome. However, their expected outcome mean scores were slightly greater than PTE. So, although they are not sure of their capacity, these teachers, as candidates, somewhat believe that they could impact student outcome.

Table 2
Mathematics Teacher Entry and Exit Teaching Efficacy

	MTEBI (entry), M (SD)	SEBEMT (exit), M (SD)
PMTE	2.53 (1.16)	4.04 (0.76)*
MTOE	2.72 (0.70)	4.27 (0.91)*

Note. MTEBI = Mathematics Teaching Efficacy Belief Instrument; MTOE = Mathematics Teaching Outcome Expectancy; PMTE = Personal Mathematics Teaching Efficacy; SEBEMT = Self-Efficacy Beliefs About Equitable Mathematics Teaching and Learning.

*p < .001.

Table 3
Science Teacher Entry and Exit Teaching Efficacy

	STEBI (entry), M (SD)	SEBEST (exit), M (SD)
PSTE	1.76 (0.55)	4.00 (0.71)*
STOE	2.34 (0.46)*	4.33 (0.94)*

Note. PSTE = Personal Science Teaching Efficacy; SEBEST = Self-Efficacy Beliefs About Equitable Science Teaching and Learning; STEBI = Science Teaching Efficacy Belief Instrument; STOE = Science Teaching Outcome Expectancy.

*p < .001.

Exit equity teaching efficacy. In conducting this analysis, we first examined differences between mathematics teachers' MTOE and PMTE scores. Greater MTOE mean scores than PMTE mean scores, $p < .001$, were noted. Employing paired t-tests, we then compared the ATEP teachers' entry with their exit equity PMTE. A subsequent paired t-test was run comparing entry with exit MTOE scores. Significant differences were found when comparing entry and exit subscales (see Table 2). Similarly, differences for the science teachers were noted on the SEBEST subscales, with STOE scores being greater than PSTE scores. Last, significant differences were noted when examining entry and exit subscales (see Table 3).

Again, it is interesting that teachers appear to be more confident about their capacity to make a difference than in their teaching capabilities. These findings are contrary to other findings in which Latino mathematics teacher candidates' OEB did not correlate to their personal teaching beliefs or positive attitudes (low anxiety) toward mathematics (Tillman, An, & Boren, 2013). In this study, Tillman et al. conjectured that the candidates' OEB were influenced by contextual factors such as considering mathematics difficult to learn, students' preexisting negative attitudes toward mathematics, and poor teaching approaches. Perhaps because a number of these ATEP candidates were mid-career individuals, they relied on past career success in responding to the OEB items. Moreover, a high percentage indicated that they had chosen the teaching profession because they wanted to make a difference in students' lives. One ATEP teacher shared,

> I became a teacher because I found that I enjoyed sharing knowledge so much that I was not fulfilled as a research scientist. Yes, I was discovering new things and I was part of the leading edge of science, forging tremendous discoveries, but there were no longer the intense intellectual discussions that I had in graduate school seminars and classrooms.

Thus it is important to not discount these prior experiences or motives in relation to efficacy beliefs. These ATEP teachers approached the teaching task from this lens, and as they attained greater knowledge, skills, and confidence, their teaching efficacy beliefs were altered.

Qualitative Findings: Program Sources of Efficacy Analysis

Given these quantitative results, we then examined our qualitative data (focus groups, forums, interviews, archival records, program evaluations) to determine whether the participants' teaching efficacy was supported through the project activities, including professional development, induction support, and course work, as well as through contextual experiences within the school setting. Deductive analysis revealed that these experiences served as sources of efficacy for ATEP participants. First, we outline program experiences as sources supporting PTE. Then, we discuss how these experiences supported participants' OEB.

Physiological arousal supporting personal teacher efficacy. In this study, sources of physiological arousal are operationalized as contextual factors that foster feelings of joy, excitement, and satisfaction. As novices, the majority (71%) rated the ATEP induction support system as effective for assisting them in becoming teachers. Many spoke about the espirit de corps they felt as members of a cohort–community of practice, which assisted them through the most difficult assignments; Angela stated, "The camaraderie within the cohort has given me the support I need to get through difficult days." Getting to know and work with others in the university setting was another highlight; they spoke positively about their rewarding experiences. Maria exuded with confidence, "I have learned a lot of effective strategies to incorporate in my class." Larissa reflected on strategies that she had learned to meet the needs of ELs and verified their effectiveness: "In my experience, science has it easy with ELLs [English language learners]. There are so many images and graphic organizers that we can use to show ELLs . . . that we can then integrate into a picture glossary." This validation encouraged other participants to implement these strategies with greater confidence.

Throughout ATEP, peer support not only affected teachers' experiences but also buttressed their retention. Respondents felt that their relationships with colleagues were effective and emotionally contributed to their development. Some found a supportive community of practice in others: "I was lucky enough to find a school where other teachers (in and out of my department) provided me with support and assistance. They were there for me on a daily basis to ensure that I didn't need anything or have questions on anything."

The campus climate created by administrators impacted participants' efficacy. Elibeth noted, "In my campus, I have very supportive administration and staff. I don't think I would have done it without all their help." Alejandra also spoke about her administrator, who was an excellent mentor who had worked with ELs:

> He used to be a biology teacher and a science specialist so he was able to help me with the curriculum when I needed the help. I remember one time I was panicking because the activity I had planned wasn't going well at all and I was on a time crunch with the content. I called him and asked for his advice. He came up with an activity for me that was quick and easy to grade. It worked much better than what I had planned.

The role that campus administrators play in a teacher's efficacy is crucial. In general, if teachers feel supported by their campus administrators, they are more likely to remain teaching on a particular campus. When asked to rate the support that they had received from campus administrators, 64% felt that this support was effective, whereas 14% were undecided. In the words of many, "they have always been there for me to offer constant support in resources, motivation, and personal issues when needed."

This supportive climate likely contributed to the ATEP teachers' high job

satisfaction (100%), with teaching meeting their professional expectations. Some teachers professed altruistic motives for entering the profession and, given their experiences, felt that all teachers should receive high-quality teacher preparation. For example, Lolita expressed, "I have high expectations for my students and I feel teachers should be held up to the high standards themselves and provide quality instruction for their student population and have positive impact on the lives and education of people."

However, it is also important to recognize that novice teachers are confronted with the politics of schools and the challenges of working with ELs. Jorge explained, "At my district there is too much in-fighting on curriculum issues between district and teachers, teachers and teacher to suit me. Some of these are quite contentious and not in the best interest of the student's education." Some teachers spoke not only of the challenges of being in this fray but also of the relationships with other teachers in the school as being a particularly difficult and unanticipated challenge. The intergenerational gap was reflected in comments such as concerning the "reluctance of older teachers to try new techniques." These challenges may inhibit teachers' efficacy development. In these teachers' voices, we realize that not all experiences were positive. Fortunately, in the case of ATEP participants, the positive outweighed the negative, as demonstrated by the teachers' high retention and commitment. Lorraine pronounced, "I still get the greatest enjoyment out of seeing the spark in their eyes when they have finally 'got it' . . . and report back how easy the STAAR [state-mandated] test was for them!" Cristina's experience briefly portrays the satisfaction and confidence of helping and impacting ELs:

> Many of the students who were ESL, started signing up for Saturday school only if I were to teach the class. In my short time at Laleer, I am now known to be the teacher who can work with the most challenging kids either because of language or behavioral problems. This reputation makes me very proud, because I know this is the result of very balanced measures of patience, discipline, authority, and the ability to love, respect, and never give up on students. Some of the students who started very upset for having two math classes, not only enjoy my class now, but they also have a different perspective about it.

Verbal persuasion supporting personal teacher efficacy. Sources of verbal persuasion are operationalized in this study as feedback on performance about particular teaching and learning tasks. For example, peers and mentors provided critical feedback that supported teachers' development. After observing a special education–mathematics teacher working with ELs, Effie, a mentor, wrote, "Mr. Macias demonstrated outstanding ability to engage each student, knowing his/her strengths and disabilities. Great Job Mr. Macias." Following a geometry lesson observation, Effie praised another mathematics teacher about establishing positive relationships with students, managing the classroom effectively, and offering a positive environment and about validating students' efforts and success. Again, the teacher is congratulated for her efforts: "Great ideas and good job."

Evidence of verbal persuasion as a source of teaching efficacy was observed in the online forum as teachers validated each others' ideas and provided examples of successful strategies for working with ELs:

> LYNN: I think student teaching, and coteaching will work for new teachers to get good practice with real-world practice and not overwhelm them. In math, there are many hands-on activities to help ELLs. Check book, measuring Furniture, counting money, etc.
>
> JAN: I also agree with the coteaching methods. Some ideas teachers should have in the classroom for ELL learners is to put yourself in their shoes. Pretend if you were new to the English language and you walk into the room. Is your room intimidating? (Too much can be overwhelming.) Here are some cool ideas that I have spot-checked in the science classrooms: word wall, picture glossary, language-based science games, and encourage participation.
>
> CLARISSA: Jan, I really love your strategies! In my clinical experience, I have seen teachers put ELLs on the spot with the intent of involving them in participation; however, the students become very self-conscious and say nothing at all. . . . Your strategies and techniques are great because they create a comfortable environment and benefit all students. Great post!!

In sum, it was evident that verbal persuasion experiences with mentors and peers provided teachers with an opportunity to receive feedback on culturally efficacious practices when working with ELs.

Vicarious experiences supporting personal teacher efficacy. Sources of vicarious experiences are operationalized as observing the modeling of an activity the teacher strives to accomplish. Course work, professional development, field experiences, observing master teachers, and coaching activities served as vicarious experiences. Frank surmised,

> The seminars I attend through ATE/ATEP gave me the value feedback and reinforcement that my career change was the right decision. In addition to the cultural awareness I was exposed to through courses and seminars, I learned how much different K–12 education was than from 15 years ago when I finished high school.

These accolades reflected both the content provided by the ATEP program and the quality of the faculty. Joe indicated, "There have been certain professors that have enabled me to expand my horizons on several issues such as school reform, Title I districts, multicultural awareness, classroom management and many other issues."

ATEP's intensive support system is highly regarded by school administrators and participants because project staff monitored and coordinated teachers' induction support with district- and school-sponsored activities. An administrator recognized the importance of novice teachers observing classrooms and students "because it allows them to see what the students are like." Clarissa shared her observation in a science classroom with ELs, explaining, "I have even seen teachers wait for up

to 5 minutes for a student to respond, knowing that the student is having a difficult time responding!" In a critical reflection about working with ELs, Melissa spoke of the importance of observations as a means of increasing teaching efficacy:

> You have to invest time to observe and learn about the new culture and behavior. You would then be able to adjust your behavior to avoid any conflict and more frustration. The best strategy would be to write everything down and reflect on it daily. Ask yourself what worked, what didn't work and why, and how you can improve the next day.

These vicarious experiences provided teachers an opportunity to observe strategies and reflect critically on the path to becoming successful culturally efficacious teachers of ELs.

Mastery experiences supporting personal teacher efficacy. Sources of mastery experiences are operationalized in this study as opportunities for teachers to successfully accomplish a teaching and learning task. Principals' initial observations concluded that ATEP first-year teachers had the content but faced "quite a challenge" when "disseminating that [content] to students and communicating and engaging students." In subsequent years, as a result of course work, induction support, and professional development, teachers began to demonstrate greater confidence in their teaching and their ability to impact students' achievement. Analisa, a mathematics teacher working with ELs, shared,

> I have increased my knowledge about diverse students (culturally and linguistically). For example, I have learned that all students should be viewed individually. Each student brings a different perspective into a classroom. . . . To accommodate diverse learning styles and diverse backgrounds in my classroom, I need to understand each of my students.

ATEP experiences had a positive effect on the teachers and also a lasting and positive impact on their teaching efficacy. This helped teachers meet their goals and improved learning for all students, as Analisa reflected:

> As a clinical teacher. I have improved my ability to make lessons relevant, engaging and appealing to best suit the needs of my students by relating and applying real-world situations to math and allowing them to use prior knowledge.

The bond formed between teacher and mentor cannot be understated. Teachers valuing the induction support described their mentors in glowing terms; Anastasia commented,

> From the very beginning of my first year at my school, my mentor teacher has never failed to assist me in classroom management issues, instructional strategies, lesson plan construction and overall development of me as a quality teacher in training.

Rafael felt extremely "blessed" with a great science department and, more specifically, an excellent mentor. Seventy-five percent of the respondents reported

that their overall experience in their ATEP induction support program had been rewarding. Ultimately, each teacher sought out the support he or she needed from the variety of individuals.

Administrators also valued the induction support, emphasizing the quality of the mentoring and coaching: "They [ATEP] had someone come for content, to show them [teachers] how to do the lesson. They had someone else help with classroom management." Another administrator stated, "UTSA has a pretty nice structure in what is planned for those teachers." "They [ATEP] didn't just leave the teachers here but rather they continued to nurture [them]." Principals' interviews identified the value that ATEP teachers brought to the campus to meet the needs of ELs. Principals' comments about ATEP teacher quality and effectiveness were positive and encouraging: "The ATEP teacher has had the same successes and concerns that most first-year teachers have"; "I feel positive about it, and I think the quality of teachers is good." Other principals provided greater feedback: "We got six people from ATEP for science and mathematics . . . and they've been fantastic. . . . They have excellent attitudes. . . . They all have a command of mathematics or science." The general feeling among principals is reflected in the following comment: "I've been very impressed with the quality of the candidates that I've selected. . . . Some of my [principal] peers don't like working with alternative certification people, because they don't feel that they have the depth, knowledge, pedagogy and ability to work with the students." A final analysis revealed that administrators rated ATEP teachers as being very well prepared as compared to ACP participants. Yet ATEP teachers were rated as equal or about the same when compared to traditional, university-prepared teachers. As the ATEP teachers demonstrated mastery in their practices, district personnel reported high satisfaction and offered teachers continuing contracts and hired new cohorts—a practice rarely seen in participating school districts. To date, nearly 84% of ATEP teachers have remained in the profession and maintained their commitment to working with students in high-need schools.

Experiences supporting teaching outcome efficacy beliefs. OEB is operationalized as a teacher's beliefs that his or her practices will result in outcomes or differences. Articulating a caring relationship and engaging students in the learning process are critical to a teacher's cultural efficacy in today's classroom (Siwatu, 2007) and to success with ELs (Lewis et al., 2012). We found evidence that ATEP teachers view themselves as caring and engaging teachers who promote their students' success (see Table 4).

We observed that, indeed, ATEP teachers are establishing caring, positive teacher–student relationships in their classrooms. Many echoed that it was particularly rewarding to work with students from diverse backgrounds: "My students are the world to me and ATE ATEP has helped build strong relationships with not only them but my coworkers as well." Victoria revealed how she engages students: "They like to play games . . . they like some fun things with games. . . . You can

always ask them something that relates to them." Jasmine, a mathematics teacher, shared with enthusiasm the effort she makes to learn the ELs' native languages:

> Making connections does not only mean a lot for the students. It meant a lot more to me as a teacher when I see how happy my students are as they think how I care for them. I believe teaching is more about caring.

As Collier (2005) noted, "in essence, caring is the fuel for teacher efficacy working in tandem to create the stable, capable and committed teaching force required for the effective education of our nation's children" (p. 358). Essentially, the teachers' feeling of satisfaction is aroused when students express their gratification. Furthermore, as an observable outcome, the "student and teacher success experienced within communities of caring increases confidence or efficacy in teaching skills and student ability to learn" (p. 358).

Student academic success in high-need schools is the underlying goal of the program and can serve to reinforce the teachers' efficacy. The external evaluator asked ATEP novice teachers to self-assess their impact on students' learning. Although teachers reported a greater sense of confidence in their capacity to teach and in their students' ability to learn, their self-reports initially focused on student grades as a measure of learning. Similar trends were found in subsequent years. After 3 or more years in the classroom, teachers attributed their success as "engaging students in instruction," "being able to reach every single one of my students," and "being able to hold students to high expectations." Teachers' initial judgments regarding student success were a reflection of their outcome efficacy beliefs. As teachers gained mastery experiences, follow-up debriefings demonstrated a different sense of their OEB. As Richard indicated,

> the program really puts an emphasis on being culturally efficacious and that is the most important quality you can have working at my school. Being completely honest, working in this school district was a major culture shock. Their values and beliefs are so different from mine. From my previous classes and the workshops . . . I knew the importance of learning about the new culture and trying to understand their differences rather than trying to make them conform to my beliefs.

Table 4
Characteristics of a Caring and Engaging Teacher

	Very much	Somewhat	Not at all	Undecided
I trust my students.	54%	39%	8%	0
My students trust me.	77%	23%	0	0
I am honest with my students.	92%	8%	0	0
My students are honest with me.	54%	46%	0	0
I care that all my students succeed in class.	92%	8%	0	0
My students know that I care for their success.	92%	0	0	8%
My students know that I am a dependable person.	100%	0	0	0

Note. Compiled by Accelerated Teacher Education Program external evaluator.

Ostensibly, the vicarious and mastery experiences of observing master teachers, developing a professional growth plan, participating in online professional development, modeling of teaching practices, and team teaching supported teachers' OEB development. Teachers' personal success and students' reception also promoted their cultural efficaciousness as teachers of ELs.

Discussion

Our mixed methods analyses reveal that program and school-context experiences work in tandem to support mathematics and science teachers' efficacy in working with ELs. Although differences were noted on exit as compared to entry efficacy scores for both the mathematics and science teachers, given the use of two different instruments and the use of self-reported measures, we caution over interpreting the results. Still, qualitative evidence indicates that these secondary mathematics and science teachers are supported through ATEP to become culturally efficacious.

Specifically, for mathematics and science teachers working with ELs, ATEP program sources of efficacy include the cohort model–community of practice; synergistic relationships between teachers, mentors, and school leaders; and the feedback teachers receive on their instructional practices. Although these program structures (e.g., cohort model–community of practice, synergistic relationship between schools and teacher education program) and practices (e.g., mentor and school leader discussion and feedback on teachers' instructional practices) are not necessarily innovative in and of themselves, when viewed as sources of efficacy development for working with ELs, these structures and practices appear to be significant vehicles for supporting mathematics and science teachers' usage of culturally efficacious practices with ELs. Rader-Brown and Howley (2014) found that teachers often defer to strategies recommended for all learners when working with ELs opposed to specific research-based strategies for ELs, which underscores the need for structuring culturally efficacious learning experiences to support teacher development. The commitment to cultural efficacy reflected in the program sources of efficacy is a qualitatively distinctive feature in the ATEP design and played a key role in the culturally efficacious development of mathematics and science teachers in this study.

We expect teachers to be successful with all students, yet often teacher preparation programs do not address populations like ELs; hence there is a lack of preparedness (see Durgunoglu & Hughes, 2010). Thus we posit that there must be intentionality if we are to have successful outcomes. The CEEM exhibits this type of intentionality because the teacher's developmental path is defined, linked to program design, and viewed as an evolutionary process. Akiba (2011) found that three program characteristics are significant for preparing teachers to address diversity: (a) The classroom must function as a learning community, (b) the instructor must model constructivist and culturally responsive teaching, and (c) teachers must have field

experience for understanding diverse students. Similarly, our study's findings reveal that all three of Akiba's program characteristics are associated with ATEP's efficacy sources for teachers developing culturally efficacious practices. For example, the ATEP cohort model offers vicarious and physiological efficacy sources via peer support that foster a community of practice enabling the mathematics and science teachers to examine and recognize unexplored identities and multiple selves and begin acquiring a deeper understanding of cultural knowledge. The design of ATEP utilizing the CEEM to assist faculty with a framework to support teacher development, coupled with the mentors' modeling in schools and field experiences, act as mastery and verbal program sources of efficacy. Interview and focus group data reveal that the mathematics and science teachers are acquiring cultural efficacy by exploring the sociocultural context of the classroom through teaching interactions and observing mentors modeling instruction. Taken as a whole, the program structure and practices provide efficacy sources that nudge the movement of mathematics and science teachers along an evolutionary cycle of developing and actualizing culturally efficacious practices with ELs.

Furthermore, it is important to note that the success of a teacher preparation program is dependent on the reciprocal collaboration between the teacher education program and schools (Flores & Claeys, 2010/2011). The urgency to assess the existing school culture before making a concerted effort to integrate new teachers cannot be understated. A school culture that devalues particular students or embraces a student deficit perspective can be counterproductive for new teachers' creativity, initiative, and efficacy. In this sense, the role of teacher education programs in supporting teachers' efficacy development must also include leading innovation for teachers and school leaders already in schools (Gist, 2014b). Research has suggested that even teachers who have the best teacher preparation are ineffective in unsupportive school contexts (Picower, 2011). Essentially, a collaborative synergy and commitment to improving teacher development are required between school leadership and teacher education leadership. For this to occur, teacher education program leaders must embody and model their cultural efficacy by striving to become transformative guides whose practices impact educational outcomes in schools and communities in meaningful ways.

Desimone, Smith, and Phillips (2007) explored policy influences on mathematics and science teachers' participation in professional development by examining policy attributes (i.e., authority, power, consistency, and stability) and found that stability and authority were the most influential. Therefore culturally efficacious teacher education programs situated to work persuasively with schools and districts over a long period of time may be best suited to discovering ways to create positive long-term impacts on ELs' outcomes. The power of synergistic, reciprocal, and collaborative relationship building between schools and teacher education programs is vital. Authoritative teacher education policies alone cannot ensure the development of effective teachers. However, policies that support the structures and practices that

facilitate collective buy-in and interest of teacher education programs and schools working together over a sustained period of time are needed to better understand the nuances for developing culturally efficacious mathematics and science teachers who will make a difference in ELs' academic outcomes (Battey et al., 2013; Rios-Aguilar, González Canche, & Moll, 2012).

Although many factors affect teachers' success, the most important indicator within our control is the design of teacher preparation. The CEEM undergirds the preparation of culturally efficacious mathematics and science instruction by intentionally and strategically moving novice teachers through an iterative cycle: (a) awakening cultural consciousness, (b) acquiring cultural competence, (c) developing cultural proficiency, (d) actualizing cultural and critical responsivity, and (e) realizing cultural efficacy. On the basis of the study's findings about the design of ATEP structures and practices in general, and the CEEM in particular, several research implications can be drawn. For one, instead of focusing on the entire teacher education program, future teacher education research studies may focus on exploring the impact of one program efficacy source (e.g., culturally efficacious discussion and feedback protocol) on the development of mathematics and science teachers' culturally efficacious work with ELs. Another research design could compare the impact of the different teacher education program sources of efficacy on the development of teachers' culturally efficacious practices to determine areas in which additional resources should be focused or intensified over the course of the program. For example, do some efficacy sources move teachers from awakening to actualizing levels of culturally efficaciousness at a faster rate? Also, investigating the impact of the mathematics and science teachers' culturally efficacious practices on student outcomes is critical for future research. In sum, as researchers and program developers, we must take up the challenge to develop ethical and rigorous methodologies to map the path of impact from teacher education program sources of efficacy to culturally efficacious mathematics and science teachers' influences on ELs' academic achievement.

References

Akiba, M. (2011). Identifying program characteristics for preparing pre-service teachers for diversity. *Teachers College Record, 113*(3), 658–697.

Ashton, P. T., & Webb, R. B. (1986). *Making a difference: Teacher's sense of self-efficacy and student achievement*. New York: Longman.

Bandura, A. (1993). Perceived self-efficacy, cognitive development, and functioning. *Educational Psychologist, 28*, 117–148.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Bandura, A. (2002). Social cognitive theory in cultural context. *Applied Psychology: An International Review, 51*(2), 269–290.

Bartell, T. G. (2011). Caring, race, culture, and power: A research synthesis toward supporting mathematics teachers in caring with awareness. *Journal of Urban Mathematics*

Education, 4(1), 50–74.

Battey, D., Llamas-Flores, S., Burke, M., Guerra, P., Kang, H. J., & Kim, S. H. (2013). ELL policy and mathematics professional development colliding: Placing teacher experimentation within a sociopolitical context. *Teachers College Record, 115*, 1–44.

Brownell, M. T., & Pajares, F. (1999). Teacher efficacy and perceived success in mainstreaming students with learning and behavior problems. *Teacher Education and Special Education, 22*(3), 154–164.

Celedón-Pattichis, S. (2008). What does that mean? Drawing on Latino and Latina students' language and culture to make mathematical meaning. In *Mathematics for every student: Responding to diversity, Grades 6–8* (pp. 59–73). Reston, VA: National Council of Teachers of Mathematics.

Civil, M. (2007). Building on community knowledge: An avenue to equity in mathematics education. In N. S. Nasir & P. Cobb (Eds.), *Improving access to mathematics: Diversity and equity in the classroom* (pp. 105–107). New York: Teachers College Press.

Claeys, L., & Muñoz, H. (2014). Unearthing sacred knowledge: Enlazándonos con la comunidad. In B. B. Flores, O. A. Vásquez, & E. R. Clark (Eds.), *Generating transworld pedagogy: Reimagining la clase mágica* (pp. 67–80). Lanham, MD: Lexington/Rowman & Littlefield.

Clark, E. R., & Flores, B. B. (2005). Creating a just society: Multicultural teacher education and the changing classroom. *Teacher Education and Practice, 18*(3), 315–332.

Clark, E. R., & Flores, B. B. (2014). The metamorphosis of teacher identity: An intersection of ethnic consciousness, self conceptualization, and belief systems. In P. Jenlink (Ed.), *Teacher identity and struggle for recognition: Meeting the challenges of a diverse society* (pp. 3–14). Lanham, MD: Rowman& Littlefield.

Coady, M. R., Harper, C., & de Jong, E. J. (2011). From preservice to practice: Mainstream elementary teacher beliefs of preparation and efficacy with English language learners in the state of Florida. *Bilingual Research Journal, 34*(2), 223–239.

Coady, M. R., Harper, C., & de Jong, E. J. (2015, February 5). Aiming for equity: Preparing mainstream teachers for inclusion or inclusive classrooms? [Online]. *TESOL Quarterly*. doi:10.1002/tesq.223

Collier, M. D. (2005). An ethic of caring: The fuel for high teacher efficacy. *The Urban Review, 27*(4), 351–359. doi:10.1007/s11256-005-0012-4

Cone, N. (2009). Preservice elementary teachers' self-efficacy beliefs about equitable science teaching: Does service learning make a difference? *Journal of Elementary Science Education, 21*, 25–34.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches*. 2nd ed. Thousand Oaks, CA: Sage.

Darder, A. (2011a). *A dissident voice: Essays on culture, pedagogy, and power counterpoints: studies in the postmodern theory of education*. New York: Peter Lang.

Darder, A. (2011b). *Culture and power in the classroom: A critical foundation for the education of bicultural students*. Boulder, CO: Paradigm Press.

Darling-Hammond, L. (2006). Assessing teacher education: The usefulness of multiple measures for assessing program outcomes. *Journal of Teacher Education, 57*(2), 210–138.

Desimone, L. M., Smith, T. S., & Phillips, K. J. R. (2007). Does policy influence mathematics and science teachers' participation in professional development? *Teachers College Record, 109*(5), 1086–1122.

Durgunoglu, A. Y., & Hughes, T. (2010). How prepared are the U.S. preservice teachers to

teach English language learners? *International Journal of Teaching and Learning in Higher Education, 22*(1), 32–41.

Flores, B. B., & Claeys, L. (2010/2011). Academy for Teacher Excellence: Maximizing synergy among partners for promoting college access for Latino teacher candidates. *The Urban Review, 43*(3), 321–338.

Flores, B. B., & Clark, E. R. (2004). A critical examination of Normalistas self-conceptualization and teacher efficacy. *Hispanic Journal of Behavioral Sciences, 26*(2), 230–257.

Flores, B. B., Clark, E. R., Claeys, L., & Villarreal, A. (2007). Academy for Teacher Excellence: Recruiting, preparing, and retaining Latino teachers though learning communities. *Teacher Education Quarterly, 34*(4), 53–69.

Flores, B. B., Clark, E. R., Guerra, N., & Sánchez, S. (2008). Acculturation among Latino bilingual education teacher candidates: Implications for teacher preparation institutions. *Journal of Latinos and Education, 7*(4), 288–304.

Flores, B. B., Desjean-Perrotta, B., & Steinmetz, L. E. (2004). Teacher efficacy: A comparative study of university and alternatively certified teachers. *ACTION in Teacher Education, 26*(2), 27–46.

Flores, B. B., Ek, L., & Sánchez, P. (2011). Bilingual education candidate ideology: Descubriendo sus motives y creencias. In B. B. Flores, R. H. Sheets, & E. R Clark (Eds.), *Teacher preparation for bilingual student populations: Educar para transformar* (pp. 40–58). New York: Routledge.

Flores, B. B., Hernández, A., García, C. T., & Claeys, L. (2011). Teacher Academy learning community's induction support: Guiding teachers through their zone of professional development. *Journal of Mentoring and Tutoring: Partnership in Learning, 19*(3), 365–389. doi:10.1080/13611267.2011.597124

Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice*. New York: Teachers College Press.

Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice*. New York: Teachers College Press.

Gist, C. D. (2014a). A culturally responsive counter-narrative of effective teaching. *Cultural Studies of Science Education, 9*(4), 1009–1014.

Gist, C. D. (2014b). *Preparing teachers of color to teach: Culturally responsive teacher education in theory and practice*. New York: Palgrave Macmillan.

Gist, C., Flores, B. B., & Claeys, L. (2014). A Competing Theory of Change: Critical Teacher Development. In C. Sleeter, L. V. Neal, & K. Kumashiro (Eds.), *Addressing the demographic imperative: Recruiting, preparing, and retaining a diverse and highly effective teaching force* (pp. 19–31). New York: Routledge.

Hoy, W. K., Goddard, R. D., & Sweetland, S. R. (2000). Academic emphasis of urban elementary schools and student achievement in reading and mathematics: A multilevel analysis. *Educational Administration Quarterly, 36*(5), 683–702.

Karabiyik, B., & Korumaz, M. (2013). Relationship between teachers' self-efficacy perceptions and job satisfaction level. *Procedia–Social and Behavioral Sciences, 116*(2014), 826–830.

Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African American children*. San Francisco: Jossey-Bass.

Lewis, J. L., Ream, R. K., Bocian, K. M., Cardullo, R. A., Hammond, K. A., & Fast, L. A. (2012). Con cariño: Teacher caring, math self-efficacy, and math achievement among

Hispanic English learners. *Teachers College Record, 114*, 1–42.

Lin, H. L., Gorrell, J., & Taylor, J. (2002). Influence of culture and education on U.S. and Taiwan pre-service teachers' efficacy beliefs. *Journal of Educational Research, 96*(1), 37–46.

Lucas, T., & Villegas, A. M. (2013). Preparing linguistically responsive teachers: Laying the foundation in preservice teacher education. *Theory Into Practice, 52*(2), 98–109.

McKinnon, M., Moussa-Inaty, J., & Barza, L. (2014). Science teaching self-efficacy of culturally foreign teachers: A baseline study in Abu Dhabi. *International Journal of Educational Research, 66*, 78–89. doi:10.1016/j.ijer.2014.03.001

Moseley, C., Bilica, K., Wanless, A., & Gdovin, R. (2014). Exploring the relationship between teaching efficacy and cultural efficacy of novice science teachers in high-needs schools. *School Science and Mathematics Journal, 114*(7), 315–325.

Moseley, C., & Utley, J. (2006). The effect of an integrated science and mathematics content-based course on science and mathematics teaching efficacy of pre-service elementary teachers. *Journal of Elementary Science Education, 18*, 1–12.

Murugaiah, P., Azman, H., Thang, S. M., & Krish, P. (2012). Teacher learning via communities of practice: A Malaysian case study. *International Journal of Pedagogies & Learning, 7*(2), 162–174.

National Association for Research in Science Teaching. (2014). *Equity position statement*. Retrieved from https://narst.org/ngsspapers/equity.cfm

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Retrieved from http://standards.nctm.org/document/index.htm

National Science Teachers Association. (1996). *National science standards*. Retrieved from http://www.nsta.org/publications/nses.aspx

Nieto, S. (2004). *Affirming diversity: The sociopolitical context of multicultural education*. New York: Pearson Learning.

Nika, S. D. (2014). Teacher professional development: Trends, prospects and restrictions. *European Journal of Social Behaviour, 1*(1), 5–9.

Noddings, N. (2012). The caring relation in teaching. *Oxford Review of Education, 38*(6), 771–781.

Onwuegbuzie, A., & Teddlie, C. (2002). A framework for analyzing data in mixed methods research. In *Handbook of mixed methods in social and behavioral research* (pp. 351–383). Thousand Oaks, CA: Sage.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66*, 543–578.

Pajares, F. (1997). Current directions in self-efficacy research. *Advances in Motivation and Achievement, 10*, 1–49.

Picower, B. (2011). Resisting compliance: Learning to teach for social justice in a neoliberal context. *Teachers College Record, 113*(5), 1105–1134.

Rader-Brown, L., & Howley, A. (2014). Predictors of the instructional strategies that elementary school teachers use with English language learners. *Teachers College Record, 116*, 1–34.

Reeves, J. (2006). Secondary teacher attitudes toward including English-language learners in mainstream classrooms. *Journal of Educational Research, 99*(3), 130–142.

Riggs, L., & Enochs, L. (1990). Towards the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education, 74*, 625–637.

Rios-Aguilar, C., González Canche, M. S., & Moll, L. C. (2012). A study of Arizona's teach-

ers of English language learners. *Teachers College Record, 114*, 1–33.

Ritter, J. M., Boone, W. J., & Rubba, P. A. (2001). Development of an instrument to assess prospective elementary teacher self-efficacy beliefs about equitable science teaching and learning (SEBEST). *Journal of Science Teacher Education, 12*(3), 175–198.

Rodriguez, A. J. (2005). Teachers' resistance to pedagogical and ideological change: Definitions, theoretical framework, and significance. In A. J. Rodriguez & R. S. Kitchen (Eds.), *Preparing mathematics and science teachers for diverse classrooms: Promising strategies for transformative pedagogy* (pp. 1–30). New York: Routledge.

Salazar, M. C. (2013). A humanizing pedagogy: Reinventing the principles and practice of education as a journey toward liberation. *Review of Research in Education, 37*(1), 121–148.

Sheets, R. (2005). *Diversity pedagogy: Examining the role of culture in the teaching–learning process*. Boston, MA: Pearson.

Siwatu, K. O. (2007). Preservice teachers' culturally responsive teaching self-efficacy and outcome expectancy beliefs. *Teaching and Teacher Education, 23*, 1085–1101.

Sleeter, C., Neal, L. V., & Kumashiro, K. (2014). *Addressing the demographic imperative: Recruiting, preparing, and retaining a diverse and highly effective teaching force*. New York: Routledge.

Swackhamer, L. E., Koellner, K., Basile, C., & Kimbrough, D. (2009). Increasing the self-efficacy of inservice teachers through content knowledge. *Teacher Education Quarterly, 36*, 63–78.

Swars, S. L. (2005). Examining perceptions of mathematics teaching effectiveness among elementary preservice teachers with differing levels of mathematics teacher efficacy. *Journal of Instructional Psychology, 32*, 139–147.

Takahashi, A. (2011). Co-constructing efficacy: A "communities of practice" perspective on teachers' efficacy beliefs. *Teaching and Teacher Education, 27*, 732–741.

Téllez, K., & Waxman, H. C. (2006). Preparing quality teachers for English language learners: A critical overview of critical issues. In K. Téllez & H. C. Waxman (Eds.), *Improving educator quality for English language learners: Research, policies, and practices* (pp. 1–22). Mahwah, NJ: Lawrence Erlbaum Associates.

Texas Education Agency. (2014). *Academic excellence indicator system 2012–2013*. Retrieved from http://ritter.tea.state.tx.us/perfreport/tapr/2013/index.html

Tillman, D. A., An, S. A., & Boren, R. L. (2013). Hispanic female pre-service elementary teachers' mathematics teaching self-efficacies, attitudes, and student outcome expectations. *Journal of Mathematics Education, 6*(2), 27–47.

Tschannen-Moran, M., & Woolfolk Hoy, A. E. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education, 17*, 783–805.

Tschannen-Moran, M., & Woolfolk Hoy, A. E. (2007). The differential antecedents of self-efficacy beliefs of novice and experienced teachers. *Teaching and Teacher Education, 23*(6), 944–956.

Turkan, S., De Oliveira, L. C., Lee, O., & Phelps, G. (2014). Proposing a knowledge base for teaching academic content to English language learners: Disciplinary linguistic knowledge. *Teachers College Record, 116*(3), 1–30.

Villegas, A. M., & Lucas, T. (2002). *Educating culturally responsive teachers*. New York: State University of New York Press.

Wagler, R. (2011). Out in the field: Assessing the impact of vicarious experiences on pre-

service elementary science teaching efficacy. *Electronic Journal of Science Education, 15*(2), Article 7336. Retrieved from http://ejse.southwestern.edu/article/view/7336

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge, UK: Cambridge University Press.

Wenner, G. (2001). Science and mathematics efficacy beliefs held by prospective versus practicing teachers: A five year prospective. *Journal of Science Education and Technology, 10*, 181–187.

Woolfolk, A. E., & Hoy, W. K. (1990). Prospective teachers' sense of efficacy and beliefs about control. *Journal of Educational Psychology, 82*(1), 81–91.

Woolfolk Hoy, A., & Spero, R. B. (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teaching and Teacher Education, 21*, 343–356.

Yoon, B. (2008). Uninvited guests: The influence of teachers' roles and pedagogies on the positioning of English language learners in the regular classroom. *American Educational Research Journal, 45*, 495–522.

Zapata, M. (2013). Substantiating the need to apply a sociocultural lens to the preparation of teachers in an effort to achieve science reform. *Cultural Studies of Science Education, 8*, 777–801. doi:10.1007/s11422-013-9513-8

Zeichner, K. M. (2003). The adequacies and inadequacies of three current strategies to recruit, prepare, and retain the best teachers for all students. *Teachers College Record, 105*(3), 490–519.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology, 25*(1), 82–82.

Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal, 29*(3), 663–676.