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Integrating a Focus on Academic Language, English Learners, and Mathematics: Teacher Candidates' Responses on the Performance Assessment for California Teachers (PACT)

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Throughout the United States, teacher educators are developing new strategies to improve the preparation of mainstream teachers for linguistic diversity. In this article, we explore teacher candidates' responses to the Performance Assessment for California Teachers (PACT), a preservice assessment required for credentialing that requires candidates to consider the English language demands of content-area instruction, to enact supports for English learners and others who may struggle with those demands, and to develop ways to promote the academic language development of these students. We report on a study examining written responses on the PACT from 8 elementary teacher candidates who chose mathematics as the focus for their teaching event. We found that the PACT induced teacher candidates to consider language issues and the needs of language learners in a content area often thought to be language-free, yet one in which language in fact plays a crucial role. Such responses provide important information that can be used not only for credentialing decisions but also by teacher educators, teacher-education programs, and teacher candidates themselves in supporting the academic-language development of ELs in content areas such as mathematics.

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INTRODUCTION

As linguistic diversity increases throughout the United States, so does the need for *all* K–12 teachers to be prepared to teach students from immigrant and language minority backgrounds. Such preparation has long been a concern in California, the focus of our research, where over 37% (2.3 million) of all students come from homes where English is not the dominant language, and the state's 1.4 million English learners (ELs) represent 23% of the entire school-aged population (California Department of Education, 2011). Recently, many other states, including those in the South and Midwest, have experienced rapid growth in the number of students from immigrant and language minority backgrounds.¹

Yet, nationwide, a majority of teachers with ELs in their classrooms have not received special preservice or in-service training in either second language development or pedagogical strategies for working with students learning English (Lucas, 2011). Furthermore, while most teacher-education programs now include some focus on ELs, only a small subset of teacher-education programs require courses dedicated to these students or require fieldwork experiences with them (U.S. General Accounting Office, 2009). Only a tiny fraction of teachers teaching ELs have a university degree in Teaching English as a Second Language (TESOL) or bilingual education (Christian, 2006), and even in schools where such specialists exist, mainstream teachers provide a greater proportion of instructional time (Evans, Arnot-Hopffer, & Jurich, 2005). Yet, even in states such as California, one of the few that makes instructional knowledge relevant to the teaching of ELs mandatory for all credential earners (Echevarría, Vogt, & Short, 2010),² teachers have historically felt underprepared to meet the needs of ELs in their classrooms (Gándara & Maxwell-Jolly, 2006; Gándara, Maxwell-Jolly, & Driscoll, 2005).

In an effort to contribute to discussions throughout the United States regarding the preparation of mainstream teachers for linguistic diversity (e.g., Bunch, 2010, 2013; Fillmore & Snow, 2002; Lucas, Villegas, & Freedson-Gonzalez, 2008; Valdés, Bunch, Snow, & Lee, 2005), we explore recent efforts in California to require a focus on language issues in general and ELs in particular on the Performance Assessment for California Teachers (PACT). The PACT, in the pilot phase during the time we conducted our research, was

¹For example, the number of ELs in South Carolina's public schools increased from 2,000 in 1995 to 16,000 in 2005. Kentucky saw a 417% increase over the same 10-year period. North Carolina's EL population grew 370% to over 70,000 ELs (Payán & Nettles, 2008).

²One of California's 13 Teaching Performance Expectations (TPE) is directed solely to teaching of English learners, requiring that "Candidates for a Teaching Credential know and can apply theories, principles, and instructional practices for English Language Development leading to comprehensive literacy in English" (California Commission on Teacher Credentialing, 2013, p. 14).

later approved as one means by which teacher candidates can demonstrate mastery of the state's Teacher Performance Expectations (TPE) required for a teaching credential (Merino & Pecheone, 2013). Unlike traditional "paper and pencil" tests of teacher competency, the PACT requires candidates to compile a "Teaching Event" consisting of a video clip of their own teaching, lesson plan documentation, samples of student work, and written description and analysis of typically around 10,000 words. The available evidence suggests that the PACT is psychometrically sound and at least adequate for distinguishing between those candidates who should receive a license and those who should not (Duckor, Castellano, Téllez, & Wilson, 2013). In fact, a new nationwide performance assessment, the edTPA (see <http://edtpa.aacte.org/>) extends PACT's general structure and focus for use across a range of states' licensing standards.

The PACT was, to our knowledge, the first preservice performance evaluation in the country required for licensure that set out to measure teacher candidates' knowledge and skills in areas such as academic language, language demands, and teaching ELs. Through four evaluation components (planning, instruction, assessment, and reflection), the PACT requires candidates to respond to prompts and evaluation rubrics designed to focus specific attention on academic language, language demands of content-area instruction, and the needs of ELs and other students for whom the language of instruction might be challenging.³

For elementary teacher candidates choosing to focus their Teaching Events on mathematics,⁴ the PACT requires a focus on issues related to language and language learners in a content area often considered to be language-free, yet one where language in fact plays a crucial role (Dale & Cuevas, 1987; Gutiérrez, 2002; Khisty, 1995, 2001; Khisty & Chval, 2002; Moschkovich, 2002, 2007a, 2007b, 2010; Pimm, 1987; Schleppegrell, 2010). Teacher candidates' ability to demonstrate knowledge and skills related to the integration of language and mathematics is particularly important given the persistent underachievement in mathematical performance among ELs and urgent calls at the state and national levels to address these disparities (Abedi & Gándara, 2006; Office of Public Instruction for the State of Washington, 2008; Ortiz-Franco & Flores, 2001; Tate & Rousseau, 2007). Beyond the scores on the examinations themselves, requiring such a focus on a high-stakes teacher performance assessment has the potential to inform and augment efforts of teacher-education faculty and programs to consider the needs of ELs when preparing teachers for delivering instruction

³For more information on the PACT's structure and requirements, see Merino and Pecheone (2013).

⁴In some teacher-education programs, individual candidates can choose to focus their Teaching Event on either English/language arts or mathematics. Programs also have the option of choosing one of the two foci for an entire cohort.

in mathematics and other content areas (Bunch, Aguirre, & Téllez, 2009; see also Bunch, 2010; Grossman, Schoenfeld, & Lee, 2005; Valdés et al., 2005).

As educational researchers and teacher educators, we have played various roles in efforts to integrate a focus on ELs, academic language, and mathematics into the PACT. Collectively or individually, we have contributed to the development of the academic-language rubrics, have participated in efforts to assist teacher educators in preparing their candidates for this portion of the assessment, have trained scorers for evaluating the PACT and have taught preservice teacher-education courses to students preparing for the PACT. In this article, after describing state requirements for the preparation of mainstream teachers for ELs, we describe the PACT's approach to integrating a focus on academic language, English learners, and mathematics. We then highlight findings from an analysis of written responses of 8 preservice elementary teacher candidates as they responded to PACT prompts asking them to integrate an understanding of the role of academic language for ELs and other students during mathematics lessons. The findings illustrate the potential of preservice performance assessments to create a forum for candidates to consider language issues relevant to designing effective mathematics instruction for ELs. We conclude by arguing that, beyond their gatekeeping function for licensing, such assessments have the potential to play other important roles, including as sources of formative assessment useful for candidates, teacher-education faculty, and preparation programs as they work toward improving the preparation of teachers for working with linguistically diverse students.

PACT: INTEGRATING A FOCUS ON LANGUAGE AND ENGLISH LEARNERS

How best to assess preservice teachers' knowledge and skills cannot be considered apart from larger debates surrounding the most effective ways to prepare teachers for working with linguistically diverse populations (Bunch, 2010, 2013; Téllez & Waxman, 2006). Fillmore and Snow (2005) suggest that teacher-education programs include designated courses on the educational applications of contrastive linguistics, first language acquisition, second language acquisition, and other areas of educational linguistics. However, teacher educators have argued against adding more courses to preservice teacher-education programs, especially given the legislative demands to shorten or even eliminate preservice programs (Baca & Escamilla, 2002; Levine, 2006; Richardson, 2002; Tom, 1997). Moreover, research on teacher development suggests that adding content in teacher-education coursework without providing the opportunity to practice instructional strategies in genuine teaching settings rarely enhances or even alters preservice teachers' knowledge and skills (Knowles & Holt-Reynolds, 1991). Alternatively, Valdés

et al. (2005) call for an integrated approach that infuses an explicit focus on language and linguistics, including the preparation of teachers for working with linguistically diverse students, throughout teacher-education programs (see also Bunch, 2010).

Consistent with research supporting the integration of language and content as a means to facilitating the development of both areas (Bunch, 2006; Bunch, Abram, Lotan, & Valdes, 2001; Bunch, Lotan, Valdés, & Cohen, 2005; Schleppegrell, Achugar, & Oteiza, 2004; Valdés et al., 2005), the PACT recognizes the need to merge teacher candidates' understanding of and engagement with academic language, content learning, and second-language development. Specifically, the PACT requires candidates to focus on an EL as one of their three focal students.⁵ Prompts throughout the PACT ask candidates to discuss ELs, the language demands of instruction and assessment, and academic language. In fact, every task area in the PACT (Planning, Instruction, Assessment, and Reflection) includes prompts about language and language learners. As shown in the following examples from the PACT prompts used statewide during the time of our research (2004–2006), candidates were prompted to focus specifically on language demands, academic language, and language development:

1. How do key tasks in your plan build on each other to support student learning of the curriculum content and the development of academic language related to that content?
2. When you consider content learning of your students and the development of their academic language, what do you think explains the learning or differences in learning that you observed during the learning segment?
3. Describe any language supports used to help your students (including English learners as well as other students struggling with language) understand the content/or academic language central to the lesson.

Conceptualizing and Operationalizing “Academic Language”

The PACT assesses candidates' knowledge and skills using two Academic Language rubrics, one measuring their ability to articulate the language demands of the lesson and one measuring their efforts to promote students' development of academic language while providing students access to core curricular content (see Appendix).⁶ The Academic Language and Language Demands rubrics are unique from the other PACT rubrics in that they are designed to assess teachers' work across the entire Teaching Event.

⁵If candidates do not have ELs in their classrooms, they are instructed to “select a student who is challenged by academic English” (PACT Consortium, 2004a, p. 14).

⁶The Appendix presents the Academic Language rubrics as used during the time of our study (2004–2006). For the rubrics currently in use, see <http://pactpa.org>.

The PACT's approach to academic language and language demands was developed in the midst of widespread discussion and debate among both scholars and practitioners concerning the nature of academic language, the most effective means of promoting its development in the classroom, and how teachers should be prepared for supporting students' acquisition of it (see Adger, Snow, & Christian, 2002; Bailey, 2007; Bunch, 2006, 2010; Garcia, 2002; Solomon & Rhodes, 1995; Valdés, 2004). Many teacher educators and educational researchers have emphasized the distinction between decontextualized "cognitively academic language proficiency" (CALP) and less cognitively demanding "conversational" and "basic interpersonal communication skills" (BICS) (Cummins, 1984, 2000). However, this distinction has been criticized for ignoring the social context that all language use entails and the privileged status of language associated with the dominant middle class (see Bartolomé, 1998; Cummins, 2000; MacSwan & Rolstad, 2003; Rivera, 1984). Bunch (2006, 2014) has demonstrated that the "language of ideas" students use when grappling with classroom concepts often varies from the "language of display" expected for oral and written presentation of those ideas, but that both are necessary to engage substantively with academic work in classroom settings.

Other scholars and practitioners have focused on the vocabulary demands of academic settings (see Bailey, 2007; Nation, 2001). While this approach can be helpful for articulating an important aspect of the academic-language demands facing English learners, focusing solely on academic language as a discrete set of vocabulary terms can limit teachers' understandings of what their students are capable of doing in academic settings and possibly even compromise the authenticity of the content and language to which students are exposed (Bruna, Vann, & Perales Escudero, 2007). Furthermore, a focus on academic vocabulary alone ignores the fact that meaning is constructed, for both academic and other purposes, in units larger than words (Halliday, 1994; Halliday & Hasan, 1976).

At the time of our study, the PACT development team had chosen to require teacher candidates to move beyond a focus on BICS and CALP or academic vocabulary alone. Instead, candidates were expected to describe the broader language demands of the curriculum and instruction their students were expected to navigate, as well as to articulate how their students were able to demonstrate what they know and can do using students' developing linguistic resources (Valdés et al., 2005). This perspective was influenced by sociocultural and sociolinguistic approaches focusing on the functions of language in particular academic settings and social contexts, and how language is used in those contexts (Gutiérrez, 1995; Halliday, 1994; Hawkins, 2004; Johns, 2002; Schleppegrell, 2004; Schleppegrell & Colombi, 2002; Unsworth, 2000). From these perspectives, students engage in a wide variety of oral and written text types in school to learn and demonstrate what they know and can do. In turn, teachers' conceptions of academic language must go beyond vocabulary lists and "transition words" to include a focus

on more fundamental roles of language. These include students' engagement in classroom tasks, must express what they are learning and must develop expanding linguistic repertoires for communicating with different audiences for different purposes (Bunch, 2009, 2010; Hawkins, 2004).

While teacher-education programs participating in the PACT were free to develop their own approaches to preparing teachers for academic language, the PACT prompts and rubrics focused on candidates' ability to address language demands and academic language as related to their own instruction and their own students' learning. During the time of our research, academic language was described in the PACT handbook as "the language needed by students to do work in schools" (Sato & Curis, 2005, p. 21). In order for a candidate's score on the "understanding language demands" portion of the rubric to merit a 3 or higher (see Appendix), the candidate needed to identify "language demands of the learning tasks and assessments that *go beyond vocabulary* to include specific text types or other language demands that are challenging for individual students or groups of students" (PACT Consortium, 2004b; emphasis added). The rubric noted that "text types can be oral (e.g., presentations of problem solutions, descriptions of mathematical reasoning, partner or group discussions) and/or written (e.g., diagrams, graphs, or charts; equations)," and that other language demands could include "a teacher's oral presentation of information, responding to a question in class, listening to or reading directions, or sharing information orally with a partner" (PACT Consortium, 2004b).

Language, ELs, and Mathematics

Teacher preparation has often ignored the language demands required for ELs' success in mathematics (Aguirre, 2009; Campbell, Adams, & Davis, 2007; Grossman et al., 2005). Yet, research has shown that language plays a key and complex role in mathematics understanding and communication (Forman, 1996, 2003; Lampert & Cobb, 2003; Moschkovich, 2010; Pimm, 1987, Schleppegrell, 2010; Spanos, Rhodes, Dale, & Crandall, 1988). Spanos et al. describe the complex language demands of mathematics, including syntactic features (uses of comparatives such as greater than, less than), semantic features (technical vocabulary like coefficient; everyday words with specific math meanings such as square, power; synonymous words such as plus, add, combine), and symbolic notation (e.g., Σ , π , $>$). These features are important components of the mathematical register, comprised of a set of meanings, words, and structures appropriate to the practice of mathematics (Kelly & Bazerman, 2003; Moschkovich, 2000; Pimm, 1987). It is important to keep in mind that the linguistic demands of mathematics teaching and learning are integrally related to the mathematics itself. As Barwell (2005) points out, "It is not enough . . . to analyze the language of mathematics or to import a general theory of language learning into mathematics teaching" (p. 147).

The complexity of language and mathematics intensifies when a student must communicate mathematical understanding in a language other than that used at home. Yet, research has shown that ELs can demonstrate their understanding of mathematics if conceptions of language are broadened beyond focusing on vocabulary proficiency and the mathematical register (Moschkovich, 2002, 2007a, 2007c). For example, Moschkovich (2002) argues that if evidence of mathematical understanding only focuses on language as explicit vocabulary usage, then other forms of language and thus understanding may be missed. Students bring linguistic resources that help them make sense of the mathematics, including those expressed in their first language as well as nonverbal communication through representations (e.g., gestures, pictures, graphs, and tables).

Successful mathematics teachers of ELs understand the complexity of language and its role in mathematics learning, while providing opportunities for students to hear and use language as a means to negotiate linguistic and conceptual meaning, both in English and students' home languages. The opportunities are especially important when ELs are asked to comprehend and solve word problems, as well as sometimes to write their own (Gutiérrez, 2002; Khisty, 1997, 2001; Khisty & Chval, 2002; Khisty & Viego, 1999; Turner, Celedón-Pattichis, Marshall, & Tennison, 2009). Although research has explored the connections between language and mathematics learning in the practice of experienced teachers (Anhalt & Ondrus, 2007, 2011; Khisty & Chval, 2002; Musanti, Celedón-Pattichis, & Marshall, 2009; Turner, Celedón-Pattichis, & Marshall, 2008), less is known about how to cultivate such knowledge among preservice teachers (Campbell et al., 2007). Our research examined the potential of assessments such as the PACT for eliciting preservice teachers' discussion of the relationship between language and mathematics and how these candidates incorporated their understandings into their own classroom practice to support ELs.

HOW TEACHER CANDIDATES RESPONDED TO PACT PROMPTS

In order to examine the potential of the PACT to induce a focus on academic language and ELs, we explored Teaching Events for 8 elementary teacher candidates focusing on mathematics. The selected candidates, each of whom completed the PACT in either 2005 or 2006, were enrolled in different teacher-education programs throughout the state and were student teaching in K–5 classrooms with at least 50% ELs. The majority of students in most of these preservice teachers' classrooms were identified as Latino, with Spanish being the predominant primary language of the ELs (see Table 1).⁷

⁷We selected the candidates from a larger corpus of Teaching Events collected by the PACT administrative office for benchmarking, revisions of rubrics, and the training of scorers. Beginning with a sample representing a range of overall scores, geographical locations,

TABLE 1. Teacher Candidates, Grade Level, Percentage of Students Classified as ELs, and Primary Languages Spoken

Candidate (pseudonym)	Grade level	Percent of students in class designated as ELs	Primary languages spoken
Angela	Kindergarten-1st combination	90%	Spanish (100% of ELs)
Belinda	2nd	75%	Spanish (100% of ELs)
Christine	Kindergarten	78%	Spanish (93% of ELs); Chinese (7% of ELs)
Denise	1st	74%	Spanish (percent unknown); Others (percent unknown)
Elizabeth	3rd	98%	Spanish (percent unknown); Others (percent unknown)
Fiona	2nd	50%	Spanish (percent unknown)
Grace	5th	78%	Spanish (percent unknown); Tongan (percent unknown); Cambodian (percent unknown)
Holly	3rd	60%	Spanish (percent unknown); Arabic (percent unknown); Korean (percent unknown); Vietnamese (percent unknown)

Note. Candidates were required to note the percent of students in their classrooms who were classified as ELs and the primary language of those students, not the percent of ELs speaking each primary language spoken. Some candidates chose to include these data while others did not.

We analyzed candidates' written work associated with the Teaching Events on three levels (Miles & Huberman, 1994). First, we documented every instance of candidates' use of the term *academic language*, developing preliminary codes and compiling separate charts for each candidate's Teaching Event. Because teachers do not always use this term when discussing the role of language in the education of ELs, our second and more comprehensive analysis focused on analyzing each Teaching Event for candidates' discussions of language, language learners, and the teaching and learning of mathematics, whether or not they explicitly referred to academic language. We refined our previous coding and identified additional emergent categories (Strauss, 1987). For the third level, we conducted cross-case comparisons using the data generated during the first two rounds. During each step, at least two researchers independently conducted analyses for each Teaching Event and came together to check for consistency, to refine codes, and to discuss emerging findings.

and teacher-preparation-program approaches toward academic language, we selected the 8 candidates who taught in courses with the highest numbers of ELs. Candidates' names and teacher-education programs remained anonymous to us.

The emergent and sometimes overlapping themes suggest that the PACT induced a wide variety of comments that articulated different levels of understanding about language and mathematics instruction for ELs. In addition to candidates' written comments explicitly related to academic language, the candidates also discussed the role of language in mathematical learning and teaching, language demands, the role of students' native (non-English) languages, teaching supports, teaching challenges, and family/community connections. Elsewhere, we have explored how the PACT provided a forum for examining how these 8 teacher candidates articulated the language-related challenges associated with teaching and learning mathematics in linguistically diverse classrooms, as well as the supports they used in the classroom during their Teaching Event (Bunch, Aguirre, & Téllez, 2009). Here, we focus specifically on teachers' understandings of academic language and its relationship to mathematics teaching.⁸

Academic Language

The 8 teacher candidates ranged widely in the number of times they referred to academic language, as well as in their apparent conception of the term. Far surpassing any of the other candidates in terms of the number of times she used the term was Christine, who made 37 references to academic language throughout her Teaching Event materials. Grace used the term 13 times; Belinda used the term 8 times; and Holly and Denise each used the term 6 times. Three candidates, Angela, Elizabeth, and Fiona, did not use the term at all, even when responding to the prompts that asked them to explicitly address the concept. The lack of any mention of the term by 3 of the 8 candidates was surprising, given the emphasis on academic language in both the prompts and rubric. However, as will be discussed, these 3 candidates did address issues of language in other ways in their written work on the PACT, suggesting that the academic-language prompts may have stimulated reflection on language issues even if candidates did not use the term itself.

Academic language as vocabulary. When discussing academic language per se, candidates predominantly discussed vocabulary. Although we

⁸Our primary goal was to document the range of ways teacher candidates responded to the PACT's prompts requiring them to discuss language demands, academic language, and ELs in relation to mathematics teaching and learning. Therefore, a number of other questions were beyond the scope of the study, including how teachers' written work compared with our own judgment about the qualities or characteristics of their teaching as demonstrated on the video segments, whether candidates' official PACT scores (which we did not have access to in the first place) were consistent with our interpretations of the quality of their work, and the relationship between candidates' articulation of issues related to academic language and ELs on the PACT and the content or quality of the instruction they received in these areas in their teacher-education programs.

were aware of the growing popularity of the “academic language as vocabulary” approach among some teacher educators, we were surprised by the dominance of this perspective in the PACT Teaching Events. As described above, the two academic-language rubrics were designed in part to get candidates to move *beyond* a conception of academic language as vocabulary alone. However, upon closer analysis of the candidates’ discussions of vocabulary, we found a wide variety of ways in which candidates expressed the nature of the vocabulary demands of their lessons and the implications of those demands for the teaching and learning of mathematics. This finding challenged what we realized was our own overly simplistic view of the limitations of the “academic language as vocabulary” stance. In fact, as we will explore later, it was through the teacher candidates’ discussions of vocabulary that some offered compelling comments regarding the relationship between language and mathematics learning and teaching.

Although candidates at times simply listed the words that they believed ELs would not know, many of their discussions went well beyond such lists. For example, Belinda’s comments on vocabulary demonstrate this range of perspectives. At times, Belinda took a somewhat traditional stance on the need for students to know particular words in order to participate in her lesson on measurement:

The academic language presented may be terms that the students have not heard before. By discussing these new words in detail as they are presented, I hope to guarantee that the students are not confused by the vocabulary. (Planning Commentary, p. 25)

Belinda also offered vocabulary support strategies, such as word walls, with each word translated into Spanish with an accompanying picture. She highlighted the fact that some words have “double meanings . . . depending on the context” (p. 25). For example, regarding the word *foot*, Belinda stated that she “will need to make it clear to students that this measurement does not hold the same meaning as a foot that is attached to our leg” (p. 25). However, Belinda also demonstrated the awareness that addressing academic language not only requires teaching students unfamiliar words or homonyms but also involves focusing on how words are most effectively used for particular mathematical purposes:

I found myself saying “smaller than,” rather than “less than”. It is important that I model the use of the academic language so that the students will become familiar with all the terms and use them.” (Analyzing and Reflecting Commentary, p. 47)

Belinda’s discussion of vocabulary, however, went beyond what students do *not* know. She also emphasized the need for teachers to start with students’

own experiences and ways of speaking and to build upon those experiences in math lessons. This is evident as Belinda discussed the introduction to one lesson on perimeter:

I asked them if we were to go outside and take a walk around the playground, how would I know how far they all walked? They told me that they would “add it all up,” which we renamed as *calculating the perimeter*. (Implementing Instruction Commentary, p. 29, emphasis added)

In this example, Belinda was clearly interested in students’ understanding of the mathematical expression “calculating the perimeter.” Importantly, however, she did not view students’ understanding of the phrase as a prerequisite for understanding the *concept* of perimeter, writing that “none of the students had heard the word perimeter before, but they understood quickly what the word meant” (p. 49). Belinda made it clear that students already understood the concept of perimeter in their suggestion to “add it all up,” and that her role in this case was to model the mathematical terms for the concept. Thus, Belinda asserted the importance of vocabulary development, while simultaneously assuring that her understanding of students’ mathematical understanding was not eclipsed by students’ use of more “everyday” language.

Belinda was not the only candidate whose descriptions of vocabulary moved beyond simplistic notions of lists of words that students were lacking. Christine, the candidate whose Teaching Event featured the most uses of the term academic language, linked her vision of vocabulary as tools that can be used to facilitate particular mathematical procedures and understandings:

Each day students will be taught the necessary vocabulary and have a multitude of opportunities to learn the meaning behind the vocabulary, practice the vocabulary and learn how to apply the principles behind the vocabulary . . . [*more than, less than, and equal to*] . . . This information is important for students to learn because not only is it providing the academic language for them to use when comparing in any context, it is also providing them with a deeper understanding of number relationships. (Planning Commentary, p. 94)

In this example, Christine discussed the “principles behind the vocabulary,” signaling her understanding that a focus on vocabulary should be integrally related to mathematical concepts, in this case for “comparing in any context” and for “a deeper understanding of number relationships.”

Avoiding “academic language.” It was evident that the 3 candidates who did *not* use the term academic language held widely different views from each other concerning the role of language in mathematics. On one end

of the spectrum, Fiona explained her belief that the language demands of mathematics are minimal because “math deals with numbers,” a comment we will discuss later. On the other end of the spectrum, Elizabeth, in discussing her lesson plans, emphasized the importance of drawing student attention to vocabulary and using specific mathematical terms and definitions. According to Elizabeth, it was important for students to “practice saying the words dividend, quotient, and divisor” (p. 17). Angela, like Fiona and Elizabeth, also avoided the term academic language. But unlike Fiona and Elizabeth, Angela used the prompts to comment on issues of language and ELs in varied and substantive ways. When responding to a prompt asking how her learning tasks build on each other to support content learning and academic-language development, Angela discussed how her lesson on the concept of equality began with an opportunity to assess student understanding through a discussion of “the definition of the equals sign.” According to Angela, “beginning with a math discussion helps to access student prior knowledge and to engage them early on what they already know,” and “[p]roviding a definition early on provides the students with something they can hold on to and carry with them throughout all of the lessons.” Angela’s comments demonstrated that it was not necessarily the use of the term academic language that indicated teachers’ thinking deeply about the relationship between language and mathematics teaching and learning but rather how they responded to the prompts asking them to reflect on this relationship.

Beyond “Academic Language”: The Role of Language in Mathematics Learning

Our more comprehensive analysis of the entirety of each candidate’s written work revealed wide variation in the ways teachers described the relationship between language and mathematics learning, beyond their use of the term *academic language*. Most teachers (5 out of the 8) reported an important connection between language and mathematics. Among the 3 who did not highlight such a connection, Fiona stood out as emphasizing a *limited* relationship between language and mathematics. She argued that mathematics is “focused on numbers” and therefore a content area devoid of language. Fiona defined language development primarily in terms of opportunities to read and write generally, without specific connections to the teaching or learning of mathematics. Writing in response to a prompt about academic language, she argued that because her Teaching Event focused on a mathematics lesson, there was little need to focus on language development outside of learning new vocabulary words. When discussing the developing understandings of one of her ELs, Fiona made explicit her view of the limited relationship between language and mathematics understanding:

As a student, sample C is very observant and is able to complete any assignment that is modeled to them and does not deal with the English language. For example C is quick to pick up on math and science lessons because math deals with numbers and science lessons deal with a lot of pictures. The challenge for this student is the language barrier, however, he/she is beginning to pick up on language and is able to now use the correct mathematics vocabulary such as add and subtract. (Assessment Commentary, p. 3 of 3)

Fiona's response highlights her view of the limited role language plays outside of vocabulary development. Because mathematics "deals with numbers," she asserted that her EL could "pick up" the mathematics learning. Although Fiona considered English a "barrier," she believed it did not prevent this student from performing well on her mathematics lessons. According to Fiona, therefore, while vocabulary development was part of the language challenge for this student, mathematics understanding remained unaffected by the student's language background.

In contrast to Fiona, a majority of the candidates described the importance of language to facilitate mathematical understanding. For example, Grace, in her instruction-planning commentary, maintained that accessing language was "necessary to mathematical understanding":

Within the body of each lesson I have devoted a lot of attention to helping students access the language necessary to understanding the content. Step by step demonstrations are supported visually and verbally. With class discussion and guided practice students will have opportunity to observe, follow along, and apply the skills associated with the new academic vocabulary before they are asked to do independent work. (Planning Commentary, p. 27)

This excerpt highlights several instructional strategies Grace used to support her students' access to "the language necessary to understanding the content."

Beyond access and vocabulary development, teacher candidates highlighted mathematical communication, discussion, and discourse as a means for students to make meaning of the content and to "challenge their mathematical thinking." For example, Angela discussed the role of mathematical discussion on student thinking:

Math discussion provides an opportunity for students to take risks in talking about their mathematical thinking or for students to be challenged in their thinking through the ideas and feedback of others. It also provides me with an opportunity to assess students' prior knowledge and ways of thinking about mathematical concepts. (Planning Commentary, p. 13)

Here, Angela articulated the dual role mathematical discussion played in her instruction. She highlighted the importance of mathematical discussion for *challenging* students' thinking as well as its importance for *revealing* students' thinking in order to inform teachers' planning and instruction.

Another vehicle of language in relation to mathematics learning described by a teacher candidate focused on the importance of mathematical communication of ideas both orally and in writing. Grace clearly articulated this role in her assessment of one of her ELs on a fifth grade lesson on functions:

As a result of this segment I saw that student C had developed confidence with graphing procedures, but I need to continue helping him develop the habit of expressing math ideas in words and thus connect meaning, underlying concepts, with mechanical procedures. He was great at graphing the ordered pairs, but consistently had difficulty talking or writing about patterns, connecting the concepts with the symbols. (Assessment Commentary, p. 42)

According to Grace, language played an extensive role in the meaning making and expression of developing mathematical proficiency that included conceptual understanding and procedural fluency of students. In turn, students' abilities to express mathematical ideas in words, orally and in writing, needed nurturing to facilitate mathematical understanding.

Meanwhile, Christine attempted to unpack the subtle relationship between language and content in her kindergarten class:

Based on these observations I have found that students as learners of academic language can be very different from students as learners of academic content. In my class, which has a large range of both academic ability and language proficiency, it is very important for me to be aware of each level for each student. I think sometimes students who do not possess the academic language might be over looked as not possessing the academic content. When teaching students who are learning in a second language I have found it key to focus on both aspects. It is important for students to acquire the language, it is important for students to acquire the content, and it is important that I am able to assess each separately. (Assessment Commentary, p. 116)

As a teacher of second-language learners, Christine highlighted the importance of understanding that language and mathematics have discrete and integrated roles and relationships for student learning. From her perspective, she must attend to both these aspects and be able to assess them separately. Christine's discussion suggests the development of an integrated knowledge that highlights the complexities and saliency of language and mathematics learning beyond vocabulary (cf., Gutiérrez, 2002; Khisty & Viego, 1999).

CONCLUSION

Our primary goal in this article was to explore what is possible when mainstream teacher candidates are called upon to focus on language demands and the development of academic language in substantive ways when planning for, engaging in, and reflecting on their teaching of mathematics to ELs. To that end, we explored candidate responses on a preservice licensure exam designed to foster such a focus. We found a range of ways in which the PACT provided a forum for teacher candidates to discuss their perspectives about academic language, the language demands inherent in mathematics lessons, their vision to support students from a variety of linguistic backgrounds, and the relationship between language and mathematics teaching and learning (for a discussion of other topics the PACT elicited related to mathematics instruction for ELs, see Bunch et al., 2009).

Most of the candidates we focused on, whether they situated their discussion explicitly around “academic language” or not, articulated what they saw as an important relationship between language and mathematics teaching and learning, arguing that language facilitated mathematics learning. In contrast, a few candidates deemphasized this relationship or even argued that language was not important for the teaching and learning of mathematics. Despite explicit efforts of the PACT to expand candidates’ focus on academic language beyond vocabulary alone, a discussion of vocabulary dominated most candidates’ treatment of the role of language in mathematics teaching and learning throughout their work on the PACT. Nonetheless, we found that teacher candidates’ articulation of the role of vocabulary varied widely, and these discussions revealed much about their understanding of the relationship between language and mathematics teaching and learning. Thus, while our findings suggest that more explicit efforts may be needed to encourage preservice teachers to move beyond vocabulary in their understanding of academic language (see Moschkovich, 2007d), they also point to the need for closely examining candidates’ conceptions of vocabulary and its role in mathematics learning as indicators of their preparation for teaching mathematics to ELs.

Clearly, further research is necessary to explore the role of the PACT in assessing teachers’ ability to effectively integrate knowledge and skills related to academic language for teaching mathematics to ELs. In the meantime, we believe that insights gained from performance assessments that ask teacher candidates to integrate a discussion of language demands, academic language, and ELs with statements about their overall planning, instruction, and evaluation of student learning are potentially useful in a number of ways, including those that go beyond their primary purpose as a high-stakes test of minimal competency (Darling Hammond, 2006; Thompson & Téllez, 2010). Provided that the teacher-education faculty with whom candidates work have the necessary expertise to guide them (Costa, McPhail, Smith, & Brisk, 2005),

such assessments could inform teacher-education curriculum and instruction and play a formative assessment role as teacher candidates address these issues during their teacher-education programs—although as Lit and Lotan (2013) point out, there are dilemmas associated with the formative use of high-stakes, summative teacher examinations. At the minimum, assessments such as the PACT can provide teacher-preparation programs themselves with important information as they attempt to focus explicit attention on helping beginning teachers develop the knowledge and instructional practices that connect language and mathematics learning and teaching for English teachers in integrated and substantive ways.

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APPENDIX: PACT ACADEMIC LANGUAGE RUBRICS (2004–2006)

ACADEMIC LANGUAGE UNDERSTANDING LANGUAGE DEMANDS

EM10: How does the candidate describe student language development in relation to the language demands of the learning tasks and assessments?

Level 1	Level 2	Level 3	Level 4
<ul style="list-style-type: none"> The <i>description of the language demands</i> of learning tasks and assessments is <i>superficial</i>. 	<ul style="list-style-type: none"> Moving beyond obvious language errors, the candidate's description of language demands <i>focuses primarily on vocabulary</i> that students may find challenging <i>and indicates why</i>. 	<ul style="list-style-type: none"> The candidate identifies language demands of the learning tasks and assessments that <i>go beyond vocabulary</i> to include <i>specific text types⁹ or other language demands</i> that are challenging for individual students or groups of students. The candidate discusses students' <i>strengths and needs</i> in relation to these language demands <i>and articulates what makes those</i> particular text types or other demands <i>challenging</i> for particular individuals or groups of students. 	<ul style="list-style-type: none"> The candidate identifies language demands of the learning tasks and assessments that go beyond vocabulary to include specific text types or other language demands that are challenging for individual students or groups of students. The candidate discusses students' strengths and needs in relation to these language demands and articulates what makes those particular text types or other demands challenging for particular individuals or groups of students.

(Continued)

⁹Text types can be oral (e.g., presentations of problem solutions, descriptions of mathematical reasoning, partner or group discussions) and/or written (e.g., diagrams, graphs, or charts; equations).

¹⁰These other demands might include understanding a teacher's oral presentation of information, responding to a question in class, listening to or reading directions, or sharing information orally with a partner.

APPENDIX (Continued)

ACADEMIC LANGUAGE UNDERSTANDING LANGUAGE DEMANDS				
EM11: How do the candidate's planning, instruction, and assessment support academic language development?				
Level 1	Level 2	Level 3	Level 4	
<ul style="list-style-type: none"> The candidate gives <i>little support to students</i> to meet the language demands of the learning tasks. <p>OR</p> <ul style="list-style-type: none"> <i>Language and/or content is oversimplified</i> to the point of significantly limiting student access to the core content of the curriculum. 	<ul style="list-style-type: none"> The candidate attempts to use scaffolding or other support¹¹ to address <i>identified gaps</i> between students' current language abilities and the language demands of the learning tasks and assessments. These supports <i>provide immediate access to content</i> without providing opportunities for students to develop further language proficiency. 	<ul style="list-style-type: none"> The candidate's use of scaffolding or other support provides access to core content while also <i>providing explicit models, opportunities for practice, and feedback</i> for students to <i>develop further language proficiency</i> related to the demands of the learning tasks and assessments. 	<ul style="list-style-type: none"> The candidate's use of scaffolding or other support provides access to core content while also providing opportunities for students to develop further language proficiency related to the demands of the learning tasks and assessments. The candidate <i>articulates why</i> the instructional strategies chosen <i>are likely to support</i> specific aspects of students' language development. 	

¹¹Such support might include one or more of the following: modeling of strategies for comprehending or constructing texts; explicit communication of the expected features of oral or written texts (e.g., using rubrics, models, and frames); use of strategies that provide visual representations of content while promoting literacy development (e.g., graphic organizers); vocabulary development techniques (context cues, categorization, analysis of word parts, etc.); opportunities to work together with students with different kinds of language and literacy skills, etc.