A Snapshot of Teacher Candidates' Readiness
for Incorporating Academic Language in Lesson Plans

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With the national rollout of edTPA that champions language supports in content lessons, there is a renewed interest in academic language across disciplines and related pedagogy in the U.S. This study examines current knowledge of academic language demonstrated by teacher candidates at middle grades. An analysis (n = 42) of teacher candidates' lesson plans suggests that most teacher candidates associate academic language with content vocabulary only and are not prepared for planning mathematics instruction with academic language demands and supports. In particular, teacher candidates (1) were unfamiliar with the language function and how to conceptualize process and use of language in content lessons and (2) struggled to recognize the teacher's role to provide support for all students with differing language needs.

The introduction of nation-wide teacher performance instruments in the U.S., such as edTPA (Teacher Performance Assessment) has renewed interest in certain aspects of teachers' practice, such as academic language. Evolving from California's Performance Assessment for California Teachers (PACT), edTPA is a performance-based assessment tool to measure beginning teachers' classroom teaching. In particular, teacher candidates incorporate academic language in their planning and instruction as part of the edTPA tasks, which are evaluated with specific criteria for designing language-embedded tasks aimed to meet learning objectives.

Background

The relevance of language in mathematics has increasingly brought attention in the field of mathematics education. The learning of mathematics involves dialogues and social interactions (Moschovitch, 2011; Sfard, 2000), and the language of mathematics is the semiotic system to communicate mathematics (Lemke, 1990; Pimm, 1987; Schleppegrell, 2010). However, the formal language of mathematics poses a major challenge to students in the form and structure of the language of mathematics. With this challenge, part of the efforts to train teacher candidates to provide language supports in the teaching of mathematics must include reflecting the role of teachers to facilitate learning opportunities to bridge the gap between natural language and the

formal language of mathematics and, more fundamentally, to support students in finding their own language of family, self, and mathematics (Adler, 2001; Marks, Secada, & Doane, 1996).

However, research shows inconclusive results about the construct of academic language as a skill to be developed through activities, and there exists little consensus on whether or not its mastery can be clearly measured in classrooms (Krashen & Brown, 2007; Snow & Uccelli, 2009). The research to date has focused on defining the construct and developing the pedagogy for English Language Learners (ELLs) rather than on discovering a mechanism for language development in all mathematics learners (Zacarian, 2012). More importantly, there is little foundational work on assessing future teachers' awareness about the role of language in mathematics, the academic language demands, and appropriate language support in classrooms. In particular, few studies investigate teacher candidates' lesson planning with academic language.

Thus, we embarked on examining teacher candidates' current knowledge about academic language and language support prior to student teaching. This type of analysis is important as teacher educators need to better understand how academic language both serves and challenges the teacher and the learners of mathematics. In our study, we asked: To what extent do middle grades teacher candidates (1) understand academic language and (2) plan a lesson with academic language? To answer the first part of the

question, a survey was conducted to measure perceptions of academic language held by teacher candidates. The second part of the question was investigated by evaluating lesson plans constructed by teacher candidates. The survey questions and the lesson plan evaluation rubrics were based on edTPA's framework (**see Table 1**) on academic language.

Theoretical Perspectives
Language and Mathematics

Mathematics is a language itself and therefore consists of natural language for discursive interactions and a highly symbolic language of notations and symbols to represent mathematical meanings (Chapman, 1993; Schleppegrell, 2010). For example, students in algebra use symbols and notations, and mathematical texts involve the use of definitions and statements to establish mathematically truthful statements grounded in previous proofs (Ko & Knuth, 2009; Lakatos, 1976). Nonetheless, all statements and arguments in these texts are made in words and sentences; therefore, the use of language is quite evident.

Due to the language differences with respect to the formal language of mathematics versus natural language, and how people use and process each, the concept of register has emerged as important in understanding how the learner develops ways to understand mathematics and to participate in mathematics discourse. Halliday and Hasan (1976) defined register as the linguistic elements associated with situations or contexts. Halliday (1978) characterized register in terms of field (e.g., school mathematics), tenor (e.g., students, teachers), and mode (e.g., discourse, texts). Pimm (1987) suggested that mathematics is a register that carries a set of meanings that is appropriate to a particular function of language, and registers have to do with the social usage of particular word meanings and symbols use. Chapman (1993) added that register is the particular kind of language for specific contexts and that the school mathematics register includes a specialized vocabulary with spoken and written forms including symbols.

The formal language of mathematics may not be part of students' colloquial language as it includes specialized ways of using words and symbols with certain syntactic preferences. This is especially true for written mathematics – mathematicians reason algebraically and use symbolic language in writing to represent their ideas. In mathematical texts, symbolization—including numbers, operations, various syntax or conventional grammar of relationships—is employed and strictly enforced (MacGregor & Stacey, 1997). In this view, writing is not only an interplay between content knowledge and rhetorical knowledge, but also a special process in which written or semiotic representations affect mathematical thinking (Misfeldt, 2011).

Academic Language Framework from edTPA

Language facilitates learning in school, but there exist multiple forms and patterns of language with varying degrees of difficulty for students. In particular, Schleppegrell (2010) stated that language in mathematics is "conceptually dense, interpersonally alienating, and highly structured texturally in unfamiliar ways" (p.74).

More generally, Solomon and Rhodes (1995) introduced theories of academic language: that academic language refers to distinct linguistic functions and structures particularly needed for language minority students to understand; that it is the language in school that is not conversational language, or that academic language is a register in lexical and syntactic features of various contexts. Academic language can be described as the language used by learners to understand and communicate in the academic disciplines (Cummins, 1981). Most definitions mention that learners use academic language to understand content and communicate such understanding to others.

Building from the body of research literature on the various features of academic language used across disciplines, edTPA evaluates the teacher candidate's readiness for teaching academic language (**see Table 1**) and examines how the candidate (a) identifies a language function in relation to the focus of the lesson, (b) plans a learning task that enables students to participate in the content with vocabulary, syntax, discourse, and mathematical precision, and (c) presents an evidence-based narrative of teaching academic language.

Table 1
Process Standards of Academic Language Framework Adopted by edTPA
Connected Elements of Academic Language

Process
Use language to enhance content understanding
Address different needs of student language use
Provide opportunity and support to increase use of language
Monitor and guide students' use of language
Integrate use of language in regular classroom activities
Foster language developments for all students

Language functions. Language functions were initially used with reference to typical intellectual activities involving information and language, such as analysing and synthesizing information, sharing knowledge, and expressing views (Chamot & O'Malley, 1987; Clark, 1975). Later, linguists and educational researchers attended to social or academic settings in which learners are motivated to participate in interactions of language. For example, Brown and Yule (1983) proposed two functions of language, transactional and interactional. The learning of mathematics involves interpreting mathematics texts, using natural language to transfer knowledge, and participating in discourse to have social relationships (Chapman, 1993). Dutro and Moran (2003) claimed that English language instruction should offer opportunities often with tasks (i.e., functions) in which the learner uses various forms of language (e.g. vocabulary) and develops fluency (Hill-Bonnet & Lippincott, 2010).

The field of mathematics education has a long tradition of recognizing the interrelation between language and mathematics as well as a growing need for our mathematics teachers to consider various aspects of language in mathematics instruction. In particular, mathematics teachers are encouraged to create opportunities in which students socially interact with peers and experience various forms of mathematical argumentations, thereby constructing meanings through corrections, retractions, and replacements (Krummheuer, 1998; Voigt, 1994). Language can also function to communicate information and facilitate problem solving, which is the bulk of what we do when we learn (Zwiers, 2008).

Vocabulary. There have been multiple ways developed to explain the vocabulary in mathematics. First, vocabulary could be taught in the context of a system of words and phrases with subject specific meanings (Cummins, 1981). Secondly, vocabulary could also refer to general academic vocabulary used across disciplines (e.g., compare, analyze, evaluate). Lastly, subject-specific words comprise another part of math vocabulary, which are also called tier three words, technical vocabulary, or

content-specific vocabulary (Baumann & Graves, 2010; Beck, Mckeowen, & Kucan, 2002; Lubliner & Smetana, 2005).

Brozo and Simpson (2007) defined academic vocabulary as lexical knowledge that enables students to engage with texts in school. Thompson and Rubenstein (2000) provided a comprehensive list of vocabulary issues and examples in mathematics instruction. Additionally, Coxhead (2000) developed a collection of academic words which are most frequently found in academic texts. Later, DiGisi and Fleming (2005) described three types of mathematics vocabulary for solving word problems: mathematics vocabulary, procedural vocabulary, and descriptive vocabulary.

Research identified the complexity of lexical knowledge as developmental process with multiple reiterations in various contexts (Nagy & Scott, 2000; Ward, 2005). Mathematics leaners are expected to use vocabulary to represent their knowledge and to develop mathematical concepts (Thompson & Rubenstein, 2000). Adams, Thangata, and King (2005) discussed the complexity of working with words that have multiple meanings and suggested the following: that students learn vocabulary in various modes, mediums, and contexts, that students define terms in their own words, and that students use pictures and diagrams along with natural language. Thompson, Kersaint, Richards, Hunsader, and Rubenstein (2008) claimed that the unique characteristics of mathematics vocabulary are closely related to the degree to which students comprehend mathematics text. Martiniello (2008) reported that the most linguistically complex word problems in mathematics were those with complex grammatical structures as well as general vocabulary that were central to comprehending the problem. Pierce and Fontaine (2009) suggested that vocabulary instruction in the mathematics classroom offer definitions of math terms in everyday language, facilitate deep processing of word meanings in various contexts, and provide opportunities to verbally speak these words in social interactions in the class.

Syntax. Mathematics has developed structural coherence and consistency for written expressions, especially with a collection of mathematical syntax, with regard to elements, operators, and relations (Pimm, 1987). Pimm (1987) elaborated the syntax of written mathematical forms and explained that symbols are combined to represent mathematical relationships and ideas, and algebra involves a great deal of symbol manipulation according to the grammar of symbolic expressions. For example, in his book, *Speaking Mathematically*, Pimm (1987) provides examples of transformations from one mathematical object to another (**see Table 2**). Other examples include: all real numbers that are larger than 2 are written symbolically $\{x| \ x \in \mathbb{R}, \ x > 2\}$; $\sin^2(x)$, $\sin(2x)$, and $2\sin(x)$ all mean different mathematical objects; students are purposefully taught that in general $-x^2 \neq (-x)^2$, $(a + b)^2 \neq a^2 + b^2$, or $\sqrt{a} + \sqrt{b} \neq \sqrt{(a + b)}$; the vertex form of a quadratic function $f(x) = ax^2 + bx + c$ with $a \neq 0$ can be equivalent to $f(x) = a(x - h)^2 + d$. Similarly, there exists preferred ways of expressing mathematics objects. For example, $5x$ is more natural than $x5$; $y = 4x^2 + 7x - 4$ can be preferred to $y = -4 + 4x^2 + 7x$ as a standard form of quadratic function; $3 - (-5)$ is preferred to $3 - - 5$.

Table 2

Examples of Syntax in the Transformations of Surface Forms (Pimm, 1987)

Transformations	Surface forms
Reducing fractions to lower terms	$p/q \rightarrow r/s$, where r, s are whole numbers with $p \times s = r \times q$; $0 \leq r < p$; $0 < s < q$
Extended place value notation	$x_n \cdots x_1 \rightarrow x_n \cdot 10^{n-1} + \cdots + x_1$, where each x_i in place-value notation is a digit $0 - 9$ with $i = 1, 2, 3, \ldots n$.
Factoring	$x^2 + (a+b)x + a \cdot b \rightarrow (x+a)(x+b)$
$\times$ deletion	$a \times b \rightarrow a \cdot b$
Expanded notation	$ab \rightarrow 10a + b$
Squaring	$(a+b)^2 \rightarrow a^2 + 2ab + b^2$

Additionally, Gowers, Barrow-Green, and Leader (2008) attempted to explain the language and grammar of mathematics in terms of four basic concepts such as sets, functions, relations, and binary operations. Their examples of surface forms include: the set $\{(x, y): x^2 + y^2 = 1\}$ represents a circle of radius 1 about the origin $(0, 0)$; $f: A \rightarrow B$ means f is a function with domain A and range B; a relation $\sim$, defined on a set A has to have the properties of reflexive, symmetric, and transitive to be an equivalence relation.

With reference to the preferred use of language, edTPA's language about syntax is similar to one that defines syntax as the set of conventions for stringing together symbols, words, and phrases in structures to create and express meanings (e.g., sentences, formulas, graphs) (Kersaint, Thompson, & Petkova, 2009), and it also refers to forms and grammatical structures widely accepted in the pertinent disciplines.

Pimm (1997) suggested that mathematical syntactic rules can be taught, learned, and applied at the surface level, and some students could misunderstand that mathematics is only formulation and manipulation of symbols based on rules. He noted that excessive adherence to the strict conventions of symbols is not an essential aspect of doing mathematics. Civil (1998) added that an emphasis on form over meaning could hinder productive mathematical conversations. Most research in the 1990s about language in mathematics instruction, however, focused on vocabulary and random examples of grammatical forms (O'Halloran, 2000). Research studies found that students struggled with syntax when translating a mathematical concept from conventional English into a set of symbols and when interpreting mathematical expressions in conventional English (Barwell, 2005; Kinzel, 1999).

Discourse. Discourse refers to ways in which those who practice mathematics speak and write to articulate their understanding of concepts or transfer knowledge (Cazden, 1988; Zwiers & Crawford, 2011). Gutierrez,

Sengupta-Irving, and Dieckmann (2010) supported mathematics discourse as a cultural activity that integrates the language of the classroom and the language in mathematical learning and provides students with opportunities to understand and master the norms of the mathematics community.

Reformed mathematics teaching champions the idea that the learning of mathematics should reflect the ways mathematicians do mathematics, which involves developing understanding of mathematical concepts and theories and participating in the task of proving or explaining (Lampert, 1990). Later, Smith and Stein (2000) added that mathematics classroom discourse should be purposeful to develop students' mathematical thinking and reasoning. In fact, communication is one of the NCTM (2000) process standards, which recommends students participate in mathematical discourse to question and argue mathematical concepts and that teachers facilitate mathematical dialogues that allow students to reach deeper mathematical concepts. Ideally, teacher candidates are expected to identify appropriate discourse structures in which students use academic language and participate in tasks such as making sense of problems, making an argument, and critiquing reasoning presented.

Academic language is instrumental in academic discourse socialization. In Forman's (1996) notion of learning mathematics as a discursive activity, students offer multiple perspectives to the classroom, and the teacher facilitates the negotiation of meanings from various representations and utterances. This academic interaction necessitates socio-mathematical norms (Cobb, Wood, & Yackel, 1993) and involves a multifaceted process of linguistic and social resources (Greeno, 1998; Nasir, 2002). Over time, the sociolinguistic nature of interactions – the role of language as a social, cultural, and linguistic resource to facilitate discursive activity – in schools or within the communities of mathematicians has led people to explore the interrelation between language and mathemat-

ics. In particular, those who support functional views of language in research on language and mathematics conceptualize the role of language as the means for understanding and the resources for knowledge construction (Brown & Yule, 1983; Lampert & Cobb, 2003; Solano-Flores & Trumbull, 2003).

Methods

The participants of the study included teacher candidates (n=42) at middle level in two large state universities and one small private college in southern U.S. states. Thirty-four teacher candidates were seniors, and eight teacher candidates were juniors in undergraduate teacher preparation programs. Twenty-nine teacher candidates were female, and thirteen teacher candidates were male. All participants had no prior student teaching experience. No incentive was provided for the participants. Initially 65 teacher candidates were invited for the study in spring, 2012, and ultimately 42 surveys were collected in fall, 2013. The notion of academic language was previously used in the teacher education programs from which participants were drawn.

The anonymous survey had five open-ended statements and questions (**see Table 3**) and was conducted in the last two days of the methods courses. The lesson plans were part of the regular assignments of the courses. The instruction for lesson plans stated that teacher candidates must address academic language in learning objectives and include relevant language-embedded tasks aimed to improve students' capabilities for effective communication in mathematics. Three qualified scorers (i.e., pre-trained edTPA coders) were recruited thanks to college research funds. These scorers had been trained by the Stanford Center for Assessment, Learning, and Equity (SCALE) to score edTPA portfolios at middle grades and passed qualifying rounds of benchmark scoring in 2012 before they evaluated these lesson plans. The study did not investigate the implementation of lesson plans.

Table 3
Academic Language Survey Items

Survey Items
[1] Please try to define academic language in your own words.
[2] What words come to your mind when you think about academic language?
[3] Describe your own learning experience of mathematics with academic language. Please describe in two parts, if possible, one before college and another one while you're in college.
[4] The following words refer to the NCTM process standards: Problem Solving, Reasoning and Proof, Communication, Connections, and Representation. Please categorize them into two groups. (1) One group is for the standards that you feel are important in your teaching and (2) another group is for the standards that you feel are not as important in your teaching.
[5] Please describe your teaching in which you provide some specific ways to improve middle grader learners' use of academic language.

Analysis

The survey data were analysed by two graduate research assistants who had completed three research methods courses, including a qualitative research methodology course. For each question in the survey, responses were coded independently with key words and brief descriptions. Later the descriptions and key words were shared and revised for consistent coding and categorizing (Gibbs, 2007). The codes and categories were used to tally frequency or capture the essence of responses including broad patterns or noticeable responses.

Lesson plans were evaluated by pre-trained edTPA coders, and a spreadsheet was created to document the scores. For each criterion in Table 4, a dichotomous variable measured whether the lesson plan adequately met that criterion, and each criterion corresponded to a component of academic language, such as vocabulary, language function, process of practice, discourse, syntax, or mathematical precision.

Table 4
Criteria Applied in Grading Teacher Candidates' Lesson Plans with Academic Language

Elements	Criteria
Vocabulary	• Listing vocabulary or mathematical symbols • Using words and phrases with content-specific meanings (e.g., polygon, quadratic equation, radicand) and general academic verbs (e.g., illustrate, validate, classify). • Providing opportunities for students to use the listed vocabulary/symbols with a task during the lesson
Language Function	• Specifying how students engage in learning (e.g., explain, discuss, categorize, write a proof) while actively using language in the objective section of lesson plans
Discourse	• Providing opportunities for students to have a discourse and learn ways to improve ability to communicate
Syntax	• Providing opportunities for students to consider the grammatical structure or conventions in written or verbal communications
Mathematical Precision	• Offering opportunities for students to examine mathematical precision in written work/conversations.
Process of Practice	• Attending to students' current competency in academic language including prior knowledge and pre-assessments. • Providing specific tasks in which students use academic language while achieving learning objectives • Showing evidence of differentiated planning to meet differing needs of all students to actively use language • Showing evidence of lesson planning by which students use academic language in their learning of mathematics and improve content understanding

Findings

Survey Results

Teacher candidates' definitions of academic language demonstrated some overarching patterns, revealing teacher candidates' fragmented perceptions of academic language. About 54% (n=22) of teacher candidates indicated that academic language includes academic words or styles used in scholastic writing. About 25% (n=10) of teacher candidates indicated that academic language is content-specific vocabulary. The remaining 21% (n=9) of teacher candidates indicated uncertainty and did not provide answers. Also, when they think about academic language, about 76% (n=32) of teacher candidates mentioned the word vocabulary came to their mind. Other words mentioned include dictionaries, English language learners, term papers, and word banks.

When asked about experiences learning mathematics with academic language, some teacher candidates (n=28) mentioned that they could relate to academic language as a tool to address the needs of English language learners. Other teacher candidates (n=18) claimed they learned of research findings and effective pedagogical strategies to improve vocabulary. The majority of them (n=31) failed to describe their learning mathematics with academic language by stating "I don't recall I learned mathematics with academic language," or "I had to know all the terms myself, but teachers didn't test me on them as long as I knew how to solve problems."

When asked to categorize the NCTM process standards–Problem Solving, Reasoning and Proof, Communication, Connections, and Representation–into two groups, about half of the survey participants categorized Problem Solving and Reasoning and Proof as important in teaching, 13 participants categorized Communications and Representations as not so important in teaching mathematics. Connections were categorized inconsistently.

When asked to propose specific ways to improve middle grade learners' use of academic language, the majority of strategies recommended by teacher candidates included vocabulary instruction (n=39), word maps (n=19), root analysis (n=21), journal writing (n=9), reflection papers (n=5), use of word walls (n=32), drawing a picture of the word (n=17), synonyms and antonyms (n=23), daily pop quiz (n=18), singing songs about words (n=11), or writing stories (n=4). In addition, three responses provided statements regarding the proposed strategies' relevance for middle grade learners.

Lesson Plans

The teacher candidates' lesson plans were evaluated according to the rubric criteria in Table 4. The percentage of criteria that teacher candidates met ranged from 10% to 70%. The mean percentage of criteria met was 31.9% (SD = 13.4; $mode$ = 30%). The majority of teacher candidates (n=32) met fewer than 40% of the criteria. Most teacher candidates (n=31) met the vocabulary criteria. Some teacher candidates (n=22) demonstrated competencies for mathematical precision. Few teacher candidates met the criteria for the following elements of academic language (**see Table 5**): language function, syntax, discourse, and most of the process of practice components.

Table 5
Results from Lesson Plan Evaluations

Elements	Criteria	The participants (*n*=42) who met the criteria
Vocabulary	• Listing vocabulary or mathematical symbols • Using words and phrases with content-specific meanings (e.g., polygon, quadratic equation, radicand) and general academic verbs (e.g., illustrate, validate, classify). • Providing opportunities for students to use the listed vocabulary/ symbols with a task during the lesson	74%
Language Function	• Specifying how students engage in learning (e.g., explain, discuss, categorize, write a proof) while actively using language in the objective section of lesson plans	12%
Discourse	• Providing opportunities for students to have a discourse and learn ways to improve ability to communicate	24%
Syntax	• Providing opportunities for students to consider the grammatical structure or conventions in written or verbal communications	8%
Mathematical Precision	• Offering opportunities for students to examine mathematical precision in written work/conversations.	52%
Process of Practice	• Attending to students' current competency in academic language including prior knowledge and pre-assessments.	52%
	• Providing specific tasks in which students use academic language while achieving learning objectives	12%
	• Showing evidence of differentiated planning to meet differing needs of all students to actively use language	24%
	• Showing evidence of lesson planning by which students use academic language in their learning of mathematics and improve content understanding	20%

Discussion

The findings of this study reveal a snapshot of a student teacher as someone who has little understanding of academic language, thus struggling with developing teaching repertoires that engage students in academic language. The teacher candidates in this study believed vocabulary instruction constituted academic language, identifying learning vocabulary as the most significant outcome of teaching academic language. Thus, it is not surprising that most strategies for teaching academic language focus on increasing vocabulary. While writing activities were mentioned, we found little evidence that teacher candidates implemented writing activities to introduce discourse in instruction. The teacher candidates placed little value on addressing academic language in instruction, and most teacher candidates regarded the Communication standard as secondary to Problem Solving and Reasoning and Proof. This indicates the teacher candidates were neither introduced to the developmental aspect of academic language nor to processing academic language in the broad scheme of learner-centred classroom practice.

Such beliefs could be influenced by the lack of experience with learning mathematics while actively using language. Most candidates indicated that their mathematics classrooms provided little language support. The data show that teacher candidates fell back on their past learning experiences in mathematics to imagine a practice of teaching academic language.

This study's analysis of teacher candidates' lesson plans adds more to this snapshot of a teacher candidate as someone who plans to teach vocabulary and to facilitate learning opportunities in which students use pertinent vocabulary but does not recognize vocabulary as a tool to articulate understanding and participate in classroom discourse; instead, they think of vocabulary as part of the content to be memorized with little connection to mathematical thinking and reasoning.

Additional areas of concern include (a) teacher candidates were unfamiliar with supporting language needs of all students; (b) few teacher candidates addressed syntax in planning; (c) teacher candidates struggled with ways to formulate learning objectives that enhance content understanding; and (d) few teacher candidates demonstrated evidence of consideration of middle grade learners and their language developments.

We note that the findings could come across as a litany of deficit skills related to teacher candidates' readiness for teaching academic language. We disagree with this notion. Rather, we believe the findings offer the baseline data with regard to current school mathematics curriculum and practice that reflect little attention to language demand and supports in content courses. In turn, this

supports the view that teacher educators should work with teacher candidates – those who had little language support when they were students – to develop in-depth understanding of language in content learning including knowledge of academic language and students' language needs. For example, teacher candidates can learn to identify the effective use of mathematics language functions in model lesson plans and examine various implementations of teaching academic language in video-taped lessons. We often hear that veteran mathematics teachers struggle with creating opportunities in which students use language to better understand mathematics. For beginning teachers, their learning in the teacher preparation program may enable them to at least conceptualize the role of language in mathematics; that is, teacher candidates examine the role of language in mathematical discourse for students to represent mathematical concepts or present their mathematical ideas in symbolic conventions, relevant diagrams, or appropriate grammatical structures.

Implications

As teacher educators address teaching academic language in mathematics classrooms in their teacher preparation programs, more efforts are necessary to validate the effectiveness of developing knowledge and skills for teaching with academic language. A follow-up study should involve observing instruction in the teacher preparation program with an aim for increasing teacher candidates' knowledge and skills related to academic language. It also merits some attention for us to further develop the survey and the instrument as stand-alone assessment tools for teacher candidates' readiness for teaching academic language and ultimately to examine ways academic language in the instruction impacts student learning and achievement in middle grades classroom.

However, part of the challenge for researchers and mathematics teacher educators is that the use of academic language, as part of the communication process, makes it difficult to assess in a reliable way through reviewing planning documents such as lesson plans. In the current study, we want to note that the case for the importance of academic language was based on edTPA. However, there is little consensus in the field of mathematics education why an assessment instrument such as edTPA should attribute academic language so much importance that teacher preparation programs must be framed by it. In that sense, understanding the role and nature of academic language demonstrated by the mathematics learner, as well as the teacher, should precede the efforts to measure teachers' skills to teach academic language.

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