



The Development of Core Academic Language and Reading Comprehension in Pre-Adolescent and Adolescent Learners

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**The Development of Core Academic Language and Reading Comprehension
in Pre-Adolescent and Adolescent Learners**

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A Thesis Presented to the Faculty of
the Graduate School of Education of Harvard University
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**To my former middle school students,
who inspired and continue to inspire this work.**

In this dissertation, I choose to avoid the use of the first person because this work was always the product of many minds, hands, and hearts working together. First, I must thank my advisor, **Paola Uccelli**, whose amazing mentorship through this dissertation and six years of academic development have helped me to become a citizen scholar. It has been a rare day in my six years in the program—whether over e-mail or huddled around a small round table in her office enveloped by the smell of yerba mate—that I have not benefitted from Paola’s simple and elegant solutions to problems of research design, wry advice about navigating the professional landscape or, above all, her extensive support for me as a scholar, a writer, and a person. Paola has described our work as the ‘craft of the possible’ and through her I have learned that good research begins with a vision for what can be and becomes a reality through collective tenacity. Second, I would like to thank **Nonie Lesaux**, a mentor, co-author, and ceaseless champion. With a deep commitment to making research accessible and practical for school-based colleagues, Nonie’s gentle pragmatism has become a model for me of how educational researchers might aspire to make a difference in lives of the children who are the focus of our research efforts. Through her advice delivered with equal parts humor and kindness, Nonie has also taught me so very much about navigating the academy as a woman and a scholar, and for this I (and my future advisees!) am forever grateful. Third, I would like to thank **Catherine Snow** for allowing me to participate in her vision for adolescent literacy reform through the CCDD project and for her constant support for my development as a thinker and a writer. I will never sit typing at my computer that I will not be reminded of Catherine’s advice to say it simply, watch the commas, and to beware of over-used hyphens. It is fair to say that there will not be a day in my professional career going forward that I will not think of you—Paola, Nonie, and Catherine—as I work to become the mentor and scholar that you have given me the tools to be.

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In closing, I would like to thank my family, who at every stage of my education has believed that I could accomplish great things. I choose to study struggling readers because I had been one and knew that a single person could have a profound impact on such a learner’s life chances. My ability to pursue this doctorate is in large part due to the many late hours my mother spent at the kitchen table with me as an elementary schooler—writing again and again the words I could not spell and reading aloud the words I could not. I thank you, **mom**, for everything. In addition, I am forever grateful to

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Thesis Abstract

Many adolescents struggle to comprehend text, a fact which has led educational researchers to speculate that these reading struggles might be linked with students' levels of familiarity with the vocabulary and language found in these texts. However, few studies have identified the school-relevant language skills beyond vocabulary that contribute to variation in reading comprehension growth during the middle school years. With the goal of focusing additional attention on the central role of academic language in text comprehension, I explore the relationship between these language skills, referred to as Core Academic Language Skills (CALS), and reading comprehension. Study 1 of this thesis examines the concurrent development of academic language skills and reading comprehension for English Learners and their English proficient peers attending urban middle schools and followed over two academic years, from grade 6 to 7 ($n=833$). Parallel process latent growth modeling results suggest that academic language and reading comprehension skills develop concurrently, with rapid growth in CALS being associated with rapid growth in reading comprehension skills. Furthermore, initial levels of CALS predict rates of growth in reading comprehension. Focused on learners mostly reading below grade-level, this study highlights the potential for CALS-focused instruction to serve as a point of leverage for improving pre-adolescent and early adolescent learners' reading comprehension outcomes.

Study 2 builds on this first study by examining the co-development of academic language and reading comprehension in a broader age range for whom academic language instruction may be most critical—English proficient middle grade learners attending schools serving predominately low-income students. For decades, research has

highlighted the impact of socioeconomic status on reading achievement suggesting the need to further investigate potentially malleable skills, such as academic language skills, that might be taught as part of comprehensive literacy initiatives designed to support pre-adolescent and adolescent struggling readers. Results revealed that students' initial level of academic language proficiency was associated with their rate of reading comprehension growth across the two years they were followed and that socioeconomic status impacted reading comprehension growth indirectly via its influence on students' initial levels of academic language skill. Results are not surprising given that academic language skill is a core component of reading comprehension. The main contribution of these findings is in revealing the significant impact of a specified core set of academic language skills on reading comprehension development. Findings suggest that these potentially malleable school-relevant language skills, shown to be unequally distributed within classrooms, constitute a promising skillset that can inform interventions designed to achieve both excellence and equity in literacy instruction during early adolescence.

Chapter 1: Introduction

In U.S. classrooms today, one of the most pressing issues is preparing students to become life-long learners, able to learn from text long after their years as students have ended. How to more effectively support the development of this skill set is of particular concern. The majority of middle grade students in our classrooms today are struggling readers: over 60% of U.S. 4th and 8th graders fail to demonstrate reading proficiency on the National Assessment of Educational Progress (NAEP, 2015). In an information-based society where literacy skills have become a prerequisite for successful participation in the labor market and in civic society, teaching our students to become successful readers is also a matter of equity. While the majority of U.S. adolescents are reading below grade-level, children coming of age in low-income homes and communities are disproportionately represented in these ranks. Today, 79% of 4th graders and 80% of 8th graders from low-income homes perform below proficient on the NAEP reading assessment (NAEP, 2015). English learners, unsurprisingly, given that they face the dual challenge of learning a new language while mastering content, also struggle in large numbers (August & Shanahan, 2006). In light of these statistics, one essential question for educators, school leaders and policy makers is: *What malleable skills can we address through instruction to improve the reading comprehension skills of the upper elementary and middle school students, particularly of those students who are acquiring English as an additional language at school and/or come from low-income households?* While there is no easy answer to this question, I focus in this dissertation on later acquired language skills as one set of potentially malleable skills that might be targeted to support early adolescent students who struggle with reading. Students are acquiring language from

birth onwards; however, the skills needed to read more complex texts (academic language skills) continue to develop across schooling, which is why I refer to this language as ‘later acquired.’ In particular, I examine the longitudinal relations between academic language and reading comprehension skill, as one possible pathway through which socio-economic status might impact reading achievement, for students in upper elementary and middle school.

In this chapter, I outline the prior research on academic language and reading comprehension relations that form the foundation of this thesis. In addition, I discuss the theoretical underpinnings that have shaped my understanding of reading-language relations and which inform this thesis.

Prior Research: Operationalizing the Core Academic Language Construct & Examining Academic Language—Reading Comprehension Relations

Operationalizing CALS | In this thesis, I draw on five years of prior work led by Paola Uccelli and in collaboration with a host of other collaborators to define academic language proficiency—an endeavor that began as part of a larger Institute of Educational Sciences (IES) Project. This work led to the delineation of the construct called Core Academic Language Skills (CALS) that can inform language-focused instruction and research. Conceptualized as a construct within the umbrella term *academic language proficiency*, CALS refer to knowledge of the language features that are found in academic texts across content areas. CALS does not include knowledge of the language that is unique to a particular discipline. Instead, CALS includes knowledge of language identified as part of the academic register generally. Below, I describe the skills included

in CALS and explain why each academic language skill encompassed in CALS is likely to be linked with text comprehension for middle graders.

Skill in understanding morphologically complex words. The typical academic text contains a high number of morphologically complex words that are comprised of units of language that convey meaning, including nominalizations (e.g., nouns like ‘educator’ derived from a verb form, ‘to educate’) (Biber, Reppen, Conrad, 2002; Halliday, 2004; Schleppegrell, 2004). When encountering an unknown word a skilled reader may make use of her knowledge of word parts to determine the meaning. Consider for instance, how your knowledge of the prefix ‘anti-’ (meaning ‘against’) might help you to infer the purpose of ‘antifreeze’ when you encounter this word in a text about car mechanics. It is no surprise, then, that middle grade students who are able to engage in morphologically manipulating complex words (e.g., making ‘to question’ into ‘questionable’) also demonstrate skill in reading comprehension (Kieffer & Lesaux, 2010, 2012; Kieffer & Box, 2013; Kieffer, Biancarosa & Mancilla-Martinez, 2013). For English learners (EL), and especially for those from low-income families, as well as for monolinguals from low-SES homes, multi-syllabic and compound words appear to play an important role in disrupting text comprehension (Heppt, Haag, Bohme, & Stanat, 2015).

Skill in understanding complex syntax. Academic texts contain denser syntactic structures, like center-embedded clauses, extended noun phrases, and sentential subjects (Bailey et al., 2007; Halliday, 2004; Schleppegrell, 2004). This is because these structures help writers to convey more complex information. For readers, unpacking all of the information conveyed in a single complex sentence

might be challenging and thus might compromise comprehension. Individuals who have better syntactic knowledge also demonstrate higher levels of reading comprehension throughout the life course (e.g., Brimo, Apel, & Fountain, 2015; Mokhtari & Thompson, 2006; Mokhtari & Niederhauser, 2013; Nation & Snowling, 2000; Taylor, Greenberg, Laures-Gore, & Wise, 2011).

Skill in understanding school-relevant connectives and discourse markers.

Academic writers use both connectives (e.g., *although*,) and discourse markers (e.g., *First, Second, in other words*) to demonstrate to readers how ideas are related and how texts are organized (Hyland, 2004). Several studies have provided evidence that knowledge of these words and phrases supports readers' online processing, text memory, and ability to recall information learned from a text (Hyönä & Lorch, 2004; Meyer & Poon, 2001).

Skill in anaphoric resolution. Readers often need to resolve what are called 'anaphors,' or words or phrases appearing later in a text that refer to a prior participant or idea ('*Photosynthesis occurs when...this process*') (Flowerdew, 2003; Hunston & Francis, 2000). Although studies in this area are few, for upper elementary school students the skill to track a person or idea through a text seems to support text understanding (Sánchez & García, 2009).

Awareness of argumentative text organization. Most students master narrative text structures in elementary school, by about age 10. However, knowledge of how

expository genres are organized seems to continue to develop into high school (Berman & Nir-Sagiv, 2007). As they move into the middle school years, students' knowledge of expository text structures supports their successful navigation of increasingly complex texts (Rex, Thomas & Engel, 2010).

Awareness of writer's perspective. Academic writers often signal their orientation towards statements—whether agreeing, disagreeing, expressing certainty or uncertainty—through language. They use epistemic stance markers including hedges and boosters (e.g., *Evidence suggest; It may be the case; It seems that*) (Halliday, 2004; Hyland, 1998). Readers who have knowledge of these language forms can use this information to detect a writer's bias or to evaluate the level of certainty of a claim.

Knowledge of academic metalinguistic vocabulary. Students also need knowledge of the language used in instructional contexts to talk about thinking and learning, what we call 'academic metalinguistic vocabulary.' Terms like, *argument, debate,* and *generalize* typify metalinguistic vocabulary.

Academic Register Awareness. While generally under-explored in the literature, proficient academic language users require both knowledge of language forms and awareness of when the academic register is useful for communications (Bar-Ilan & Berman, 2007). A first step in developing this awareness is recognizing that a writer is using the academic register, which signals to the reader that the skills listed above should

be used to support text comprehension. This register awareness has just begun to be explored as a contributor to text comprehension (Terry, Connor, Johnson, Stuckey & Tani, 2015).

CALS-Reading Comprehension Relations | Our team's prior efforts demonstrate how these CALS support text comprehension. In particular, a cross-sectional study of students in grades 4-6 finds that after accounting for students' word reading fluency and vocabulary depth, the skills tapped by the CALS-Instrument contribute unique, individual variance to students' reading comprehension (Uccelli, Phillips Galloway, Meneses, Barr, & Dobbs, 2015). However, many questions remain regarding these relations over time. Of great interest is the development of these skills in English Learners (ELs) and for students from low-income homes and communities for whom exposure to the language of school has been documented to be less frequent (Heath, 2012). In this thesis, I begin to explore these questions in two longitudinal studies. In the first study, I examine the relation over time between Core Academic Language Skills (CALS) and text comprehension in a sample of students followed over two years, from grades 6-7. In so doing, I aim to describe the development of CALS from grade 6 through grade 7 and its relation with reading comprehension during a developmental period in which students are increasingly faced with complex texts. In this study, I focus on English learners and their peers attending U.S. public middle schools serving students predominately from low-income homes. This gives insight into how we might support students that have been historically ill-served in school to participate in academic discourse communities.

In the second study, I build on these findings by further exploring the relations between CALS, reading comprehension, and Socioeconomic status (SES) for a sample of English proficient learners followed from grades 5-7. Motivated by findings that highlight differences in the rates of exposure to school-like language experienced by middle-income and low-income students in home, classroom, and community contexts, this study is the first to my knowledge to directly test the hypothesis that SES-related differences in academic language proficiency are linked with reading achievement over time for middle graders. This study utilizes longitudinal data collected from two cohorts of English-proficient students followed over two academic years from grades 5 to 6 and 6 to 7. Through the use of parallel process latent growth modeling, this study examines the relation between developmental trajectories of academic language and reading comprehension, as well as their relations with socioeconomic status. By using longitudinal data, an approach that results in more accurate estimates than cross-sectional methods, this study extends prior research in this area (Cole & Maxwell, 2003). In addition to highlighting the important role of academic language proficiency in reading comprehension development, results highlight academic language skills as one pathway through which socioeconomic status impacts growth in reading comprehension skills during early adolescence. By using measures that make visible the skills and competencies that may differentiate students from low-income and middle-income homes, I hope this study shifts researchers' attention to CALS as a set of malleable skills that could be developed in our classrooms to advance equity. In addition, by showing that students from low-income homes and their middle-income peers experience similar rates of CALS growth during middle school, this study advocates for a growth mindset. While

we talk often about literacy achievement gaps in our field, we talk less about the rates of growth in literacy-related skills that students experience and the obvious opportunity that this growth presents for educators. My goal in this study is to add nuance to this conversation.

Together, these studies highlight the importance of academic language in reading comprehension for all adolescents; but also underscore their particular relevance for English Learners and students from low-income households, who may have less exposure to this register.

Theoretical Underpinnings

In this section, I outline the theoretical lenses that motivate and inform this thesis. These are the ideas that shape my own thinking and appear both explicitly and implicitly in the chapters that follow.

How does academic language develop?

Language-Reading Relations in Component Models of Reading Comprehension | In this thesis, language proficiency is understood as a set of component skills and knowledge that support the process of reading comprehension (RAND Reading Study Group, 2002). This componential view of reading has a long history in the field (e.g., Gough & Tunmer, 1986; Perfetti, Landi, & Oakhill, 2005; Scarborough, 2003); yet relevant to this thesis because it provides a psychological model to situate the specific academic language skills that are hypothesized as points of leverage for instruction and intervention. In addition to background knowledge and motivation, at least three broad buckets of component skills are considered in the literature: (i) skills that allow readers to accurately and efficiently read words, like phonological decoding and word recognition skills; (ii) the skills and

knowledge needed by readers to comprehend language in text, skills like concept knowledge and linguistic knowledge (the focus of this thesis); and (iii) cognitive skills that help readers to efficiently make inferences and to engage in other self-regulatory practices (Brown, Palincsar, & Armbruster, 1984; Perfetti & Stafura, 2014). In these studies, I focus on the second bucket of skills—linguistic knowledge. More accurately, I focus on one component of language proficiency that is hypothetically essential to later school reading proficiency: Core Academic Language Skills of CALS (defined above). Specifically, in Chapter 2, I adopt a componential view of reading development and aim to advance the field by offering a more precise understanding of the developmental relations between this specific set of academic language skills and reading comprehension during middle school.

Sociocultural Perspectives | Because reading and language development are both cognitive and socially-mediated processes, this thesis is also rooted in a larger theory of language development based on sociocultural perspectives. From this orientation, academic language proficiency is indexed by the ability to signal group membership using language and to move between and within linguistic communities. Furthermore, academic language proficiency is viewed as the result of prior opportunities to be exposed to and to use the language of schooling—at home, in the community, and at school. Entering school entails expanding all students’ language resources in new ways; but for those socialized into school-like practices at home, school language and reading practices typically constitute more natural extensions to the interactions they have at home (Heath, 1983; 2012). For others, often students from low-income families or others

just learning English at school, these chances to learn academic English are far less frequent (Carter, 2005; MacLeod, 2004; Halliday, 2004; Snow & Uccelli, 2009; Suarez-Orozco, Suarez-Orozco & Todorova, 2008). This is what I refer to as an ‘academic language opportunity gap’ in this thesis. While these students may be skilled communicators at home, in peer groups, or in their communities, the unfamiliar language expectations of the classroom often place them at a distinct disadvantage, which is not a trivial one. Learning often depends on students’ comprehension of complex texts that contain academic language. To examine these relations further, in Chapter 3 I empirically examine how academic language skills may serve as a pathway through which SES impacts reading comprehension. In so doing, I highlight the relevance of focusing our attention of malleable skills susceptible to instruction in classrooms, like CALS, rather than on student attributes (SES, English Learner designation).

In addition, social development theory informs how I situate teachers as agents of language development and frame the goals of this thesis. I view language learning in classrooms as mediated by teachers, who as experienced academic-language users are able to scaffold the academic-language learning of their early adolescent students (Vygotsky, 1978). Because they know how language works in academic settings, teachers are well-poised to make these expectations explicit. At the same time, though, skillful users of academic language are often blind to the challenges it can pose to novice learner. To build this knowledge base, Chapters 2 and 3 of this thesis explores developmental patterns in academic language-reading comprehension development. To further support translation of this work to practice, Chapters 4 of this thesis aims to

translate the developmental research findings from prior chapters into a theory of change that might be adopted by educators or researchers to design academic language instruction.

Functional Perspectives | A third theoretical line that informs the view of language invoked in this thesis is systemic functional linguistics (SFL) (Berman & Ravid, 2009; Berman & Verhoeven, 2002; Halliday, 2004; Schleppegrell, 2004). From this perspective, academic language is a functional tool that evolved to support the types of precise and concise communication of ideas and content that goes on in classrooms. In this thesis, this theory base offers a complement to the view of academic language proficiency drawn from the sociocultural view described above. From the SFL perspective, academic language proficiency is demonstrated when students are able to select (in the case of writing or speaking) or access (when reading or listening) the language forms that are most useful for communicating complex thoughts and concepts clearly. In Chapters 2 and 3 of this analysis, the CALS measure employed attempts to capture students' knowledge and awareness of academic language features that are common in texts used in school settings and in academic discourse communities. Prior studies assess knowledge of language forms broadly without attention to context (e.g., assessing morphology/syntax knowledge generally without selecting those forms most likely to be in academic texts). In contrast, we assess only language features that are most common and useful for understanding or carrying out particular communicative functions common in school settings (e.g., persuasion, explanation, and defining unknown terms), but that tend to be infrequent in colloquial peer-to-peer conversations.

Why should we be concerned about students' academic language proficiency?

Theories of Social Stratification | Finally, this thesis is motivated by an interest in creating classrooms that stem social stratification, rather than foster it. For clarity, 'stratification' refers to the differential access to resources (material or symbolic, e.g., prestige) experienced by individuals relegated to particular social categories (Massey, 2007). In fact, within the context of Bourdieu's metatheory of social stratification, language patterns are a primary way through which socioeconomically disadvantaged adolescents are marginalized within school settings (Massey, 2007). 'Linguistic competence' or the skill of speakers/writers to use academic and conversational language following a listener's or reader's expectations is, for Bourdieu, a form of linguistic capital¹. Like other forms of capital, linguistic capital is unequally distributed (Bourdieu & Thompson, 1991).

Our research suggests that all adolescents, regardless of the language environments they inhabit, will have to acquire additional language skills to read academic texts successfully (Uccelli, Barr, Dobbs, Meneses, Phillips Galloway, & Sánchez, 2015; Uccelli, Phillips Galloway et al., 2015). Drawing on theories of social stratification, the stakes are particularly high, though, for students who recurrently have fewer opportunities --inside or outside of school-- to adequately master academic language. Research suggests that these students are more likely to be from low-income communities or to enter classrooms as English Learners (Reardon, 2011, 2013; Kieffer, 2008). Entering classrooms with lower levels of

¹ I prefer the term, 'rhetorical flexibility' to 'linguistic competence,' and so adopt this throughout.

proficiency than the one assumed by teachers and school curricula and then not being provided with enough rich opportunities to acquire these skills at an accelerated rate, these students are at risk for lagging behind in their development of academic language proficiency. Through the life course, lower academic language proficiency may prevent these learners from participating in higher education or in other realms of our information-based economy. In this sense, I argue –as have many others-- that not teaching academic language explicitly or with enough intensity only reinforces stratification within our larger society (Attewell & Lanvin, 2007; Bowles, 1977; Massey, 2007; Meyer & Rowan, 1978). In this sense, this thesis (especially Chapter 3) aims to highlight the specific language skills that require attention in academic settings for researchers and educators to support the more equal distribution of academic language skills needed for reading, writing, and thinking tasks in classrooms. With implications for teacher capacity building, this third paper speaks to the need to communicate emerging research to classroom-based practitioners, who are simultaneously grappling with mandates to teach academic language and to meet the needs of an increasingly linguistically diverse student population.

Thesis Motivations & Organization

To date, no prior studies have been undertaken to explore CALS growth longitudinally or to describe how CALS relate to reading comprehension growth across the middle grades. Scholars contend that these skills are essential for text comprehension growth (Snow & Uccelli, 2009), but the empirical research base remains thin. The last decade has been a

period of increased study of single aspects of later language academic development in middle grade populations (Farnia & Geva, 2013; Low & Siegal, 2005; Mancilla-Martinez & Lesaux, 2010, 2011; Mokhtari & Niederhauser, 2013; Sánchez & Garcia, 2009). Yet, few studies to date examine academic language as a composite of multiple skills that together support the development of reading comprehension. Scarcer still are studies of academic language skill development in particular subgroups—students from low-income homes and communities, ELLs (Crosson & Lesaux, 2013; Kieffer & Lesaux, 2008).

To move the field forward, the research agenda must be two-fold. First, researchers must describe the typical development of CALS and reading comprehension skills in the middle grade population, and second, they must investigate this development in subpopulations within the middle school population. In this thesis, I begin this task through the two primary studies presented in Chapters 2 and 3. Conducted within the context of a larger research program led by Drs. Paola Uccelli and Catherine Snow, these studies represent the cumulative efforts of a larger, highly collaborative team (please see acknowledgements). For this reason and because many heads are always better than one, I use plural language throughout this thesis to describe the actions of the researchers. In the Chapters that follow, I first paint a picture of the developmental relations between CALS and reading comprehension across grades 6-7 for a cohort of English Learners and their peers. This study is designed to offer insights into typical development of these skills and their relations over time. In Chapter 3, I describe the pathways through which SES impacts reading comprehension by focusing on academic language, thus offering insight into the relevance of these skills for particular groups. In Chapter 4, I explore the relevance of these findings to instruction by presenting a model that specifies the

expected relationships between language skills and reading comprehension in middle graders. In Chapter 5, I conclude this thesis by pulling together the findings across the two research studies and by proposing a series of future research directions.

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Chapter 2

Title: Examining Developmental Relations between Core Academic Language Skills and Reading Comprehension Throughout Early Adolescence

Abstract

Although many adolescents struggle to comprehend text, few studies have identified the school-relevant language skills, referred to as Core Academic Language Skills (CALS), which might contribute to variation in reading comprehension skills during this developmental period. To expand the research base, this study examines the concurrent development of academic language skills and reading comprehension in a sample of English Learners (n=103) and their English-proficient peers (n=730) followed over two academic years, from grade 6 to 7. Parallel process latent growth modeling results revealed that academic language and reading comprehension skills developed concurrently, with growth rates in CALS positively associated with growth rates in reading comprehension skills. Furthermore, initial levels of CALS predicted rates of growth in reading comprehension. Focused on a group of learners the majority of whom were reading below grade-level, this study highlights the potential for CALS-focused instruction to serve as instructional leverage for improving adolescent learners' reading comprehension outcomes.

Introduction

For reading researchers and educators, one of the most pressing questions is:

When middle graders struggle with reading comprehension, in what ways might their academic language skills play a role? This focus on language skills is largely driven by what we know about reading development in the middle schoolers: the majority of students (even those who entered elementary school classified as English Learners) have developed adequate basic word recognition skills (Farnia & Geva, 2013; Geva & Farnia, 2012; Kieffer & Lesaux, 2012; Whitehurst & Lonigan, 2001). In contrast, inadequate familiarity with the language of school texts is a primary source of variability in reading comprehension outcomes for middle graders (Deshler & Hock, 2007). In other words, whereas some middle graders continue to experience challenges with decoding (Wanzek, Roberts, Linan-Thompson, Vaughn, Woodruff & Murray, 2010), the majority typically can read the printed words on a page, but struggle to construct meaning because the words, sentence structures, and patterns of text organization are too unfamiliar.

In seeking to support middle grade learners, the field has largely turned to vocabulary training, recommended by the National Reading Panel, to improve reading comprehension (e.g., Beck & McKeown, 1991; Cain & Oakhill, 2011; National Institute of Child Health and Human Development, 2000; Oakhill, Cain & McCarthy, 2015; Ouellette, 2006). The paradox, however, is that mounting evidence from intervention studies focused on vocabulary shows only marginal impacts on reading comprehension development over time (Elleman, Lindo, Morphy, & Compton, 2009; Stahl and Fairbanks, 1986). While many factors might impact the success of these interventions, one possible explanation increasingly borne out in the research literature is that

vocabulary is only *one* important piece of a much larger constellation of language comprehension skills that support text comprehension skills for middle graders (Quinn, Wagner, Petscher, & Lopez, 2015; Uccelli, Barr, Phillips Galloway, Meneses, Sánchez & Dobbs, 2015; Uccelli, Phillips Galloway, Barr & Dobbs, 2015). Because this broader conceptualization of academic language proficiency is relatively new, it remains unclear how this set of skills typically develops over time and whether they support *growth* in reading comprehension across development for middle schoolers.

In our work, we refer to this constellation of language skills as Core Academic Language Skills (CALS) (See Uccelli, Barr et al., 2015 and Uccelli, Phillips Galloway, et al., 2015 for prior studies of CALS). CALS refer to high-utility language skills that parallel the linguistic features prevalent in academic texts across content areas, but which are infrequent in colloquial conversations (e.g., knowledge of logical connectives, such as *nevertheless, consequently*; knowledge of structures that pack information densely, such as nominalizations or embedded clauses; knowledge of structures for organizing argumentative texts). To be clear, CALS are not situated as globally relevant to all reading tasks; instead, they are particularly pertinent to the types of reading that students do in academic settings. Our prior cross-sectional studies suggest that CALS pose challenges to novice readers, and support the successful navigation of academic texts in skilled readers.

As an extension of our cross-sectional studies, in this study we explore how CALS develop over time and whether these skills are related to text comprehension across development. We explore these questions in a sample of students followed from the beginning of grade 6 until the end of grade 7 (n=833). To capture CALS, we make

use of a novel and psychometrically robust assessment: the Core Academic Language Skills-Instrument or CALS-I. Given the newness of the CALS construct, we first describe students' typical growth trajectories as academic language learners by analyzing four waves of CALS-I data. We separately explore the impact of English Learner designation on CALS trajectories as a descriptive exploration. Second, we empirically test whether academic language proficiency when operationalized as a broader construct supports gains in reading comprehension. To answer this second research question, we examine English Learners (ELs) and English Proficient students (EPs) as a single sample representative of those students attending U.S. urban schools. By focusing on students attending schools in two large urban districts where, according to state standardized assessment data, large numbers of students were reading below grade level, this study seeks to make visible a set of skills that, if targeted instructionally, holds the promise of supporting adolescent struggling readers in modal U.S. settings. In the sections that follow, I first describe the CALS construct and a series of prior cross-sectional studies that shed light on how these skills develop and support text comprehension in upper elementary and middle grade students. I then share the results of this analysis and conclude by discussing the implications of this study for practitioners and researchers.

Core Academic Language Skills: Definition & Prior Research

Defining Academic Language Proficiency for Research & Practice |

Defined broadly, academic language includes *both* the unique ways that language is used in each content area (*disciplinary academic language*) and the crosscutting features of the academic register found across disciplines (*Core Academic Language Skills*). The

prevalence of ‘core academic language’ or ‘CAL’ in middle grade texts is linked with their usefulness for conveying abstract ideas and concepts (Halliday, 2004; Snow & Uccelli, 2009). The learning occurring in schools centers on mastering abstract concepts and ideas, communicated almost entirely through language. For example, on a typical school day, a 6th grader might learn about a cell’s structure and function in life science, Spartan military training in social studies, and probability theory in math class. Although the topics are dissimilar and the situated disciplinary practices of each content area distinct, a common set of language demands is present: producing and understanding definitions, explanations, descriptions, and arguments using increasingly precise, concise, and reflective language (Bailey, 2007; Butler, Bailey, Stevens, Huang & Lord, 2004). In fact, Bailey notes the “remarkable similarities across disciplinary discourses” in middle school settings in the U.S. (2007, p. 10). Again, we refer to this common set of skills needed to navigate texts in all classrooms as ‘Core Academic Language Skills’ or CALS.

Support for the CALS construct comes from diverse lines of research: (i) linguistic research that has documented common language features appearing in the texts written by experts across academic disciplines (see Snow & Uccelli, 2009 for a full discussion); (ii) developmental studies revealing growth in core academic language skills among adolescents, including increased skill in producing texts that are lexically precise, morpho-syntactically complex, and organized following predictable organization patterns (e.g., Benelli, Belacchi, Gini, & Lucangeli, 2006; Berman & Ravid, 2009; Berman & Verhoeven, 2002; Christie & Derewianka, 2013) and (iii) current educational standards and assessments that emphasize ‘academic language’ (Lee, Quinn, & Valdés, 2013; Stage, Asturias, Cheuk, Daro, & Hampton, 2013).

Defining CALS as the sum of these many reading-related competencies is a departure from the way in which academic language has typically been captured in prior studies. Academic language skill is often solely indexed by measures of vocabulary (e.g., Connor, Radach, Vorstius, Day, McLean & Morrison, 2014). While knowledge of word meanings certainly comprises an important piece of the school-relevant language puzzle, a consistent finding of our prior work is that CALS can be distinguished from vocabulary knowledge, with each making unique contributions to students' reading comprehension (Uccelli, Barr, et al., 2015; Uccelli, Phillips Galloway, et al., 2015). Vocabulary and CALS skills are highly correlated, however. This makes good sense. As students are accumulating knowledge of the words that pepper complex texts (e.g., Anglin, 1993; Nagy, Anderson, & Herman, 1987), they are most certainly also being exposed to the other language features that surround these words in text. Below, I present an overview of the linguistic skills that we call CALS or Core Academic Language Skills, which informed the design of the Core Academic Language Skills-Instrument or CALS-I, the measure used to capture academic language proficiency in this study.

Skill in unpacking dense morpho-syntactic structures:

- a. *Unpacking complex words | Skill in morphological decomposition.* Academic texts contain many morphologically complex words, which allow writers to convey complex ideas concisely (Biber & Gray, 2011; Schleppegrell, 2004). For instance, nominalizations (nouns formed from verb forms) like 'researcher' or 'investigation' convey the same amount of information to readers as phrases like 'a person who does research' or 'a procedure undertaken to determine whether a hypothesis is correct.'

Readers who are unfamiliar with a word encountered in text, but able to use knowledge of word parts, have an advantage over peers without this skill. For instance, a reader encountering the adjective ‘credible’ who knows that –ible roughly means ‘able to’ has an advantage over a peer without this morphological awareness. Both English Learners and English-proficient middle graders who can derive complex words are better able to comprehend academic texts (Carlisle, 2000; Kieffer & Lesaux, 2008).

- b. *Unpacking complex sentences | Skill in understanding complex syntax.* Complex syntactic structures, like center-embedded clauses, appear frequently in academic texts, where the goal is to pack multiple ideas into a single statement to convey information concisely (Halliday, 2004; Schlepppegrell, 2004). The challenge facing readers is to unpack the many ideas in a single sentence to understand the text. Unsurprisingly then, syntactic skills have been shown to positively contribute to reading comprehension (e.g., Mokhtari & Thompson, 2006; Mokhtari & Niederhauser, 2013; Nation & Snowling, 2000; Taylor, Greenberg, Laures-Gore, & Wise, 2011).

Understanding school-relevant connectives and discourse markers. Academic writers make use of discourse markers and connectives (words and phrases like *although*, *in other words*) to signal relations between ideas and to mark text transitions (Hyland, 2004). These words and phrases may support readers by facilitating on-line processing and by aiding recall of what has been read (Cain & Nash, 2011; Crosson & Lesaux, 2013; Derakhshan, Sani, Ghalaei, & Izadi, 2015; García, Bustos, & Sánchez, 2015; Hyönä &

Lorch, 2004; Williams, Pollini, Nubla-Kung, Snyder, Garcia, Ordynans, & Atkins, 2014; van Silfhout, Evers-Vermeul, & Sanders, 2015).

Skill in anaphoric/cataphoric resolution. To avoid repetition in texts, writers frequently make use of anaphoric and cataphoric reference, or words or phrases appearing in a text that refer to a prior/later participant or idea (e.g., ‘*Mary* is turning 5. *She* is excited about the party’). For readers, these ideas must be linked to achieve comprehension (Givón, 1992). Whereas anaphors and cataphors that refer to concrete objects, like ‘*Mary*’ in the sentence above, are common in everyday speech, academic texts make use of so-called ‘conceptual anaphors (e.g., *The series of chemical reactions* used by aerobic organisms to generate energy are referred to as the ‘Krebs cycle.’ *This process...*)’ (Benitez-Castro, & Thompson, 2015; Flowerdew, 2003). For upper elementary school students, the skill to resolve conceptual anaphora is positively associated with reading comprehension (García, Bustos, & Sánchez, 2015; Sánchez & García, 2009).

Skill in argumentative text organization. Knowing how to organize expository texts develops between the middle school and the high-school years (Berman & Nir-Sagiv, 2007). While research linking text organization skills to text comprehension comes primarily from studies of narrative text comprehension in younger children, knowledge of new text structures is hypothesized to be no less important in the upper grades (Oakhill & Cain, 2000). In this research, we focus on skills in structuring argumentative texts (i.e., thesis, arguments, examples, conclusion) as likely contributors to reading comprehension

during these years (Meyer & Poon, 2001; Rex, Thomas, & Engel, 2010; Williams et al., 2014).

Understanding academic metalinguistic vocabulary. While vocabulary has for decades been identified as an important predictor of text comprehension (Griffin, Burns & Snow, 1998; NICHD, 2000; RAND Reading Study Group, 2002), the specific subset known as ‘metalinguistic vocabulary’ is hypothesized to be of particularly high utility across content areas during the middle school years. These words appear frequently in texts and academic discussions because they refer to argumentation steps, thinking processes or text-based discourse practices (e.g., *counterargument, generalization, synthesis, evaluate*).

Understanding stance markers that signal a writer’s viewpoint, especially a writer’s degree of certainty. In academic texts, writers often make use of language to convey to readers how certain or uncertain they are about a proposition (e.g., *Certainly, It is unlikely that*) (Hyland, 1998). While research on whether awareness of these epistemic terms improves reading comprehension is still rare, a few studies suggest that their presence supports adult readers in interpreting the author’s perspective (Camiciottoli, 2003; Sanders & Noordman, 2000). This aspect of CALS supports determining an author’s stance, bias, or perspective about an issue within or across texts.

Skill in identifying academic register. Whether students use their CALS resources when reading or not seems to hinge on whether they recognize a text to be academic or not, a

skill we call ‘academic register awareness’ (Bar-Ilan, & Berman, 2007). So far, we have operationalized this domain as the recognition of academic definitions because these are short texts that contain many of the features found in academic writing writ large (See Table 2 for more details).

The Development of Academic Language Proficiency | Because the CALS construct has been recently operationalized for research and practice, this study first examines developmental patterns, both in initial status and rates of growth, in academic language proficiency. To date, several cross-sectional studies using the CALS-I to capture academic language skills document an upward trend in these skills throughout the middle school years. Uccelli and colleagues (2015) find that CALS-I scores were significantly higher for students in later grades, with grade 6 students demonstrating significantly higher levels of proficiency than students in grades 4 and 5. Consistent with findings from prior cross-sectional studies that examine the production of oral or written expository texts, these studies, which examine mostly receptive academic language skills, suggest that the transition from elementary to middle school is a watershed moment in school-relevant language development (Aparici, Rosado, & Perera, 2016; Beers & Nagy, 2009; Berman, 2007; Nippold, 2007). Furthermore, prior studies using the CALS-I find that English Learners, who by definition enter school having had less exposure to English than their English proficient peers, display, as would be expected, academic language skills below those of their English proficient classmates (Uccell), Barr, et al., 2015). However, so far we have *not examined* CALS in a longitudinal sample; thus, we lack information about typical rates of growth in CALS throughout the middle grades.

While CALS show an upward trend on aggregate, prior cross-sectional CALS research has revealed considerable individual variability. For instance, in one study, the mean percent correct CALS-I score in 4th grade was .52 (SD=.28) and in 6th grade .63 (SD=.26); however, some students in 4th grade scored as high as .73 and some students in grade 6 scored as low as .32 (Uccelli et al., 2015b). This is unsurprising in light of the large individual differences in language development, particularly in vocabulary skill for both monolingual and bilingual middle grade learners (Biemiller & Slonim, 2001; Mancilla-Martinez & Lesaux, 2010, 2011). Yet, cross-sectional data can only provide general trends. To understand developmental trajectories, the same group of students needs to be followed over time. Language learning is a complex process impacted by the texture of students' language experiences. I therefore anticipate large variability in rates of academic language growth, and plan to document that variability for both English proficient and EL students.

Academic Language Proficiency and Reading Skill: Hypothesized Relations | In addition to exploring these growth trajectories, I examine the developmental relations between academic language skills and reading comprehension. Without question, linguistic skills play a central role in text understanding throughout development. For instance, within the Reading Systems Framework, knowledge of language at different levels (phonology, syntax, morphology, lexicon) is situated as chief among the skills that support text comprehension (Perfetti and Stafura, 2014). Drawing on this model and numerous others (Gough & Tunmer, 1986; Kintsch & van Dijk, 1978; RRSF, 2002), I predict that students with higher levels of CALS will also demonstrate higher levels of

text comprehension. Furthermore, students with more developed CALS might be expected to experience faster gains in reading comprehension than peers because they are able to leverage these language skills when reading. For instance, faster rates of growth in academic language skills may be linked with more rapid growth in reading comprehension skills across development because as students engage with text—where academic language features occur in the highest prevalence—they are both building additional CALS and honing their skills as text comprehenders.

To date, empirical evidence linking the CALS construct to reading comprehension is just emerging and this study is the first to explore this development over time. However, cross-sectional studies examining the relation between CALS and reading comprehension among both monolingual English speakers and English Learners provide some evidence that these skills may be intertwined, at least for students in grades 4-8. For instance, Uccelli and colleagues (2015b) found that when controlling for students' vocabulary depth, word reading fluency, and a host of socio-demographic factors, 4th to 6th graders' CALS scores uniquely predicted their reading comprehension scores. Other studies that examined the influence of lexical and grammatical features—like those included in the CALS construct—on the comprehension of test items find that these features pose particular challenges to both language-minority learners and native speakers (Abedi, Leon, Wolf & Farnsworth, 2008; Haag, Heppt, Stanat, Kuhl, & Pant, 2013; Martiniello, 2008). For instance, a study in carried out in Germany (Heppt, Haag, Böhme, & Stanat, 2015) found that lexical and grammatical features of academic language in test questions posed particular challenges to 4th graders with home languages different than German, with especially marked effects for long and complex words and

average sentence length (see Martiniello, 2008 for similar results with English learners in the U.S.). Language-majority students from low-SES environments encountered similar challenges, although to a lesser extent (Heppt et al., 2015). An open question for the field, however, is whether academic language development is associated with growth in reading comprehension skills and if so, in what ways—a question that is particularly pressing for educators attempting to support adolescents struggling to gain proficiency as readers.

The Current Study

In the current study, we aim to extend the existing research base by first exploring the longitudinal development of academic language skills in English Learners and their English Proficient peers followed over two academic years (grades 6-7). Notably, formed English Learners, who had been reclassified by their respective districts as ‘English Proficient’ are grouped with their peers never designated as English Learners. Then, by modeling the growth of academic language and reading comprehension simultaneously using a latent variable approach, we examine the inter-relation between academic language skills and text understanding. This study contributes to our understanding of the language-reading comprehension relations and represents an important initial step in describing development for middle graders experiencing typical instructional conditions in large, linguistically diverse school districts. With an interest in informing instructional approaches that disrupt inequity and offer equal opportunity, we focus on a particular group, students attending U.S. public schools serving low-income communities in urban settings. Specifically, we address two research questions:

1. What are the average initial levels and rates of growth in Core Academic Language Skills (CALS) between 6th and 7th grade for a cohort of English Learners and their English Proficient peers?
2. Are CALS levels at the beginning of 6th grade associated with concurrent levels of reading comprehension? Are rates of growth in CALS associated with rates of growth in reading comprehension?

Method

Sample | This study was conducted within the context of a large multi-year study investigating predictors of skilled reading comprehension among upper elementary and middle grade students. While the larger investigation included 24 schools drawn from three districts in the Northeastern United States that were randomized to treatment and control conditions, data for the present study are from control schools only ($n = 12$). The participants in this study included all students who participated in the study control group ($n=833$ students). The sample was balanced by gender (50% female). Reflecting the demographics of the urban and semi-urban communities of the schools, the sample was relatively ethnically diverse (36% Black, 17% White, 16% Latino, 3% Asian, >1% Multiple Race/Other) and comprised primarily by students from low-income families (82% eligible for free/reduced price lunch). 12% of students were designated as English language learners (ELLs) according to school records (in contrast, to the national estimate average of 9%). Finally, 19% of students in the sample were identified as eligible for special education services (Table 1). In year two of the study, attrition was modest with 88 students leaving the study (about 10% of the total sample); however, 53 students joined the sample (about 6% of the sample). Neither the students who left the study nor those who entered at the start of the second year differed from peers who

consistently participated in the study in their demographic characteristics or performance on achievement measures (all $ps > 0.05$). State standardized ELA testing data from Maryland and Massachusetts (available for 67% of the sample) provide an initial indicator of the reading and academic achievement levels of students in the sample. The vast majority (82%) performed in the ‘needs improvement’ range, 13% performed at grade-level and 5% above grade-level. ²

****Insert Table 1 Here****

Measures | students were assessed in the fall and spring of 6th and 7th grade. Trained administrators administered the following measures as part of the students’ regular school day.

Core academic language skills. The Core Academic Language Skills-Instrument (CALS-I) is a group-administered instrument designed to assess the various components of CALS in grades four to eight (Uccelli, et al., 2015a). The CALS-I is a 50-minute paper and pencil test that includes eight short tasks: Connecting Ideas, Tracking Themes, Organizing Texts, Breaking Words, Comprehending Sentences, Identifying Definitions, Interpreting Epistemic Stance Markers, and Understanding Metalinguistic Vocabulary. Tasks use various formats to assess students’ skills including multiple-choice, matching, or short written responses. For additional information on the tasks included in the CALS-I, see Table 2. The CALS-I was designed following a rigorous design process that

² These numbers are estimated on an incomplete data file; when our school partners provide complete data, these numbers will be revised to reflect the true sample.

unfolded in the following order: a task design phase, and pre-pilot study, a series of qualitative and quantitative pilot studies, an expert review panel, and a norming phase (for more information, see Uccelli et al., 2015a, 2015b). Two forms of the CALS-I, which are vertically aligned, were used in this study: CALS-I-Form 1 for grade six ($\alpha = .90$, number of items = 49) and CALS-I-Form 2 for grade seven ($\alpha = .86$, number of items = 46). Most items in the CALS-I are dichotomously scored as correct or incorrect. The partial-credit items --which are not scored dichotomously-- were rescaled to be between 0 and 1 so all items were equally weighted. Rasch item response theory analysis was used to generate factor scores using a vertically equated scale. These factor scores are used in the present analysis.

****Insert Table 2 Here****

Reading comprehension. The Global Integrated Scenario-based Assessment (GISA), developed by Educational Testing Service, is a computer-based assessment that uses scenarios to motivate text comprehension. In a scenario-based assessment design, students are provided with a plausible purpose for reading (e.g., to decide if a wind farm is a good idea for your community) and a collection of text-based sources (e.g., website, e-mail, news article, textbook excerpt) that include text types regularly encounter at school (e.g., expository texts). After reading the passages, students answer a series of comprehension questions, some requiring simple recall of details from the text and others requiring text-based inferences, distinguishing claims and evidence, integrating information across multiple texts, questioning, predicting, and summarizing. Though it is a relatively new instrument and psychometric analyses are still ongoing, evaluations suggest that GISA is appropriate for assessing a wide range of ability levels, and can

reliably measure a range of complex reading skills that go beyond those assessed in more traditional, low-inference comprehension assessments (O'Reilly, Weeks, Sabatini, Halderman, & Steinberg, 2014; Sabatini, O'Reilly, Halderman & Bruce, 2014a, b). ETS results from a study of middle school students revealed that GISA possessed adequate psychometric properties (Sabatini, O'Reilly, Halderman & Bruce, 2014a), including robust estimates of internal consistency (alpha) reliability (0.89) and split half reliability (.76), with each half of the test showing adequate alpha reliability ($\alpha = 0.80$ and $\alpha = 0.82$, respectively). Test-retest reliability was $r(283) = .87$ and there was no significant difference in mean scores. GISA also demonstrated strong concurrent validity with other reading comprehension tests, as well as component reading subtests. GISA is currently designed to produce a single score, which is reported on a common, cross-form scale based on a large-scale study conducted by the ETS research team. Scaling used a concurrent, multi-group approach, with a two-parameter logistic IRT model (2PL) for form pairs. Factor scores are used in this analysis.

Covariates. English Learner (EL) status (yes=1, no=0), free or reduced price lunch eligibility (yes=1, no=0), and special education eligibility (yes=1, no=0) –as reported in school records— were included as time-invariant covariates. Students' initial values for each sociodemographic variable were used in this analysis because they were found to be highly stable across the years of the study.

Data Analytic Approach | To address the research questions in this study, we conducted latent growth modeling using MPLUS, version 7.4. To answer our first research question,

we made use of multi-group latent growth modeling to model English Learners' and English Proficient students' latent growth trajectories in CALS. To address our second research question, we made use of a parallel latent growth model to capture students' growth trajectories in CALS and reading comprehension simultaneously. Figure 1 is a path model showing the hypothesized relations between the growth trajectories in academic language proficiency and reading comprehension between grades 6 and 7. The upper portion of the figure represents a student's CALS development as a linear function of time using a four-indicator (representing the four testing occasions) two-factor measurement model. The hypothesized relation between the two latent constructs, a student's initial CALS status (intercept) and true rate of change in CALS (slope), is represented via a single-headed arrow (Path A). Similarly, the lower portion of the figure represents a student's reading comprehension development as a linear function of time. For both constructs, time is captured in months to more accurately model the time between each testing occasion. In the center of the path model, both single-headed and double-headed arrows represent the residual covariances of the hypothesized reciprocal relations among the individual growth parameters describing linear change in academic language proficiency and reading comprehension.

Of particular interest are paths D, E and F. Path D tests whether initial starting values of CALS at the start of grade 6 predict growth in reading comprehension for the students in the study. Path E tests the covariance between the two slopes, giving insight into whether growth in academic language skills and reading comprehension covary when controlling for the influence of a student's initial level of CALS and reading comprehension (RC) (controlling for Paths A and B). Path F offers insight into the

covariance between initial levels of both skills, indicating whether higher initial values of CALS are associated with higher initial reading comprehension values.

To control for student-level characteristics known to impact language and literacy outcomes, English learner status, eligibility for free or reduced lunch status, and special education status were treated as time-invariant covariates. Because students were drawn from 12 schools and clustering is not recommended with fewer than 30-50 unique clusters, we conducted this modeling without accounting for nesting. To assess that this would not violate any assumptions, separate models were fitted for each school district; however, nested model tests confirmed that the students' starting values and rates of growth in CALS and reading comprehension did not differ significantly across the three districts, justifying the use of a single model in this analysis (all p s > 0.05). To account for any missing data, we made use of full information maximum likelihood (Bollen & Curran, 2006). Across the variables included in the analysis the percentage of missing data did not exceed 20%, with the exception of the measures administered in the final wave of the study for which 27% of the data was missing (Little & Rubin, 2002).

****Insert Figure 1 Here****

Results

Exploring growth in CALS for English Learners and their classmates | To answer our first research question and before fitting a parallel process model for the concurrent development of CALS and reading comprehension, we first modeled growth in each outcome separately to determine the most suitable functional form for each growth trajectory. In addition, these univariate latent growth models provide insight into students' initial levels (intercept) and rates of growth (slope) for both CALS and reading

comprehension separately when controlling for free and reduced lunch eligibility (used as a proxy for family socioeconomic status) and special education designation. Following standard estimation procedures, all intercept loadings for the observed variables at each testing occasion were fixed to 1; to represent months of maturation elapsed from the first occasion of measurement in the fall of grade 6, slope terms were fixed to 0, 9, 12, 21 for the first, second, third, and fourth wave of assessment, respectively. To model growth for English Learners and their classmates separately, a multigroup model was fit to the data. Free or reduced lunch eligibility and special education eligibility functioned as time-invariant covariates and were regressed onto the latent variables' slope and intercept. Table 3 provides the observed means and standard deviations for CALS-I scores for the total samples and by students' English proficiency status. Because the scores in this table are represented as factor scores, values range from negative to positive. To evaluate model fit, we adopted the guidelines provided by Kline (2011). A model was considered well-fitting if the comparative fit index (CFI) and Tucker-Lewis index (TLI) values exceeded 0.95, and if the root mean square error of approximation (RMSEA) and root mean square residual (SRMR) were smaller than 0.08.

****Insert Table 3 Here****

After examination of observed data that suggested a linear growth trajectory, a linear model was fit to the data. This linear model capturing growth in CALS demonstrated good model fit $\chi^2(10) = 53.03$, $p = 0.00$, CFI=0.98, TLI=0.96, RMSEA=0.07 (90% CI=0.05-0.09), SRMR=0.05. Subsequently, a quadratic term was added to the model to assess whether this functional form was a better fit to the data, however, this model failed to converge. A multigroup model was then fit to the data to obtain growth

trajectories for English Learners and English Proficient students. This model also showed good model fit $\chi^2(16) = 55.76$ $p=0.00$, CFI=0.98, TLI=0.97, RMSEA=0.08 (90% CI=0.06-0.10), SRMR=0.06. Results of the linear model (Figure 2) show trajectories of CALS growth experienced by English Learners (EL) and English Proficient (EP) students from grade 6 to 7 (See Table 4 for coefficient values). Nested model tests of an unconstrained model in which both the slope and intercept were permitted to vary between the EL and EP students and a model in which the parameter of interest (either slope or intercept) was constrained to be equal across the two groups were used to assess whether there were differences in starting values or in rates of growth between the two groups. These tests suggested that while English Learners had significantly lower CALS scores at the start of the study ($\Delta -2LL = 34.47$, $\Delta df = 1$, $p = 0.000$), their skills grew as rapidly as their English proficient peers'. In other words, despite their significantly lower initial CALS, English learners exhibited academic language rates of growth that did not differ statistically from English Proficient students ($\Delta -2LL = 0.16$, $\Delta df = 1$, $p = 0.689$). To support interpretation, these gaps in CALS performance at each testing occasion are re-expressed in differences in standard deviation using Hedge's G and in months of growth. This latter metric can be understood as the months of learning that would be required for English Learners to close the gap at the designated time point. Given the significant differences in CALS initial status, EL students, despite experiencing growth in these skills over time, would have required 37.5 months of learning (or three additional years) over the two previous years to perform at commensurate levels as their English Proficient peers at the end of grade seven. Substantively, these results highlight CALS as an area of particular challenge for EL learners, who developed these skills at about the same rate as

EP classmates but did not generally catch-up over the two years they were followed in this study. Of greater importance for instruction, however, is that for both EL and EP students, adolescence seems to be a time for CALS growth, with both groups developing as CALS users across the two years they were followed.

Our analysis also suggests that these skills are particularly impacted by students' socioeconomic opportunities. Figure 3 shows results disaggregated by English learner status and SES. While SES exerts a strong impact on the performance of English proficient students, with students from low-income homes performing below peers from middle-income homes, this influence is less evident for English learners, who demonstrate similar levels of proficiency regardless of SES.³

****Insert Figure 2 , 3 Here****

****Insert Table 4 Here****

Examining CALS-Reading Comprehension Relations | To address our second research question, whether higher CALS scores at the start of the study and over time were associated with growth in reading comprehension, we fitted the parallel process latent growth model depicted in Figure 1. Table 5 displays the correlation matrix for all variables included in this model. Before fitting the combined model, univariate models were fit for each process separately to confirm that the trend could be modeled as linear. The results for the model capturing CALS growth are reported above. For the univariate model of reading comprehension, the linear model had good model fit $\chi^2(13) = 85.94$,

³ It is worth noting, however, that very few EL students in this sample were ineligible for free or reduced-price lunch making these results worthy of additional verification in a larger, more socioeconomically diverse sample.

$p=0.00$, CFI=0.96, TLI=0.94, RMSEA=0.08 (90% CI=0.07-0.10), SRMR=0.03⁴. A

quadratic term was added to the model to assess whether this functional form was a better fit to the data, however, this model demonstrated poorer fit overall.

****Inset Table 5 Here****

Next, the parallel process model was fit to the data. The model demonstrated good model fit $\chi^2(30) = 182.503$, $p=0.00$, CFI=0.97, TLI=0.95, RMSEA=0.08 (90% CI=0.07-0.09), SRMR=0.03. Corroborating our findings from the univariate models, the positive significant slope values for both CALS ($\beta = 2.15, p < 0.001$) and reading comprehension ($\beta = 1.63, p < 0.05$) indicated that both skills independently experienced growth from the beginning of 6th grade to the end of 7th grade (Table 6). To examine CALS-reading comprehension relations, we evaluated the magnitude and direction of the covariance parameters (Paths E and F). Notably, the CALS and reading comprehension intercepts positively co-varied ($\beta = 0.79, p < 0.001$) suggesting that students with more developed CALS skills also demonstrated higher-levels of text comprehension at the start of the study at the beginning of grade 6 (Path F). Similarly, we found a strong positive relation between rates of growth in CALS and rates of growth in reading comprehension ($\beta = 0.68, p < 0.001$) when controlling for the impact of initial status of CALS and RC on the slope factor (Path E). Thus, students with more rapid rates of growth as academic language users also experienced more rapid rates of growth in their text comprehension abilities from the beginning of grade 6 to the end of grade 7. Furthermore, examination of Path D suggested that students who entered the study with more developed CALS skills experienced faster rates of growth as text comprehenders

⁴ The residual variance of the slope was constrained to 0 because it was insignificant.

over the next two years ($\beta = 1.05, p < 0.001$). Curiously, and for discussion in the next section, Path C modeling the relation between initial reading comprehension levels and growth in CALS was not significant in this sample.

This model also offers insight into differences in skill development for English Learners and their English proficient classmates. Mirroring the results of our univariate models, examination of the intercept values suggested that, in comparison to their EP peers, EL students demonstrated lower Core Academic Language Skills (CALS) ($\beta = -0.60, p < 0.001$) and reading comprehension scores ($\beta = -0.42, p < 0.001$) at the start of grade 6 (Table 6). However, EL status exerted no impact on rates of growth in either skill (Table 6). Similar trends were observed for the other covariates including free/reduced lunch status and special education status, which influenced students' initial CALS scores, but exerted no influence on rates of growth.

****Inset Table 6 Here****

Discussion

To date, the relationship between academic language growth and reading skill in the middle grades has generally been conceptualized as continuous and, at least to an extent, reciprocal. But given the lack of longitudinal studies of these skills, it has been unclear exactly how these two facets of development related over time. In large part, this is the result of not having measures that adequately capture this construct, a methodological stumbling block that we attempted to overcome in this study. By harnessing the availability of a measure to capture academic language proficiency, this study lends empirical support to the statement that academic language skills are an important contributor to text comprehension for adolescent learners. Specifically, this

study contributes to an emerging research base that examines academic language, with the specific goal of specifying the academic language skills that support middle grade readers as they progress through schooling. We focused in particular on English Learners and their peers attending U.S. public urban middle schools serving students predominately from low-income homes. In so doing, we describe the upward developmental trajectory of Core Academic Language Skills (CALS) experienced by students attending modal U.S. schools from the beginning of grade 6 to the end of grade 7 and its relation with reading comprehension, during a developmental period in which students are increasingly faced with complex texts.

Three key findings emerge from this study, each with important implications for how educators and researchers understand and promote academic language development for English Learners and their peers. First, on average, English Learners begin Grade 6 with CALS scores far below those of their English Proficient peers (Figure 2, 3); but experienced similar rates of growth in these skills from grade 6 to grade 7, suggesting that this may be a period for CALS growth for both groups. Second, initial CALS scores at the start of grade 6 were positively and significantly associated with initial reading comprehension scores and rates of growth in academic language skills and reading comprehension skills were also significantly associated, such that students with more rapid growth in CALS experienced more rapid growth in reading comprehension. Third, CALS scores at the start of grade 6 were related to growth in reading comprehension skills across grades 6 and 7.

Overall, these findings advance our understanding of academic language proficiency by demonstrating the developmental nature of CALS and by more precisely

quantifying developmental progressions of a particular subset of language skills found to be critical to support reading comprehension development, within and across English proficiency groups. Our finding that EL students lag behind English Proficient peers confirms the current concerns about ELs' academic language development. Importantly for policy and practice, however, the rates of CALS growth experienced by these EL students also suggest that this a period in which English Learners are developing as academic language users. An important caveat to these findings is that English Proficient students from low-income homes also appear to require support in acquiring academic language skills. This suggests that academic language instruction should be part of day-to-day instruction and a focus of whole class teaching, especially in settings serving large numbers of students from low-income environments. By identifying a broader constellation of language skills that make important contributions to text comprehension, this study adds to prior research that has identified similar patterns for vocabulary development (Mancilla-Martinez & Lesaux, 2010) and sheds light on a concrete set of skills that require instruction. This finding should inspire optimism about the potential of CALS as a point of instructional leverage when attempting to support reading comprehension development in adolescents.

Expanding Understandings of Language that Guide Practice and Research |

For Research | These results offer important insight into the nature of academic language skill development. Notably, our finding that academic language skills show significant growth over time lends empirical support to the claim that this constellation of skills can be characterized as one that develops throughout adolescence (Snow & Uccelli, 2009).

Furthermore, this growth appears to be incremental. Academic language learning, therefore, follows similar patterns to other facets of language development.

Our finding that both initial levels and rates of growth in CALS are related to reading comprehension has important implications for theory and research. Students' initial CALS levels predicted growth in reading comprehension; and students who experienced more rapid rates of CALS growth also experienced more rapid rates of growth in reading comprehension skills. These results are in-line with prior research examining vocabulary development that finds strong evidence for a reciprocal links between vocabulary size and reading comprehension (Biemiller & Slonim, 2001; Nagy & Scott, 2000; Verhoeven & van Leeuwe, 2008; Verhoeven, Van Leeuwe & Vermeer, 2011). Taken together the results of this study and of those focused on vocabulary give us insights into how we might augment existing theoretical models of reading comprehension. Theoretical models of reading comprehension have long suggested that linguistic comprehension skills that support skilled reading include a range of linguistic competencies that operate at lexical, syntactic and discourse levels of a text (e.g., Kintsch and van Dijk's construction-integration model (1978), as well as Perfetti and Stafura, 2014). Designed to describe reading as a general process, these models conceptualize language as a broad, unspecified domain. The challenge arises, however, when we attempt to use these general models to understand the specific challenges that readers encounter when reading academic texts in the classroom. Potentially the field might benefit from theoretical models that specify a specific set of language skills that support students to make sense of texts at school. While strategically limited in their scope to focus on only skills needed when reading academic texts, this new generation of models

would offer a level of specificity that is necessary if we are to design instruction or measure the impact of interventions that aim to impact older readers' academic text comprehension skills. These models would have practical advantages for researchers and educators who are focused primarily on supporting students to manage challenging school texts, a task that demands a focus on particular, rather than general skills. This study offers some evidence for the inclusion of Core Academic Language Skills (CALS) in such a model.

As noted above and hypothesized at the onset of this study, we found that initial levels of CALS predicted students' rates of growth in reading comprehension. These results are in line with those from prior studies examining vocabulary-reading comprehension relationships. For instance, third-grade vocabulary predicted fifth-grade reading comprehension when controlling for third-grade reading comprehension in a study conducted by de Jong and van der Leij (2002). Quinn, Wagner, Petscher, and Lopez (2015) also find that from grade 1 to 4, reading comprehension growth depended in part on vocabulary knowledge at the beginning of the study. The authors suggest that this finding supports Anderson and Freebody's instrumental hypothesis (1981), the better a learner's knowledge of the word meanings in a text, the better the learner's ability to understand the text. Our findings offer some evidence that it is not only knowledge of word meanings—but of language found in academic texts more generally—that is associated with the development of text comprehension skills.

Finally, though, initial levels of reading comprehension did not predict rates of growth in CALS in this sample. This may be because of the potential impact of academic language proficiency in limiting access to grade-level texts. For samples including large

numbers of struggling readers—like the sample used in this study— reading comprehension skills at the start of grade 6 might simply be too under-developed to support academic language learning through independent reading. Students reading below grade-level presumably have had fewer opportunities to engage productively with the complex language and discourse structures in the texts that they regularly encounter. This study is, however, the first one to identify this relation. The possibility of a bidirectional relation in which RC intercept also predicts CALS growth needs to be examined in future studies with larger and even more diverse samples.

For Practice | Without question, equipping students with the skills they require to become skilled readers is a central goal of today’s middle grade educators; but to date these efforts have largely focused on fostering students’ vocabulary skills and, in a small subset of studies morphological skills, both for English proficient students (Baumann, Edwards, Boland, Olejnik, & Kame’enui, 2003; Kirby, Bowers & Deacon, 2009; Nunes, Bryant, & Olsson, 2003) and English Learners (Carlo, August, McLaughlin, Snow, Dressler, Lippman... & White, 2004); Lesaux, Kieffer, Faller, & Kelley, 2010). And, yet, practitioners engaged in the day-to-day work of teaching complex text to struggling readers have long-expressed the idea that it is not only word-level features that pose challenges to their students. Building on this observation from practice, here we document the facilitative role of knowledge of lexical, syntactic and discourse organization features common in academic text (i.e., CALS) to text comprehension. In so doing, these results can support middle school educators in identifying some key academic language features of texts that demand instructional attention (e.g.,

‘pedagogical language knowledge’) (Bunch, 2013). To do this, educators, themselves, must develop an awareness of the multiple dimensions of the language of school texts, which are often transparent to them as skilled readers, but challenging for their students.

Although not designed to examine a particular instructional approach for fostering reading comprehension skills, this study certainly highlights the necessity of approaches that accelerate CALS growth, especially for students who might not have had enough opportunities to learn this language outside or inside of school, especially English Learners and many students who grow up in low SES environments. On the surface, the finding that English Learners perform at levels far below peers may appear to motivate a targeted intervention for ELs. It is important to remember, however, that the English proficient students in this sample were predominately struggling readers, performing below benchmarks on state standardized tests. This suggests that sustained and systematic instruction might focus on accelerating CALS development in both groups. Given the high-utility nature of CALS and its relevance across content areas, we can imagine that content-area teachers might scaffold conceptual learning, while also emphasizing CALS as a transection of language skills that manifests itself in situated discipline-specific practices.

Instructional practices that are particularly concerning in light of these data is the prolonged focus on building conversational English skills with English Learners and the tendency to avoid teaching complex or sophisticated text documented in educational settings serving high numbers of struggling readers (Kibler, Walqui, Bunch, 2015; Wong Fillmore, 2014). In contrast, recent efforts to build educators’ instructional expertise offer a window into how during this developmental period, school-relevant language skills

might be scaffolded in classroom instruction. For instance, Wong Fillmore (2014) advocates for a pedagogy that presents students with small segments of complex text to support them in attending to the text's meaning and discourse structures simultaneously. Verplaetse (2014) and Phillips Galloway, Stude and Uccelli (2015) emphasize how sociocultural approaches that build language reflection through interaction with teachers and with peers, might be used to foster knowledge of academic language via scaffolded talk (Phillips Galloway et al., 2015). Koelsch, Chu, and Banuelos Rodriguez (2014) highlight how professional development can foster content-area teachers' knowledge of pedagogical routines that develop students' "language for learning," which encompasses language needed to learn disciplinary concepts and for participating in disciplinary practices. While these various instructional approaches are all currently hypothesized to foster academic language learning in the classroom, we suggest that the cross-disciplinary conceptualization of the CALS construct—which this study demonstrated to be linked with reading comprehension— might augment these efforts by promoting a shared academic language building agenda across content area classrooms.

Limitations and Directions for Further Research | Because few studies to date have investigated the relation between a cross-disciplinary academic language skillset and text comprehension, additional studies are needed to replicate these findings. In particular, studies that examine this relation over a longer developmental period are necessary to inform theory building. Furthermore, studies examining larger groups of English learners with more detailed information about these students' linguistic histories could shed light on whether the performance of the English Learners in this study is indicative of the

larger population. For instance, some studies find that English Learners and English Proficient students who share the experience of growing up in low-income homes and attending schools that serve large numbers of students from high-poverty communities also demonstrate similar trajectories of reading and language development (Kieffer, 2011; Kieffer & Vukovic, 2012; Mancilla-Martinez & Lesaux, 2010). This study does not find this parity (Figure 3). This is likely a feature of the way the sample is constructed. For instance, Kieffer (2011) follows English learners attending U.S. schools from kindergarten to grade 8 finding that those students who begin elementary school with limited English proficiency attain similar levels of reading skill as their monolingual English peers attending the same schools by the end of middle school. In contrast in this study, we capture a snapshot of the population from grade 6 to 7 and because of a lack of detailed information on the language proficiency levels of our sample examine all students classified as English Learners as a single group. It is quite likely, though, that there is much inter-individual variability in English proficiency levels in this group.

In addition and in contrast to the majority of longitudinal studies examining language and reading development in English Learners, which typically characterize the performance of these students against monolingual norms for English speakers, here we examine the performance of ELs in relation to English proficient peers—both those who are former English learners and English only learners—attending middle schools in the same large, urban districts. This design has been utilized in some prior work (Chiappe, Siegel, & Wade-Woolley, 1999; Kieffer & Vukovic, 2012; Lesaux & Siegel, 2003), we adopt this approach here because it allows for us to understand the common and unique needs of students in these educational settings where the majority shares the ecological

influence of growing up in low-income homes and communities. Yet, this approach also leads to limitations. All students no longer designated as English Learners by our school district partners are grouped with monolingual English peers in this study, reducing our ability to isolate the typical trajectories of CALS development experienced by reclassified EL students coming up through U.S. schools. Based on our prior cross-sectional studies (Uccelli, Barr, et al., 2015) that find that these former EL students perform at similar levels and, in some instances at higher levels, than monolingual English peers, we might anticipate that an analysis that would disaggregate these results would yield results like those found in prior work.

Future studies should add time-varying covariates, such as vocabulary knowledge or word reading skills, to the models predicting reading comprehension. It is possible that concurrent growth in reading comprehension and academic language skills might be accounted for by some third variable. We do not have any reason to believe this is the case, however, given that this relationship was robust to the addition of the socio-demographic controls used in this study. Furthermore, prior studies demonstrate that the CALS construct, while moderately correlated with word reading and vocabulary depth, makes a unique contribution to reading comprehension. Nevertheless, future studies might build on this design by including these additional covariates. In addition, studies using experimental designs to examine whether targeted efforts to increase CALS proficiency impact the concurrent developmental process between reading comprehension and academic language are necessary.

Conclusion

Here, we document the developmental trajectories for English Learners and their English proficient peers on a set of skills recently operationalized for research and practice known as Core Academic Language Skills. We find that English Learners begin grade 6 with CALS that are far below their peers, perhaps not surprising given that these students are, by definition, in the process of acquiring English. However, it is important to observe that ELs develop these skills at similar rates as their English proficient classmates, indicating middle school growth in CALS. We also found that students' rates of growth in CALS were strongly related to growth in reading comprehension. This implies that students' rapid (or slow) development in one skill is linked with development in the other. These findings raise important questions about how instruction might leverage this finding to support students to become successful comprehenders of academic text and full participants in the academic community.

Table 1: Sample demographics (n=833)

		n (%)
Gender		
	Female	419 (50%)
SES		
	Free/Reduced-price lunch eligible	683 (82%)
Language Status		
	Classified as English Language Learners	103 (12%)
Ethnicity		
	Black/African American	298 (36%)
	White	139 (17%)
	Latino/Hispanic	133 (16%)
	Asian	21 (3%)
	Two or more races	5 (>1%)
	Not reported	237(28%)
Special Education Status		
	Classified as SPED	160 (19%)
Total		833

Table 2: Tasks included on the CALS-I

<i>CALS-I Tasks</i>	<i>Skills measured</i>	<i>Sample items</i>	<i>Additional examples of instances within this domain</i>
Unpacking dense information: Complex words <i>Selected items from Kieffer's (2009) adaptation of Carlisle (2000)</i>	Skill in decomposing morphologically-derived words	SAMPLE ITEM: Administrator reads a set of morphologically derived words followed by an incomplete sentence and students are asked to complete the sentence by extracting the base from the derived word: <i>ethnicity. The city had many _____ groups.</i>	Additional examples of morphologically complex words prevalent in academic texts: <i>invasion, durability, contribution, civilization, fairness,</i>
Unpacking dense information: Complex sentences <i>Selected and adapted items from the TROG-2 (Bishop, 2003)</i>	Skill in understanding complex syntax	SAMPLE ITEM: Administrator reads a sentence and students are asked to select the picture that corresponds to the target sentence. Four pictures are presented, three of which depict sentences altered by a grammatical element, e.g., <i>The sheep the girl looks at is running.</i>	Additional examples of syntactically complex structures prevalent in academic texts: <i>expanded noun phrases (i.e., neither...nor), center-embedded sentences</i>
Connecting ideas logically	Skills in understanding school-relevant connectives and discourse markers	SAMPLE ITEM A: Students are asked to select the missing marker from among four options: <i>Kim was sick _____ she stayed home and did not go to school</i> Options: <u>OTHERWISE</u> , <u>YET</u> , <u>IN CONTRAST</u> AND <u>AS A RESULT</u> SAMPLE ITEM B: Students are asked to select the best continuation for an incomplete sentence, from among three options: <i>Most teachers think that homework is important. <u>ON THE OTHER</u></i>	Additional examples of connectives and discourse markers prevalent in academic texts: <i>consequently, nevertheless, nonetheless in conclusion,</i>

		<u>HAND</u> ...	
<i>Tracking participants and themes</i>	Skill in anaphoric resolution	SAMPLE ITEM: Students are asked to match the underlined text with its antecedent by selecting among three options: <i>China resisted the move for change. In 1989 students protested to demand changes, but the army opposed these changes. Troops were sent to stop <u>the movement</u>.</i>	Additional examples of reference chains that are prevalent and challenging in academic texts: <i>Tracking participants' reference chains</i> <i>Resolving conceptual anaphora (EXPLAIN)</i>
<i>Organizing argumentative texts</i>	Skill in argumentative text organization	Students are asked to order six fragments of a brief essay (introduced by conventional markers: 'in my opinion,' 'one reason' 'in conclusion') in order to display a conventional argumentative text structure.	Additional examples of increasingly complex argumentative text structures prevalent in academic writing:
<i>Recognizing academic definitions</i>	Skill in identifying academic definitions	Students are asked to select the most <i>academic</i> definition, from a set of three definitions of the same familiar word.	Word definitions used for this task included: <i>umbrella, clown, debate.</i>

Table 3: Means and standard deviations for CALS-I and GISA factor scores.

	English Proficient	English Learner	Total Sample
	Mean (SD)	Mean (SD)	Mean(SD)
Fall, Grade 6			
<i>Academic Language (CALS-I)</i>	0.50 (0.99)	-0.18 (0.57)	0.41(0.99)
<i>Reading Comprehension (GISA)</i>	0.64 (0.55)	0.19 (0.24)	0.59 (0.53)
Spring, Grade 6			
<i>Academic Language (CALS-I)</i>	0.95 (1.26)	0.18 (0.84)	0.85(1.13)
<i>Reading Comprehension (GISA)</i>	0.84 (0.60))	0.37 (0.26)	0.79(0.58)
Fall, Grade 7			
<i>Academic Language (CALS-I)</i>	0.97(0.88)	0.31 (0.57)	0.89(0.94)
<i>Reading Comprehension (GISA)</i>	1.06 (0.74)	0.49 (0.29)	1.00 (0.72)
Spring, Grade 7			
<i>Academic Language (CALS-I)</i>	1.24 (1.14)	0.57 (0.51)	1.15(1.05)
<i>Reading Comprehension (GISA)</i>	1.07 (0.73)	0.64 (.38)	1.02(0.71)

Table 4: Standardized parameter estimates for univariate latent growth model of CALS for EL and EP students

*p<0.05, **p<0.01, ***p<0.001, two-tailed

	Initial Levels (Intercept)				Growth Rate (Slope)				Covariance between Initial Levels and Growth Rate	
	English Proficient		English Learner		English Proficient		English Learner		English Proficient	English Learner
	Coeff. (SE)	Residual Variance (SE)	Coeff. (SE)	Residual Variance. (SE)	Coeff. (SE)	Residual Variance (SE)	Coeff. (SE)	Residual Variance (SE)	Coeff. (SE)	Coeff. (SE)
Core Academic Language Skills (CALS-I)	6.45 (0.19)** *	0.78 (0.03)** *	6.72 (0.68)** *	0.95 (0.04)** *	2.01 (0.37)** *	0.99 (0.02)**	1.54 (0.41)** *	0.98 (0.04)** *	-0.16 (0.10)	-0.40 (0.15)* *

Table 5: Correlation matrix for all measures

	1	2	3	4	5	6	7	8	9	10
1. CALS-I, Grade 6, Fall	-									
2. CALS-I, Grade 6, Spring	0.85	-								
3. CALS-I, Grade 7, Fall	0.83	0.85	-							
4. CALS-I, Grade 7, Spring	0.80	0.83	0.85	-						
5. RC, Grade 6, Fall	0.71	0.71	0.69	0.66	-					
6. RC, Grade 6, Spring	0.69	0.74	0.70	0.70	0.71	-				
7. RC, Grade 7, Fall	0.73	0.76	0.76	0.75	0.76	0.79	-			
8. RC, Grade 7, Spring	0.68	0.71	0.69	0.74	0.67	0.69	0.73	-		
9. Free or reduced lunch eligibility	-0.22	-0.23	-0.21	-0.24	-0.23	-0.16	-0.18	-0.20	-	
10. Special education status	-0.38	-0.37	-0.39	-0.39	-0.26	-0.30	-0.30	-0.28	0.02	-
11. English Learner status	-0.22	-0.21	-0.21	-0.19	-0.21	-0.19	-0.19	-0.14	0.03	0.05

RC=Reading Comprehension; CALS-I=Core Academic Language Skills-Instrument

Table 6: Parameter estimates for the parallel process latent growth model for CALS and reading comprehension.

	Unstandardized coefficient (SE)	Standardized coefficients (SE)
<i>Model Intercepts</i>		
CALS intercept	1.06 (0.07)***	1.13 (0.07)***
CALS slope	0.04 (0.00)***	2.15 (0.37)***
RC intercept	0.97 (0.05)***	1.45 (0.09)***
RC slope	0.03 (0.00)***	1.63 (0.30)***
<i>Associations between growth factors</i>		
Path A	-0.00 (0.01)	-0.16 (0.25)
Path B	-0.02 (0.01)**	-0.89 (0.21)***
Path C	0.00 (0.01)	0.108 (0.22)
Path D	0.02 (0.01)***	1.05 (0.17) ***
Path E	0.00 (0.00)**	0.68 (0.17)***
Path F	0.38 (0.03)***	0.79 (0.04)***
<i>Covariates</i>		
CALS Intercept		
English Learner Status	-0.60 (0.09)***	-0.21 (0.03)***
Free or Reduced Lunch Status	-0.51 (0.08)***	-0.22 (0.03)***
Special Education Eligibility	-0.96 (0.08)***	-0.39 (0.03)***
CALS Slope		
English Learner Status	0.00 (0.00)	0.02 (0.08)
Free or Reduced Lunch Status	-0.00 (0.00)	-0.07 (0.07)
Special Education Eligibility	-0.01 (0.00)	-0.120 (0.09)
RC Intercept		
English Learner Status	-0.42 (0.07)***	-0.21(0.04)***
Free or Reduced Lunch Status	-0.35 (0.06)***	-0.21 (0.04)***
Special Education Eligibility	-0.48 (0.06)***	-0.28 (0.04)***
RC Slope		
English Learner Status	0.00 (0.01)	0.08 (0.08)
Free or Reduced Lunch Status	0.00 (0.00)	0.03 (0.07)
Special Education Eligibility	-0.00 (0.00)	-0.02 (0.09)

Figure 1. Hypothesized parallel process model of English Core Academic Language Skills (CALS) and Reading Comprehension (RC). Note: Path A=CALS slope regressed on CALS intercept; Path B=RC slope regressed on RC intercept; Path C= CALS slope regressed on RC intercept; Path D=RC slope regressed on CALS intercept; Path E=covariance between CALS slope and RC slope; Path F=covariance between CALS intercept and RC intercept.

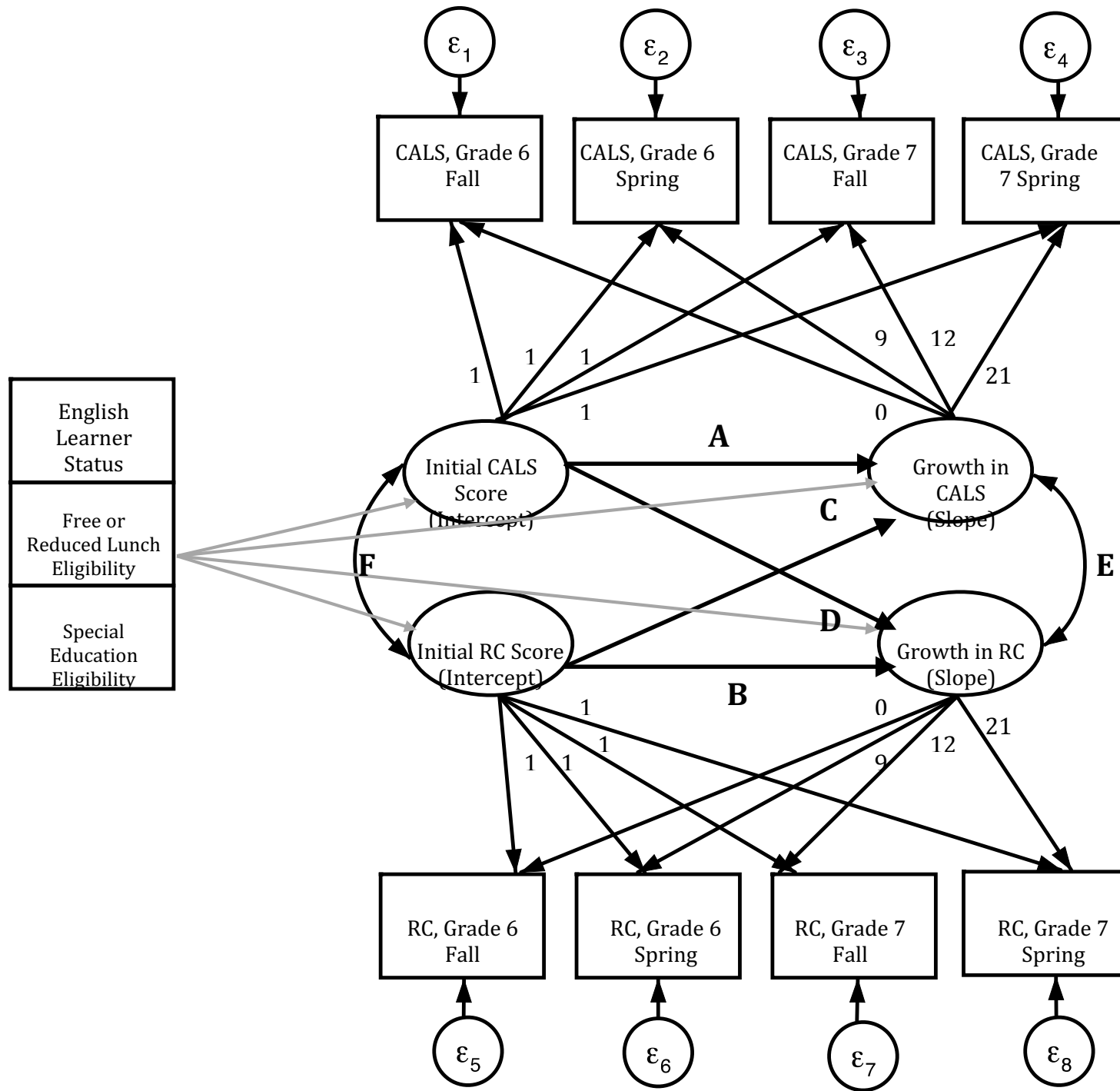


Figure 2: Average Growth Trajectories of Core Academic Language Skills growth from grade 6 to 7 for English Proficient (EP) and English Learner (EL) students (n=833)

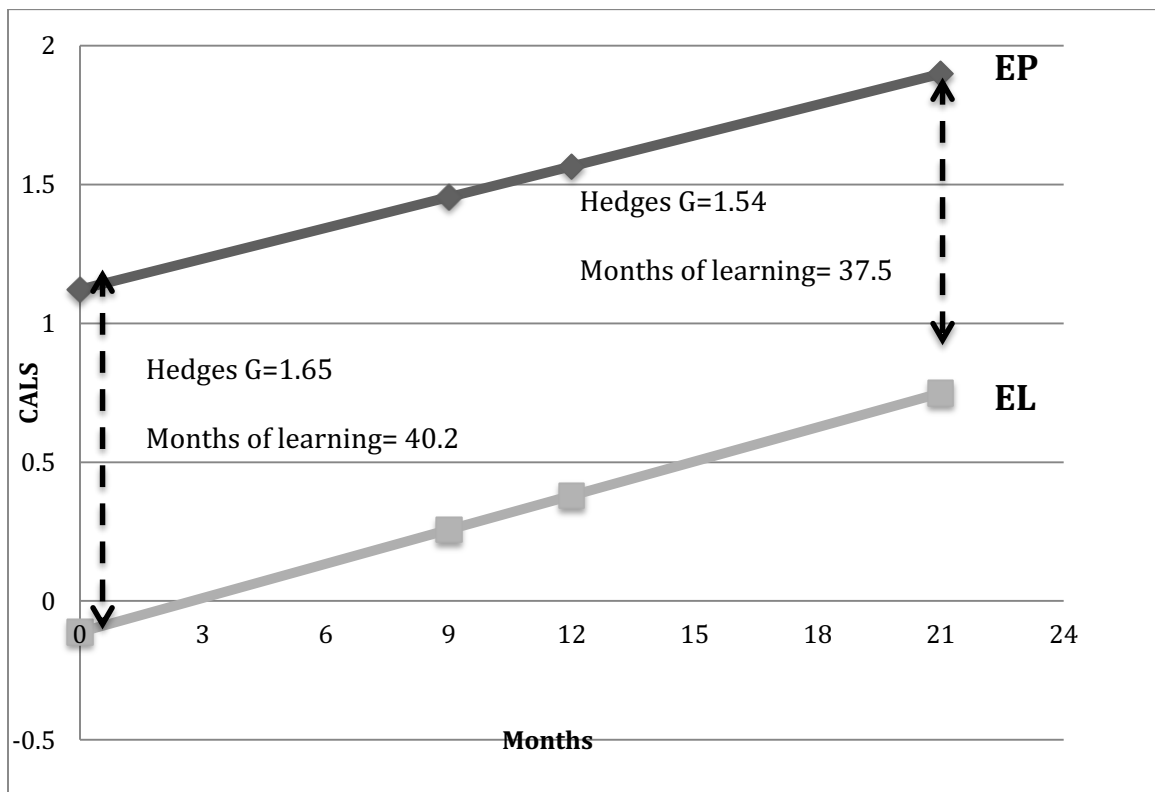
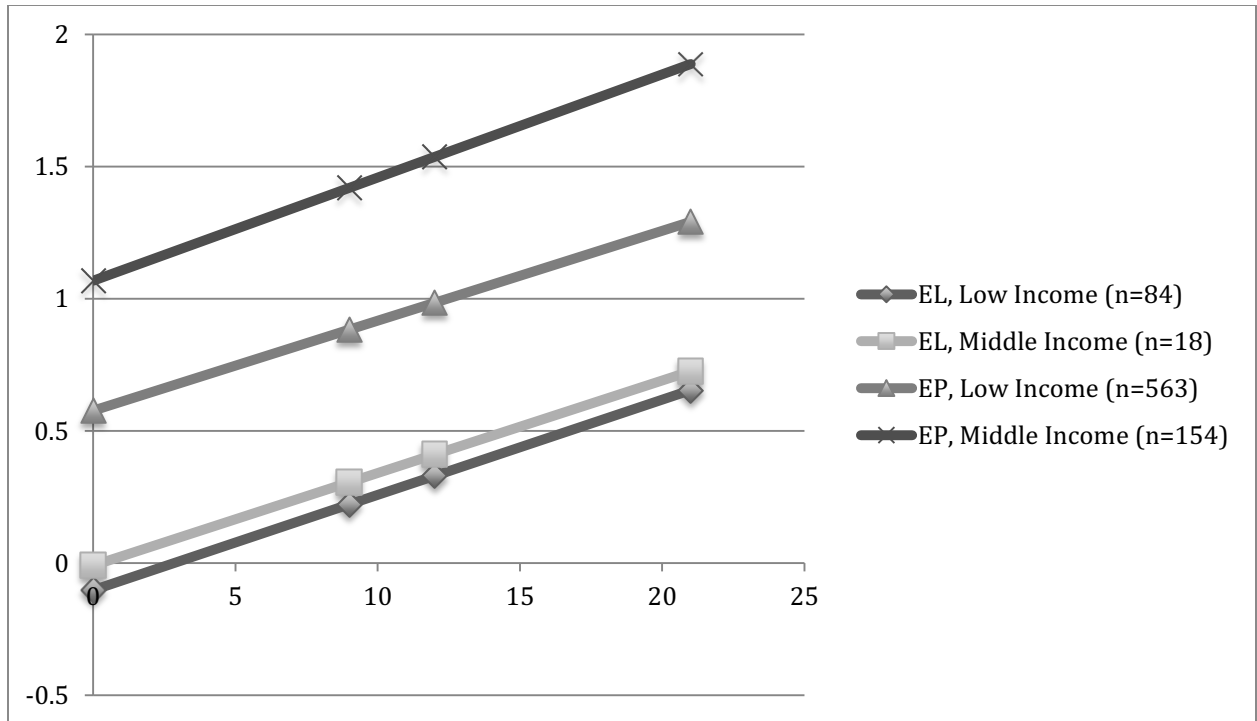


Figure 3: Trajectories of Core Academic Language Skills growth from grade 6 to 7 for English Proficient (EP) and English Learner (EL) students designated as eligible and ineligible for free or reduced price lunch (n=833)



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Chapter 3

Intended Audience: American Educational Research Journal

Examining Academic Language Skills and Reading Comprehension Development in Middle Grade English Proficient Learners

Abstract

In this study we examined the impact of academic language development on reading comprehension growth in a socioeconomically diverse sample of middle school students. Students' academic language development was assessed via the Core Academic Language Skills-Instrument (CALS-I), an innovative measure of high-utility cross-disciplinary academic language skills (Uccelli, Barr, et al., 2015; Uccelli, Phillips Galloway, et al., 2015). Longitudinal data on CALS and reading comprehension were collected from two cohorts of English proficient students, each followed over two academic years from 5th to 6th and from 6th to 7th grade (n=1307). Results revealed that students' initial level of academic language proficiency was associated with their rate of reading comprehension growth across the two years they were followed. Socioeconomic status impacted reading comprehension growth indirectly via its influence on students' initial levels of academic language skill reflecting the reality that academic language skill is a core component of reading comprehension. The main contribution of these findings is in revealing the significant impact of a specified core set of academic language skills on reading comprehension development. Findings suggest that these potentially malleable school-relevant language skills, shown to be unequally distributed within classrooms, constitute a promising skillset that can inform interventions designed to achieve both excellence and equity in literacy instruction during early adolescence.

Introduction | Contemporary educators are preparing students to enter into an increasingly global society in which success depends on one's ability to employ literacy skills to move between diverse professional and social communities (Chang, 2014; Taylor, 2016). In particular, participation in academic and professional spheres requires the skills to read and understand sophisticated texts, often for the purpose of learning independently. However, developing the skills needed to learn from text is an area of particular concern given that the majority of middle grade students in our classrooms struggle with text comprehension: over 60% of U.S. 4th and 8th graders failed to demonstrate reading proficiency on the National Assessment of Educational Progress (National Center for Educational Statistics, 2015). In schools serving large numbers of students growing up without access to economic resources, these rates are even higher, with 79% of 4th graders and 80% of 8th graders from low-income backgrounds performing below proficient in reading assessments (National Center for Educational Statistics, 2015). Amidst rising income inequality since the 1970s, these income-related achievement gaps in literacy are especially concerning (Reardon & Robinson, 2008; Reardon, 2011; Reardon, 2013).

Certainly, a myriad of complex factors require attention in order to reduce the profound societal socio-economic disparities in literacy achievement so often reproduced and reinforced in the educational system. While many factors are at play, those that might be addressed by teachers in our schools deserve particular attention. For instance, research that illuminates the teachable skills that support successful reading comprehension during the upper elementary and middle school years is particularly critical to inform more effective research-based instruction. To date, however, too few

studies examine the development of the skills needed by older readers to manage the task of learning from text, with most studies focused on younger readers (Biancarosa & Snow, 2006). This leaves a modest but still critical question unanswered: which malleable skills are promising for teachers to scaffold strategically in their classrooms in order to reduce SES-based disparities in reading during early adolescence? One potentially important set of skills are ‘academic language skills,’ the specific skills needed to understand the language used in school texts (Snow & Uccelli, 2010).

Although decades of literature highlight differences in the rates of exposure to school-like language experienced by learners from low-income backgrounds in classroom and community contexts, this study is the first to our knowledge to directly test the hypothesis that academic language development impacts reading comprehension growth in a socioeconomically diverse sample. The challenge for the field has been to *directly* capture middle-grade students’ academic language skills in the absence of a single, easily administered measure. In this study, we capitalize on the availability of a new, psychometrically robust measure of academic language proficiency, the Core Academic Language Skills Instrument or CALS-I (Uccelli, Barr, et al., 2015; Uccelli, Phillips Galloway et al., 2015). Using longitudinal data collected from two cohorts of English proficient students, each followed over two academic years from 5th to 6th or from 6th to 7th grade (n=1307), we examined whether students’ initial academic language skills or rate of growth are associated with students’ reading comprehension trajectories, examining simultaneously how SES impacts these developmental relations during middle school.

In the sections that follow, we first introduce an operational definition of academic language proficiency. Then, we briefly review the literature that lead us to hypothesis that academic language development may play a central role on students' reading comprehension development, as well as in furthering our understanding the relation between socioeconomic status and reading comprehension. We then present the design and results of examining longitudinal data from middle grade students attending schools in large urban districts. Finally, we discuss how the results of this study might inform literacy research and instruction.

Defining Academic Language Proficiency

By middle school, all students, regardless of socioeconomic status, face new challenges in comprehending the language found in school texts. To understand increasingly complex texts at school, students must develop their proficiency with academic language. Bailey (2007) suggests that academic language proficiency encompasses two subcomponents: *discipline-specific academic language skills* and *cross-disciplinary academic language skills*. Knowledge of *Discipline-specific academic language* is needed to convey disciplinary unique concepts and reasoning in mathematics, history and the other disciplines (Bailey, 2007; Schleppegrell, 2004). As a complement to these disciplinary skills, to be successful in academic reading in all classrooms, students also develop proficiency in the language that is common to academic texts across content areas, or so-called *cross-disciplinary language skills*. The present study focuses on this second set of academic language skills. More specifically, guided by our prior work, we focus on 'Core Academic Language Skills (CALS)' (see Uccelli, Barr et al., 2015 or

Uccelli, Phillips Galloway et al., 2015 for additional discussion). While the construct of CALS is described in great detail in our prior studies, here we briefly describe the academic language skillsets that are included in the CALS operational construct (Table 1).

****Insert Table 1 Here****

We draw from a large body of linguistics research to argue that CALS serve functional purposes. It is these functions that make the language of school worth teaching. In classrooms, which are microcosms of larger academic discourse communities (Moje & Luke, 2009; Phillips Galloway, Lawrence & Moje, 2011), academic language serves three primary functions: (1) a medium for communicating complex ideas and knowledge precisely (the communicative function); (2) a tool that enables linguistically precise thinking about abstract processes (e.g., the Krebs's cycle in biology) and ideas (e.g., modernism in English Language Arts) (the epistemic function); and (3) as a tool for signaling membership in academic and professional communities and for gaining entrance to these communities (e.g., a 'ticket and visiting card') (the socio-symbolic function) (Delpit, 1992; Heller & Morek, 2015). In addition to these functions, we make the argument that academic language learning supports personal identity development in adolescents. Because academic language might also expand the language resources used to express our belief systems (feminism, libertarianism) and our human experiences (racism, colonialism, hegemony), we argue that it might also contribute to extending the repertoire of linguistic tools for making sense of ourselves and our experiences interacting with others. While giving students access to this language might

be seen as reinforcing their participation in academic communities that maintain the status quo (see Flores & Rosa, 2015); as emphasized by Paulo Freire and others, enlarging students' language and literacy choices can also offer students valuable tools to critique, resist and even reform existing systems (political, social, education) into more equitable ones (Freire & Macedo, 2005). This language can also support students' access to prior and current authors' ideas and texts that raise awareness of social inequities, expand our language to talk and contest injustice, and are important agents in criticizing the status quo. It is for these reasons that we place such emphasis on the importance of academic language instruction in middle grade settings.

Support for CALS- Reading Comprehension Relationships

Models of reading comprehension and prior research on SES-reading relations

To begin to understand the potential role of academic language skills, we turn to existing models of reading comprehension. Models and theories of reading comprehension, including the Simple View of Reading, universally highlight two broad domains of skill that support text understanding: word reading skills and the skills needed to understand the content, which are called 'language comprehension skills' (Alexander & Jetton, 2000; Gough & Tunmer, 1986; Hoover & Gough, 1990; Kintsch, 1994, 1998; Perfetti & Stafura, 2014; RAND Reading Study Group, 2002). While word reading skills are generally mastered by early elementary school, language comprehension skills encompass the entire universe of language skills and knowledge of the world required to

read with understanding, and continue to develop throughout the life course. For instance, in a recent analysis of upper elementary students attending high-poverty schools, the vast majority of students (80%) struggled to comprehend text because of their language comprehension skills alone, with only 15% of students struggling with both word-reading and language comprehension skills (Kieffer & Vukovic, 2012). The role of language in these results is perhaps best understood in relation to Kintsch's discourse-processing theory (1994, 1998), which suggests that word meaning knowledge and grammatical knowledge support readers to both build text understanding at the sentence, between-sentence and paragraph levels. Language is, therefore, implicated at various levels of the text comprehension process—and a fundamental component to attend to in interventions designed to support developing readers.

Studies have reported SES-based disparities in reading achievement, with students from low-income backgrounds, on average, performing significantly below their peers from middle-income homes and communities (Reardon, 2013; Sirin, 2005; Verhoeven & van Elsäcker, 2016). Reardon (2013) finds that for children born in the 1990s, the gap in standardized reading test scores between those from low-income families and learners from families at the 90th percentile of income distribution was roughly 1.25 standard deviations. Moreover, this gap is 40 percent larger than the gap observed several decades earlier in the 1970s (Reardon, 2013). Contrary to the belief that this gap widens during the school year, study after study finds a striking pattern: the income-related literacy achievement gap evident at school entry in kindergarten remains relatively unchanged as students progress through school (Reardon, 2011; Sirin, 2005). In other words, schools do not seem to exacerbate inequality in literacy outcomes, but they do little to stem it. It

may be unrealistic to think that classroom instruction alone might address these disparities; but students spend vast amounts of each day in schools, where instruction can be a powerful lever for fostering equity. To design innovative interventions, we first need to elucidate which skills might be promising to help accomplish this urgent goal. Our hypothesis in this study is that a set of high-utility cross-disciplinary academic language skills that we have investigated extensively during the past five years, might offer a promising path. Given that our prior research has been entirely cross-sectional so far (Uccelli, Barr et al., 2015; Uccelli, Phillips Galloway et al., 2015), examining longitudinal data is essential before we can make any claims about developmental relations between CALS and reading comprehension. Thus, if this study reveals evidence in favor of our hypothesis that CALS are an important predictor of reading comprehension growth, then the findings will provide more robust evidence of the pedagogical relevance and potential of these skills for the middle school years.

Evidence from prior research-based, language-focused reading interventions

The challenge, however, is that despite the general acknowledgement that language matters for the comprehension of words, sentences and texts, the ways in which we measure language proficiency and teach it lacks the specificity needed to support educators wishing to teach students to read more complex academic texts. For instance, quantitative research inspired by Simple View of Reading often measures language proficiency as either a global and underspecified construct (*listening comprehension*) or as discrete language skills (*morphology, syntax, or vocabulary*) (Geva & Farnia, 2012; Perfetti & Stafura, 2014) useful for reading any type of text. In contrast, in this study, we

focus on a subset of language skills sampled for their particular usefulness for reading academic texts.

While this prior research has generated useful insights into the many skills and competencies that support skilled reading, additional evidence for the utility of examining academic language skills comes from studies that have attempted to translate this developmental research to practice. For example, interventions for adolescent readers, particularly students in high-poverty urban districts, have primarily focused on building vocabulary knowledge because extensive developmental literature links variability in vocabulary knowledge with reading comprehension (Deshler, Palincsar, Biancarosa, & Nair, 2007; Elleman, Lindo, Morphy, & Compton, 2009; Proctor, Dalton, Uccelli, Mo, Snow, & Naugebauer, 2011). Although effective at supporting vocabulary growth, these interventions have rarely had measurable impacts on standardized reading comprehension outcomes. Designing instructional interventions that can close the literacy achievement gap may hinge on identifying a broader array of ‘teachable skills.’ Among other possibilities, these results from vocabulary interventions might suggest that additional language skills may be at play. For instance our prior studies suggest that, in addition to vocabulary knowledge, academic language skills, as operationalized in this study, appear to play a strong facilitative role in 4th to 8th graders’ text understanding (Uccelli, Barr et al., 2015; Uccelli, Phillips Galloway et al., 2015). While these cross-sectional studies offer an initial indication of the importance of academic language to text comprehension, in this study, we for the first time explore concurrent developmental trajectories in CALS and reading comprehension. More specifically, we investigate whether students' initial levels of academic language skills are associated with their rates of growth as text

comprehenders, examining simultaneously how SES impacts these developmental relations during middle school.

The Current Study

This study was conducted with two cohorts of English proficient students followed over two academic years, from grade 5 to grade 6 and grade 6 to 7. This age range was examined because it is a developmental period during which both later developing language skills (Nippold, 2007) and reading comprehension experience growth. Given the novelty of the CALS construct, we first explore typical trajectories of growth in academic language proficiency in each cohort separately for students eligible and ineligible for free/reduced price lunch. While differences in academic language proficiency between students from low-income homes and their peers from middle income homes have been documented in prior studies examining vocabulary, this empirical study is the first to our knowledge to make use of a psychometrically robust measure to document these differences in academic language proficiency levels in middle graders. We then examine the hypothesis that academic language proficiency might be associated with reading comprehension growth between grades 5 and 7. We also explore if levels of academic language skills might partially account for the well-documented relation between socioeconomic status (SES) and reading comprehension during early adolescence. Specifically, we address two primary research questions:

Research question 1: What are typical trajectories of academic language proficiency for English proficient students from low-income and middle-income family backgrounds?

Research Question 2: Are academic language proficiency trajectories linked with reading comprehension development throughout the middle grade years in a sample of English proficient students from low-income and middle-income family backgrounds?

To capture academic language proficiency, we made use of the Core Academic Language Skills-Instrument (CALS-I), an innovative measure of academic language proficiency (Uccelli, Barr et al., 2015; Uccelli, Phillips Galloway et al., 2015). The larger aim of this inquiry is to identify a set of skills that if targeted instructionally might support students from all socioeconomic backgrounds to participate in the academic and professional communities. This study extends prior research linking reading comprehension to SES by using longitudinal data analysis to generate more accurate estimates than those generated by traditional cross-sectional methods (Cole & Maxwell, 2003).

Methods

Study Design and Sample

The sample used in this study was drawn from the control group of students participating in a randomized controlled trial of an intervention designed to increase middle graders' reading comprehension skills. A total of 12 elementary and middle schools across three districts—representing a sub-sample of the larger sample—participated in this study. The three districts, located in the Northeastern U.S., served predominately ethnically diverse, low-income students. The sample was comprised of two cohorts: cohort 1 was followed from the beginning of grade 5 until the end of grade 6 (n=574) and cohort 2 was followed from the beginning of grade 6 until the end of grade 7

($n=733$). For cohort 1 and 2, about 50% were female; 81% of 5th graders (cohort 1) and 79% of 6th graders (cohort 2) were eligible for free or reduced price lunch, mirroring trends in the districts overall. 51% of the 5th graders were designated by the district as African American, 15% as Latino/a, and 29% as white. 44% of 6th graders were designated by the district as African American, 23% as Latino/a, and 29% as white (see Table 2 for additional demographics). In the district in which the majority of the sample was enrolled, percentages of students in the participating schools scoring below proficient on the 2013 state ELA assessment ranged from 55 to 79 percent.

*****Insert Table 2 Here*****

In this study, we draw on data collected at the beginning and end of two consecutive school years. All data were collected by trained research assistants from all students who had received parental consent to participate in the study. Over the two academic years, 1,307 students participated in the study. A total of 233 students from the original cohorts left the study. There were no significant differences, however in academic language scores between those that left the study ($ps > .05$) and those who remained.

Primary Measures and Administration Details

Academic Language| Core Academic Language Skills-Instrument (CALS-I) The Core Academic Language Skills-Instrument (CALS-I) is a group-administered assessment for grades 4-8 designed to assess core academic language skills (CALS)

(Uccelli, Barr, et al., 2015, Uccelli, Phillips Galloway, 2015). The research-based CALS-I used in the present study was the result of a process that included expert linguists, psychologists, psychometricians, and educators and which unfolded in the following sequence: a *Task Design Phase and Pre-Pilot Study*, a *Pilot Study I* and an *Expert Review Panel*. The CALS-I consists of a 50-minute paper and pencil test. Tasks assess students' skills through a range of multiple-choice, matching, or short written responses. The items that were not scored dichotomously as correct/incorrect were rescaled to be between 0 and 1, so that all items were equally weighted in estimating the total score. A confirmatory factor model fitting CALS-I items to a single factor produced good model fit offering evidence of unidimensionality (RMSEA = .06, CFI = .95, and TLI = .94). Reliability evidence was robust (.93 as indexed by coefficient alpha and .90 by split half reliability). Using Rasch IRT analysis, factor scores were generated for the CALS-I⁵.

Reading Comprehension | The Global Integrated Scenario-based Assessments

(GISA), developed by ETS, are computer-based assessments that make use of scenarios to give students a semi-authentic purpose for reading (e.g., decide if a wind farm is a good idea for your community), using a collection of source materials (e.g., a blog, e-mail, or article). Strategic approaches to reading are assessed by adding a range of empirically supported reading strategies as tasks (e.g., summarization, use of graphic organizers, questioning). To allow for re-testing, the GISA consists of passages on a range of topics (e.g., organic farming, wind power, and satellites). A recent study of

⁵ CALS-I scores are on an IRT factor score metric. The difference between an IRT factor score metric and an observed score metric is that an observed score metric assumes that an increase in one item correct results in an equal increase in true score across the entire range of the assessment. Conversely, IRT factor scores assume that one unit correct in the tails of the distribution results in a different magnitude increase in true score relative to the center of the distribution.

middle school students administered the organic farming version of the GISA revealed adequate psychometric properties (Sabatini, O'Reilly, Halderman & Bruce, 2014), including Internal consistency (alpha) reliability (0.89) and split half reliability (.76), with each half of the test showing adequate alpha reliability ($\alpha = 0.80$ and $\alpha = 0.82$ respectively). Test-retest reliability was $r(283) = .87$ and there was no significant difference in mean scores. The GISA also demonstrated a strong concurrent validity with more conventional reading comprehension tests, as well as component reading subtests. For this study, the following versions of the GISA were administered: Organic Farming (6th grade) and Wind Power (7th grade). Scores are reported on a common scale based on a large-scale study conducted by the ETS research team. Scaling used a concurrent, multi-group approach, with a two-parameter logistic IRT model (2PL) for form pairs. Though it is a relatively new instrument and more nuanced evaluations are ongoing, the authors of the GISA suggest that it is appropriate for assessing a wide range of ability levels, and can reliably measure a range of complex reading skills that go beyond those assessed in more traditional, low-inference comprehension assessments (O'Reilly, Weeks, Sabatini, Halderman, & Steinberg, 2014; Sabatini, O'Reilly, Halderman & Bruce, 2014a, b).

Socioeconomic Status | Following the majority of school-based studies, socioeconomic status was indexed by students' eligibility for federally-funded free/reduced price lunch (FRL eligibility) in the first year of the study. This eligibility is determined with reference to U.S. Federal income poverty guidelines. Students eligible for reduced or free lunch were from homes in which the before tax income for a family of four did not exceed \$42,643 or \$29,965, respectively (Federal Register, 2012). While arguments have

been made for the use of multiple measures of SES, this study draws on recent research suggesting that FRL is a suitable proxy for a host of ecological factors (including the percent of families and households living in poverty in a community or school and median household income) (Nicholson, Slater, Chriqui, & Chaloupka, 2014).

Demographic Covariates

To control for additional factors that might influence the relation between SES and reading comprehension various time-varying covariates were added to the model. These included demographic variables obtained from the district. Specifically, students' English Learner (EL) designation (1=designated not English proficient; 0=English proficient) and eligibility for special education services (1=eligible for special education services; 0=ineligible for services). Gender (1=female; 0=male) was also included as a covariate to control for potential differences in literacy behaviors between boys and girls reported in prior studies (Millard, 1997; Smith & Wilhelm, 2002). Dummy variables were created to capture race/ethnicity and were also included in the modeling: African American, White, Asian, Latino/a, or multiple races/ethnicities.

Literacy Skill Covariates

Eligibility for Literacy Intervention In addition to academic language, other skills are linked with reading proficiency including word decoding skills and vocabulary knowledge. To account for students' word decoding skills and general vocabulary levels at the start of the study, we made use of data collected as part of a prior study to identify struggling readers eligible for additional intervention. Students selected by their schools

were assessed using the RISE, a computer administered diagnostic reading assessment for grades 5-10 produced by the Educational Testing Service (ETS). Students who demonstrated word recognition/decoding skills and/or vocabulary skills in the lowest quartiles were designated as eligible for this intervention. Here we use a categorical variable to capture whether a student was eligible or ineligible for this supplementary intervention during the three years of the study.

Data Analytic Approach & Model Specification

All analyses were conducted with a Structural Equation Modeling (SEM) framework in Mplus Version 7.11 (Muthen & Muthen, 2012) using parallel process latent growth modeling. However, before fitting the parallel process model, we separately estimated univariate latent growth models for academic language proficiency and reading comprehension skill for each of the cohorts using four waves of data.

To answer our first research question, we made use of the well-fitting univariate models of academic language proficiency to examine within-cohort differences. Each cohort was further disaggregated by eligibility for free/reduced price lunch, offering insight into initial levels (intercept) and rates of growth (slope) for both Core Academic Language Skills (CALS) separately by SES, while controlling for race/ethnicity, special education designation, gender and eligibility for literacy intervention. All intercept loadings for the observed variables at each testing occasion were fixed to 1; to represent months of maturation elapsed from the first occasion of measurement in the fall of grade 5 (cohort 1) or in the fall of grade 6 (cohort 2), slope terms were fixed to 0, 9, 12, 21.

To answer our second question, these models and the relevant demographics were combined to form the final parallel process model, allowing us to simultaneously examine individual changes in academic language and reading comprehension. Covariances were allowed between all variables assessed at a given time point. Autoregressive paths were estimated simultaneously from the intercept of academic language proficiency to the slope of reading comprehension and from intercept of reading comprehension to the slope of academic language while controlling for baseline measures of each construct. Pathways were also estimated between all demographic and other control variables and the intercept and slope of each construct. For parsimony, insignificant paths were pruned from the model in the final stages of model fitting. Finally to examine the potential indirect influence of SES on reading comprehension via CALS I this socioeconomically diverse sample, pathways were estimated from SES measured at Time 1 to the intercept of CALS (Path A), and from the CALS intercept to the slope of reading comprehension (Path B) (Figure 1) (Cheong & MacKinnon, 2012). Similarly, the indirect influence of SES on CALS growth was evaluated by examining the paths from SES to initial reading comprehension scores (Path C), and from the reading comprehension intercept to the slope of CALS (Path D). We examined the indirect effects by calculating the product of the paths (e.g., Path A x Path B). Paths H and G represent the direct effect of SES on growth in reading comprehension and CALS skills across the two years of the study. Bootstrapping with 10,000 iterations, as a non-parametric method for calculating standard errors and confidence intervals for the indirect effects, was used in this study (Hayes, 2013). Compared to competing methods, bootstrapping allows for greater power to identify indirect effects and offers more

accurate estimates of Type 1 error rates because the sampling distribution of the indirect effect is not assumed to be normal (Preacher & Hayes, 2008).

*****Insert Figure 1 Here*****

For all models, full information maximum likelihood estimation was used to manage missing data (Bollen & Curran, 2006). Complete data were available for all demographics (SES, gender, EL status, special education eligibility, race). In addition, complete data were available for the literacy skill covariate that identified students as eligible for supplementary reading intervention on the basis of demonstrating low-word reading/ decoding and reading vocabulary. The percentages of missing data for the other study variables were as follows for cohort 1 across the four waves of testing (followed from grade 5 to grade 6): reading comprehension=71-82%, academic language proficiency=70-80%. Cohort 2 (followed from grade 6 to 7) also had mostly complete data: reading comprehension= 65-82%, academic language proficiency= 68-85%. Fit for each model was evaluated using typical indices: the root-mean square error of approximation (RMSEA), and the comparative fit index (CFI). Models with a RMSEA of less than .08 and CFI above .93 were considered to have adequate fit (Hu & Bentler, 1999).

Results

Descriptive Statistics and Correlations

Descriptive statistics and correlations among indicators are presented in Table 3a and 3b. For cohort 1 (followed from grade 5-6) there was considerable rank-order stability in

academic language skills from Time 1 to Time 2 ($r=0.79$), from Time 2 to Time 3 ($r=0.87$), and from Time 2 to Time 3 ($r=0.87$). Similarly, reading comprehension also demonstrated rank-order stability, with cross-time correlations ranging from 0.70 to 0.73. For cohort 2 (followed from grade 6-7) rank-order stability in academic language skills was also evident: from Time 1 to Time 2 ($r=0.85$), from Time 2 to Time 3 ($r=0.85$) and from Time 3 to Time 4 ($r=0.85$). Reading comprehension performance was also fairly consistent with cross-time correlations ranging from 0.71 to 0.79. For both groups, English Learner designation and SES as indexed by free/reduced lunch eligibility were negatively related to reading comprehension and academic language proficiency at all time points.

*****Insert Table 3a and 3b Here*****

RQ1: Average trajectories of academic language proficiency

To gain insight into whether SES impacted students' initial levels and rates of growth in academic language proficiency, we employed multi-group latent growth curve modeling by SES separately for each cohort. For each cohort, the multi-group model capturing growth in CALS using a linear function demonstrated good model fit (cohort 1: $\chi^2(16)=19.07$, $p=0.00$, CFI=0.99, TLI=0.99, RMSEA=0.03 (90% CI=0.00-0.07), SRMR=0.02; cohort 2: $\chi^2(28)=81.69$ $p=0.00$, CFI=0.97, TLI=0.96, RMSEA=0.07 (90% CI=0.06-0.09), SRMR=0.03). Figure 2 display the results of the linear model illustrating CALS growth trajectories by SES for grades 5 to 6 (cohort 1) and grades 6 to 7 (cohort 2) (See Table 4 for coefficient values). All covariates that were insignificant were pruned from the models, leaving only those that appear in Table 3. Of particular note is the

impact that special education status and eligibility for literacy intervention appears to exert on CALS starting values.

*****Insert Figure 2, Table 4 Here*****

For each cohort, both nested model tests of an unconstrained model in which both the slope and intercept were permitted to vary by students' SES and a model in which the parameter of interest (either slope or intercept) was constrained to be equal across students from low-SES and middle-SES families were used to assess whether there were differences in starting values or in rates of growth between by SES for students in each cohort. Results suggested that while students with low SES had significantly lower levels of academic language proficiency at the start of the study (cohort 1: $\Delta - 2LL = 6.58$, $\Delta df = 1$, $p = 0.01$; cohort 2: $\Delta - 2LL = 36.33$, $\Delta df = 1$, $p = 0.000$), they exhibited rates of growth in academic language that did not differ statistically from students from middle-income families (cohort 1: $\Delta - 2LL = 2.70$, $\Delta df = 1$, $p = 0.100$; cohort 2: $\Delta - 2LL = 0.95$, $\Delta df = 1$, $p = 0.33$).

To aid interpretation, these gaps in CALS performance are re-expressed in differences in standard deviation using Hedge's G and in "months of growth." This latter metric can be understood as the months of learning that would be required for students from low-income homes to perform at the same level as middle-income peers at each of the time points. Substantively, these results highlight CALS as an area of particular challenge for middle graders from low-income homes, who enter classrooms with less familiarity with the language of school than their peers from middle-income homes. More relevant for instruction, however, is that learners on average appear to experience similar rates of growth across middle school. Thus, while, on average,

student's CALS grow and they do so at similar rates across SES groups, school instruction is not accomplishing the more ambitious goal of positively disrupting the initial rank order of students' language and reading proficiencies (at least over a two-year period). These findings underscore the urgent need to find the right instructional levers in order to positively disrupt the rank order stability, which is a required step towards educational equity.

RQ 2: Exploring academic language proficiency and reading comprehension relations

To examine academic language and reading comprehension relations, the model depicted in Figure 2 above was fitted to the data for both cohorts separately. For cohort 1, the model fit the data well, $X^2(df=39)=128.91$, $p<0.001$, RMSEA=0.06, 90% CI [0.05, 0.08], CFI=0.97, TLI=0.96, SRMR=0.03. For cohort 2, the model also demonstrated adequate fit: $X^2(57)=304.05$, $p<0.001$, RMSEA=0.08, 90% CI [0.07, 0.09], CFI=0.95, TLI=0.92, SRMR=0.08. Paths of interest are shown in Figure 3. For both samples, Path F (the covariance between initial CALS proficiency levels and initial reading comprehension levels) was statistically significant suggesting that students with higher (or lower) levels of academic language skills demonstrated on average higher (or lower) levels of reading comprehension skill. Path E (the covariance between rates of growth in CALS and reading comprehension skills across the two years of the study) was also significant for both cohorts of students, suggesting that those learners that developed CALS more rapidly (or more slowly) also grew more quickly (or slowly) as text comprehenders. For both cohorts, initial levels of academic language proficiency were linked with higher rates of growth as text comprehenders across the two years of the

study (Path B). Curiously, cohort 1's initial levels of reading comprehension appear to exert a strong influence on their rates of academic language growth, but this pattern was not observed in cohort 2 (Path D) (Tables 5a and 5b).

****Insert Tables 5a and 5b Here****

Given our population of focus, we also examined pathways of influence through which SES impacts reading comprehension, we by calculating the products of the indirect paths. For students followed from grade 5 to grade 6 (Cohort 1), SES had a small, though significant, negative effect on students' initial reading comprehension levels (standardized coefficient=-0.19), which in turn had a significant moderate-to-large effect on students' growth rates in text comprehension across the two years they were followed (standardized coefficient=1.05). Together, these paths yielded a significant, though small, negative indirect effect (standardized coefficient=-0.07), thus suggesting that a modest portion of the effect of SES on CALS growth is mediated by students' initial levels of reading comprehension. The results were similar for cohort 2. For Cohort 2, students followed from grades 6 to 7, SES again exerted a small, significant effect on students' initial CALS levels (standardized coefficient=-0.24, which then had a significant moderate effect on students' reading comprehension growth across the two years they were followed (standardized coefficient=0.35). Together these paths yielded a significant, small negative indirect effect (standardized coefficient=-0.21), suggesting that SES exerts influence on students' reading development via differences in their initial academic language skills. In examining pathways through which SES influences reading outcomes, these findings suggest that it is initial differences in levels of CALS—but not CALS rates

of growth—that account for persistent differences in reading outcomes among middle graders. Notably, the direct paths from SES to growth in reading comprehension (Path G) and from SES to growth in CALS (Path H) were not significant for either cohort, suggesting no direct effect of family income on students’ rates of growth as readers or as academic language users. In contrast, family income as captured through free/reduced price lunch status directly and significantly impacted students’ initial levels of CALS and reading comprehension skill (Paths A and C) (Tables 5a and 5b).

****Insert Figure 3 Here****

This is not to suggest that individual variability in academic language skills does not exist within the population. In fact, in Figure 4a and 4b, we model growth trajectories for prototypical students performing at the 50th and 98th percentiles in initial CALS levels and rates of growth for cohort 1 and 2. In Figure 4a, what is most notable is that our prototypical student from a low-income context at the 98th percentile in CALS starting values and rates of growth (or 2 standard deviations above the average) began with CALS scores below her middle income peer, but developed CALS at a faster rate over the two years of the study, nearly ‘catching up’ by the end of the study (Figures 4a, 4b). While these are not actual students in our sample, this projection offers insight into the heterogeneity that might be found within classrooms.

****Insert Figure 4a and 4b Here****

Discussion

In this study, we evaluated two key questions regarding the relation between academic language and reading comprehension development for upper elementary and middle grades in two cohorts followed over two academic years, from grades 5 to 6 and 6 to 7. First, we examined differences in academic language proficiency between students from low-income homes and their middle-income peers using a psychometrically-robust measure of academic language proficiency. We then examined the hypothesis that academic language proficiency and reading comprehension are linked developmental processes in middle grade populations. In exploring these two research questions, this study yielded two important findings for research and practice. First, consistent with the results from ethnographic and cross-sectional studies, students from low-income backgrounds on average exhibit less developed academic language skills than their middle-income peers. Secondly, academic language is revealed as a set of skills that impacts reading comprehension development across grades 5-7, with higher initial levels of academic language proficiency linked with faster rates of growth as text comprehenders. These findings advance the current understanding of language and reading comprehension relations during the upper elementary and middle school years by showing the critical role of a high-utility cross-disciplinary set of language skills on reading comprehension. In examining developmental relations between academic language skills and reading comprehension skills in a sample of students attending schools serving primarily low-income communities, this study also illuminates one way in which SES impacts reading development. While socioeconomic status is frequently cited as a factor that contributes to the literacy achievement gap observed between students from low-incomes homes and their middle-income peers, this study suggests that

the influence of family income may be indirect, with SES influences reading comprehension via differences in students' initial levels of academic language proficiency. However, students—regardless of family income—experience similar rates of growth in academic language skills across the middle grade years. Whereas the impact of SES on reading comprehension has been amply documented (see Reardon, 2011, 2013; Sirin, 2005), this study begins to shed light on one subset of potentially malleable language skills, which constitute one pathway (among many) through which intervention and instruction might support adolescent readers, particularly those from low-income homes and communities.

Implications for Theory & Research

With few exceptions, studies that link language to reading comprehension outcomes have focused on subsets of the middle school population, such as English learners (Geva & Farnia, 2012; Kieffer & Lesaux, 2012), or on proficient native speakers during early elementary school (Dickinson & Tabors, 2002; Verhoeven, van Leeuwe, & Vermeer, 2011). In this study, we focus on English proficient middle grade students and identify academic language as an important pathway through which reading comprehension outcomes are impacted. While we readily acknowledge the importance of teaching academic language to English Learners, this study suggests this instruction is also important for their English proficient peers coming of age in low-income homes and communities.

One intriguing finding from this study is that the bidirectional predictive relation between reading comprehension initial levels and CALS development, which appear to

be present only in the first cohort (students followed from grades 5 to 6). In this cohort, we observe that initial levels of reading comprehension skill influences students' CALS growth over the two-year period that they were followed. In contrast, for cohort 2, students followed from grades 6 to 7, this relationship was curiously not present. These findings are not without precedents in the literature. In research involving Dutch students, Verhoeven and colleagues (2011), for instance, find that vocabulary knowledge was reciprocally related to reading comprehension, but only for students in the lower elementary school. There are certainly many possible explanations for these differences. It may be an artifact of the samples or measures used in this analysis. For instance, large numbers of students performing below grade-level on state assessments of reading proficiency comprise this sample. These students, who struggle to access grade-level texts, may be unable to use reading as a mechanism for academic language learning either because the below-grade level texts they encounter do not contain these features or because they struggle to make sense of grade-level texts that do contain academic language. This inability to access text and to learn language from it may become more common in the upper grades when text is more challenging. Finally, this result may be an artifact of the reading comprehension measures used in this study, which while vertically equated differ for students in grades 6 and 7.

In proposing our construct and designing the CALS-I, we drew from established theories of language development and hypothesized these school-relevant language skills would be primarily linked with opportunities to encounter and use academic language. While the literature documents that students coming of age in low-income communities often experience limited access to this school-like language inside or outside of school

(an ‘academic language opportunity gap’), rarely are the skills most impacted by this differential access directly assessed (vocabulary research offers one exception). Instead, in the field of reading research, student-level SES is frequently used as a control variable. In this study, we offer an alternative possibility. Informed by our prior cross-sectional research, in this study we focused on Core Academic Language Skills, as measured by the CALS-I, to examine how SES interacts with developmental relations between CALS and reading comprehension. The CALS-I is a measure that directly captures individual differences on learners' skills, whether they come from higher or lower SES environments. The strong associations between CALS and SES suggest that one way to understand SES in relation to reading comprehension skill is as a proxy for a student's level of experience with the language of text.

Capturing students' language skills directly also reveals that variation in academic language proficiency exists not only between students from low-SES homes and their middle grade peers, but also within SES groups. While on average, our analysis suggests that students eligible for free and reduced price lunch demonstrate CALS-I scores that are consistently below their middle-income peers, we are not suggesting that this is always the case (Figures 4a and 4b). In fact, when we disaggregate the sample into quadrants, we observe the true variation in the sample's levels of academic language proficiency. It is on these grounds that we urge the field to move to measures that directly capture students' skills and which allow for individual variability.

Implications for Practice

This study also seeks to further unpack our understanding of the literacy achievement gap, and to inform future research-based initiatives designed to equitably

and effectively address individual differences in school settings. While students growing up in low-income communities on average demonstrate less developed academic language skills; our findings reveal that their rates of growth as language users are no different than those of middle-income learners. However, as noted above, these results also indicate variability in CALS development within students from low-incomes homes and communities (Figures 4a, 4b). This suggests that rather than use SES as a proxy for requiring additional reading support in school settings, schools might individually assess the academic language proficiency levels of students in a classroom as a way to inform instruction and intervention.

These results also suggest that large proportions of students in low-income inner city schools who struggle with reading comprehension might benefit from instruction that seeks to rapidly accelerate their academic language learning; they are unlikely to benefit from instruction that solely focuses on teaching reading strategies (common in settings serving struggling students), in the absence of instruction that fosters understanding of the language in text. In addition, interventions that focus entirely on building vocabulary, while critical, seem to lack necessary attention to the academic language skills highlighted in this study. Instead, Academic language instruction certainly emerges in this study (and in others we have conducted) as an important facet to address instructionally (Uccelli et al., 2015a, 2015b).

However, simply teaching more academic language forms is not likely to have much impact without attending to the broader context of language learning. For example, a narrow focus on teaching language forms without teaching *when*, *why* and *how* these forms should be used is a teaching practice that runs the risk of leaving students with only

partial mastery of the academic register (Slobin, Gerhardt, Kyratzis, & Guo, 2014). This instruction serves two purposes (Slobin et al., 2014) that correspond with the goals of language learning broadly. First, during this instruction, students are supported to use new language forms to engage in familiar functions. For example, learning to use ‘additionally’ instead of ‘and’ when writing to signal the addition of an idea. Second, students are also learning new forms to engage in new types of communication, such as learning that ‘it may be the case’ can signal uncertainty in academic speech and writing. CALS (e.g., connecting ideas explicitly, packing dense information, tracking themes, understanding a viewpoint) cannot be taught as isolated units of language or forms, but instead require that teachers and students pay attention to these aspects of language and expand them in the context of reading together, discussing texts together, talking/debating about complex abstract ideas together. In that sense, aligned with recent research that identifies text-based discussion and classroom talk as key mechanisms to improve reading comprehension, these findings add yet another important set of skills to be considered and included in those research-based initiatives.

Whereas speakers are enculturated at home into the discourse practices required for colloquial conversations in their respective communities (Heath, 1983, 1996, 2014; Schieffelin & Ochs, 1986), the process of learning language at school is often much less supported (Cummins, 2007; Schleppegrell, 2004; Snow & Uccelli, 2009)ⁱ. Instruction needs to accomplish two goals: building knowledge of language forms and fostering awareness about when to use these newly acquired pieces of language. Emerging research focused on non-mainstream English speakers suggest that proficient users of school language bring both knowledge of academic language forms *and* demonstrate the

skill to appropriate select academic language forms over conversational ones when reading, writing, and speaking at school (metalinguistic awareness) (Terry, Connor, Johnson, Stuckey, & Tani, 2015). Unsurprisingly, students who demonstrated metalinguistic skill also demonstrated higher-levels of reading comprehension (Terry et al., 2015). Supporting students to be ‘tuned in’ to language, therefore, seems to be central component of supporting them to move fluidly between academic and social settings. In other words, teaching CALS is not simply about teaching language forms, it is also about raising students’ awareness about the affordances—and limitations—of the academic register and of its particular forms.

Limitations and Future Directions

This study would benefit from the addition of other measures directly capturing factors known to contribute to reading comprehension, such as word reading and vocabulary breadth and depth. Additional non-cognitive factors, such as motivation and executive functioning, would also add nuance to these analyses. While the majority of middle graders have well-developed basic word reading skills, controlling more directly for phonological decoding would certainly strengthen our claims regarding CALS. Though prior studies suggest that free and reduced lunch status is highly related to other indices used to capture SES, future studies might build on these findings by operationalizing socioeconomic status as a composite using multiple measures to generate a continuous rather than a dichotomous variable. Replicating these findings in more socioeconomically diverse samples, with more students ineligible for free or reduced lunch would also enrich our understanding of how these factors are related in the

wider population of middle grade students. Finally, English learners were excluded from this sample. We can imagine, however, that a parallel analysis involving this group would yield useful information for the field.

Conclusion

In this study, we document the developmental trajectories of academic language proficiency and their relation with reading comprehension in a socioeconomically diverse sample of English proficient early adolescents followed longitudinally in grades 5 to 7. Emerging as one potentially powerful component of instruction designed to support text comprehension development, academic language proficiency is shown in this study to be unequally distributed in the school age population, with students from low-incomes homes entering middle school with fewer of these school-relevant language resources than their middle-income peers. Furthermore, this study focuses on academic language as a key componential skillset of reading comprehension and suggests that among many factors this skillset may be partially relevant in understanding SES-based discrepancies in reading achievement. While this study did not document the contexts in which students' language skills are developed, one explanation for these differences may be that some learners have experienced unequal rates of exposure to and participation in school-like language practices ('an academic language opportunity gap'). Using this lens to interpret the data from this study, we suggest that classrooms, where complex texts and ideas are the fodder of teaching and learning may serve as powerful contexts for providing this exposure via interventions that target academic language, among other skills germane to text comprehension.

Table 1: Academic language skills included in the CALS construct and assessment

Core Academic Language Skill	Description	Link to Reading Comprehension & Classroom-Based Learning
<i>Skill in understanding morphologically complex words</i>	The typical academic text contain more complex words, many of contain meaningful word parts, like suffixes and affixes (Biber & Gray, 2011; Carlisle, 2000; Halliday, 2004; Schleppegrell, 2004). Students with knowledge of what word parts mean can better discern the meaning of unknown words.	When encountering an unknown word, a skilled reader may make use of her knowledge of word parts to determine the meaning. Consider the following example: a student reading the sentence: ‘it is questionable whether Marcia will be able to attend the game’ may make use of her knowledge of the word, ‘question’ and the suffix ‘-able’ to determine that the author is conveying uncertainty about Marcia’s attendance at the game. It is no surprise, then, that middle grade students who are able to engage in morphological manipulation of complex words (for instance, to make ‘to question’ into ‘questionable’) also demonstrate skill in reading comprehension (Kieffer & Lesaux, 2008, 2012; Kieffer & Box, 2013; Kieffer, Biancarosa & Mancilla-Martinez, 2013). For English learners, and especially for those from low-income families, as well as for monolinguals from low-SES homes, multi-syllabic and compound words appear to play an important role in disrupting text comprehension (Heppt, Haag, Böhme, & Stanat, 2015).
<i>Skill in understanding complex syntax</i>	Given the need to concisely convey large amounts of information, academic texts contain denser syntactic structures, such as center-embedded clauses, noun phrases, and dependent clauses (Halliday, 2004; Schleppegrell, 2004).	Because making sense of the information in a text requires that students understand these syntactic and grammatical structures, it is unsurprising that syntactic knowledge appears to positively contribute to reading comprehension in children, adolescents, and adults (e.g., Mokhtari & Thompson, 2006; Mokhtari, K., & Niederhauser, 2013; Nation & Snowling, 2000; Taylor, Greenberg, Laures-Gore, & Wise, 2011). In particular, some studies suggest that comprehending prepositional phrases is likely to pose greater challenges to English Learners than to native speakers (Martiniello, 2008).

<i>Skill in understanding school-relevant connectives and discourse markers</i>	Academic writers employ both connectives (e.g., <i>although, in other words</i>) and discourse markers (e.g., <i>First, On the other hand</i>) to signal to readers how ideas are related and how texts are organized (Freebody & Anderson, 1983; Hyland, 2004).	Several studies have provided evidence that knowledge of these words and phrases supports online processing, text memory, and the skill to learn from texts (Hyönä & Lorch, 2004; Meyer & Poon, 2001).
<i>Skill in anaphoric resolution</i>	Understanding academic text often requires readers to resolve what are called anaphors, or words or phrases appearing in a text that refer to a prior participant or idea (<i>'Photosynthesis occurs when...this process'</i>). Anaphors serve as instructions to the reader/listener to link ideas in a text (Flowerdew, 2003).	Although studies in this area are few, for upper elementary school students the skill to resolve anaphora seems to support text understanding (Sánchez & García, 2009).
<i>Skill in argumentative text organization</i>	Texts follow specific structures (e.g., cause-and-effect, persuasive essay) at the sentence and paragraph-level that signal to readers where information can be located within the text.	The majority of students master narrative text structures in elementary school, by about age 10. However, the majority of learners do not appear to develop complete knowledge of how expository genres, like persuasive essays or non-fiction texts, are organized until around high school age (Berman & Nir-Sagiv, 2007). In the middle grades and above students depend on knowledge of additional text organization structures to navigate increasingly complex texts (Rex, Thomas & Engel, 2010).
<i>Knowledge of metalinguistic, academic vocabulary</i>	When discussing text—or learning processes—in the classroom, students must have familiarity with the language used to describe thinking and learning, what we call metalinguistic vocabulary.	These are words like 'thesis,' 'hypothesize,' and 'generalization.' To date, this skill has not been examined as a predictor of reading comprehension. However, prior studies examining academic vocabulary knowledge often include similar words. These studies suggest that knowledge of these words is a robust predictor of academic success (de Jong & van der Leij, 2002; Quinn, Wagner, Petscher, & Lopez, 2015).

<i>Awareness of writer's perspective/stance</i>	Academic writers often signal their stance towards statements—whether agreeing, disagreeing, expressing certainty or uncertainty—through language.	The language used to signal stance in writing is less explicit than the language used to communicate perspectives conversationally, readers require additional language knowledge to grasp a writer's bias or to evaluate the level of evidence provided for a claim. For instance, a writer might need knowledge of hedges and epistemic stance markers (e.g., <i>Evidence suggest</i> ; <i>It may be the case</i> ; <i>It seems that</i> ; the <i>alleged assassin</i>) (Halliday, 2004; Hyland, 1998).
<i>Academic Register Awareness</i>	Recognition that a writer is using the academic register signals to the reader that the skills listed above should be used to support text comprehension (Bar-Ilan, & Berman, 2007).	This metalinguistic awareness has just begun to be explored as a contributor to text comprehension (Terry, Connor, Johnson, Stuckey & Tani, 2015); however, these findings suggest that this is a promising area for study.

Table 2: Sample demographics Cohort 1 (n=574) and Cohort 2 (n=733) students

	Cohort 1	Cohort 2
Gender		
Female	51%	50%
SES		
Free/Reduced-price lunch eligible	81%	79%
Special Education Status		
Classified as Special Education Eligible	14%	17%
Eligibility for Literacy Intervention (Intervention Status)		
Low word reading/vocabulary scores	5%	8%
Race		
White	29%	29%
Asian	2%	2%
Latino	15%	23%
African American	51%	44%
Native American/Pacific Islander	NA	NA
Multiple races reported	1%	2%
No Race Information Reported	2%	1%

Table 3a: Correlations between all modeled variables, means and standard deviations (Grade 5)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. CALS, Grade 6, Fall	1.00																
2. CALS, Grade 6, Spring	0.81	1.00															
3. CALS, Grade 7, Fall	0.84	0.87	1.00														
4. CALS, Grade 7, Spring	0.80	0.84	0.87	1.00													
5. GISA, Grade 6, Fall	0.71	0.70	0.71	0.72	1.00												
6. GISA, Grade 6, Spring	0.69	0.73	0.72	0.72	0.69	1.00											
7. GISA, Grade 7, Fall	0.70	0.75	0.75	0.77	0.71	0.73	1.00										
8. GISA, Grade 7, Spring	0.66	0.72	0.71	0.73	0.68	0.71	0.71	1.00									
9. Free or reduced lunch eligibility, Fall, grade 5	-0.18	-0.16	-0.18	-0.17	-0.18	-0.17	-0.19	-0.17	1.00								

Table 3b: Correlations between all modeled variables, means and standard deviations (grade 6)

[illegible]

Table 4: Intercepts and significant covariates for CALS latent curve growth models for cohort 1 and 2.

		Initial Levels (Intercept)				Growth Rate (Slope)				Covariance between Initial Levels and Growth Rate	
		Free or Reduced Price Lunch Eligible		Free or Reduced Price Lunch Ineligible		Free or Reduced Price Lunch Eligible		Free or Reduced Price Lunch Ineligible		FRL Eligible	FRL Ineligible
		<i>Coeff. (SE)</i>	<i>Residual Variance (SE)</i>	<i>Coeff. (SE)</i>	<i>Residual Variance. (SE)</i>	<i>Coeff. (SE)</i>	<i>Residual Variance (SE)</i>	<i>Coeff. (SE)</i>	<i>Residual Variance (SE)</i>	<i>Coeff. (SE)</i>	<i>Coeff. (SE)</i>
Cohort 1	Model Intercepts	0.80 (0.06)***	0.54 (0.04)***	1.22 (0.14)***	0.75 (0.11)***	0.03 (0.00)***	0.00 (0.00)**	0.05 (0.01)***	0.01 (0.00)	-0.00 (0.00)	-0.00 (0.01)
	Covariates										
	Special Education Eligibility	-0.61 (0.21)**		-1.00 (0.09)***		-		-			

Table 5a: Selected results from final fitted path analysis models for direct and indirect contributions of SES to reading comprehension Cohort 1 (followed from grades 5-6).

	Unstandardized coefficient (SE)	Standardized coefficients (SE)	Bootstrapped 95% CI ⁺
<i>Model Intercepts</i>			
CALS intercept	0.71 (0.10)***	0.80 (0.10)	0.60, 0.99
CALS slope	0.03 (0.01)***	0.98 (0.37)	0.53, 1.68
RC intercept	1.04 (0.05)***	2.11 (0.31)	1.55, 2.77
RC slope	0.01 (0.00)***	0.55 (0.64)	0.22, 8.68
<i>Direct associations between growth factors and key predictors</i>			
Path A	-0.26 (0.09)**	-0.30 (0.11)	-0.18, -0.02
Path B	0.01 (0.00)**	0.52 (0.52)	0.30, 1.64
Path C	-0.14 (0.05)**	-0.29 (0.11)	-0.21, -0.05
Path D	0.03 (0.01)***	. 0.46 (0.18)	0.31, 0.81
Path E	0.00 (0.00)*	0.71 (0.98)	0.37, 2.27
Path F	0.28 (0.02)***	0.83 (0.07)	0.72, 0.98
Path G	0.00 (0.00)	0.69 (0.81)	-0.01, 0.01
Path H	0.00(0.00)	0.00 (0.23)	-0.01, 0.01
<i>Indirect associations</i>			
Path A x Path B	-0.00(0.00)*	-0.05(0.06)	-0.32, -0.04
Path C x Path D	-0.01(0.00)*	-0.07(0.06)	-1.61, -0.04
<i>Significant Covariates</i>			
CALS Intercept			
Female	0.12 (0.06)*	0.13 (0.06)	0.01, 0.26
Special Education Eligibility	-0.90 (0.09)***	-1.02 (0.10)	-1.20, -0.83
African American	-0.53 (0.07)***	-0.59 (0.08)	-0.74, -0.44
Reading Intervention Eligibility	-0.26 (0.13)*	-0.29 (0.15)	-0.60, -0.01
RC Intercept			
Special Education Eligibility	-0.44 (0.05)***	-0.89 (0.16)	-1.24, -0.60
African American	-0.36 (0.04)***	-0.51 (0.66)	-1.01, -0.50
RC Slope			
Female	0.01 (0.00)***	0.65 (0.70)	0.31, 8.37
African American	-0.01 (0.00)*	-0.51 (0.66)	-8.74, -0.18

+ Bootstrapped Intervals that contain 0 are insignificant.

Table 5b: Selected results from final fitted path analysis models for direct and indirect contributions of SES to reading comprehension Cohort 2 (followed from grades 6-7) (n=733)

	Unstandardized coefficient (SE)	Standardized coefficients (SE)	Bootstrapped 95% CI
<i>Model Intercepts</i>			
CALS intercept	1.03 (0.08)***	1.09 (0.09)	0.95, 1.26
CALS slope	0.03 (0.00)***	1.72 (0.53)	1.34, 2.77
RC intercept	1.02 (0.07)***	1.57 (0.13)	1.37, 1.83
RC slope	0.03 (0.00)***	1.37 (1.69)	0.95, 5.29
<i>Direct associations between growth factors and key predictors</i>			
Path A	-0.56 (0.08)***	-0.24 (0.04)	-0.30, -0.18
Path B	0.01 (0.00)***	0.35 (0.43)	0.19, 1.05
Path C	-0.29 (0.06)***	-0.18 (0.04)	-0.24, -0.11
Path D	0.00 (0.00)	0.05 (0.09)	-0.10, 0.22
Path E	0.00 (0.00)**	0.55 (0.89)	0.26, 1.80
Path F	0.33 (0.02)***	0.71 (0.05)	0.62, 0.81
<i>Indirect associations</i>			
Path A x Path B	-0.00(0.00)**	-0.21(0.25)	-0.20, -0.05
Path C x Path D	0.00(0.00)	-0.02(0.04)	-0.37, 0.02
<i>Significant Covariates</i>			
CALS Intercept			
Female	0.16 (0.09)***	0.17 (0.07)	0.04, 0.30
Special Education Eligibility	-1.03 (0.08)***	-1.09 (0.07)	-1.33, -0.94
RC Intercept			
Female	0.12 (0.05)**	0.18 (0.07)	0.05, 0.32
Special Education Eligibility	-0.52 (0.05)***	-0.80 (0.08)	-0.95, -0.65
African American	-0.27 (0.05)***	-0.41 (0.08)	-0.56, -0.26
Latino	-0.17 (0.05)**	-0.25 (0.07)	-0.39, -0.10
RC Slope			
White	-0.01 (0.00)*	-0.38 (1.00)	-1.25, -0.02

Figure 1: Parallel process model fit to cohort 1 and 2 with paths of interest labeled.

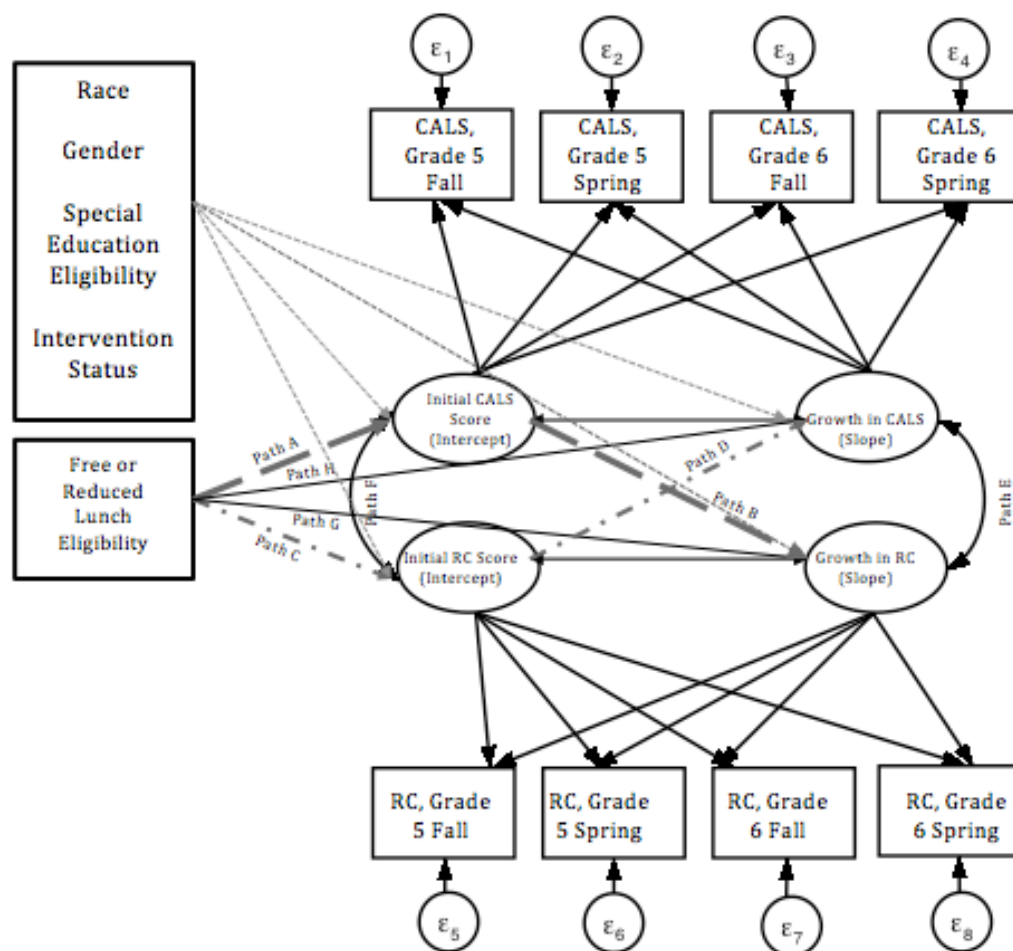


Figure 2: Trajectories of CALS growth for students followed over two academic years, from grades 5-6 and 6-7, disaggregated by free or reduced lunch eligibility.

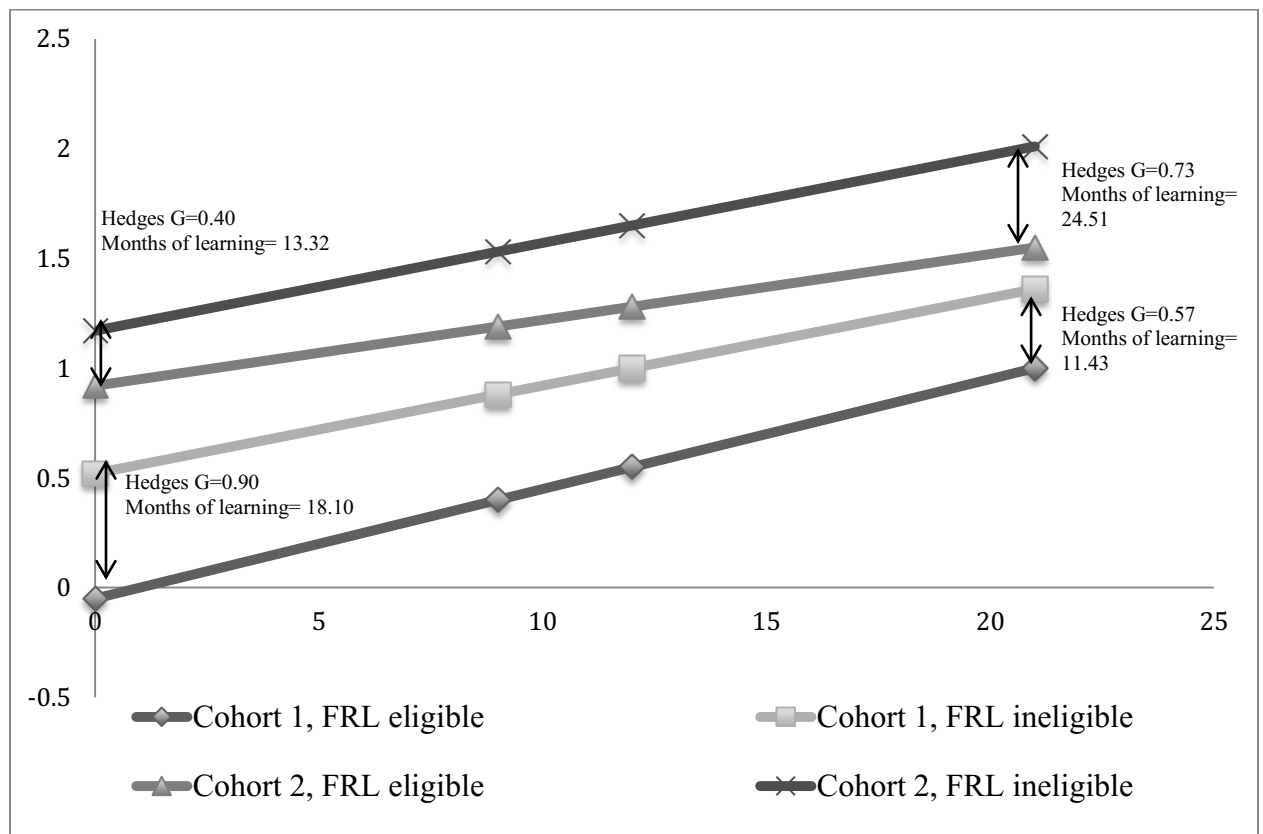


Figure 3: Parallel process model with paths used to examine the indirect effect of SES in cohorts 1 and 2.

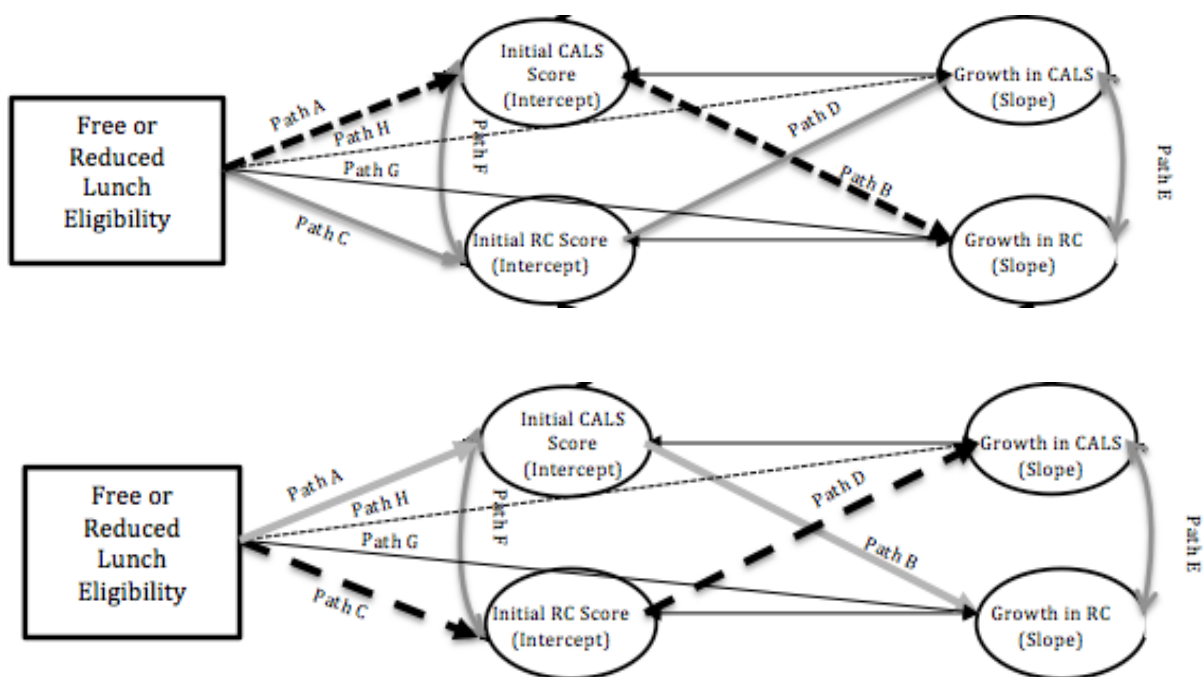


Figure 4a: Growth trajectory for a prototypical student demonstrating average initial CALS scores and rates of CALS growth and a peer demonstrating initial CALS scores and rates of growth in the 98th percentile (Cohort 1).

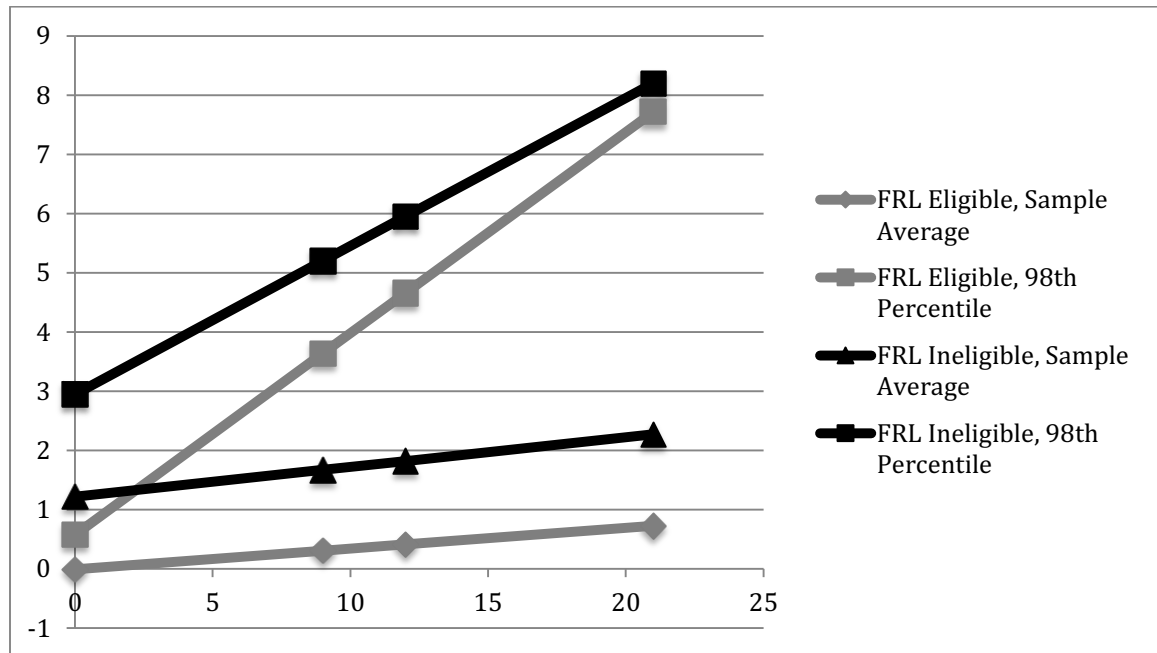
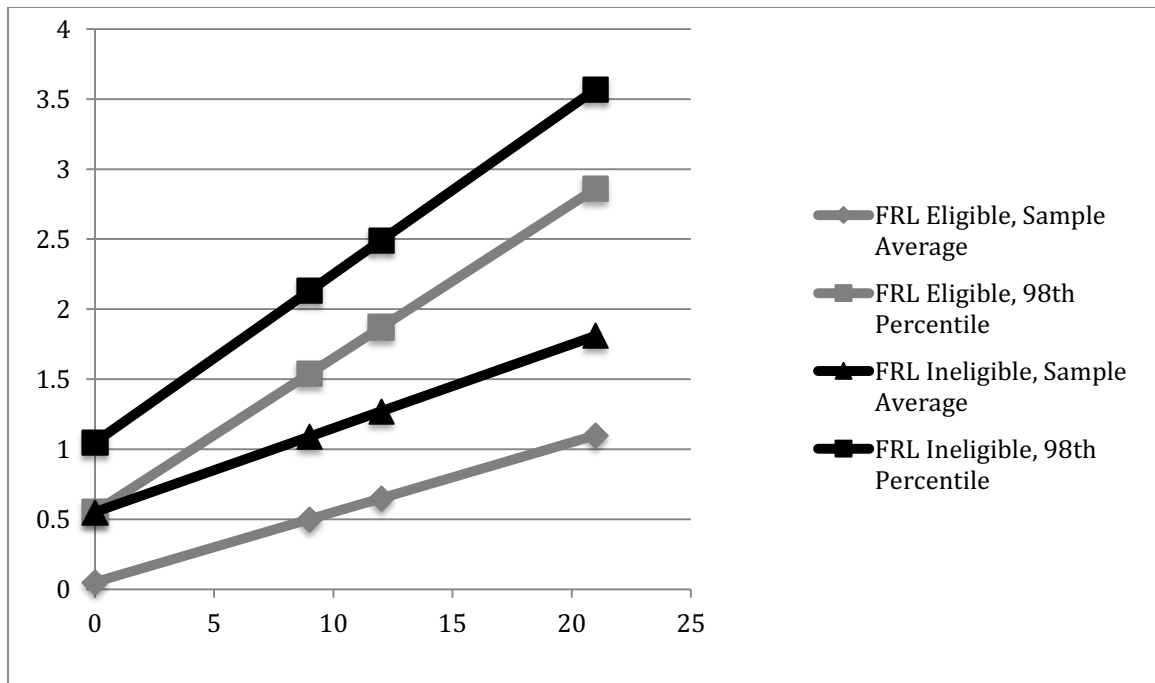


Figure 4b: Growth trajectory for a prototypical student demonstrating average initial CALS scores and rates of CALS growth and a peer demonstrating initial CALS scores and rates of growth in the 98th percentile (Cohort 2).



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Chapter 4

What's Academic Language Got to Do With It?: A Theory of Change for Linking Academic Language Skills to Text Comprehension for Middle Graders

Abstract

In this article, we draw on five years of research with two aims: (1) first, we delineate the set of cross-content-area language skills encompassed under the term, 'core academic language' with the goal of supporting practitioners to identify the language of school text that is most challenging for middle grade readers, and so must be taught; (2) second, we use our prior research findings on the contribution of these core academic language skills to reading comprehension outcomes for middle grade students to propose a theory of change to guide instruction. More specifically, we introduce a model that delineates the anticipated relations among instructional inputs, academic language growth, and reading comprehension development. Despite important advances in reading instruction, the field continues to struggle with how to more effectively expand the language skills that support adolescents' literacy. By specifying the relations between academic language growth and reading comprehension skills as identified through our developmental research, the proposed theory of change provides the field with an initial roadmap for designing instruction that capitalizes on emerging research. This article concludes with a series of instructional implications that can be drawn from this proposed theory of change.

Teaser: *Academic language and text comprehension development support each other, but what does this mean for how we design middle grade instruction?*

Introduction

The lesson began with Mr. Ruiz explaining that there are areas of land, known as the short grass prairie, running from the foot of Rocky Mountains to New Mexico, where the American Bison once grazed. While people also inhabit the short grass prairie today, Mr. Ruiz hoped to teach his 6th grade physical science students about how this ecosystem functioned for the plants and animals that live there. After pre-teaching the words, ‘prairie’ and ‘ecosystem,’ Mr. Ruiz reads aloud from a nonfiction text: *“All of the living things in the shortgrass prairie ecosystem work together to keep healthy. These species might not survive in a different ecosystem—a forest or a swamp, for example. But each plant and animal is right at home here, getting everything it needs from the prairie...”* (adapted from Finton, 2004, pg. 7). Three paragraphs into the text Mr. Ruiz paused to pose what he assumed was a relatively straightforward comprehension question that was ‘right there’ in the text: ‘How do the living things on the prairie stay healthy?’ Diondra, as if on queue, responded ‘they work together to keep healthy.’ Pleased with this answer, but unsure his students grasped that the author was referring to plants and animals living on the prairie (not people!), Mr. Ruiz asked a follow-up question: ‘who or what ‘work together?’’ Jaime raised his hand and with certainty responded: ‘the people, the people living in the short grass prairie, the settlers.’ Using his background knowledge and without making the connection between the phrase, ‘living things in the short grass prairie ecosystem’ in the first sentence to the phrase, ‘plants and animals’ in the second, Jaime had misinterpreted the text.

With a lesson that focused heavily on pre-reading and post-reading activities, Mr. Ruiz wondered: *‘What could I have done to support my students to navigate the language of the text in this lesson? And, beyond this lesson, how should I think about building students’ language in the context of developing their skills as readers?’* These are central questions to ask in today’s educational settings in which we increasingly recognize the central role of advanced language skills in successful reading comprehension. Knowledge of word meanings and of grammar rules are necessary for understanding any text, regardless of its level of complexity; but, by middle school, students like Jaime need additional language skills. In upper grade classrooms, texts convey complex and abstract

ideas, which are often expressed through academic language. Educators working with middle grade students intuitively understand this. They've seen first hand how their students struggle. However, the mandate to teach academic language—found in today's educational standards and echoed in professional resources—offers little guidance for teachers like Mr. Ruiz, who rightfully asks, 'besides teaching vocabulary words, what language should I be teaching?' And, beyond this lesson, will developing my students' academic language skills actually help them to become better text comprehenders?'

In this article, we draw on five years of research to delineate the set of cross-content-area language skills that are encompassed under the term, *core academic language skills*. Our aim is to support practitioners like Mr. Ruiz to identify the language of school texts that is most challenging. We advocate for teaching those academic language features that are the highest utility for pre-adolescent and adolescent readers, and so should be taught in the course of text-based instruction. The second aim of this article is to use findings from our research about how academic language skills relate to reading comprehension outcomes to design a 'theory of change to guide instruction'—a model that delineates the anticipated relationships among instructional inputs, academic language growth, and reading comprehension development. Using data that explores the relations between academic language skills and reading comprehension development in middle graders followed over two academic years (grades 5 to 6 and 6 to 7) as well as cross-sectional studies of students in grades 4-8, we specify a theory of change that can guide the design and evaluation of teaching and educational intervention. Certainly, the field is still delineating the key instructional practices that support academic language growth. However, by specifying the relationships between academic language growth and

reading comprehension skills, this theory of change provides the field with a roadmap for designing instruction that capitalizes on emerging research.

In the sections that follow, we first explain what we mean when we say, ‘academic language.’ Next, we summarize several studies that shed light on how academic language and reading comprehension skills are related during the developmental period from 4th to 8th grade. Finally, we present our data-driven theory of change to inform academic language and reading comprehension instruction and intervention and a tool to aid educators in identifying these academic language features in text. Drawing on our own research and aligned with recent research that identifies text-based discussion as key mechanisms to improve reading comprehension, our findings add yet another important layer to be considered and included in research-based initiatives aiming to support text comprehension for middle schoolers.

Academic Language Defined

Here we argue that reading comprehension should be viewed as a context-specific competency, such that a skilled reader of comic books, for example, may not be a skilled reader of expository texts in the middle grade classroom. Reading an academic, expository text requires additional language resources that may not be necessary when reading a narrative text in the elementary grades, reading popular fiction after school, or engaging with a peer’s post on a social networking site. It is not that these tasks *don’t* pose language demands to readers. After all, reading a blog post requires additional awareness of internet lingo; and, reading fiction texts for pleasure may demand familiarity with descriptive language. Non-fiction text, though, contains a subset of

particular language features that is not found as often in other types of texts. We refer to this as ‘Core Academic Language’ or CAL. CAL is found in texts across disciplines (hence the term, ‘Core’), yet is infrequent in colloquial conversations. For illustration, we show a short segment of text taken from a middle grade textbook that contains a number of CAL features (Figure 1).

*****Insert Figure 1 Here*****

Likely as a result of exposure to and through interactions using these language features, students demonstrate growth in these Core Academic Language Skills (CALS) throughout the upper elementary and middle school years (Berman, 2007; Christie & Derewianka, 2013; Nippold, 2007). Incidentally, educational standards, school texts, and achievement tests in U.S. schools also place a premium on CALS mastery (Bailey, 2007). We hypothesized in designing the CALS model that these skill would support reading comprehension during the upper elementary and middle school years (Uccelli, Barr, Dobbs, Phillips Galloway, Meneses, & Sánchez, 2015a). While the construct of CALS is described in great detail in our prior studies, here we briefly enumerate the academic language skills that it encompasses:

Skill in understanding morphologically complex words. The majority of academic text contains many morphologically complex words, including nominalizations (e.g., nouns like ‘racism’ ‘researcher’ that are derived from verbs) (Biber & Gray, 2011; Schleppegrell, 2004). These words contain meaningful word parts such as ‘-er’ in the word ‘researcher’ (meaning human agent). Understanding morphology seems to impact

text understanding because a skilled reader can make use of her knowledge of word parts to determine the meaning of an unknown word encountered in a text. Consider the following example: a student reading a text containing the sentence: ‘Michael’s anti-establishment politics caused problems at school’ may make use of her knowledge of the word, ‘establishment’ and the affix ‘anti-’ to determine that this means ‘against the establishment.’ Unsurprisingly, middle grade students who can morphologically manipulate complex words (to make ‘to problem solve’ into ‘problem solver’) are also better text comprehenders (Kieffer & Lesaux, 2008; Kieffer & Box, 2013; Kieffer, Biancarosa & Mancilla-Martinez, 2013).

Skill in understanding complex syntax. Given the need to concisely convey large amounts of information, academic texts contain denser syntactic structures than are found in other types of text. These include center-embedded clauses, noun phrases and dependent clauses (Bailey, 2007; Schleppegrell, 2004). Because these structures contain important information, high levels of syntactic knowledge have been linked to reading comprehension skill in children, adolescents, and adults (e.g., Mokhtari & Thompson, 2006; Mokhtari & Niederhauser, 2013; Nation & Snowling, 2000; Taylor, Greenberg, Laures-Gore, & Wise, 2011).

Skill in understanding school-relevant connectives and discourse markers.

Writers make use of connectives (e.g., *although*, *in other words*) and discourse markers (e.g., *First*, *Second*) to signal how ideas are related and how texts are organized. Because these words serve as signposts that signal how ideas are

related in a text, several studies suggest that knowledge of these words and phrases supports readers' recall and learning from text (Hyönä & Lorch, 2004; Meyer & Poon, 2001).

Skill in anaphoric resolution. Understanding academic text often times requires readers to resolve what are called 'anaphors.' These are words or phrases appearing later in a text that refer to an earlier reference to the same participant or idea in the text, which must be connected to achieve text comprehension ('*Photosynthesis* occurs when...*this process*') (Flowerdew, 2003; Hunston & Francis, 2000). Although studies in this area are few, upper elementary school students who can successfully resolve anaphoras seem to understand text better (Sánchez & García, 2009).

Skill in argumentative text organization. By about age 10, most students master narrative text structures; but, it is not until high school that most appear to develop a complete knowledge expository genres, like the persuasive essay or non-fiction text (Berman & Nir-Sagiv, 2007). Because most content area texts tend to be non-fiction, in the middle grades and above students depend more heavily on knowledge of expository text organization structures to make sense of texts (Rex, Thomas & Engel, 2010).

Knowledge of metalinguistic, academic vocabulary. In addition to mastering these language skills, students also need knowledge of the language used in

instructional contexts to talk about thinking and learning, what we call ‘metalinguistic academic vocabulary.’ These terms include words like ‘generalization,’ ‘counterargument,’ ‘reason,’ and ‘discussion.’

Together, these skills in combination with general vocabulary knowledge support students in navigating more complex texts. I have not presented an exhaustive inventory of academic language features, but merely a starting place for identifying the language skills that should be targeted through instruction.

Building a Model to Drive Instruction: Links Between Core Academic Language Skills and Complex Text Comprehension

While existing models of reading comprehension have moved the field forward, they are not designed to inform instruction focused on complex texts in middle grade classrooms. In fact, we need additional models that highlight the role played by advanced language skills, like CALS. To design such a model, we turn now to research that sheds light on the role of academic language to text comprehension processes.

Do core academic language skills predict text comprehension?

Decades of research find links between students’ levels of language skill and successful text comprehension. Most frequently, though, vocabulary is examined as a predictor of reading outcomes. For instance, third-grade vocabulary predicted fifth-grade reading comprehension when controlling for third-grade reading comprehension in a

study conducted by de Jong and van der Leij (2002). Quinn, Wagner, Petscher, and Lopez (2015) also find that from grade 1 to 4, reading comprehension growth depended in part on vocabulary knowledge at the beginning of the study. Vocabulary certainly plays an important role in text comprehension, but the other language skills included in the CALS model also play a role. Geva and Farnia (2013) note that, among other predictors, syntax knowledge was an important, unique predictor of 6th grade reading comprehension levels in a group of English Proficient and English Learner students followed from grade 1. Our own research suggests that CALS skills uniquely predict reading comprehension, explaining about 12% of the variance in students' reading comprehension outcomes after accounting for students' knowledge of vocabulary (Uccelli Phillips Galloway, et al., 2015). In other words, CALS and vocabulary both require instructional attention in today's lessons for adolescents.

Our research also suggests that this instruction may be particularly important for some students, such as English Learners and those growing up in low-income homes, who tend to have fewer opportunities to be exposed to academic language (Heath, 2014; Heller & Morek, 2015; Heppt, Haag, Böhme, & Stanat, 2015). In fact, a recent study we conducted of middle graders (grades 5-7) suggests that growing up in a low-income home impacts students' reading outcomes indirectly via their academic language skills. This suggests that educators have a central role to play in supporting these learners to acquire academic language skills.

Do core academic language skills and text comprehension skills show a bidirectional relationship?

The challenge that many educators face, though, is that there have been few studies of how academic language skills impact text understanding. In imagining how core academic language skills impact text comprehension, two possibilities emerge: the relation may be unidirectional, such that better language knowledge leads to higher levels of text comprehension and/or better reading comprehension skills lead to greater growth in CALS; or the relation may be bidirectional in that students with higher levels of language skill are better able to access text and, as a result of additional exposure to the language contained in text, over time develop higher levels of language skill.

To date, most research suggests that this relationship is bidirectional. Cunningham and Stanovich (1997) and Stanovich (1986) find that facets of language knowledge demonstrate bidirectional relations with reading comprehension. Furthermore, Verhoeven and van Leeuwe (2008) note a strong influence of vocabulary on students' later reading comprehension as well as a weak influence of reading comprehension on later vocabulary skills. Echoing these findings, Geva and Farnia (2013) find that linguistic knowledge (including vocabulary, syntactic skills) and reading comprehension are mutually enhancing over time. Better readers and comprehenders of text appeared to acquire more language skills than their peers who struggled with these tasks. The authors reasoned that because these students were exposed to a greater range of complex linguistic structures as a consequence of their exposure to more complex texts, they, in turn, were able to leverage these skills to both improve their reading comprehension skills *and* to build additional language skills.

Mirroring these other studies, our own research finds bidirectional relations between CALS and reading comprehension. For instance, in two large cohorts of English

Proficient students followed from grade 5 to 6 and from grade 6 to 7, those with higher initial CALS levels grew more quickly as text comprehenders than their peers with lower initial levels of CALS proficiency (Phillips Galloway & Uccelli, in preparation).

Curiously—and for reasons we cannot explain—only students followed from grade 5 to 6 who had higher initial reading comprehension skills exhibited faster rates of growth in CALS across the two years of the study. Students followed from grades 6 to 7 did not exhibit this pattern of development.

Our studies also shed light on the rate at which students are developing these skills. Students who experienced more rapid growth in CALS skills were also developing text comprehension skills more rapidly. Remarkably, rates of growth seem to be fairly uniform. English Learners, students from low-incomes homes and students in the same grades experiencing similar rates of growth on academic language measures, suggesting the impact of instruction or exposure on this skill is the same for these various subgroups.

CALS encompasses a broader array of skills than have been examined in prior studies, but the results are remarkably similar. It seems to be the case that as a reader engages with text, she is developing vocabulary skills, syntax skills and the host of other competencies assessed on the CALS-I. This paints a picture of academic language learning that is linked with text exposure.

A Theory of Change for the Relation Between CALS and Reading Comprehension to Inform Instruction & Intervention

Drawing on the developmental research discussed above, we specify a theory of change that illustrates the likely relations between academic language growth and reading

comprehension development. We offer this theory of change to educators as a tool for designing instruction that views academic language and reading comprehension skills as linked competencies. For educators like Mr. Ruiz, this model offers insight into how academic language and reading comprehension instruction might be conducted in the classroom. Specifically, we suggest that this model leads to key instructional implications that shape daily reading instruction in middle grade classrooms.

*****Insert Figure 2 Here*****

Implications for Instruction

Instructional Principles

This model situates academic language development and reading comprehension as linked competencies. The types of instructional interactions that support the development of these skills remains a topic of continued study, and likely will be for the foreseeable future. However, some general instructional principles can be derived from the work to date.

Principle 1: Teach vocabulary and academic language | Our research suggests that academic language is related to—but also distinct from—vocabulary. Each skill supports students in the act of reading complex text. It is the case that the field has been plagued by the misconception that teaching academic language is synonymous with teaching vocabulary. Often this takes the form of reviewing a few key vocabulary words before reading without much engagement with the language of the text *while* reading, effectively

missing the opportunity to support students to observe academic language in text—its ‘natural habitat.’ In these lessons that seek to frontload vocabulary, the academic language challenge of a text is viewed only through the lens of identifying single words, with minimal attention to the challenges posed by the other aspects of CALS highlighted above that appear within text, for instance syntax and anaphoric resolution. In addition, lessons that teach vocabulary in the context in which these words appear best support students to use these words correctly; After all, words frequently occur in the same syntactic structures and with the same connecting words across texts.

Principle 2: *View the very act of reading as academic language teaching, and vice versa*

| This theory of change presents reading comprehension and academic language skills as linked both in development and in instruction, despite the tendency to view these skills as distinct. This is certainly a shift in how we have traditionally designed instruction. The finding from our research that academic language and reading appear to have a reciprocal relations at some ages and stages of development suggests that it is, at least partially, through engagement with text that students are acquiring academic language; and that by developing more advanced academic language skills, students are also becoming better readers. Engaging students with reading grade-level texts is, therefore, not only about teaching the information in the text—it is also about exposing students to grade-level language. In this vein, we advocate exposing all students, especially those who are struggling readers, to texts on grade-level at least during a portion of the instructional day. This requires educators, like Mr. Ruiz, help students to move between the more complex language of text and the language that is familiar to students. This begins, of

course, with identifying the academic language features within text that pose the greatest difficulty to middle grade learners.

Principles in Action

Scaffolding students into short segments of text that contain the rich ideas and the language needed to describe them can be challenging; nonetheless, innovative approaches that use talk about text and language analysis in combination offer great promise (see Wong Fillmore, 2014). To support educators in identifying academic language features to teach explicitly during lessons, we offer a series of ‘look fors’ to use when preparing to teach text-based lessons and questions to ask students during reading. For instance, if we return to the example of Mr. Ruiz’s classroom, and apply this set of ‘look fors’ to the text he had selected to read with his students, we can see the challenge of tracking participants within the text. Matching ‘living things’ in sentence one to ‘species’ in sentence two and, finally, to ‘plants and animal’ in sentence three is certainly challenging: *“All of the living things in the shortgrass prairie ecosystem work together to keep healthy. These species might not survive in a different ecosystem—a forest or a swamp, for example. But each plant and animal is right at home here, getting everything it needs from the prairie...”* (adapted from Finton, 2004, pg. 7). By posing questions (Who or what is the author referring to here? How do you know?) to support students to identify these connections, Mr. Ruiz might scaffold his students into higher levels of text understanding. The goal of this chart is not to make language learning a rigid, lockstep component of reading

instruction. Instead, we hope that this tool can be used to support students in using the language of text to better understand the information a text contains.

*****Insert Figure 3 Here*****

Conclusions

While the methodologies for teaching academic language are still developing, our research suggests that teaching academic language might be a promising component in the design of an instructional diet for adolescent learners. In this article, we draw on five years of research with two aims: (1) to describe the language skills that are encompassed under the term, ‘academic language’ in order to support practitioners to identify the language of school text that is most challenging for pre-adolescent and adolescent learners, and so should be taught in the course of literacy instruction; and (2) second, we use findings from our research to propose a ‘theory of change to guide instruction’—or a model that delineates the anticipated relationships between instructional inputs, academic language growth and, reading comprehension development. By specifying the relationships between academic language growth and reading comprehension skills, this data-driven theory of change provides the field with a roadmap for which relationships to address in instruction and evaluate when assessing the efficacy of instructional inputs.

Figure 1: Features of academic language that pose challenges to middle grade readers

Academic language: History textbook
(6th grade)

Later, in the 1200s BC, the Assyrians from northern Mesopotamia briefly gained control of Babylon. **However**, **their empire** was soon overrun by invaders. After this defeat, the Assyrians took about 300 years to recover their strength. **Then**, starting about 900 BC, **they** began to conquer all of the Fertile Crescent. They even took over parts of Asia Minor and Egypt.

The key to the Assyrians' success was their strong army. Like the Hittites, the Assyrians used iron weapons and **chariots**. **The army** was very well organized, and every soldier knew his role.

Autonomous text with authoritative, detached stance

Words that link ideas explicitly
(connectives)

Words that link the same participants
(reference chains)

Complex information
(complex words)

Densely packed information
(complex syntax)

Example from Holt Social Studies, Grade 6

?

?

Figure 2: A Theory of Change for the Relationship Between CALS and Reading Comprehension to Inform Instruction & Intervention

A Theory of Change for the Relationships between CALS' Growth and Growth in Academic Text Comprehension

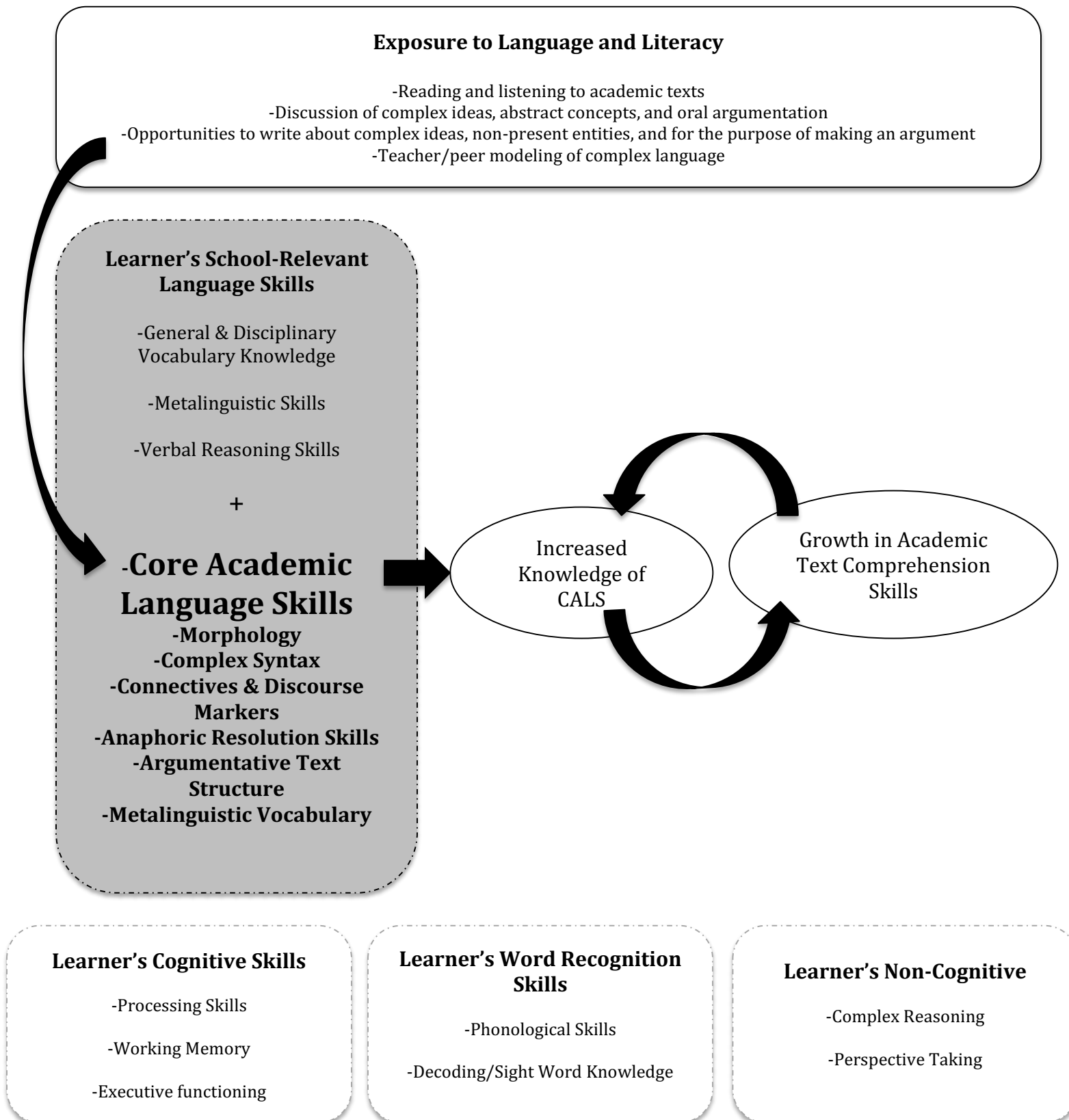


Figure 3: CALS Lesson Planning Chart

<i>CALS Dimension</i>	<i>Examples</i>	<i>'Look fors' in text</i>	<i>CALS conversation starters</i>
<i>Un/packing dense information</i> <i>(a) Complex words*</i> <i>Skill in breaking down complex words</i>	<i>invasion</i> <i>durability</i> <i>contribution</i>	<i>Words ending in -ion, -ility, -tion, -ion, -ed, -tion</i> <i>Words beginning with ex-, un-, anti-</i>	<i>What does this root/prefix/suffix tell us?</i> <i>Do you see any words you know in this word?</i> <i>Do you know other words with the same ending?</i> <i>What do they have in common with this word?</i>
<i>(b) Complex sentences*</i> <i>Skill in understanding complex sentence structures</i>	<i>expanded noun phrases</i> <i>The adorable puppy, always eager to play, followed me everywhere.</i> <i>center-embedded clauses</i> <i>The decrepit car, In which my parents drive me to school, stopped suddenly in the middle of the road.</i>	<i>Commas, semicolons, dashes</i>	<i>Why is the information contained between the commas important?</i> <i>What is the author telling us more about?</i>
<i>Connecting ideas logically</i> <i>Skill in understanding school-relevant words that connect ideas</i>	<i>consequently</i> <i>nevertheless</i> <i>in conclusion</i>	<i>Connecting words, Transition words</i>	<i>What does this word tell us about how the ideas are related?</i> <i>Do you know another word that means the same thing?</i>
<i>Tracking participants and themes</i>	<i>The <u>king</u> was known for <u>his</u> military rule, often</i>	<i>Pronouns</i>	<i>Who or what is the author referring to here? How do you know?</i>

<i>Skill in tracking people or ideas through a text</i>	<i>referred to as a <u>tyrant</u> by his subjects.</i> <i>The <u>Kreb's cycle</u> is a <u>process</u> through...</i>	<i>Terms referring to the same idea/person</i>	
<i>Organizing analytic texts</i> <i>Skill in organizing argumentative texts</i>	<i>Some think...Others think...</i> <i>The first reason...The second reason...</i>	<i>Text structures</i>	<i>In whole texts:</i> • <i>Where should I look for the main idea? The details? The conclusion?</i> <i>In paragraphs:</i> • <i>Based on this sentence, what do you think the author will say next?</i>
<i>Understanding metalinguistic vocabulary</i> <i>Skill in understanding precise meanings, particularly the meaning of vocabulary that refers to the process of thinking and reasoning</i>	<i>counterclaim</i> <i>evidence</i> <i>precise</i> <i>hypothesis</i> <i>inference</i>	<i>Words in directions and texts that cue students to engage in particular ways of thinking or processes.</i>	• <i>What does this word mean in this context?</i>
<i>Interpreting writers' viewpoints</i> <i>Skill in interpreting words that signal a writer's attitude or level of certainty about a claim</i>	<i>impossible</i> <i>presumably</i> <i>conclusively</i>	<i>Stance markers (words that signal how an author feels about a claim or how certain he/she is about the claim)</i>	• <i>How does the author feel about x? how do you know?</i> • <i>How certain is the author about his/her evidence? How do you know?</i>

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Chapter 5

In this thesis, I report the results of two studies exploring the newly operationalized construct of Core Academic Language Skills (CALS). Specifically, this thesis explores two key hypotheses regarding the nature of CALS: 1) that CALS would contribute to reading comprehension development over-time in adolescents, potentially demonstrating a pattern of co-development; 2) that CALS—as a set of skills that are the result of having had opportunities to use ‘school-like’ language—would serve as a potential explanatory mechanism for the well-documented differences observed in literacy achievement between students from low-income families and their middle-income peers. In so doing, these studies contribute to our growing understanding of the development school relevant language skills development in middle graders.

In study 1, I examine the concurrent development of academic language skills and reading comprehension in for English Learners and their English proficient peers followed over two academic years, from grade 6 to 7. Parallel process latent growth modeling results suggest that academic language and reading comprehension skills develop concurrently, with rapid growth in CALS being associated with rapid growth in reading comprehension skills. Additionally, initial levels of CALS predict rates of growth in reading comprehension. Focused on learners where the majority were reading below grade-level, this study highlights the potential for CALS-focused instruction to serve as a point of leverage for improving adolescent learners’ reading comprehension outcomes. Extending the results of this first study, study 2 examines the hypothesis that this broader array of academic language skills impacts reading achievement for middle graders in a broader range of grades. Using longitudinal data collected from 5th and 6th grade English-

proficient students attending schools serving high-poverty communities followed over two academic years, we identify malleable skills that might be targeted via instruction to support of students who may enter classrooms with less familiarity with the language of academic texts. In this study, we focus on the middle grades as a developmental period during which both later developing language skills and reading comprehension experience growth. To capture these skills, we made use of the Core Academic Language Skills-Inventory (CALS-I), an innovative and comprehensive measure of academic language proficiency (Uccelli, Barr et al., 2015; Uccelli, Phillips Galloway et al., 2015). Results suggest that initial CALS skills impact the rate at which students develop as readers and that socioeconomic status impacts reading comprehension growth indirectly via its influence on students' initial levels of academic language skill. Taken together these studies add support to the argument that teaching academic language may be one vital lever among many for supporting reading comprehension growth, especially for learners who have had fewer opportunities to be exposed to the language of school.

This set of studies adds further evidence for the addition of CALS to theoretical models of reading comprehension. To date, these models only vaguely specify the language skills that support text comprehension, with a heavy focus on vocabulary.

Directions for Future Research

These studies provide evidence for theory building, but not to make causal claims about CALS development. In study 1, relationship between growth in reading comprehension and CALS could be the result of a so-called 'third variable,' or time-varying variable, that during the developmental period studied causes improvement in both skills simultaneously. Similarly, in study 2, other unmeasured variables (background

knowledge, for instance) may serve as additional pathways through which SES impacts reading comprehension. Experimental studies that include additional controls are, therefore, necessary. In addition, further studies of CALS-reading comprehension relationships in broader populations including more students not classified as struggling readers as well as a wider age span are necessary to propose a complete theoretical model.

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Education

Doctor of Education, Harvard University, Cambridge, MA

Program in Human Development & Education

Advisor: Paola Uccelli; Ad Hoc Committee Members: Nonie Lesaux, Catherine Snow;
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Cumulative GPA: 4.0/4.0

Bachelor of Arts, University of Pennsylvania, Philadelphia, PA

Program in History and Sociology of Sciences with a concentration on public policy

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Thesis: Doing Well by Doing Good?: An Impact Evaluation of Service Learning
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Fellowships, Honors, and Awards

Harvard Graduate School of Education, Larsen Fellowship 2010-2015

Dean's Summer Fellowship, Summer 2013

Qualifying paper passed with distinction, Spring 2013

Jeanne Chall Memorial Travel Grant, Spring 2013, 2015

Doctoral Student Travel Grant, Summer 2012, Fall 2012, Fall 2013, Summer 2015

National Endowment for the Humanities Grant for Study in Italy, Summer 2009

Michael Pressley Memorial Fellow, Benchmark School, January 2006 - 2010

Phi Beta Kappa, University of Pennsylvania, 2005

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Teaching and Research Experiences

Instructor in Education

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H811C: Literacy Instruction in Linguistically and Culturally Diverse Classrooms (Fall, 2015)

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Teaching Fellow & Reading Specialist Practicum Supervisor 2011-
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- H800 – Reading Specialist Licensure Practicum, Spring 2012, 2013
- H801 – Literacy Assessment and Intervention Practicum, Fall 2011, 2012
- Capstone Experience Teaching Fellow, Fall 2012, Spring 2013
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Academic Language Research Team Coordinator 2010-
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Harvard University Graduate School of Education, Cambridge, MA

Catalyzing Comprehension through Discussion and Debate Project, IES-Funded Initiative

- Assisted with development and piloting of a battery of assessments to understand the development of academic language in upper elementary and middle school students

Michael Pressley Memorial Fellow

Benchmark School, a School for Struggling Readers, Media, PA

As a teacher-researcher (8th grade Latin, 8th grade English and 7th grade social studies):

- Created and administered research protocols to qualitatively and quantitatively assess pedagogical interventions to improve students' comprehension of expository texts

Teacher, Reading Specialist Trainee 2005-
2006

Samuel Powel Elementary School, Philadelphia, PA

- Evaluated and provided instruction to struggling readers in grades 1-4.

Early Childhood Teacher

Parent Infant Center, Philadelphia, PA

As a classroom co-teacher teaching students ages 3-4.5:

- In collaboration with colleagues developed and implemented a balanced program of instruction, supported the development of self-care routines and emergent literacy skills.

Educational Consulting

Educational Consultant

Boston Public Schools, Department of Early Childhood, Boston, MA

As a consultant in collaboration with Dr. Nonie Lesaux and her team:

- Developed curriculum for the Focus on First initiative targeting first grade readers.

New York City Department of Education, Office of English Language Learners, New York, NY

As a consultant in collaboration with Dr. Nonie Lesaux:

- Developed and implemented professional development for teachers and administrators serving students in grades k-8 on the topics of Response to Intervention (RTI), literacy development for English Language Learners (ELLs), and literacy reform.
- Provided coaching in to teachers in select New York City middle schools.

Rigorous and Regulated Early Childhood Initiative, Harvard Graduate School of Education

As a consultant:

- Developed and implemented a module for coaches of early childhood teachers.

Articles

Phillips Galloway, E., & Uccelli, P. (2015). Modeling the relationship between lexico-grammatical and discourse organization skills in middle grade writers: insights into later productive language skills that support academic writing. *Reading and Writing*, 28(6), 797-828.

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Mason, P. A., & **Phillips Galloway, E.** (2012). What Children Living in Poverty Do Bring to School: Strong Oral Skills, Let Them Talk!. *Reading Today*, 29(4), 29-30.

Books

Lesaux, N.K., **Phillips Galloway, E.**, & Marietta, S. (forthcoming). *Advanced Literacy Instruction in Linguistically Diverse Settings: A Guide for School Leaders*. Guilford Press.

Book Chapters

Phillips Galloway, E. & Lesaux, N.K. (2015). Reading Comprehension Skill Development and Instruction for Adolescent English Language Learners: A Focus on Academic Vocabulary Instruction. In K.L. Santi and D.K. Reed (Eds.), *Improving Comprehension for Middle and High School Students*. Springer.

Phillips Galloway, E., Lawrence, J.F., & Moje, E.B. (2013). Research in disciplinary literacy: Challenges and instructional opportunities in teaching disciplinary In J. Ippolito & J.F. Lawrence (Ed.). *What Middle and Secondary Teachers Need to Know About Adolescent Literacy*. Cambridge, MA: Harvard Ed. Press.

Gaskins, I. & **Phillips Galloway, E.** (2010). Beyond Strategy Instruction: Looking at Person, Situation, Task, and Text Variables. In T. Gunnings & J. Collins (Ed.). *Developing Struggling Students' Higher Level Literacy*. Newark, DE: International Reading Association.

Conference Presentations and Papers

Phillips Galloway, E., & Uccelli, P. (April, 2016). Core Academic Language Skills: A Relevant Construct to Understand and Promote Adolescents' Expository Writing Quality? American Educational Research Association (AERA), Washington, D.C.

Dobbs, C. & **Phillips Galloway, E.**, & Uccelli, P. (April, 2016). Explicit instruction in the language of school: A pilot study of an academic language unit. American Educational Research Association (AERA), Washington, D.C.

Uccelli, P., **Phillips Galloway, E.**, Allen, M. & Aguilar, G. (April, 2016). Core Academic Language Skills and Practices: Promoting language development through research-based critical learning. American Educational Research Association (AERA), Washington, D.C.

Phillips Galloway, E. & Uccelli, P. (March, 2016). The Role of Academic Language Skills in the Reading Comprehension of Middle Grade Students: Evidence from Mediation Models. Society for Research on Educational Effectiveness (SREE). Washington, D.C.

Dobbs, C., **Phillips Galloway, E.**, & Bacon, C., (July, 2015) Metalinguistic skill in a register-matching task: A qualitative pilot study of middle grade English learners. Society for the Scientific Study of Reading (SSSR), Kona, Hawaii.

Uccelli, P., **Phillips Galloway, E.**, & Barr, C.L., (July, 2015). Beyond vocabulary: Validation of a novel instrument to capture school-relevant language skills. Society for the Scientific Study of Reading (SSSR), Kona, Hawaii.

Phillips Galloway, E., Stude, J., Dobbs, C.L. , Uccelli, P. (April, 2015). The Power of Peers: An Examination of Classroom Discussion as a Context for Developing Adolescents' School-Relevant Metalinguistic Skills. American Educational Research Association (AERA), Chicago, IL.

Uccelli, P., **Phillips Galloway, E.**, & Barr, C. (March, 2015). Capturing Growth in School-Relevant Language Skills During the Upper Elementary School Years. Society for Research in Child Development (SRCD), Philadelphia, PA.

Phillips Galloway, E., Uccelli, P., & Barr, C. (July, 2014). Core Academic Language Skills: An Expanded Operational Construct and its Associations with Reading Comprehension. Presented at the Society for the Scientific Study of Reading (SSSR), Santa Fe, New Mexico.

Phillips Galloway, E., Al-Adeimi, S. Qin, W., Uccelli, P., & Meneses, A. (2014, July). Exploring Developmental Trends in Pre-Adolescents' Definitional Skills. Presented at the Society for the Scientific Study of Reading (SSSR), Santa Fe, New Mexico.

Meneses, A. Qin, W., **Phillips Galloway, E.**, Al-Adeimi, S. Uccelli, P. (2014, July). Exploring Trends in Adolescents' and Pre-Adolescents' Definitional Skills. Presented at the International Association of Child Language (IASCL), Amsterdam, Netherlands.

Uccelli, P., **Phillips Galloway, E.**, Barr, C.L., Meneses, A., , Sánchez, E., Dobbs, C.L. (2014, July). Core Academic Language Skills (CALs): An Operational Construct for Exploring Variability in Adolescents' and Pre-Adolescents' Academic Language Skills. Presented at the International Association of Child Language (IASCL), Amsterdam, Netherlands.

Phillips Galloway, E., Stude, J., Uccelli, P. (2014, July). The Role of Peers in Adolescents' Talk about Academic Language. Presented at the International Association of Child Language (IASCL), Amsterdam, Netherlands.

Phillips Galloway, E., Al-Adeimi, S., Figa, M., Santilli, C., Uccelli, P., & Dobbs, C.L., (2014, April). You would talk to teachers with fancy words and more respect: Adolescents reflecting metalinguistically on the academic register. Presented at the American Educational Research Association Annual Conference, Philadelphia, PA.

Mason, P. & **Phillips Galloway, E.** (2013, December). Developing as Social Equity Literacy Teachers: Video Self-Analysis Projects That Move Teachers Forward. Presented at the Literacy Research Association Conference, Dallas, Texas.

Phillips Galloway, E., Lawrence, J., & Moje, E. (2013, December). Getting to the Core of Adolescent Literacy: A Framework for Meeting Common Core Challenges. Presented at the Literacy Research Association Conference, Dallas, Texas.

Uccelli, P., **Phillips Galloway, E.**, Barr, C., Dobbs, C., Ronfard, S., Meneses, A. (2013, December). Beyond Academic Vocabulary: The CALS Construct. Presented at the Literacy Research Association Conference, Dallas, Texas.

Uccelli, P., **Phillips Galloway, E.**, Dobbs, C., & Ronfard, S., (2013, April). General Academic Language Proficiency: A Key Predictor of Adolescents' Reading Comprehension. Presented at the Society of Research in Child Development Biannual Meeting, Seattle, Washington.

Phillips Galloway, E., Uccelli, P., Barr, C., (2013, April). Modeling the Relationship Between Lexical, Grammatical, and Discourse Structure Knowledge and Academic Writing Proficiency for Middle-Grade Writers. Presented at the American Educational Research Association Annual Conference, San Francisco, California.

Uccelli, P., Barr, C., Dobbs, C., **Phillips Galloway, E.**, Meneses, A., Sánchez, E., (2013, April). Identifying Cross-Disciplinary Academic Language Skills Throughout the Middle School Years. Presented at the American Educational Research Association Annual Conference, San Francisco, California.

Phillips Galloway, E. & Uccelli, P. (2013, March). Anticipating the challenges of complex texts for middle grade EL learners: A focus on academic language. Presented at the Regional Educational Laboratory Southeast, Miami, Florida.

Uccelli, P., **Phillips Galloway, E.**, & Dobbs, C. (2012, October). Assessing Academic Language: A workshop. Presented at the Center for Research on the Educational Achievements and Teaching of English Language Learners Conference entitled: English language learners in content areas: Teaching for Achievement in the Middle Grades, Orlando, Florida.

Lawrence, J.F., **Phillips Galloway, E.**, Yim, S., Lin, A., (2012, November). Macro-contextual factors impacting the development of proficient analytic writers: Insights into the literacy lives of adolescents gleaned from a comprehensive document analysis. Presented at the Literacy Research Association Conference, San Diego, California.

He, W., **Phillips Galloway, E.**, Hsu, J., White, C., Lawrence, J.F., & Snow, C.E.

(2012, November). Academic vocabulary instruction across the content areas: Results from a randomized trial of the Word Generation Program. Presented at the Literacy Research Association Conference, San Diego, California.

Stude, J., **Phillips Galloway, E.** & Uccelli, P. (2012, August). *Negotiating communicative practices in schools: Student's reelections on the academic register*. Presented at Sociolinguistics Symposium 19, Berlin, Germany.

Lawrence, J.F., **Phillips Galloway, E.**, Yim., S.B. & Lin, A. (2012, July). *Content area writing: The literacy lives of American adolescent writers and implications for EFL contexts*. Presented at the Korea Association of Teachers of English (KATE) International Conference, Seoul, South Korea.

Uccelli, P., Meneses, A. , **Phillips Galloway, E.**, Barr, C. (2012, July). *To define nouns: An academic challenge that reveals later-language development in adolescent students*. Presented at the Society for Text and Discourse conference, Montreal, Canada.

Phillips Galloway, E. & Gaskins, R. (2009, December). *Facilitating Students' Understanding of Expository Texts in Social Studies: Applying an Instructional Approach Centered on the Essential Understandings and the Action Cycle*. Presented at the National Reading Conference, Albuquerque, New Mexico.

Gaskins, I., Gaskins, R., Morris, J., **Phillips Galloway, E.**, Rahm, M., & North, S. (2009, May). *Facilitating Struggling Readers Engagement and Deep Understanding as They Interact With Narrative and Expository Texts: Integrating Four Elements--Explicit Strategies Instruction, Writing, Quality Discussions, and a Conceptual Framework*. Presented at the International Reading Association Conference, Minneapolis, Minnesota.

Gaskins, R., & **Phillips Galloway, E.** (2008, December). *Why Did They Do That?!: Making Sense of Human History Through the Essential Understandings*. Presented at the National Reading Conference, Orlando, Florida.

Practitioner Workshops & Series

Lesaux, N. & **Phillips Galloway, E.** (January, 2013-present). Implementing RTI: A institute for leaders. Presented for the Office of English Language Learners, New York City Department of Education, New York, New York.

Phillips Galloway, E. & Uccelli, P. (2013, March). Implementing the Common Core State Standards: Anticipating the academic language challenges of complex texts for middle grade EL learners. Presented for the Office of English Language Learners, New York City Department of Education, New York, New York.

Phillips Galloway, E. & Uccelli, P. (2013, March). Anticipating the challenges of complex texts for middle grade EL learners: A focus on academic language. Presented at the Regional Educational Laboratory Southeast, Miami, Florida.

Phillips Galloway, E. & Dobbs, C., (2012, August). What is academic language? Presented at the Strategic Educational Research Partnership Summer Institute. Boston, MA/Baltimore, MD.

Dobbs, C. & **Phillips Galloway, E.,** (2011, August). Assessing academic language. Presented at the Strategic Educational Research Partnership Summer Institute. Boston, MA.

Other Publications

Uccelli, P., & **Phillips Galloway, E.** (2012). Supporting deep reading comprehension of academic texts through text dependent questions: A Guide for practitioners. Report to the New York City Department of Education. New York: NYC-DOE.

Phillips Galloway, E. (2011) What is deep reading comprehension?. Report to Zaner-Bloser. Columbus, OH: Zaner-Bloser.

Manuscripts Under Review or in Preparation

Phillips Galloway, E. Disentangling the relationship between Socioeconomic Status, Language Skill and Reading Comprehension: A Mediation Model. (*in preparation*)

Uccelli, P. & **Phillips Galloway, E.** Teaching Academic Language to Adolescents: Insights from Research (*Revised and Resubmitted*).

Uccelli, P., Meneses, A. & **Phillips Galloway, E.** Mapping the developmental trajectories of word definitions. (*in preparation*).
