

Beyond Vocabulary: Exploring Cross-Disciplinary Academic-Language Proficiency and Its Association With Reading Comprehension

Paola Uccelli

Emily Phillips Galloway

*Harvard Graduate School of Education,
Cambridge, Massachusetts, USA*

Christopher D. Barr

University of Houston, Texas, USA

Alejandra Meneses

*Pontificia Universidad Católica de Chile,
Santiago*

Christina L. Dobbs

Boston University, Massachusetts, USA

ABSTRACT

Despite a long-standing awareness of academic language as a pedagogically relevant research area, the construct of academic-language proficiency, understood as a more comprehensive set of skills than just academic vocabulary, has remained vaguely specified. In this study, we explore a more inclusive operationalization of an academic-language proficiency construct, core academic-language skills (CALs). CALs refers to a constellation of high-utility language skills hypothesized to support reading comprehension across school content areas. Using the Core Academic Language Skills Instrument (CALs-I), a theoretically grounded and psychometrically robust innovative tool, we first examined the variability in students' CALs by grade, English-proficiency designation, and socioeconomic status (SES). Then, we examined the contribution of CALs to reading comprehension using academic vocabulary knowledge, word reading fluency, and sociodemographic factors as covariates. A linguistically and socioeconomically diverse cross-sectional sample of 218 students (grades 4-6) participated in four assessments: the CALs-I, a standardized reading comprehension assessment (Gates-MacGinitie Reading Test), an academic vocabulary test (Vocabulary Association Test), and a word reading fluency test (Test of Silent Word Reading Fluency). General linear model analysis of variance revealed that CALs differed significantly by grade, English-proficiency designation, and SES, with students in higher grades, English-proficient students, and those from higher SES backgrounds displaying higher scores, on average. Hierarchical multiple regression analyses identified CALs as an independent predictor of reading comprehension, even after controlling for academic vocabulary knowledge, word reading fluency, and sociodemographic factors. By specifying a set of language skills associated with reading comprehension, this study advances our understanding of school-relevant language skills, making them more visible for researchers and educators.

Academic-language proficiency, broadly understood as proficiency in the language of schooling (Schleppegrell, 2001, 2004), has increasingly become a topic of interest in educational circles because of its hypothesized contribution to reading comprehension and content area achievement (Abedi & Herman, 2010; August & Shanahan, 2006; Biancarosa & Snow, 2006). It has become commonplace to argue that the reading comprehension difficulties documented for a large proportion of students in grades 4 and above (particularly for students living in poverty and/or acquiring English as a second language in the United States) are, in large part, the result of students' challenges in understanding the academic language of school texts.

Moreover, students' academic-language proficiency is being increasingly understood in the field as a malleable factor that can be effectively scaffolded through high-quality instruction. In fact, one of the central shifts in practice advocated by the recently and widely adopted college and career readiness standards in the United States calls for "regular practice with complex texts and their academic language" (National Governors Association Center for Best Practices & Council of Chief State School Officers, n.d., para. 3) throughout the upper elementary and secondary school years. Paradoxically, though, an operational definition of academic-language proficiency that would be sufficiently precise to inform instruction remains elusive. In the absence of a comprehensive operational construct, the field continues to be largely dominated by a narrow definition of academic language as academic vocabulary.

In response to various researchers' calls for more expansive definitions (Nagy & Townsend, 2012; National Research Council, 2010; Schleppegrell, 2004; Valdés, 2004), this study examines the potential, for both research and practice, of a more inclusive operationalization of an academic-language proficiency construct (herein, *academic-language proficiency* and *academic-language skills* are used as interchangeable terms). We refer to this operational construct as *core academic-language skills* (CALS; Uccelli et al., 2014). We define CALS as a constellation of the high-utility language skills that correspond to linguistic features that are prevalent in academic discourse across school content areas and infrequent in colloquial conversations. The CALS construct includes, for example, knowledge of logical connectives (e.g., *nevertheless*, *consequently*), familiarity with structures that pack dense information in texts (e.g., nominalizations, embedded clauses), and knowledge of structures for organizing analytic texts. To be clear, we do not focus on what some have called *academic gibberish*, or unnecessarily dense and intricate structures that obscure communication (Krashen, 2012). Instead, we focus on high-utility academic language resources as tools for precise communication and learning across school content areas.

CALS are hypothesized to support reading comprehension of academic texts, and this is the main hypothesis that we seek to examine in this study. Using an innovative and psychometrically robust assessment, the Core Academic Language Skills Instrument (CALS-I), we examine variability in students' CALS, as well as the relationship between CALS and reading comprehension in a linguistically and socioeconomically diverse cross-sectional sample of students in grades 4–6. We begin by reviewing current understandings of the role of language in text comprehension. Then, we review research related to academic language and to our proposed operational CALS construct.

The Role of Academic-Language Proficiency in Comprehending School Texts

At least two broad lines of research inform our understanding of the role played by language knowledge in reading comprehension. On the one hand, psychological models of reading, such as the simple view of reading (Gough & Tunmer, 1986) and the reading systems framework (Perfetti & Stafura, 2014), situate language knowledge as a key contributor to reading comprehension. On the other hand, language-focused research (i.e., research that understands language as inseparable from social context) has shed light on the particular demands posed by the language of school texts. For instance, functional linguistics studies and ethnographic approaches document the challenges that the language of text poses to students who have had fewer opportunities to be socialized into school-like language and literacy practices (Halliday, 2004; Heath, 1983, 2012).

These psychologically focused and language-focused lines of research can be understood as complementary. However, studies that test psychological models of reading comprehension are usually not concerned with how language varies by context, and language-focused qualitative research does not typically examine quantitative associations between language and reading skills. In this study, guided by insights from these different lines of research, we first seek to identify cross-disciplinary language skills (i.e., CALS) that are required for participation in academic contexts and, second, test the hypothesis that CALS constitute an important predictor of individual variability in reading comprehension in grades 4–6.

Current psychological models of reading comprehension agree on the critical role played by language knowledge in reading comprehension (Gough & Tunmer, 1986; Kintsch, 2004; Perfetti & Stafura, 2014). The widely known simple view of reading model (Gough & Tunmer, 1986; Hoover & Gough, 1990) posits that reading comprehension is the product of two main clusters of skills: word recognition and language comprehension skills. Developmental research guided by this model unequivocally shows that language comprehension skills become a more important predictor of reading comprehension in the upper elementary school years, when basic word recognition skills become more established and less variable across readers (Geva & Farnia, 2012; Whitehurst & Lonigan, 2002). Yet, to date, research inspired by the simple view of reading model has more clearly specified the basic skills involved in word recognition (e.g., word decoding, word reading fluency) than the cluster of language-proficiency skills that increasingly support text comprehension throughout development.

A recent, more comprehensive proposal, the reading systems framework, conceptualizes reading comprehension as the result of (1) sources of knowledge (i.e., linguistic, orthographic, general) that are used by (2) processes of reading (i.e., decoding, word identification, meaning retrieval, sentence parsing, inferencing, comprehension monitoring), which take place within (3) a cognitive system with limited processing resources (Perfetti & Stafura, 2014). Perfetti and Stafura suggested that linguistic knowledge constitutes a significant contributor to reading comprehension through its influence on both word recognition skills and meaning-making skills. However, in quantitative research that explores the contributions of language knowledge to reading comprehension, language proficiency is typically measured as either a global and underspecified construct (often measured as listening comprehension) or a series of discrete language skills classified by formal linguistic levels (i.e., lexicon, morphology, syntax; Geva & Farnia, 2012; Hoover & Gough, 1990; Perfetti & Stafura, 2014). Thus, this quantitative line of research typically pays minimal attention to how language varies by context.

We argue in this article that the increasingly important role played by language skills in reading comprehension over time is in part a consequence of the particular linguistic demands posed by the school texts in the upper elementary school grades and beyond. Our approach consists of identifying the language skills called upon to understand the linguistic features that are most prevalent in school texts across content areas. In other words, instead of selecting skills only on the basis of formal linguistic levels (e.g., morphology, syntax) or without paying attention to context, we seek to identify language skills of high utility for school reading and learning. In so doing, we hope to attain a closer match between the language skills assessed and those required for successful academic reading.

Language Proficiency as an Expanding Set of Situated Practices

Adopting a sociocultural pragmatics-based view of language development, we conceptualize language as inseparable from social context, language learning as context-dependent and usage-based, and consequently, language proficiencies as the result of individuals' socialization and enculturation histories (Berman, 2004; Halliday, 2004; Ninio & Snow, 1996; Ochs, 1993; Ravid & Tolchinsky, 2002; Snow & Uccelli, 2009). Thus, we regard language learners as social agents who gradually master certain language resources to accomplish particular purposes by participating in particular practices and

contexts (Biber, Conrad, & Reppen, 1998; Halliday, 2004; L. Taylor & Geranpayeh, 2011; van Lier & Walqui, 2012).

Sociocultural research approaches that contrast home and school language and literacy practices have revealed that speakers are successfully enculturated into the language of face-to-face interaction of their respective communities (e.g., colloquial conversations with peers, interactions through social media); yet, these out-of-school practices are not always aligned with the language and literacy practices of school (e.g., the language of argumentation, the language of written informational discourse). As a consequence, many colloquially fluent students may not have been granted sufficient opportunities to be socialized into academic-language and literacy practices either at home or at school (Cazden, 2002; Fang, 2006; Heath, 1983, 2012; Moje, Dillon, & O'Brien, 2000). A few detailed case studies have revealed the struggles faced by many upper elementary and middle school readers when confronted with the specialized features of the language of school text (Fang, 2012; Fang & Schleppegrell, 2008; Fillmore & Fillmore, 2012).

Prior studies have repeatedly shown that after the early elementary school grades, language skills become the primary source of variability in predicting reading comprehension for native English speakers and English learners (ELs) and across socioeconomic levels (Dickinson & Tabors, 2002; Lesaux, 2006). Although these language skills have remained imprecisely defined, a few studies have suggested that in addition to vocabulary knowledge, morphological and syntactic skills are also predictors of reading comprehension in both native English speakers and ELs (Farnia & Geva, 2013; Kieffer & Lesaux, 2008; Mancilla-Martinez & Lesaux, 2011). The available ethnographic and quantitative research findings point to students from minoritized linguistic communities and from high-needs environments as particularly likely to experience a larger distance between the ways language is used outside of school and the ways it is used in school texts (Fillmore & Fillmore, 2012; Heath, 2012; Mancilla-Martinez & Lesaux, 2010; Reardon, Valentino, & Shores, 2012). Given that academic-language skills are often transparent to teachers, assumed to be known by students, and rarely explicitly attended to through instruction, our work is motivated by the need to make these skills visible for educators and researchers.

Advancing Theory and Research on Academic-Language Proficiency

We are certainly not the first to propose a construct of academic-language proficiency. More than 30 years

ago, Cummins (1979) raised awareness of the conceptual distinction between two components of language proficiency: basic interpersonal communicative skills (everyday colloquial-language proficiency) and cognitive academic-language proficiency, or “students’ ability to understand and express...concepts and ideas that are relevant to success in school” (Cummins, 2008, p. 487). Cummins’s work, which focused on students learning a second language at school, identified academic language as challenging to learn in spite of students’ mastery of everyday face-to-face conversational language (Cummins, 1979, 1981, 2000, 2001). To define *academic-language proficiency*, Cummins, like several other researchers, pointed to the contexts in which academic language is used (Snow & Uccelli, 2009). Although specifying its contexts of use has been effective in attracting attention to academic language, this approach is limited by its inability to specify the precise language skills that require attention in classroom instruction, assessment, or future research.

Often, academic-language skills have been narrowly operationalized as vocabulary. For example, over the last decade, a productive line of intervention studies has centered on academic vocabulary instruction as a central mechanism to improve upper elementary and middle school students’ reading comprehension (Deshler, Palincsar, Biancarosa, & Nair, 2007; Kieffer, & Lesaux, 2007; Proctor et al., 2011). This focus on vocabulary in educational research has been partially motivated by extensive developmental research documenting the substantial individual variability in vocabulary knowledge and its significant contribution to reading comprehension (Nation & Snowling, 2004; Ouellette, 2006). Despite this robust evidence from developmental studies, many vocabulary-focused interventions have evidenced significant growth in vocabulary knowledge yet only modest gains in reading comprehension (Deshler et al., 2007; Elleman, Lindo, Morphy, & Compton, 2009; Proctor et al., 2011).

The discrepancy between developmental and intervention studies may not be surprising if we understand measures of vocabulary knowledge in developmental studies as indicators of the wider set of language skills (i.e., skill in packing dense information, connecting ideas, organizing discourse), which individuals develop in synchrony as they use language for real purposes. Among many plausible explanations for the less-than-satisfactory results of vocabulary-focused interventions, one possibility is that an exclusive focus on vocabulary might fail to target additional academic-language skills that are also critical for text comprehension. In this study, without questioning the importance of vocabulary, we join other researchers in arguing for a broader construct of academic-language proficiency in which vocabulary knowledge is one

component of a more comprehensive constellation of skills (Nagy & Townsend, 2012; National Research Council, 2010; Schleppegrell, 2004; Valdés, 2004).

Our work departs from prior and current initiatives in a few ways. First, instead of conducting textual analysis, we seek to directly measure skills, and instead of discipline-specific skills, we focus on cross-disciplinary skills. Using textual analysis of the extended writing produced by students, a recent line of developmental linguistics has documented substantial growth in preadolescents’ and adolescents’ school-relevant language skills (e.g., Berman & Ravid, 2009; Derewianka, 2003). The assessment tool presented herein will complement this line of inquiry by enabling the generation of inferences about students’ abilities in a prespecified set of academic-language skills. Second, a few ongoing efforts are making substantial progress in assessing discipline-specific academic-language skills mostly directed to support ELs’ content area learning (A.L. Bailey, 2007; WIDA, 2004, 2006). Our research focuses, instead, on cross-disciplinary skills—that is, language skills called upon to participate in the prevalent language forms and functions that cut across academic discourses from different content areas (A.L. Bailey, 2007). Finally, instead of focusing on ELs exclusively, we anticipate CALS-I to be relevant for capturing variability within and between groups of bilingual or monolingual students. Despite the ubiquitous acknowledgment that EL designation is typically conflated with socioeconomic status (SES) in the United States, very minimal research so far has explored the independent contribution of each of these factors to school-relevant language and reading skills (Mancilla-Martinez & Lesaux, 2010).

Although previous studies have examined the contribution of discrete language skills (e.g., morphology, syntax) to reading comprehension, in this study, we identified and measured a more inclusive and school-relevant set of language skills. Furthermore, we examined the contribution of CALS to reading comprehension above and beyond the contribution of students’ word reading fluency, academic vocabulary knowledge, SES, and English-proficiency designation.

A Cross-Disciplinary Academic-Language-Proficiency Construct: Converging Lines of Research

The task of identifying a comprehensive subset of the language skills that support upper elementary and middle school readers in accessing texts across content areas is, however, not trivial. First, to formulate our operational construct, we embarked on a thorough synthesis

of theoretical and empirical research from various functional linguistics traditions that focused on the following:

- Profiling the linguistic features prevalent in academic texts produced by experts across disciplines (e.g., Biber & Reppen, 2002; Chafe & Danielewicz, 1987; Halliday & Martin, 1993; Hyland, 2004; Swales, 1990)
- Identifying school-relevant language skills that display developmental progress during the upper elementary and middle school years (e.g., A.L. Bailey, 2007; Benelli, Belacchi, Gini, & Lucangeli, 2006; Berman, 2004; Berman & Ravid, 2009; Berman & Verhoeven, 2002; Christie & Derewianka, 2008; Derewianka, 2003; Nippold, 2007; Ravid & Tolchinsky, 2002; Schleppegrell, 1998)
- Examining the language demands of educational standards, school texts, and achievement tests in U.S. schools (e.g., A.L. Bailey, 2007; Butler, Bailey, Stevens, Huang, & Lord, 2004; Schleppegrell, 2001, 2004)

Second, based on our review of studies in systemic functional linguistics, corpus linguistics, and other branches of functional linguistics, we generated an inventory of cross-disciplinary features that are prevalent in experts' academic discourse (for a review, see Snow & Uccelli, 2009). Third, in studies focused on oral and written texts produced by upper elementary and middle school writers, we found evidence that pointed to a developmental progression of cross-disciplinary linguistic features closely related to those documented in experts' discourse. These studies have documented, for instance, developmental shifts in the degree of lexical precision, morphosyntactic complexity, use of academic connectives, and organization of genre-specific elements in students' expository discourse (Berman & Ravid, 2009; Derewianka, 2003; Nippold, 2007; Ravid & Tolchinsky, 2002). Finally, recent research on the language demands of school has pointed to cross-disciplinary academic-language proficiency as a promising construct to be investigated. In her analysis of classroom discourse, textbooks, assessments, and educational standards in U.S. classrooms, A.L. Bailey documented "some remarkable similarities across the disciplinary discourses" (p. 10) during the middle school years. Definitions, explanations, descriptions, arguments, and debates have been described as ubiquitous text types that draw from a common linguistic repertoire across content areas (A.L. Bailey, 2007; Butler et al., 2004). Although motivated by different research objectives, all of these lines of research converge in pointing to overlapping sets of school-relevant linguistic features prevalently deployed across content areas.

Overview of the Study

This study uses an innovative operational construct (i.e., CALS) and a recently developed instrument, the CALS-I (Uccelli et al., 2014) to investigate preadolescents' cross-disciplinary academic-language skills in a cross-sectional sample of 218 students in grades 4–6 that included students designated by the school as English proficient (EP), former English learners/formerly limited English proficient (FEL/FLEP), or ELs from various socioeconomic backgrounds. Two specific research questions guided our study:

1. Do the CALS of students in grades 4–6, as measured by the CALS-I, vary by students' grade, English-proficiency designation, or SES?
2. Controlling for sociodemographic characteristics, word reading fluency, and academic vocabulary knowledge, are the CALS of students in grades 4–6, as measured by the CALS-I, predictive of students' standardized reading comprehension scores?

Drawing from empirical findings that have revealed considerable individual variability, as well as notable developmental trends, in vocabulary and other language areas throughout the upper elementary and middle school years in both bilingual and monolingual students, we hypothesized that the CALS-I scores would capture individual variability in CALS within and across grades. We anticipated that students in higher grades would achieve higher scores than those in lower grades and that EP students would score higher than ELs. Further, on the basis of well-documented contributions of sociodemographic characteristics (i.e., grade, SES, language proficiency), reading fluency, and academic vocabulary knowledge to reading comprehension, we anticipated all of these covariates to be significant predictors of reading comprehension. Our goal was to control for all of these factors to investigate the additional independent contribution of CALS-I scores to reading comprehension. As an alternative hypothesis, CALS-I scores might not capture sufficient individual variability to be a significant predictor. For instance, participants might have mastered all the language skills tested. Moreover, given that vocabulary knowledge is positioned as a critical contributor to reading comprehension (Perfetti & Stafura, 2014), CALS-I scores might be found to be predictive of reading comprehension yet not offer any unique contribution beyond the explanatory power of vocabulary knowledge.

The Proposed Construct: CALS

Informed by the research synthesis described previously, we defined *CALS* as a constellation of the high-utility language skills that correspond to linguistic

features that are prevalent in academic discourse across school content areas and that are infrequent in colloquial conversations. Then, guided by an integration of the empirical findings from different lines of research, we generated a hypothetical developmental map and designed a battery of CALS tasks. We also consulted lexical databases that document the frequency of particular words in academic texts used in different school grades (Zeno, Ivens, Millard, & Duvvuri, 1995) and the grade at which students are expected to know particular words (Biemiller, 2010; Dale & O'Rourke, 1981). Albeit some being somewhat dated, these are the most comprehensive sources available and were useful starting points to identify words documented as prevalent at different school grades. Subsequently, on the basis of a prepilot and pilot study of CALS tasks completed by students in the upper elementary and middle school grades (see Uccelli et al., 2014), we identified the following domains to be included in our initial operationalization of CALS (for a description of the tasks used for each domain, see Appendix A).

Unpacking Dense Information: Skill in Unpacking Dense Morphosyntactic Structures

Unpacking Complex Words: Skill in Decomposing Morphologically Complex Words

Morphologically complex words, particularly nominalizations, are highly prevalent in academic texts (Biber et al., 1998; Halliday, 2004; Schleppegrell, 2004). Recent research has shown that skills in decomposing morphologically complex words contribute positively to reading comprehension in upper elementary and middle school students (Kieffer & Lesaux, 2007, 2010).

Unpacking Complex Sentences: Skill in Understanding Complex Syntax

Denser syntactic structures, such as center-embedded clauses, are widely used in academic texts (Halliday, 2004; Schleppegrell, 2004). Some evidence suggests that later syntactic skills positively contribute to reading comprehension in children, adolescents, and adults (e.g., Mokhtari & Thompson, 2006; Nation & Snowling, 2000; N.A. Taylor, Greenberg, Laures-Gore, & Wise, 2012).

Connecting Ideas Logically: Skill in Understanding School-Relevant Connectives and Discourse Markers

Logical relations and discourse transitions are signaled in academic texts through explicit and precise markers (e.g., *although*, *in other words*; Hyland, 2004). Although not without some controversy,

several studies have provided evidence to suggest that discourse markers affect online processing, text memory, and learning from academic text (Hyönä & Lorch, 2004; Meyer & Poon, 2001; Meyer & Rice, 1982).

Tracking Participants and Themes: Skill in Anaphoric Resolution

Anaphors (i.e., words or phrases appearing in a text that refer to a prior participant or idea) can be interpreted as instructions to the reader/listener to link a previous idea with an element in the text (Givón, 1992). Whereas concrete anaphoric elements are ubiquitous in colloquial language (e.g., *she* refers to *Mary*), one type of anaphor, conceptual anaphora, is particularly characteristic of academic text. Conceptual anaphors have been estimated to account for approximately 20% of all anaphoric references in academic texts (Biber et al., 1998). Conceptual anaphora consists of a demonstrative determiner (e.g., *this*) with or without a hypernoun (i.e., a noun that encapsulates meanings expressed in prior discourse; e.g., "The evaporation of water occurs due to rising temperatures. This process..."; Flowerdew, 2003; Hunston & Francis, 2000). Recent research suggests that skill in resolving conceptual anaphora is positively associated with reading comprehension for upper elementary school students (Sánchez & García, 2009).

Organizing Analytic Texts: Skill in Argumentative Text Organization

In contrast to narrative organization skill, which is well achieved by ages 9 to 10, knowledge of how to structure expository discourse constitutes a later development that seems to consolidate only around high school age (Berman & Nir-Sagiv, 2007). Skills in structuring narratives have been found to contribute to reading comprehension during the primary school years, when students read mostly narrative texts (Oakhill & Cain, 2000). However, in the upper elementary and middle grades and above, students need knowledge of additional text organization structures. Given the argumentative nature of academic language (Rex, Thomas, & Engel, 2010; Toulmin, 1958), we focus on skills in structuring argumentative texts (i.e., thesis, arguments, examples, conclusion) as potential contributors to reading comprehension during these years.

Recognizing Academic Register: Skill in Identifying Academic Register

As a more integrative task, we hypothesized that register recognition skills (i.e., students' skill in identifying more academic forms of discourse in comparison with more colloquial alternatives) may also play a role in

academic reading skill. So far, we have operationalized this domain as the recognition of academic definitions (see Appendix A for more details).

Rather than an exhaustive set of skills, we conceive of this set as an initial core selection to begin to delineate an operational construct of CALS. To our knowledge, this is the first study to examine the contribution of a comprehensive set of cross-disciplinary academic-language skills to text comprehension, above and beyond the contribution of word reading fluency, academic vocabulary knowledge, and students' sociodemographic characteristics.

Methods

Participants

A total of 218 students, distributed similarly across grades 4–6, participated in this study (see Table 1). Students attended an urban public school in the Northeastern United States and were assessed toward the end of the school year as part of their regular school activities by three trained research assistants. The sample consisted of almost equal proportions of males and females (49%). The majority of the sample came from homes with low SES, as indexed by students' eligibility for free or reduced-price lunch at school. A total of 141 students (65%) qualified for free or reduced-price lunch. A total of 109 students in the sample were EP, whereas the other 109 had a current or former designation as ELs. The EL designation refers to students whose emerging English proficiency is not yet at the level expected by the district to perform ordinary classwork in English (the language of instruction) without language services. The FEL/FLEP designation refers to former ELs who in the last two years have met the district's English-proficiency criteria. Out of the total sample, 22% of the students were designated as current ELs and 28% as FELs or FLEPs by the school district.

Despite the equal distribution of students into EL/FEL versus EP groups, the majority of the students (83%) had only English listed as their home language in the official school records. A home language different from English was registered for 25 students with an EL designation, for 14 students with a FEL designation, and for two students classified as EP. The two EP students reported Vietnamese as their home language. According to school records, 21 students reported Spanish as their home language, three reported Arabic, two reported Haitian Creole, and 10 reported other distinct languages. School records also indicated that students' ethnicity was predominantly Latino/Hispanic (41%), followed by almost a third of African American students (30%) and a smaller proportion of white students (19%).

TABLE 1
Demographic Data for Students in the Sample (*n* = 218)

Demographic	<i>n</i> (percentage)
<i>Gender</i>	
Female	107 (49%)
Male	111 (51%)
<i>Grade</i>	
4	78 (36%)
5	58 (27%)
6	82 (37%)
<i>Socioeconomic status</i>	
Not eligible for free or reduced-price lunch	77 (35%)
Eligible for free or reduced-price lunch	141 (65%)
• Grade 4	46 (59%) ^a
• Grade 5	44 (76%) ^a
• Grade 6	51 (63%) ^a
<i>English-proficiency designation</i>	
English proficient	109 (50%)
English learners (total)	109 (50%)
• English learners	47 (22%)
• Former English learners	62 (28%)
<i>Ethnicity</i>	
Black/African American	65 (30%)
White	43 (19%)
Latino/Hispanic	89 (41%)
Asian	15 (7%)
Two or more races	6 (3%)
<i>Special education status</i>	
Classified as special education	30 (14%)

^aThe percentage is calculated within the grade.

Finally, less than a third of the students were identified to receive special education services by the school.

Measures

As part of this study, four assessments were administered.

CALS-I

This is a 45-minute group-administered research instrument designed to assess CALS. The research-based CALS-I used in the present study was the result of an iterative design process that integrated quantitative

and qualitative analysis and included expert linguists, psychologists, psychometricians, and educators. The development of this instrument unfolded in the following sequence: a task design phase and prepilot study, a pilot study, and an expert review panel (for more information, see Uccelli et al., 2014). The CALS-I form administered in this study included 36 items grouped into six tasks (see Appendix A for a detailed description). The items that were not scored dichotomously as correct/incorrect were rescaled to be between 0 and 1 so all items were equally weighted in estimating the total score.

Confirming prior results (Uccelli et al., 2014), a confirmatory factor model fitting CALS-I items to a single factor produced a good model fit, offering evidence of unidimensionality (root mean square error of approximation = 0.06, comparative fit index = 0.95, and Tucker–Lewis Index = 0.94). Reliability evidence was robust (.93 as indexed by coefficient α and .90 by split-half reliability). The CALS-I raw scores ranged from 0 to 36. Using Rasch item response theory analysis, factor scores were generated for the CALS-I.

Gates–MacGinitie Reading Test (GMRT)

The GMRT is a widely used, standardized, group-administered reading comprehension test that is vertically equated to allow comparison across grades (MacGinitie, MacGinitie, Maria, & Dreyer, 2000). The publisher reports Kuder–Richardson formula 20 reliability coefficients of .90–.92, as well as robust validity evidence. Extended scale scores (ESSs) were used for the present analysis. The ESS scale measures reading achievement in equal units, so the same difference in units (i.e., a difference of 25 points) means the same all along the scale. For the GMRT reading comprehension subtest, an ESS of 500 indicates average performance at the beginning of grade 5, and an ESS of 525 indicates average performance at the beginning of grade 6 (MacGinitie et al., 2000).

Vocabulary Association Test (VAT)

The VAT is a group-administered test of depth of academic vocabulary knowledge for upper elementary and middle school students designed by Lesaux, Kieffer, Faller, and Kelley (2010) based on the work of Schoon and Verhallen (1998, as cited by Carlo et al., 2004). The test includes 15 items, and all target words are drawn from the academic word list (Coxhead, 2000). Each item includes a target word in the center of a box, surrounded by six other words, three of which are immutably associated with the target word, whereas the other three are only circumstantially related to the target word. For example, *effect* has immutable associations with *cause*, *consequence*, and *result* yet only circumstantial associations with *negative*, *policy*, and *people*. Students are instructed to draw a line to the three words that always

go with or are most related to the word in the middle (Lesaux et al., 2010). The estimate of internal consistency for this task in a prior study was adequate (Cronbach's $\alpha = .78$). Prior studies have also provided convergent and divergent validity evidence (Carlo et al., 2004; Lesaux et al., 2010; Schoonen & Verhallen, 1998, as cited in Carlo et al., 2004). Of special interest is the strong correlation ($r = .67$) between this measure and a standardized measure of vocabulary knowledge (SAT 10th edition reading vocabulary subtest) reported by Lesaux and colleagues in their sample of sixth-grade ELs and EP students.

Test of Silent Word Reading Fluency (TOSWRF)

The TOSWRF is a group-administered test that measures the ability to recognize printed words accurately and efficiently in students in grades 1 and above (Mather, Hammill, Allen, & Roberts, 2004). The test comprises rows of words with no spaces between them that are ordered by reading difficulty (e.g., *dimhowfigblue*). Students are given three minutes to draw a line between the boundaries of as many words as they can (e.g., *dim/how/fig/blue*). The TOSWRF standard scores, based on a mean of 100 with a standard deviation of 15, were used in this analysis.

Analytic Plan

Drawing from prior analyses of upper elementary and middle school students' CALS-I data, the CALS-I scores were operationalized as a unitary construct (Uccelli et al., 2014). Descriptive statistics by grade and by English-proficiency designation (EL, FEL, EP) were generated for the CALS-I scores, as well as for the word reading fluency measure (TOSWRF), academic vocabulary knowledge test (VAT), and the reading comprehension assessment (standardized GMRT). To address our first research question, we conducted general linear model analysis with grade (three levels), English-proficiency designation (three levels), and SES (two levels) as between-subject factors and CALS-I scores as the dependent variable. To address our second research question, we first conducted pairwise correlational analyses to explore associations among the GMRT reading comprehension scores, CALS-I scores, word reading fluency, academic vocabulary knowledge, and the sociodemographic variables.

Finally, to assess the predictability of the CALS-I scores, hierarchical regression analyses were conducted, with reading comprehension as the outcome variable and sociodemographic characteristics, word reading fluency, and academic vocabulary knowledge as covariates. The effects of sociodemographic characteristics were explored first by entering sociodemographic variables (grade, English-proficiency designation, SES) as covariates in successive steps. Following a stepwise approach, subsequently,

word reading fluency and academic vocabulary knowledge were entered as covariates, and finally, CALS-I scores were entered as the question predictor.

Results

Descriptive Statistics

Table 2 displays students' mean scores and standard deviations by grade and English-proficiency designation for students' CALS (CALS-I), reading comprehension (GMRT), academic vocabulary knowledge (VAT), and word reading fluency (TOSWRF). CALS-I scores displayed evidence of across- and within-grade variability. As displayed in Table 2, the mean CALS-I scores per grade revealed that student performances improved across grades, more markedly in grade 6. The mean CALS-I scores per grade were lowest in grade 4, with a mean of 0.03 (standard deviation [SD] = 1.61; mean raw score = 18.79, SD = 9.98; mean percentage correct score = 0.52, SD = 0.28), and progressively higher across

grades, with the highest mean of 0.71 (SD = 1.67; mean raw score = 22.54, SD = 9.49; mean percentage correct score = 0.63, SD = 0.26) displayed by sixth graders. In addition, these mean CALS-I scores also revealed considerable individual variability within each grade. Standard deviations fluctuated from 1.62 to 1.67 across grades, displaying approximately normal distributions in each grade, with a wide range of scores. Similar trends were observed for academic vocabulary knowledge.

For reading comprehension and reading fluency, the upward trend in grade 6 is clear, yet unexpectedly, the fifth-grade subgroup displayed the lowest mean word reading fluency score and mean reading comprehension score in the full sample. Furthermore, considering that an ESS of 500 indicates average performance at the beginning of grade 5, and an ESS of 525 indicates average performance at the beginning of grade 6, the GMRT mean ESS per grade suggests that this is overall a somewhat low-performing sample.

When the descriptive statistics were disaggregated by English-proficiency designation (see Table 2), the

TABLE 2
Mean Scores (and standard deviations) for All Measures by Grade and English-Proficiency Designation ($n = 218$)^a

English-proficiency designation	<i>n</i>	Core academic-language skills (Core Academic Language Skills Instrument)	Reading comprehension (Gates–MacGinitie Reading Test)	Academic vocabulary (Vocabulary Association Test)	Word reading fluency (Test of Silent Word Reading Fluency)
<i>Grade 4</i>					
EP	40	0.22 (1.69)	504.30 (42.83)	34.60 (5.41)	99.93 (30.23)
FEL	18	0.58 (1.61)	514.72 (40.38)	33.50 (5.70)	110.67 (29.25)
EL	20	−0.85 (1.06)	469.00 (36.13)	28.90 (4.64)	83.05 (28.51)
Total	78	0.03 (1.61)	497.65 (43.77)	32.88 (5.75)	98.08 (30.82)
<i>Grade 5</i>					
EP	28	−0.07 (1.33)	490.11 (42.45)	34.14 (4.56)	87.57 (32.11)
FEL	16	0.89 (0.56)	508.88 (23.59)	35.94 (4.36)	108.75 (16.34)
EL	14	−0.52 (1.03)	466.64 (25.36)	30.93 (5.78)	87.36 (16.40)
Total	58	0.09 (1.20)	486.62 (37.16)	33.86 (5.08)	93.36 (26.68)
<i>Grade 6</i>					
EP	41	1.02 (1.60)	516.51 (39.28)	36.83 (4.53)	118.80 (27.55)
FEL	28	0.65 (1.87)	508.21 (40.18)	36.78 (3.18)	116.54 (27.12)
EL	13	−0.22 (0.90)	482.15 (34.63)	34.23 (5.17)	97.92 (24.20)
Total	82	0.71 (1.67)	508.23 (40.27)	36.40 (4.29)	114.72 (27.60)
Total sample	218	0.30 (1.60)	499.50 (41.28)	34.47 (5.27)	103.08 (29.90)

Note. EL = English learner; EP= English proficient; FEL = former EL or formerly limited EP.

^aAs a reference point, we offer here the corresponding mean raw score and mean percentage correct score by grade for the Core Academic Language Skills Instrument item response theory factor scores reported in this table. Grade 4: mean raw score = 18.79, standard deviation (SD) = 9.98; mean percentage correct score = 0.52, SD = 0.28. Grade 5: mean raw score = 19.67, SD = 7.73; mean percentage correct score = 0.55, SD = 0.21. Grade 6: mean raw score = 22.54, SD = 9.49; mean percentage correct score = 0.63, SD = 0.26.

general trend for CALS-I scores and all other measures was for students with an EL designation to display lower scores than either FEL or EP students, within grade. This was not the case for fifth graders, though. Reading fluency was the area in which this EP group of fifth graders displayed almost the lowest scores of the full sample, only 0.2 points above that of the fifth-grade EL group and even lower than the fourth-grade EL group. With the sociodemographic and assessment data available, we could not detect a pattern that would explain the somewhat unusually low scores in word reading fluency and reading comprehension for EP fifth graders.

Research Question 1: Variability in CALS-I Scores by Grade, English-Proiciency Designation, and SES

To answer our first research question, we conducted a general linear model analysis of variance with CALS-I scores as the dependent variable and three between-subject factors: grade (three levels), English-proficiency designation (three levels), and SES (two levels). Results revealed that CALS-I scores differed significantly as a function of each of these three sociodemographic factors (grade: $F[2, 212] = 5.42, p < .005$; English-proficiency designation: $F[2, 212] = 7.83, p < .0005$; and SES: $F[1, 212] = 20.51, p < .0001$). Post hoc Scheffe tests revealed statistically significant differences between the CALS-I scores of students in grade 6 (mean $[M] = 0.71, SD = 1.67$) compared with students in grades 4 or 5. However, even though fifth graders' CALS-I scores ($M = 0.09, SD = 1.2$) were on average higher than fourth graders' ($M = 0.03, SD = 1.61$), the difference was not large enough to be significant.

Post hoc Scheffe tests also revealed that students with an EL designation displayed significantly lower CALS-I scores ($M = -0.57, SD = 1.02$) than students with either a FEL or an EP designation. FEL and EP students' CALS-I scores ($M = 0.69, SD = 1.53$; and $M = 0.46, SD = 1.6$, respectively), however, were not statistically significant from one another. In fact, in grades 4 and 5, FEL students outperformed their EP peers (see Table 3). CALS-I scores also varied significantly by SES. In the full sample, the mean CALS-I score for students from higher SES backgrounds was 0.89 ($SD = 1.65$), whereas the mean CALS-I score for students from lower SES backgrounds was only $-0.03 (SD = 1.41)$.

We further explored differences in CALS-I scores by SES within each of the English-proficiency designation groups. As would be expected, differences by SES were not significant for students classified as ELs. Not surprisingly, all of these students, regardless of SES, displayed the lowest CALS-I scores in our sample, on average. Interestingly, though, CALS-I scores differed significantly by SES both within the group of FEL students and within the group of EP students (FEL: $F[1, 61] = 5.68, p < .05$; EP: $F[1, 106] = 10.21, p < .00$). As can be observed in Figure 1, on average, students from higher SES environments performed significantly higher than their peers from lower SES environments not only within the group of students formerly classified as ELs but also within the group of EP students.

Research Question 2: CALS-I Scores as a Predictor of Reading Comprehension

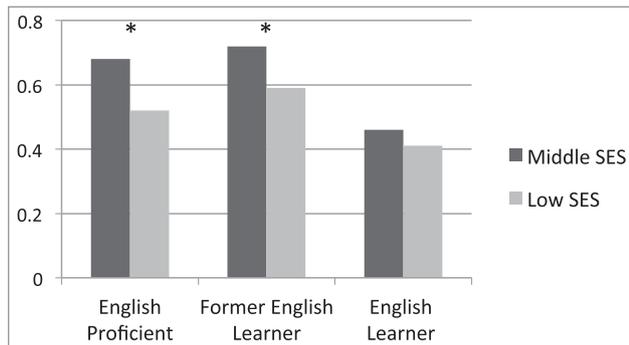
After examining correlations between the CALS-I and all other variables (see Table 3), we selected all variables

TABLE 3
Correlation Table for All Measures and Demographic Variables Included in the Models ($n = 218$)

Variable	1	2	3	4	5	6	7	8
1. Core academic-language skills (Core Academic Language Skills Instrument)	—							
2. Reading comprehension (Gates–MacGinitie Reading Test)	.73***	—						
3. Word reading fluency (Test of Silent Word Reading Fluency)	.60***	.59***	—					
4. Academic vocabulary (Vocabulary Association Test)	.64***	.59***	.54***	—				
5. Gender	.13	.07	.15*	.06	—			
6. English-proficiency designation	-.22***	-.24***	-.16	-.27***	-.01	—		
7. Socioeconomic status (eligibility for free or reduced-price lunch)	-.28***	-.24***	-.23***	-.27***	-.04	.21**	—	
8. Grade	.19*	.11	.24**	.29***	.03	-.05	.03	—

* $p < .05$. ** $p \leq .01$. *** $p < .001$.

FIGURE 1
Mean Percentage Correct Core Academic Language Skills Instrument Scores by Socioeconomic Status (SES) and English-Proficiency Designation



that displayed significant associations with reading comprehension scores for the hierarchical regression analyses. First, we explored the impact of sociodemographic factors on reading comprehension: grade, gender, SES, and language status. Grade and gender were found not to be significant predictors; however, grade was kept in all models to account for maturation and schooling experience. We entered English-proficiency designation first and then SES. As can be observed in model 1 (see Table 4), after controlling for grade, English-proficiency designation (coded as EL = 2; FEL = 1; EP = 0) was found to be a significant predictor.

Model 1 accounted for 9% of the variance in reading comprehension, 8% of which was added when English proficiency was added to a model that had grade as the sole nonsignificant predictor. In model 2, we entered SES (coded as eligible for free or reduced-price lunch = 1; not

eligible for free or reduced-price lunch = 0), which revealed a significant negative relationship with reading comprehension, accounting for 8% of the variance. In other words, model 2 indicates that controlling for grade and English-proficiency designation, students from low-SES backgrounds tended to display significantly lower reading comprehension scores than their peers from higher SES backgrounds. The inclusion of SES accounted for an additional 4% increase in the variance explained.

As a next step, we entered word reading fluency (TOWSRF) to remove the variability associated with basic word recognition skills before we explored the effect of academic-language proficiency in reading comprehension. As can be observed in model 3 (see Table 4), word reading fluency (TOSWRF) explained a significant amount of variance in reading comprehension skills, accounting for an additional 26% of the variance. Not surprisingly, these results indicate that, holding all the sociodemographic characteristics constant, students with higher word reading fluency scores tended to have higher reading comprehension scores.

In model 4, academic vocabulary knowledge was entered into the regression. Consistent with prior research, academic vocabulary knowledge accounted for a significant portion of the variance in reading comprehension, indicating that after controlling for sociodemographic characteristics and word reading fluency, students with higher academic vocabulary knowledge tended to score higher, on average, on the reading comprehension assessment. Academic vocabulary knowledge explained an additional 9% of the variance over the other covariates.

Finally, in model 5, CALS-I scores, our measure of academic-language skill and our question predictor,

TABLE 4
Regression Model to Predict Reading Comprehension (Gates–MacGinitie Reading Test extended scale scores) Based on Core Academic Language Skills Instrument (CALS-I) Scores, Controlling for Word Reading Fluency, Academic Vocabulary Scores, English-Proficiency Designation, and Socioeconomic Status (SES; $n = 218$)

	Model 1	Model 2	Model 3	Model 4	Model 5
Grade	0.10	0.11	-0.02	-0.09 [†]	-.08 [†]
English-proficiency designation	-0.26 ^{****}	-0.21 ^{**}	-0.16 ^{**}	-0.10 [†]	-0.09 [†]
SES (eligibility for free or reduced-price lunch)		-0.21 ^{**}	-0.10 [†]	-0.05	-0.01
Word reading fluency (Test of Silent Word Reading Fluency)			0.54 ^{****}	0.38 ^{****}	0.20 ^{**}
Academic vocabulary (Vocabulary Association Test)				0.40 ^{****}	0.16 ^{**}
Core academic-language skills (CALS-I)					0.50 ^{****}
Observations	218	218	218	218	218
Variance explained (R^2)	0.08	0.12	0.38	0.47	0.59
Change in R^2		0.04 ^{**}	0.26 ^{****}	0.09 ^{****}	0.12 ^{****}

Note. For each variable, beta coefficients are reported.
[†] $p < .10$. ^{**} $p \leq .01$. ^{****} $p < .0001$.

was added to the model. The results of model 5 indicate that CALS made a significant independent contribution to individual differences in reading comprehension over and above the contribution of academic vocabulary knowledge, word reading fluency, SES, English-proficiency designation, and grade. Moreover, CALS-I scores accounted for an additional 12% of the variance in reading comprehension for this sample. It is interesting to note that despite the shared variance between academic vocabulary knowledge and CALS, each of them offered a significant independent contribution to reading comprehension. Notably, once academic vocabulary knowledge and CALS were added to the model, SES was no longer significant. These results suggest that after word reading fluency was controlled for, the variability in students' academic language skills (vocabulary and other related skills) captures the very pedagogically relevant skills that are typically indexed by categorical sociodemographic variables, which can only serve as imperfect proxies of language proficiency.

Discussion

The goal of this study was to specify and empirically assess the school-relevant language skills hypothesized to support reading comprehension during the preadolescent years. Guided by our operationalization of the CALS construct, a cross-sectional sample of 218 students in grades 4–6 from different SES backgrounds and with different English-proficiency designations were administered the CALS-I. Aligned with prior research, results revealed considerable within- and between-grade variability in students' CALS-I scores with an overall upward trend across the higher grades (Uccelli et al., 2014). This study extended prior findings in a few directions. First, confirming prior research, this study revealed that students from lower SES environments and those with a designation of EL scored, on average, significantly lower than students from higher SES environments and those without an EL designation, respectively. However, a particularly interesting finding was that within the EP and FEL groups, students from lower SES backgrounds displayed, on average, significantly lower CALS-I scores than their more privileged EP and FEL peers, respectively. These results highlight the relevance of the CALS construct not only for ELs but also for students designated as EP and, presumably, monolingual students.

Finally, CALS, as measured by the CALS-I, was found to be a significant predictor of students' reading comprehension (as measured by the standardized GMRT), above and beyond the contribution of academic vocabulary knowledge (VAT), word reading fluency (TOSWRF), and sociodemographic characteristics. Although it should be of no surprise that analogous to academic vocabulary

knowledge, a broader set of general academic-language skills would be predictive of reading comprehension, the innovation of this study resides in having identified and empirically tested an initial set of high-utility cross-disciplinary academic-language skills that seem to be relevant for text comprehension and, thus, worth exploring further. Next, we interpret our findings in light of prior research, discuss pedagogical implications, and propose areas for further research.

The CALS Construct and the CALS-I: Evolving Research Tools

To our knowledge, the CALS-I is the first instrument that attempts to capture students' knowledge of a constellation of high-utility language skills that have been intentionally and systematically selected to be representative of skills regularly called upon for successful participation in reading academic texts across content areas. Our work has identified at least an initial repertoire of cross-disciplinary academic-language skill sets associated with reading comprehension during the upper elementary and middle school years (Uccelli et al., 2014). On the basis of functional linguistics research, we have classified the skill sets examined in this study into several interrelated domains: (a) unpacking dense information (i.e., skill in unpacking morphologically complex words and complex sentences), (b) connecting ideas logically (i.e., skill in understanding school-relevant connectives and discourse markers), (c) tracking participants and themes (i.e., skill in anaphoric resolution), (d) organizing analytic texts (i.e., skill in organizing school-relevant analytic texts), and (e) recognizing academic register (i.e., an integrative task that measures skill in identifying academic register). These domains are meant to offer a theoretical framework to capture important aspects of a phenomenon that in reality cannot be separated into such discrete areas.

Moreover, as we emphasize throughout this article, we do not understand the empirically tested set of skills proposed in this study as exhaustive. Instead, we consider this study as a starting point for the operationalization of a construct that needs to be explored further. Figure 2, which is intended as a visual display of the CALS construct, includes the domains that we have empirically explored in this and prior studies, as well as two additional theoretically grounded domains that we are currently investigating: (f) understanding metalinguistic vocabulary (i.e., skill in understanding academic metalinguistic vocabulary, namely, the particular subset of vocabulary words that refer to language or thinking processes and support text-based discussion and argumentation; e.g., counterargument, generalization) and (g) interpreting viewpoints (i.e., skill in understanding markers of stance, in particular markers of epistemic stance or degree of

FIGURE 2
A Visual Representation of the Interrelated Subset of Skills Comprised in the Core Academic-Language Skills Construct



certainty (e.g., *it is possible that, undoubtedly*; Uccelli, Dobbs, & Scott, 2013). Elaborating further on these two latter domains goes beyond the scope of this article, yet we mention them here as an illustration of how the CALS construct and the CALS-I constitute evolving research tools expected to be gradually refined to capture, ideally with increasing precision, some critical language skills that are pedagogically relevant and lie at the center of providing equitable opportunities to learn for all students.

Within- and Between-Grade Variability in Cross-Disciplinary Academic-Language Skills

Limited prior research has documented developmental trends in school-relevant features in upper elementary, middle, and high school students' text productions (Berman & Ravid, 2009; Derewianka, 2003). In production studies, however, inference about ability can only be made about the linguistic features that students spontaneously include in their writing, but the question of whether they might know more than what they opt to display—or can produce—in their writing cannot be answered. Moreover, in contrast to our study, most of these studies focus on describing developmental trends in middle class populations, without special attention to individual variability in linguistically and socioeconomically diverse samples.

Consistent with prior findings, CALS-I scores indicated that grade 6 students performed significantly higher than students in earlier grades. Yet, CALS-I scores did not capture between-grade variability in the youngest students in the sample (grades 4 and 5). This result may be related to the idiosyncratic nature of the sample used in this study. In particular, students in grade 5 displayed literacy skills (specifically, word reading fluency and reading comprehension) that were unexpectedly lower than those of their fourth-grade peers. Alternatively, it may be the case that grade 6 marks a particularly steep developmental shift for CALS, perhaps as a result of the increased exposure to complex texts containing academic language that students in this grade start to experience more regularly. The cross-sectional nature of this sample, however, limits the conclusions that we can draw from the between-grade variability observed.

In addition to the upward trend documented across grades, the substantial within-grade variability in CALS-I scores is particularly noteworthy yet not surprising in light of prior research that has documented substantial individual differences in language development, particularly in vocabulary learning for both monolingual and bilingual students in the upper elementary and middle school years (Biemiller & Slonim, 2001; Mancilla-Martinez & Lesaux, 2010). For educators, this finding provides insights into the diverse levels of linguistic challenges that readers in the same grade, and in the same classroom, may face when presented with complex, grade-level text. These results suggest that expanding the canon of academic-language features that are addressed through instruction as educators attempt to build deeper knowledge of content may be necessary to adequately support students in achieving the lofty goals set by the Common Core State Standards.

Beyond SES and English-Proficiency Designations: CALS as a Pedagogically Relevant Predictor of Reading Comprehension

Interestingly, in this study, the impact of the socio-demographic factors of English-proficiency designation and SES on reading comprehension became nonsignificant once academic vocabulary knowledge and CALS-I scores were added to the model. Beyond the contribution of word reading fluency, academic vocabulary and CALS seem to be among the key linguistic skills relevant for reading at school that are most influenced by these sociodemographic characteristics. These findings help further integrate the insights from quantitative and qualitative studies that have highlighted, on the one hand, the low performance in discrete language skills and reading comprehension tests usually displayed by

ELs and students from low-SES environments (Farnia & Geva, 2013; Kieffer & Lesaux, 2010) and, on the other hand, the challenges documented by particular subgroups of students with the language of schooling (Cummins, 2000; Heath, 1983, 2012). By specifying an operational CALS construct, this work contributes to making the pathway from school-relevant language skills to reading comprehension more visible for researchers and educators alike.

Moreover, and to some extent not surprising, CALS-I scores were found to be better predictors of reading comprehension than SES or English-proficiency designation. As we know, there is considerable variability in students' skills within SES groups and within language-proficiency groups (within both bilingual and monolingual students). Certainly, not all students who come from low-SES environments will display low proficiency in academic ways of using language, and conversely, not all monolingual students classified as EP will display high levels of academic-language proficiency.

By understanding language learning and use as socially situated, these results highlight the need to understand first- and second-language proficiency, not as monolithic entities but as context-dependent. More specifically, these results highlight the need to distinguish two constructs that are often discussed as one and the same: first, general language proficiency (e.g., in English or a second language) and, second, proficiency in the ways of using language at school (academic language or the language of school literacy and learning). Whereas Cummins (1979) raised awareness of this distinction for bilingual learners, our results indicate that this distinction is presumably also relevant for monolingual speakers, especially for those with fewer opportunities to participate in school-like discourse exchanges, either outside or inside school. Monolingual students, typically automatically classified as EP, might be highly fluent conversationally yet can also be unfamiliar with more academic ways of using language. As stated previously, this tended to be the case for the EP group from low-SES environments in this sample.

Categorical SES and English-proficiency designation variables are only imperfect proxies that typically index fewer opportunities to participate in school-relevant language and literacy practices. In contrast, CALS-I scores served as a better predictor of reading comprehension, offering evidence that directly links a pedagogically relevant and more comprehensive construct of academic-language proficiency to reading comprehension. For educational purposes, a pedagogically relevant construct and instrument that make the school-relevant language skills visible for instruction and research represent an initial step toward generating empirical evidence that might support teachers in identifying language strengths and areas of vulnerability in their classrooms.

Limitations of the Current Study and Future Research Directions

To conclude, adding to other well-documented skills (e.g., background knowledge, motivation, strategy use, vocabulary knowledge), this study expands the range of known contributors to reading comprehension and suggests that CALS, understood as a constellation of skills, is a relevant construct to understand students' academic literacy. It is important to remember, though, that this constitutes only one slice from the much larger enterprise of preparing students for the multiple "dimensions of school communication" (Valdés, Capitelli, & Alvarez, 2011, p. 188). Here, we discuss limitations of our study and outline future directions for the exploration of school-relevant language skills.

First, one limitation of our study is the small sample of only 218 students. Caution should be exerted in drawing inferences beyond the sample. This is particularly important in light of the fact that our sample comprises a low-performing group of students, as indicated by their lower-than-average GMRT reading comprehension scores. Even though our sample's GMRT performance is representative of urban public schools in the region, understanding cross-disciplinary academic-language development requires the inclusion of a sample with a wider range of academic literacy levels. A second limitation is the cross-sectional design. The across-grade trends reported here can only suggest directions for developmental research, which requires longitudinal studies. The next step in this research would entail following students longitudinally to document individual variability in developmental trajectories and in more diverse samples that ideally include the full range of potential performances.

Our results are promising but require further research in a variety of directions. In fact, the work presented here is only a fragment of our larger research enterprise, which focuses on understanding school-relevant language development in relation to skills not only in academic reading comprehension but also in academic writing, classroom discussion, and academic register awareness.

Furthermore, the tested set of skills examined in this study is not meant to be exhaustive and, certainly, needs to be expanded to consider other potentially relevant areas, such as understanding metalinguistic vocabulary or interpreting viewpoints (see Figure 2). Presently, we are investigating these two domains, but additional ones could still be explored. We are acutely aware that several more complex language skills involved in understanding academic texts are not measured by this instrument (e.g., the use of nominalizations to uncover agency or to create taxonomies; the realization of logical connections via nouns, verbs, and prepositions instead of via explicit connectives; Fang, Lamme, & Pringle, 2010). Informed

by our work on the CALS construct, future research that seeks to specify academic-language skills that are relevant for more advanced secondary and higher education students, as well as for younger students, could be illuminating. We also acknowledge that the reading comprehension assessment used in this study captured this ability only generally. Further examining the relationship between CALS and skills in comprehending more advanced disciplinary texts (i.e., tests that measure students' comprehension of science, social studies, and humanities texts) would be insightful.

As is the case with vocabulary knowledge (Stahl & Nagy, 2006), there is most likely a reciprocal relationship between CALS and reading comprehension, such that the more proficient a reader is in CALS, the better his or her comprehension of academic texts. Conversely, a skilled reader who can access challenging texts that contain more CALS features is afforded more opportunities to expand his or her CALS. Future studies might explore this potential bidirectional relationship further.

To be clear, we do not view academic-language proficiency as the exclusive goal of later language development. Instead, during the adolescent years, progress in language abilities entails expanding one's rhetorical flexibility (i.e., the ability to use lexicogrammatical and discourse forms appropriately and flexibly in an increasing variety of social contexts; Ferguson, 1994; Ravid & Tolchinsky, 2002). In fact, a comprehensive assessment of later language development (which the CALS-I is not, given its focus on school-relevant language) would also seek to index growth in other ways of using language. However, although the CALS-I focuses on only a subset of the wider language forms needed by adolescents to participate in a range of contexts, we opted to focus on this subset because of its centrality for academic success and presumably also for professional life and civic participation in society (LeVine, LeVine, Schnell-Anzola, Rowe, & Dexter, 2012).

Research that examines the home and community literacies that all students bring to the classroom and the potential language and literacy practices that support CALS development in diverse learners is also needed. In the continued work to make academic-language skills visible, we must also be aware of the threat posed by the deficit paradigm that would situate these skills as more valuable than the home literacy skills that learners bring to school. Beyond the language of school, preadolescent and adolescent students participate in many complex ways of using language (e.g., youth, religious, or sports discourses), and therefore, pedagogy needs to value, recognize, and build on students' existing knowledge of outside-of-school language to scaffold the expansion of the particular repertoire relevant for learning at school (Phillips Galloway, Stude, & Uccelli, 2015).

As stated by F. Bailey, Burkett, and Freeman (2008), instead of an accessible medium of instruction, the language of school is often opaque to students, while at the same time being often transparent to teachers. The CALS-I might offer a preliminary tool to make the language comprehension difficulties encountered by students salient to their instructors. In contrast to discipline-specific skills, cross-disciplinary language skills seem particularly important for pedagogy, as these are particularly invisible for content area teachers. Ideally, by identifying some of the language forms and functions that are challenging for students, educators can anticipate language-based difficulties in text. Such cross-disciplinary academic-language consciousness might support educators in identifying instructional instances where paraphrasing, unpacking, and paying explicit attention to language structures and fostering language-conscious text-based discussions with students may open new opportunities to support students' content learning and conceptual understanding (Fillmore & Fillmore, 2012; van Lier & Walqui, 2012).

As a later outcome of this research line, we could envision a pedagogically informative tool that would serve to make school-relevant language skills visible to teachers and students. Instead of a tool intended to measure individual performance, a desirable scenario would be to develop one that offers a classroom portrait as part of a comprehensive approach to understand the linguistic composition of a class, including classroom discourse observations and data on students' voices and reflections about the language of school (Phillips Galloway et al., 2015). Far from attempting to assess individual students, our goal is to develop tools to support teachers in being more attuned to the language needs of their students. Instructional initiatives informed by a precise and more comprehensive set of language skills might constitute promising next steps in this newly emerging research area.

NOTES

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PAOLA UCCELLI (corresponding author) is an associate professor of education at the Harvard Graduate School of Education in Cambridge, Massachusetts, USA; e-mail: paola_uccelli@gse.harvard.edu.

EMILY PHILLIPS GALLOWAY is a doctoral candidate at the Harvard Graduate School of Education in Cambridge, Massachusetts, USA.

CHRISTOPHER D. BARR is a research assistant professor at the Texas Institute for Measurement, Evaluation, and Statistics at the University of Houston, USA.

ALEJANDRA MENESES is an assistant professor at the Pontificia Universidad Católica de Chile in Santiago.

CHRISTINA L. DOBBS is a clinical assistant professor at Boston University in Massachusetts, USA.

CALS-I: Description of Tasks

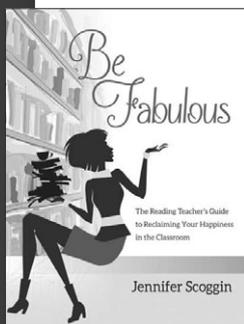
CALS-I task	Skill measured	Sample item	Source(s) for research-based design
Unpacking complex words	Skill in decomposing morphologically derived words	<ul style="list-style-type: none"> The administrator reads a set of morphologically derived words aloud followed by an incomplete sentence, and students are asked to complete the sentence by extracting the base from the derived word (e.g., “ethnicity. The city had many ___ groups.”). Additional examples of morphologically complex words tested: <i>invasion</i>, <i>durability</i>, <i>contribution</i> 	This task consists of a subset of items from Kieffer’s ^a morphological decomposition task, which is an adaptation of Carlisle’s ^b measure. ^{c-e} Responses were scored as correct or incorrect following Kieffer’s scoring protocol. Correct responses included phonetically logical versions of the word (e.g., <i>popular</i> and <i>populer</i> were scored as correct).
Unpacking complex sentences	Skill in understanding complex syntax	<ul style="list-style-type: none"> The administrator reads a sentence aloud, 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., “The sheep the girl looks at is running.”). Additional examples of syntactic structures tested: <i>neither...nor</i> construction, relative clause in object, center-embedded clause 	This task consists of a selective adaptation of the Test for Reception of Grammar version 2 (TROG-2), ^f which is suitable for ages 4 to young adulthood. From a total of 80 items, 10 were selected to assess five constructs that are prevalent in academic texts (e.g., relative clause in object, center-embedded relative clause). Contrary to the TROG-2, this adapted version was only group administered.
Connecting ideas logically	Skills in understanding school-relevant connectives and discourse markers	<ul style="list-style-type: none"> Students are asked to select the missing marker from among four options (e.g., “Kim was sick; ___ she stayed home and did not go to school.” Options: <i>otherwise</i>, <i>yet</i>, <i>in contrast</i>, <i>as a result</i>”). Students are asked to select the best continuation for an incomplete sentence from among three options (e.g., “Most teachers think that homework is important. <u>On the other hand</u>...”). Additional examples of markers tested: <i>consequently</i>, <i>nevertheless</i>, <i>in conclusion</i> 	The development of this task was informed by prior researcher-designed assessments. ^{g, h} The selection of frequent academic markers at different levels of difficulty was informed by databases of students’ word knowledge, ⁱ word frequency in school texts, ^j and academic lexical bundles derived from corpus analyses. ^{k-n}
Tracking participants and themes	Skill in anaphoric resolution	<ul style="list-style-type: none"> Students are asked to match the underlined text with its antecedent by selecting among three options (e.g., “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>.”). Additional passages were similar in length and included concrete and abstract referents. 	The design of this task was informed by a prior researcher-designed assessment used in studies of middle school students’ reading comprehension. ^o
Organizing argumentative texts	Skill in argumentative text organization	<ul style="list-style-type: none"> Students are asked to order six fragments of a brief essay introduced by conventional markers (e.g., <i>in my opinion</i>, <i>one reason</i>, <i>in conclusion</i>) in order to display a conventional argumentative text structure. 	The design of this task was informed by the story anagram task used by Stein and Glenn ^o and Cain and Oakhill ^p in their reading comprehension studies.
Recognizing academic register	Skill in identifying academic definitions	<ul style="list-style-type: none"> Students are asked to select the most academic definition from a set of three definitions of the same familiar word. Sample word definitions used for this task: umbrella, clown, debate 	This task was inspired by research on children’s register awareness. However, the specific design was not modeled after any prior research. ^{q, r}

Note. From “Core Academic Language Skills (CALS): An Expanded Operational Construct and a Novel Instrument to Chart School-Relevant Language Proficiency in Pre-Adolescent and Adolescent Learners,” by P. Uccelli, C.D. Barr, C.L. Dobbs, E. Phillips Galloway, A. Meneses, and E. Sánchez, 2014, *Applied Psycholinguistics*, advance online publication, doi:10.1017/S014271641400006X. Copyright 2014 by Cambridge University Press. Adapted with permission.

^aKieffer, M.J. (2009). *The development of morphological awareness and vocabulary knowledge in adolescent language minority learners and their classmates* (Unpublished doctoral dissertation). Harvard University, Cambridge, MA.

^bCarlisle, J.F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and Writing*, 12(3), 169–190.

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