Core Academic Language Skills: Moving beyond vocabulary knowledge to predict reading comprehension

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Moving beyond academic vocabulary

- why a focus on Core Academic Language Skills (CALS)?
- how do we operationalize and measure CALS?

The present study: CALS as predictor of reading comprehension

- do 4th and 6th-grade students’ CALS vary by grade or socio-economic status (SES)?
- do 4th and 6th-grade students’ CALS predict individual variability in reading comprehension, above and beyond the contribution of SES, decoding, and vocabulary knowledge?

Final considerations

- conclusions, limitations, future directions
Why a focus on core academic language skills?

- the Common Core State Standards in the U.S. call for “regular practice with academic language and complex texts” throughout the upper elementary and secondary school years (National Governors Association, 2010)

- in the absence of an operational definition of academic language proficiency, instructional practice and research continue to be largely dominated by a focus on academic vocabulary (Nagy & Townsend, 2012; National Research Council, 2010; Schleppegrell, 2004; Valdés, 2004)

- our hypothesis: beyond academic vocabulary, academic language proficiency includes a wider constellation of skills that are associated with reading comprehension
Integrating insights from different lines of research
Language proficiency & models of reading comprehension | Quantitative research

- The Simple View of Reading model (SVR) posits that reading comprehension is the product of two main clusters of skills: word recognition and language comprehension skills (Gough & Tunmer, 1986; Hoover & Gough, 1990)

- Yet, to date, research 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.

- Quantitative research inspired by SVR or by more comprehensive psychological models, measures language proficiency mainly as a global and underspecified construct (listening comprehension) or as discrete language skills classified by formal linguistic levels (lexicon, morphology, syntax) (Geva & Farnia, 2012; Hoover & Gough, 1990; Perfetti & Stafura, 2014)

  - minimal attention to how language varies by context of use
Language proficiency & social context | Ethnographic and linguistic research

- Ethnographic research that understands language proficiency as inseparable from social context, has shown that being a skilled language user in some social contexts does not guarantee adequate language proficiency in other social contexts (Cazden, 2002; Heath 1983; 2012)

- Functional linguistic analysis highlight the complexities in the language of texts that are infrequent in colloquial conversations and therefore expected to be challenging for struggling readers who have had fewer opportunities to be socialized into school-like language and literacy practices (Fang, 2006; Halliday, 2004; Schleppegrell, 2004)

- Qualitative studies that do not focus on testing associations between language and reading skills
Instead of selecting skills only on the basis of formal linguistic levels (e.g., morphology, syntax), we seek to identify **language skills of high utility for the particular social context of school reading**

- Instead of discipline-specific skills, we focus on **cross-disciplinary skills**, a few ongoing efforts are making substantial progress in assessing discipline-specific academic-language skills mostly directed to support ELs’ content area learning (Bailey, 2007; WIDA, 2004, 2005)

- Instead of focusing on English Learners exclusively, we anticipate that cross-disciplinary **core academic language skills (CALS)** might also display considerable variability in students designated as **English proficient** in U.S. schools

- Our goal: to examine the contribution of CALS in predicting individual variability in reading comprehension, above and beyond the contribution of students’ word recognition/decoding, academic vocabulary knowledge
how do we operationalize and measure CALS?
This study: towards a more precise definition of AL

Cummins (1980, 1981) proposed the distinction between
- BICS (Basic Interpersonal Communicative Skills)
- CALP (Cognitive Academic Language Proficiency)

- raised awareness about conversational vs. academic language, but did not specify in detail what skills CALP included

- Subsequently, most research has focused on “academic vocabulary”
Core Academic Language Skills (CALS)

DEFINITION | a constellation of the high-utility language skills that correspond to linguistic features prevalent in academic discourse across school content areas and that are infrequent in colloquial conversations (e.g., knowledge of logical markers that connect ideas, such as nevertheless, consequently; knowledge of structures that pack dense information, such as nominalizations or embedded clauses; knowledge of structures for organizing analytic texts)

HYPOTHESIS | This constellation of skills is hypothesized to support academic reading across school content areas

Uccelli, Phillips Galloway, Barr, Meneses, & Dobbs, (2015), Reading Research Quarterly
A cross-disciplinary construct: Converging lines of research

To formulate our operational construct > first a thorough research synthesis of studies that:

a) profiled the linguistic features prevalent in academic texts produced by experts across disciplines (e.g., Biber & Reppen, 2002; Chafe & Danielewicz, 1987; Hyland, 2004; Halliday & Martin, 1993; Swales, 1990)

b) identified school-relevant language skills that developmental progress during the upper elementary and middle school years (e.g., 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)

c) examined the language demands of educational standards, school texts, and achievement tests in U.S. schools (e.g., Bailey, 2007; Butler, Bailey, Stevens, Huang & Lord, 2004; Schleppegrell, 2001, 2004)
### research on AL: an inventory of features

<table>
<thead>
<tr>
<th>MORE COLLOQUIAL</th>
<th>MORE ACADEMIC</th>
</tr>
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<tbody>
<tr>
<td><strong>1. Interpersonal stance</strong></td>
<td></td>
</tr>
<tr>
<td>Expressive/Involved</td>
<td>→ Detached/Distanced (SCHLEPPGRELL, 2001)</td>
</tr>
<tr>
<td>Situationally-driven personal stances</td>
<td>→ Authoritative stance (SCHLEPPGRELL, 2001)</td>
</tr>
<tr>
<td><strong>2. Information load</strong></td>
<td></td>
</tr>
<tr>
<td>Redundancy (ONG, 1995) / Wordiness</td>
<td>→ Conciseness</td>
</tr>
<tr>
<td>Sparsity</td>
<td>→ Density (proportion of content words per total words) (HALLIDAY, 1994; SCHLEPPGRELL, 2001)</td>
</tr>
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<td><strong>3. Organization of information</strong></td>
<td></td>
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<tr>
<td>(one element is bound or linked to another but is not part of it)</td>
<td>(embedding, one element is a structural part of another)</td>
</tr>
<tr>
<td>Minimal awareness of unfolding text as discourse (marginal role of metadiscourse markers)</td>
<td>→ Explicit awareness of organized discourse (central role of textual metadiscourse markers) (HYLAND &amp; TSE, 2004)</td>
</tr>
<tr>
<td>Situational support (Exophoric reference)</td>
<td>→ Autonomous text (Endophoric reference)</td>
</tr>
<tr>
<td>Loosely connected/dialogic structure</td>
<td>→ Stepwise logical argumentation/unfolding, tightly constructed</td>
</tr>
<tr>
<td><strong>4. Lexical choices</strong></td>
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<tr>
<td>Low lexical diversity</td>
<td>→ High lexical diversity (CHAFE &amp; DANIELEWICZ, 1987)</td>
</tr>
<tr>
<td>Colloquial expressions</td>
<td>→ Formal/prestigious expressions (e.g., say/like vs. for instance)</td>
</tr>
<tr>
<td>Fuzziness (e.g., sort of, something like)</td>
<td>→ Precision (lexical choices and connectives)</td>
</tr>
<tr>
<td>Concrete/common-sense concepts</td>
<td>→ Abstract/Technical concepts</td>
</tr>
<tr>
<td><strong>5. Representational congruence</strong></td>
<td></td>
</tr>
<tr>
<td>Simple/Congruent grammar (simple sentences) (e.g., You heat water and it evaporates faster.)</td>
<td>→ Complex/congruent grammar (complex sentences) (e.g., If the water gets hotter, it evaporates faster.)</td>
</tr>
<tr>
<td>Animated entities as agents (e.g., Gutenberg invented printing with movable type.)</td>
<td>→ Compact/Incongruent grammar (clause embedding and nominalization) (e.g., The increasing evaporation of water due to rising temperatures) (HALLIDAY, 1993)</td>
</tr>
<tr>
<td>Abstract concepts as agents (e.g., Printing technology revolutionized European book-making.) (HALLIDAY, 1993)</td>
<td></td>
</tr>
</tbody>
</table>
Developing the **CALS-Instrument** (CALS-I)

- **Phase 1: Task Design**
  - Theoretically and empirically grounded item design

- **Phase 2: Pre-Pilot Study**
  - Iterative process of design, interviews, focus groups, think alouds (n=32)

- **Phase 3a: Quantitative Qualitative studies**
  - Item selection (IRT Rasch analysis), regression analysis and discourse analysis

- **Phase 3b: Expert Review Panel**
  - CALS-I reviewed by experts for content validation

- **Phase 4: Norming**
  - CALS-I administered to a large sample to establish norms (on-going)

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CALS-Instrument: Psychometric and theory-driven evaluation

CALS-Instrument
- Paper and pencil test, administered in whole-class settings, within one class period (45 - 50 min).
  - CALS-I Form 1 for 4th-6th grade
  - CALS-I Form 2 for 7th-8th grade
- Tasks assess a range of skills through multiple choice, matching, or short written responses.

- Construct validation
  - Sampling from different domains of general AL
  - Linking the selected items back to our operational construct of CALS
  - Pedagogical considerations
  - External expert review of CALS-Instrument

- IRT analysis and Criterion validation
  - Evaluation of item-level data to select a pool of items that were: representative of difficulty levels across grades using Rasch IRT analysis, predictive of MCAS-ELA (less than ideal proxy for deep reading comprehension)
CALS-I – FORM O – First pilot

- **Sample:** cross-sectional sample of 235 4th-8th grade students
- **Analyses:** Classical Test theory and IRT analysis

**Reliability**
- .92 as indexed by coefficient alpha, and
- .82 by split half reliability (evens vs. odds)

**Criterion validity**
- Criterion validity was assessed examining the relation between Academic Language Assessment scores and the MCAS-ELA
- The zero order within-grade correlations between the ALA total score and the MCAS-ELA ranged from .41 for grade 7 to .77 for grade 6 and indicated that performance on the AL-e was positively related to performance on the MCAS-ELA.

**Confirmatory Factor Analysis:**
- The final set of items was examined using confirmatory factor analysis (CFA) to determine if a single factor was being measured
- The model fit results support the presence of a single factor: CFI - .95, TLI - .95, RMSEA - .03.

Uccelli et al. (2014). *Applied Psycholinguistics*
Sample: cross-sectional sample of 413 4th-8th grade students

Analyses: Classical Test theory and IRT analysis

**CALS-I Form 1** (4th, 5th and 6th)
Reliability
.93 as indexed by coefficient alpha and .90 by split half reliability
Criterion Validity
.70 as indexed by the zero order correlation with the Gates-MacGinitie Passage Comprehension for the total sample

**CALS-I Form 2** (7th and 8th)
Reliability
.91 as indexed by coefficient alpha and .84 by split half reliability
Criterion Validity
.75 as indexed by the zero order correlation with the Gates-MacGinitie Passage Comprehension for the total sample

After the final item selection on each form, single factor CFA models were examined and found to fit the data well, providing evidence of unidimensionality
THE PRESENT STUDY| RESEARCH QUESTIONS

• Do 4th- and 6th-grade students’ cross-disciplinary academic language skills — as measured by the CALS-I — vary by students’ grade, or socio-economic status?

• Controlling for socio-demographic characteristics, word recognition/decoding, and academic vocabulary knowledge, are 4th- and 6th-grade students’ cross-disciplinary academic language skills — as measured by the CALS-I — predictive of students’ reading comprehension scores?
Table 1: Demographic data for students in the sample (n=282)

<table>
<thead>
<tr>
<th></th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>145 (51%)</td>
</tr>
<tr>
<td>Male</td>
<td>137 (49%)</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>85 (30%)</td>
</tr>
<tr>
<td>6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>197 (70%)</td>
</tr>
<tr>
<td><strong>SES</strong></td>
<td></td>
</tr>
<tr>
<td>No free/reduced lunch eligibility</td>
<td>133 (47%)</td>
</tr>
<tr>
<td>Free/Reduced-price lunch eligible</td>
<td>149 (53%)</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>48 (56%)*</td>
</tr>
<tr>
<td>6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>101 (51%)*</td>
</tr>
<tr>
<td><strong>Language Status</strong></td>
<td></td>
</tr>
<tr>
<td>Classified as English proficient</td>
<td>270 (96%)</td>
</tr>
<tr>
<td>Classified as English Language Learners</td>
<td>12 (4%)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
</tr>
<tr>
<td>Black/African American</td>
<td>13 (6%)</td>
</tr>
<tr>
<td>White</td>
<td>176 (80%)</td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>11 (5%)</td>
</tr>
<tr>
<td>Asian</td>
<td>6 (3%)</td>
</tr>
<tr>
<td>Two or more races</td>
<td>12 (5%)</td>
</tr>
<tr>
<td>Alaskan Native/Pacific Islander</td>
<td>1 (.5%)</td>
</tr>
<tr>
<td><strong>Special Education Status</strong></td>
<td></td>
</tr>
<tr>
<td>Classified as SPED</td>
<td>36 (16%)</td>
</tr>
</tbody>
</table>

*Race and Special Education Status data were available for 219 students.
* Percentage calculated within the grade.
MEASURES

Reading comprehension | *Reading Inventory and Scholastic Evaluation (RISE)*

*Reading Comprehension subtest* (22 items, 20 minutes, $\alpha = .76$): web-administered assessment that measures reading comprehension through MC questions for three passages. This assessment was developed by researchers at ETS (Sabatini, O’Reilly, Halderman, & Bruce, 2014). Scale scores were used for analysis.

Word Recognition/Decoding | *RISE Word Recognition & Decoding subtest* (50 items, 6 minutes, $\alpha = .91$): measures students’ skills in decoding and recognizing printed words as part of the RISE web-administered assessment developed by researchers at ETS (Sabatini, et al. 2014). Scale scores were used for analysis.

Academic Language Skills | *Core Academic Language Skills Instrument (CALS-I-Form 1)* (44 items, $\alpha = .93$; split reliability=.90): group-administered paper-and-pencil test designed to evaluate students' core academic language skills in grades 4 to 6 (e.g., logical connectives, nominalizations). Raw scores were used for analysis.

Academic Vocabulary | *Word Generation Vocabulary test* (50 items, $\alpha = .91$): group-administered paper-and-pencil test designed to assess knowledge of academic vocabulary through MC questions in grades 4 to 8 (Coxhead, 2000) (Hwang, Lawrence, & Snow, in preparation). Percent correct scores were used for analysis.
Descriptive statistics by grade

Table 2: Mean scores and standard deviations for all measures by grade.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Academic Language (CALS-I)</th>
<th>Academic Vocabulary (WG VT)</th>
<th>Word Recognition &amp; Decoding (RISE)</th>
<th>Reading Comprehension (RISE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4\textsuperscript{th} grade</td>
<td>85</td>
<td>20.65 (7.83)</td>
<td>0.65 (0.18)</td>
<td>363.07 (28.33)</td>
</tr>
<tr>
<td>6\textsuperscript{th} grade</td>
<td>197</td>
<td>28.44 (8.46)</td>
<td>0.60 (0.18)</td>
<td>362.69 (28.87)</td>
</tr>
<tr>
<td>Total sample</td>
<td>282</td>
<td>26.09 (9.01)</td>
<td>0.62 (0.18)</td>
<td>362.80 (28.66)</td>
</tr>
</tbody>
</table>
GLM results revealed that CALS-I scores differed significantly as a function of Grade, and socio-economic status (as indexed by eligibility for free/reduced lunch)

- CALS-I scores differed as a function of grade, with 6\textsuperscript{th} graders displaying, on average, significantly higher CALS-I scores than 4\textsuperscript{th} graders (F(1,280)=52.54, p<.0001).

- CALS-I scores differed as a function of SES within each grade, with middle SES 6\textsuperscript{th} graders displaying, on average, significantly higher CALS-I scores than their low SES peers (F(1, 195)=35.87, p<.0001). For 4\textsuperscript{th} grade, this difference approached significance (F(1,83)=3.64, p=0.06).
RQ1 | Variability in CALS-I scores within and across grades
**RQ2 | CALS-I scores as predictor of individual variability in reading comprehension**

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grade</strong></td>
<td>-0.07</td>
<td>-0.08</td>
<td>-0.09</td>
<td>-0.07</td>
<td>-0.19***</td>
<td>-0.12*</td>
</tr>
<tr>
<td><strong>English Profic.</strong></td>
<td></td>
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<tr>
<td><strong>Designation</strong></td>
<td>-0.16*</td>
<td>-0.10</td>
<td>-0.01</td>
<td>-0.00</td>
<td>0.01</td>
<td></td>
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<tr>
<td><strong>SES (Free/Red.</strong></td>
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<tr>
<td><strong>Lunch Eligibility)</strong></td>
<td></td>
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<tr>
<td><strong>Word Recog. &amp;</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Decoding (RISE)</strong></td>
<td>0.62***</td>
<td>0.45***</td>
<td>0.36***</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Academic Language</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.29***</td>
<td>0.20*</td>
</tr>
<tr>
<td><strong>(CALS-I)</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Academic Vocabulary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.22**</td>
<td></td>
</tr>
<tr>
<td><strong>(WG AV)</strong></td>
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<tr>
<td><strong>Observations</strong></td>
<td>282</td>
<td>282</td>
<td>282</td>
<td>282</td>
<td>282</td>
<td>282</td>
</tr>
<tr>
<td><strong>Variance Explained</strong></td>
<td>0.01</td>
<td>0.03</td>
<td>0.12</td>
<td>0.44</td>
<td>0.48</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>(R²)</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Change in R²</strong></td>
<td>0.03*</td>
<td>0.09***</td>
<td>0.32***</td>
<td>0.04***</td>
<td>0.02**</td>
<td></td>
</tr>
</tbody>
</table>

*p<.05, **p<.001, ***p<.0001
Summary of results

- Vocabulary knowledge is crucial, but there is more to academic language
- CALS was identified as a significant predictor of reading comprehension, above and beyond the contribution of word decoding and academic vocabulary knowledge
- CALS-I seems to capture school-relevant language skills which are typically only poorly indexed by categorical proxies such as SES (i.e., eligibility for free/reduced lunch)

- This research highlights the considerable individual variability in later language development and illustrates the critical need to pay attention to language in instruction, assessment, and research
Final considerations

CALS seems to be a promising pedagogically relevant construct

• These results – now replicated across two studies with different samples and different instruments—suggest that after basic word recognition/decoding skill is controlled for, the variability in students' core academic language skills and academic vocabulary knowledge capture the very pedagogically relevant skills that are typically only poorly indexed by a categorical SES variable

• A categorical SES variable can serve only as an imperfect proxy for identifying students in need of language and reading support

• By specifying a set of language skills associated with reading comprehension, this study advances our understanding of school-relevant language skills beyond the narrow definition of academic vocabulary and contributes relevant information for the design of more comprehensive interventions that provide cognitively demanding yet linguistically accessible and productive instruction.
Limitations and future directions

Our results are promising but require further research in several directions

- The CALS construct points to a relevant—but not exhaustive—repertoire of school-relevant language skills; more language domains need to be explored
- CALS need to be explored in larger and more diverse samples
- Longitudinal follow up to understand developmental milestones, individual trajectories and factors associated with CALS learning
- CALS in relation to other measures of oral and written language performance (research on classroom discourse and academic writing development)
- Research that explores the social contexts and specific adult-student(s) or peer interactions that support CALS learning
- CALS—just as vocabulary—most likely has a reciprocal relationship with reading comprehension that needs to be further explored
- Research that explores students’ rhetorical flexibility across contexts (inside/outside of school; cross-disciplinary/disciplinary skills)
- Students’ own voices about their knowledge and attitudes towards the language of school need to be explored; and students’ own language practices need to be valued and integrated (Galloway Phillips, Stude, & Uccelli, 2015)
Publications related to the CALS work


Other related articles


Thank you…

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Participants
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