



Academic Vocabulary and Language Skills: Predictors of Reading Comprehension of Upper Elementary and Middle School Students in Mexico

Vocabulario académico y habilidades lingüísticas: predictores de la comprensión lectora de estudiantes de primaria y secundaria en México

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Abstract

Prior studies suggest that academic language skills measures positively predicted reading comprehension outcomes of adolescents. Expanding on studies that have explored these relations in Spanish-speaking youth, the present study examines the specific contribution of academic vocabulary knowledge and academic language skills to the Spanish reading comprehension of elementary as well as middle school students in Northeast Mexico. A total of 1103 public school students in 5th and 6th elementary grades (n=671) and 1st and 2nd middle school grades (n=432) took part in the study. Participants were assessed on academic vocabulary, academic language skills, and reading comprehension. Demographic and SES data were also obtained. Aligning with prior research conducted with English speakers in the U.S. and Spanish speakers in Chile, findings revealed that academic vocabulary knowledge and academic language skills are essential to reading comprehension outcomes. Our study adds to the growing evidence of academic language skills and academic vocabulary, as key predictors of text comprehension for Spanish-speaking adolescents in Latin America and expands the sample to Mexican students.

Keywords: academic language; academic vocabulary; reading comprehension; adolescents; Latin America

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Resumen

Investigaciones previas han encontrado que las habilidades del lenguaje académico predicen positivamente los resultados de comprensión de lectura en español de los adolescentes hispanohablantes más allá del conocimiento del vocabulario académico. El presente estudio examina la contribución específica del vocabulario académico y de las habilidades de lenguaje académico a la comprensión lectora de estudiantes de primaria y secundaria en el noreste de México. Participaron en el estudio un total de 1103 alumnos de escuelas públicas de 5º y 6º de primaria ($n = 671$) y de 1º y 2º de secundaria ($n = 432$). Los participantes fueron evaluados en vocabulario académico, otras habilidades de lenguaje académico y comprensión lectora. También se obtuvieron datos demográficos y de nivel socioeconómico. En convergencia con investigaciones anteriores realizadas con hablantes del inglés en EE.UU. y hablantes de español en Chile, los hallazgos revelaron que tanto el conocimiento del vocabulario académico como las habilidades del lenguaje académico son cruciales para la comprensión lectora. Nuestro estudio se suma a la creciente evidencia de las habilidades lingüísticas académicas y de vocabulario académico como predictores clave de la comprensión lectora de los adolescentes hispanohablantes en América Latina y amplía la muestra a estudiantes mexicanos.

Palabras clave: lenguaje académico, vocabulario académico, comprensión lectora, adolescentes, Latinoamérica

Introduction

The development of proficient reading comprehension skills is a life-long endeavor. Given that reading comprehension becomes a key mechanism for learning, a large body of knowledge has resulted from research into the initial years of reading instruction (National Reading Panel, 2000; Snow, Burns, & Griffin, 1998). However, there is now a greater interest in studying the factors involved in learning to read and write in the content areas (Horning, 2007) and a broader recognition that reading development beyond those initial years requires further study (Snow, 2018). The present paper is focused on two language factors, academic vocabulary and academic language skills, that have gathered substantial evidence for a role in later reading development.

Literacy education: The Mexican context

Students' achievement on the 2018 evaluation conducted by the Programme for International Student Assessment (PISA) in reading, math, and science in Mexico is 60 to 80 points below the mean for OECD countries (Organisation for Economic Co-operation and Development [OECD], 2019), and these results have historically remained low since 2000 (Márquez Jiménez, 2017). Most Mexican students (55%) have reading abilities at level 2, which means that “these students can identify the main idea in a text of moderate length, find information based on explicit, though sometimes complex criteria, and can reflect on the purpose and form of texts when explicitly directed to do so” (OECD, 2019: p. 3). Reading scores are strongly related to SES, an association reinforced by the educational segregation that prevails in the country: students from less favored backgrounds tend to attend lower-quality schools, while students from more favored households tend to attend higher-quality schools (Backhoff, 2011; OECD, 2019).

The Mexican Educational System offers six elementary education grades for students aged 6 to 14, followed by three years of secondary education (middle school) for students 12 to 16. Basic education also includes three more years of post-secondary or *bachillerato* (Secretaría de Educación Pública [SEP], n.d.). This paper focuses on the late years of elementary education and the first two years of middle school education. Most schools in the public education system offer students at the elementary level a four-hour school day led by one teacher who implements the national curriculum. In contrast, at the middle school level, students attend a more extended school day and have 45 to 50-minute sessions with a different teacher for each subject included in the curriculum. As in most countries of the world, language arts along with math are central to the Mexican curriculum at both educational levels.

The current national curriculum for literacy education is based on the concept of oral and written language social practices and organized in three domains: literacy for learning, social participation, and literature. The first domain, literacy for learning, includes oral and written practices directly related to academic language, as students are expected to engage in formal oral presentations, discussions and debates, as well as to read, summarize, compare, comment on and elaborate, and revise expository-academic texts (SEP, 2017); nevertheless the concept of academic language is not used throughout the program and no intentional or explicit teaching of academic vocabulary or other academic language forms is prescribed. It is worth noting that practices related to giving an informed opinion and elaborating an argument are only included at the middle school level (grades 7th and beyond); for the earlier grades, oral and written language practices focus on finding, retrieving and presenting information and personal opinions about specific topics or concepts.

Understanding how academic vocabulary and academic language skills contribute to reading comprehension in the late elementary and early middle school years can contribute to informing teaching practices so that these practices target the skills students require to become competent readers in more direct and specific ways.

Literature review

Reading comprehension and linguistic knowledge. The relevance of language in reading has been long recognized and has been extensively studied in various regions of the world (Kim, Lee, & Zuilkowski, 2020). Research in Latin-American Spanish-speaking contexts has increased in the last few years. In the early school years, vocabulary development, phonological awareness, and home environment have been identified as good predictors for reading readiness (Romero, Arias, & Chavarría, 2007; Strasser, Rolla, & Romero-Contreras, 2016). Descriptive and intervention studies with kindergarten children in Latin America show that providing direct and explicit instruction in emergent literacy components offers students a better start for formal reading instruction (Pallante & Kim, 2013; Romero-Contreras, 2009; Strasser & Lissi, 2009; Villalón et al., 2011) and early elementary grades (Rolla et al., 2019). These interventions include support in mainly vocabulary, oral comprehension through shared-guided reading, phonological awareness, letter naming, and word recognition.

The explanatory power of decoding and listening comprehension for reading comprehension (Hoover & Gough, 1990) has been shown to be good for the early grades up to 3rd grade (Language and Reading Research Consortium, & Chiu, 2018), up to fifth grade (Lonigan, Burgess, & Schatschneider, 2018). However, the explanatory power of these two factors seems to decrease in 7th and 9th grades (Tilstra et al., 2009). After elementary school, there is an increasing consensus that more elements are needed to conceptualize reading comprehension for older students, such as text features and reader characteristics (Francis, Kulesz, & Benoit, 2018), background knowledge, and inferencing (Ahmed et al., 2016), vocabulary, grammar, verbal working memory, and inferencing (Lervåg, Hulme & Melby-Lervåg, 2018), as well as pragmatic, semantic, and grammatical language features (Snow & Uccelli, 2009), which are the focus of this paper.

The importance of language has not been as extensively studied for later reading as during the early years due to the lack of solid conceptualizations of the required language skills. According to Lervåg et al. (2018), listening comprehension is a second-order variable or composite formed by vocabulary, grammar, verbal working memory, and inference skills. Their longitudinal study (from 2nd to 7th grade) with Norwegian-speaking children showed that these skills, taken together, strongly predict both early and later reading comprehension. This study suggests that language input and practice play a crucial role in students' early and later reading comprehension. Therefore, students need to constantly evolve their linguistic knowledge towards more academic-like vocabulary and language, to cope with the academic texts required at each stage.

Assessing academic language skills and academic vocabulary. According to Snow and Uccelli (2009), even when terms such as the *language of education* and *language of the school* have long been used to refer to the type of linguistic skills that students need to master in order to comprehend better the kind of text they encounter in later school years, these terms are defined too vaguely to guide educational research; they thus propose the term *academic language* and offer an initial but comprehensive framework to study it (Snow & Uccelli, 2009). Following on this line, later on, Uccelli and colleagues proposed the construct of Core Academic Language Skills (CALS, Uccelli et al., 2015a).

The construct of Core Academic Language Skills (CALS) is a comprehensive and clearly defined set of linguistic skills that have proven to be useful in predicting and supporting reading comprehension of academic texts in English by monolingual and English-Spanish bilingual students (Aguilar, Uccelli, & Phillips Galloway, 2020; Phillips Galloway et al., 2020; Uccelli & Meneses, 2015; Uccelli et al., 2015a). In 2015, Uccelli and colleagues defined the following domains within CALS: 1) unpacking complex words; 2) comprehending complex sentences; 3) connecting ideas; 4) tracking themes; 5) organizing argumentative texts; 6) awareness of academic register. They also developed and evaluated a series of assessment tasks that together constituted CALS-I (Uccelli et al., 2015a).

Later on, two domains were added to the CALS construct: understanding metalinguistic vocabulary and interpreting writer's viewpoints, and former areas 1 and 2 were consolidated into one: unpacking dense information (Uccelli et al., 2015b). CALS, as measured by CALS-I, has proven to be a single construct, with adequate criterion validity, high reliability, and sensitivity to individual and grade-related variation (Barr, Uccelli, & Phillips Galloway, 2019).

Based on the CALS construct and following the general structure of CALS-I, Meneses et al. (2018) developed two sets of items to assess Spanish academic vocabulary (S-AVoc) and Spanish academic language skills beyond vocabulary (S-CALS) of monolingual Chilean students in grades 4 – 8. According to Meneses et al. (2018), the distinction between vocabulary and other academic language skills allowed investigating the unique contribution of these dimensions to reading comprehension, as there was scarce research on academic vocabulary in Spanish compared to English. These assessments were administered, along with other instruments to measure reading comprehension and fluency, to a sample of 810 4-8th grade Chilean students from various SES backgrounds. Confirmatory factor analysis revealed that S-CALS and S-AVoc are indeed part of the same construct, which is consistent with the original CALS construct in English, so they were integrated into one single instrument S-CALS-I. Three parallel regression analyses were carried out to examine the contribution of three separate predictors of reading comprehension after controls for grade, SES and reading fluency: a) S-AVoc by itself; b) S-CALS by itself; and c) both variables together. The first model showed that S-AVoc accounted only for 15%, after controls. The second model showed that S-CALS accounted for 24% of variance in reading comprehension. The final model revealed that S-CALS and S-AVoc when entered together (S-CALS-I) accounted for 25% of the variance in reading comprehension with the same controls.

In this study, we adopt the same distinction than Meneses et al. (2018) to expand on the exploration of the specific contribution of academic vocabulary and academic language skills to reading comprehension in a sample of Mexican students from relatively homogeneous SES backgrounds.

The following research questions guide this research:

Research Question 1. How does academic vocabulary knowledge contribute to reading comprehension in late elementary and middle school students?

Research Question 2. How do academic language skills contribute to reading comprehension after controlling for academic vocabulary in late elementary and middle school students?

Methods

Participants

A total of 1103 students attending public schools located in urban and marginally urban areas in San Luis Potosi, Mexico, were assessed: 671 elementary school students (grades 5th and 6th) and 432 middle school students (grades 1st and 2nd). Table 1 shows the distribution of the sample by grade, sex, and SES (low, mid, high).

Table 1
Socioeconomic characteristics of the sample (n=1103)

	Characteristic	n	Percentage
Gender			
	Female	550	49.9%
	Male	553	50.1%
Elementary grades		671	60.83%
	5th	462	41.89%
	6th	209	18.95%
Middle school grades		432	39.17%
	1st	144	13.06%
	2nd	288	26.11%
SES			
High:	A/B	114	10.34%
Medium:		811	73.53%
	C+	275	24.93%
	C	244	22.12%
	C-	178	16.14%
	D+	114	10.34%
Low:		82	7.43%
	D	75	6.80%
	E	7	0.63%
Missing data		96	8.70%

Source: Prepared by the authors.

Measures

SES

The 2018 version of the *Índice de Nivel Socioeconómico*, NSE AMAI questionnaire, created by the Mexican Association of Market Intelligence and Opinion Agencies (*Asociación Mexicana de Agencias de Inteligencia de Mercados de Opinión* [AMAI] 2017), was used to measure SES. The scale, which is in constant revision, measures various SES indicators such as parental education, household infrastructure, and access to the Internet through multiple-choice questions. Based on the results, respondents are classified into seven SES categories: category A/B is considered high SES, categories C+ C- D+ medium SES, and categories D and E low SES.

Reading comprehension measures

Two different reading comprehension measures were used: ACL for the elementary and CompLec for the middle school grades.

The battery of assessments Pruebas ACL (Català et al., 2001) is a multiple-choice silent reading evaluation of reading comprehension in Spanish, designed for identifying a reading level for individual students and groups. It evaluates literal comprehension, reorganization skills, inferential and evaluative comprehension in 35 and 36 items for 5th and 6th grades, respectively. Norms were derived for elementary students in Spain. ACL-5 has a Kuder-Richarson 20 (KR-20) reliability index of .82, and ACL-6 a reliability index of .76. As these tests include dialectal variations not known in Mexico, the 5th and 6th-grade versions were adapted for cultural relevance. These adapted versions had KR-20 reliability indices of .69 and .66 for 5th and 6th grade, respectively.

The *Prueba de Comprensión Lectora para educación secundaria* (Reading Literacy Test for Secondary Education) - CompLec (Tatay et al., 2011) is a 60-minute group paper-and-pencil test that measures reading comprehension through task-oriented reading situations following the PISA test model. Students are asked to read five texts and answer a series of questions after each text, 20 in total. Texts structures include expository, argumentative, and multimodal with text, graphs, and diagrams. Five questions assess the ability to retrieve information; ten, the ability to integrate information through relating ideas or making inferences, and five, the ability to evaluate the relevance or quality of the information in the text. CompLec has norms for middle school Spanish-speaking students from Spain and a total Cronbach's alpha reliability index of .79. After administration, a photocopying error was identified that invalidated five of the questions. For that reason, only fifteen items were scored. Reliability analysis of these 15 items in the present sample yielded a Cronbach's alpha coefficient of .74.

Academic language skills measure

S-CALS-I. Spanish-Core Academic Language Skills- I (Meneses et al., 2018) is a one-hour group test developed for Chilean students in grades 4th to 8th. A reliability estimate for the original instrument was good with a Cronbach's alpha of .88 (Meneses et al. 2018). For this research, items were revised for contextual and sociolinguistic appropriateness; adjustments were made whenever necessary. The authors of the Chilean version approved all modifications. This test includes two main variables: a larger S-CALS section to measure academic language skills, composed of 53 items and a short section to measure academic vocabulary, termed S-AVoc (see below). Separate reliability analyses of the adjusted items were carried out for these two variables. For the S-CALS items reliability was adequate (Cronbach's alpha = .89).

Academic vocabulary measures

Two tests were used to measure academic vocabulary: S-AVoc and WordgenM-Voc.

S-AVoc is a 15-item section of the S-CALS-I, which was also revised and adjusted for Mexican students. Reliability for this section was also adequate (Cronbach's alpha = .70).

On the other hand, WordGenM-Voc is an experimental vocabulary assessment with 28 multiple-choice academic vocabulary words from the selected units of the Word Generation Program (<https://www.serp.institute.org/wordgen-weekly>) used with students in this study. One of the words, “*interpretar*,” was repeated in this test and the S-AVoc task; therefore, it was eliminated from this assessment for the present analyses. A reliability analysis for this assessment without the repeated word resulted on a Cronbach’s alpha coefficient of .80.

All measures except the SES questionnaire were administered at the schools, during regular school hours, in the students’ classrooms, following the standardized tests procedures and after obtaining informed consents of participants and parents¹. Elementary students were administered the ACL scale, while middle school students were administered the CompLec scale to assess reading comprehension. The SES questionnaire was sent home for parents to answer and return.

Analytic Plan

Descriptive statistics were computed for all variables in total raw scores and percentage of correct responses as the first preliminary analysis. In order to examine the SES variable, letter classifications were converted into numbers with the highest number, seven, reflecting the highest classification, A/B. Then, a correlation table was carried out to examine bivariate correlations between all measures and grade and SES, as the second preliminary analysis. In preparation for regression analyses, collinearity diagnostics were calculated. Finally, a hierarchical regression analysis was performed to predict reading comprehension from grade, SES, academic vocabulary, and academic language.

Results

Preliminary Analysis 1: Cross-sectional patterns

To examine the proficiency level of elementary and middle school students on academic vocabulary and academic language skills, Table 2 shows descriptive statistics for raw scores for the four assessments: academic vocabulary in WordGen (WordGenM-Voc), academic vocabulary (S-AVoc), academic language skills (S-CALS), and reading comprehension (ACL or CompLec).

Comparisons across grades on the different instruments using the average percent of raw scores (see Table 2) show differences in academic vocabulary between 5th grade in elementary and 1st grade in middle school. The average scores of the two middle school grade groups are equivalent. The same pattern is observed for average academic language in S-CALS. For reading comprehension, three different instruments were used, two ACL tests, one for 5th and another for 6th grade, and CompLec, so they are not directly comparable. Comparing the two middle school grades measured with CompLec, their performance on average is quite similar.

1. This study is part of a larger Project approved by the Ethics Committees from the authors’ institutions.

Table 2
Descriptive statistics in raw scores and percentages for all measures (n=1103)

		Academic vocabulary measures				Academic language		Reading comprehension	
		WordGenM- Voc		S-AVoc		S-CALS			
Max. points		27		15		53		ACL-5: 35 ACL-6: 36 CompLec a: 15	
Grade level	n	M (% C) ^b	SD	M (% C)	SD	M (% C)	SD	M (% C)	SD
5th Grade Elementary school	462	13.10 48.50%	4.88	6.14 40.96%	2.85	19.11 36.06%	8.97	11.02 31.50%	4.62
6th Grade Elementary school	209	14.09 52.17%	4.67	7.00 46.67%	3.29	22.06 41.63%	9.58	9.93 27.58%	4.27
1st Grade Middle school	144	16.10 59.62%	4.34	8.14 54.26%	3.13	25.72 48.54%	9.90	4.8 32.01%	2.13
2nd Grade Middle school	288	15.88 58.81%	5.16	8.47 56.48%	2.89	25.41 47.95%	9.69	4.88 32.53%	2.30

Note: a = Adjusted score; b: %C = average percent of correct raw responses.

Source: Prepared by the authors.

The two vocabulary measures could not be compared. The WordGen-Voc assessment was an experimental measure, so there were no reported results for comparison. Academic vocabulary published results (Meneses et al. 2018) using the S-AVoc measure for 5th through 8th grade, ranged from 50 to 70%, whereas in the present sample the range went from 41 to 56%. Meanwhile, for academic language using S-CALS for the same grades, reported mean scores across tasks ranged from 46 to 68%, compared to this sample's 36 to 48% range. Average reading comprehension scores for 5th grade are equivalent to a standard score of 3 (out of 10), which Català et al. (2001) classify as a Low level; sixth-graders' scores are equivalent to a standard score of 2, classified as a Very low level. Similarly, average reading comprehension scores in middle schools in the present sample ranged from 32 to 32.5%, which corresponds to a level of performance below the mean according to CompLec published results for students from Spain (total mean score computed from published data for each item in Table 2 of Tatay et al., 2011, p. 811). However, two caveats should be considered: a) five questions were not included in the final CompLec scores; b) the Spanish sample included 3rd grade in middle school.

Preliminary Analysis 2: Correlations and multicollinearity tests

Pearson correlation coefficients were calculated to examine the bivariate correlations between all assessments and between these scores with grade and SES operationalized as a numeric variable. They are shown in Table 3.

Table 3

Pearson correlations in raw scores for grade, socioeconomic status and all measures.

	Grade	SES	Experimental vocabulary assessment WordGenM- Voc	Academic vocabulary S-AVoc	Academic language S-CALS
Grade	--				
Socioeconomic Status (SES)	-0.01	--			
Experimental vocabulary assessment. WordGenM- Voc	.24**	.17**	--		
Academic vocabulary. S-AVoc	.31**	.16**	.65**	--	
Academic language. S-CALS	.28**	.11**	.69**	.71**	--
Reading comprehension (elementary). ACL	-.11**	0.07	.55**	.50**	.65**
Reading comprehension adjusted (middle school). CompLec	0.01	0.02	.38**	.35**	.46**

Note: ** $p < .01$

Source: Prepared by the authors.

As seen in Table 3, there were high correlations among some variables, particularly between the two parts of S-CALS: academic vocabulary (S-AVoc) and academic language skills (S-CALS), with a correlation coefficient of $r = .71$. These high correlations suggested there could be some multicollinearity issues. In order to identify whether this was the case, collinearity diagnostics were performed, and the criteria indicated by Myers (1990) and Menard (1995) indicated there was no collinearity: the largest variance inflation factor (VIF) was 2.31 and therefore not greater than 10 which would indicate a cause for concern (Myers, 1990), and all tolerance coefficients were in a range between 0.43 and 0.99, well over 0.2, below which a problem could exist (Menard, 1995).

Table 3 also showed two interesting SES results. An unexpected result was that reading comprehension was not correlated to SES. Another result, this one more in line with expectations, was that the academic vocabulary and language measures did correlate significantly to SES.

Main analyses. Contribution of academic vocabulary and academic language to reading comprehension

The main objective of the present study was to determine whether academic vocabulary and academic language skills make distinct contributions to reading comprehension late elementary and middle school students.

To identify the relative importance of academic vocabulary and academic language skills, two hierarchical regression analyses were carried out to predict reading comprehension separately for elementary and middle students since the evaluation instruments were different. SES was controlled for, as correlational analyses showed that it was related to the linguistic variables. Since primary and middle school students were examined separately, grade was entered in the models as a dummy variable to account for its dichotomous quality. The two vocabulary measures were entered separately to examine the relative importance of each one, but in the same step since they belonged to the same construct. Table 4 shows the regression analysis to predict reading comprehension in elementary students from these two linguistic constructs.

Table 4

Regression analysis to predict Reading comprehension (Prueba ACL/ CompLec) from grade, SES, academic vocabulary, and academic language skills

Predictor variable	Elementary (n=671)					Middle school (n= 432)				
	<i>b</i>	<i>SE B</i>	β	R^2	ΔR^2	<i>b</i>	<i>SE B</i>	β	R^2	ΔR^2
Model 1				.007					.000	
(Constant)	10.86	.22				4.80	.18			
Grade	-.83	.41	-.08*			.08	.23	.01		
Model 2				.009	.002				.001	.001
(Constant)	10.08	.85				4.90	.59			
Grade	-.83	.41	-.08*			.08	.23	.01		
SES	.38	.41	.04			-.05	.26	-.01		
Model 3				.392	.383***				.173	.172***
(Constant)	4.26	.74				2.32	.60			
Grade	-1.77	.33	-.18***			.06	.21	.01		
SES	-.47	.32	-.04			-.32	.24	-.05		
Experimental vocabulary assessment	.38	.03	.42***			.13	.02	.29***		
Academic vocabulary	.41	.06	.28***			.11	.04	.15**		
Model 4				.504	.111***				.226	.053***
(Constant)	4.48	.67				1.83	.59			
Grade	-1.99	.29	-.20***			.12	.20	.02		
SES	-0.67	.29	-.07*			-.15	.24	-.02		
Experimental vocabulary assessment	0.19	.03	.21***			.07	.02	.15*		
Academic vocabulary	0.07	.06	.05			.00	.04	.00		
Academic language	0.24	.02	.51***			.08	.01	.35***		

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Source: Prepared by the authors.

As shown in Table 4, Model 1, grade accounted for some significant variance in elementary students' reading comprehension scores. Meanwhile, SES did not account for any significant variance in any group of students once accounting for grade, as shown in Model 2. Then, in Model 3, academic vocabulary, as measured by the WordGenM-Voc test and the S-AVoc, accounted for 38.3% of the variance in reading. Controlling for academic vocabulary in the last model, academic language measured by S-CALS accounted for an additional 11.1% of variance in reading comprehension. Together they explain a considerable 50.4% of reading comprehension skills in elementary students.

More modest results are seen in middle school. Neither grade nor SES contributes significant variance in reading comprehension. Academic vocabulary accounted for 17.2% of variance in reading comprehension. However, academic language contributed a unique 5.3% of variance in reading comprehension scores when controlling for academic vocabulary. Together they explained 22.6% of the variance in reading comprehension scores in middle school.

Remarkably, the contribution from one measure for academic vocabulary (S-AVoc) becomes non-significant when adding academic language in Model 4, both in elementary and middle-school students.

It must be acknowledged that the comparison between elementary and middle students is not straightforward, however, since the instruments used for assessing reading comprehension were different.

Discussion

This study addresses the influence of academic vocabulary and academic language on reading comprehension in the late elementary and middle grades, equivalent to grades 5th through 8th, in a sample of Mexican students who attend public schools. Our descriptive results indicate that while students' proficiency levels in all areas assessed show moderate positive differences between elementary and middle school students, middle graders show very little or no progress from one grade to the next. Overall, proficiency levels are below the mean scores reported for other Spanish-speaking populations (Català et al., 2011; Meneses et al., 2018; Tatay et al., 2011) on which the tests have been administered and validated.

The main focus of the study was to analyze the contribution of academic vocabulary and academic language skills to reading comprehension. Regression analysis showed that after controlling for Grade and SES, all three academic language measures predict a large proportion of the variance of elementary students' reading comprehension (RC) and a moderate proportion for middle school students' RC scores. However, academic language skills (S-CALS), when entered in the same model with academic vocabulary, takes up most of the variance. These results offer a strong support for the CALS-I construct for English (Uccelli et al., 2015a) and S-CALS-I for Spanish (Meneses et al., 2018) providing evidence that reading comprehension in the later years involves understanding complex grammatical and academic text structures beyond vocabulary (Lervåg, Hulme, & Melby-Lervåg, 2018; Snow & Uccelli, 2009).

Still, the vocabulary results suggest that a small group of academic words (42 in both tests) are essential for deriving meaning from text for upper elementary and middle schoolers. The finding that more than a third of the variance in upper elementary and over a sixth in middle schoolers' reading comprehension comes from these cross-content words shows a more extensive influence of academic vocabulary reported in a previous study in a Chilean sample by Meneses et al. (2018), who found that academic vocabulary evaluated only from the 15-word vocabulary assessment in S-AVoc accounted for 15% of unique variance after strict controls for grade, SES at the school level, and reading fluency.

Moreover, concerning the academic language results, the present findings of an 11% of unique variance in elementary and 5.3% of unique variance in middle school are in line with a 12% increase of explained unique variance in English after controlling for grade, SES, word fluency, and academic vocabulary (Uccelli et al., 2015b). It should be acknowledged that the reading comprehension assessment was adjusted. In the Spanish-speaking Chilean study (Meneses et al., 2018), 24% of the variance was explained by academic language after the same controls. In addition, academic vocabulary and academic language shared the most variance when considering both constructs together. Meanwhile, the present study showed that academic language still accounted for a significant unique variance after controlling for a more extensive set of vocabulary words than the ones used in the Chilean study. Although not precisely comparable due to these differences, the present findings on academic language in the last regression model, together with the loss of significance for one of the vocabulary coefficients, emphasizes the need for including support for academic language skills in any reading comprehension program and Spanish language arts curriculum.

One unexpected result of our study is the fact that SES was not predictive of RC, as research conducted in Mexico indicates that student achievement is highly influenced by family background (Backhoff, 2011; OECD, 2019). Collecting SES data at the individual level was intended to gain a more fine-grained picture of the SES and RC relations. It might be considered that this odd outcome is due to the restrictive range of the data (Thumin, 1993) as two-thirds of the participants shared mid-SES backgrounds. This SES distribution and the outcome, on the other hand, are not surprising given that the study was conducted in public schools in the same geographical area; in Mexico, these two characteristics, type of school and location, are highly associated with SES and quality of teaching (Backhoff, 2011).

In addition, the convergent findings with Meneses et al. (2018) that variance in reading comprehension was uniquely explained by academic language in both upper elementary and middle school, despite the differences in reading comprehension assessments across those levels, are intriguing. Of course, the study needs to be replicated, preferably with the same reading comprehension assessments for both elementary and middle school and including more students at both ends of the SES spectrum.

These results showing lower levels of academic vocabulary and language in the students sampled argue strongly for the importance of explicitly teaching them, since these kinds of students are the ones most likely to benefit from explicit instruction (Lawrence et al., 2012).

Limitations

Several limitations restrict the generalizability of these findings. First, a methodological limitation was that elementary and middle school students took different reading assessments tailored to their educational levels. Although this was done to ensure the adequacy of these assessments, it restricted the cross-age analyses that could be performed. In addition, assessment differences have been documented to exert an influence on results (Cutting & Scarborough, 2006; Keenan, Betjemann, & Olson, 2008). ACL tests were developed to assess four types of cognitive processes: literal comprehension, reorganization, inferential comprehension, and evaluative comprehension, across several genres such as narrative, expository, data interpretation, graph interpretation, and poetic interpretation. Meanwhile, the CompLec assessment was created to mirror the three types of questions (recuperation/literal, integration/inferential, and reflective/evaluative) organized into three main genres: expository, argumentative, and what the authors call “discontinuous texts” where students must integrate information between texts and figures. It can be seen the assessments are not as different in their conceptualization, but there might still be differences in the operationalization that could play a role in the results obtained.

Moreover, the reading measure for middle school students had to be adjusted due to a procedural flaw, which might have affected the results in unknown ways. The reading comprehension measure for elementary students (ACL) had low reliability with this sample. Furthermore, because this was a cross-sectional study, the comparisons between cohorts are only illustrative. A longitudinal study would be able to track changes across time with the same participants.

Unlike the study by Meneses (2018), this study did not control for fluency. Fluency could be a vital control since it has been shown that it can still play a role in the reading comprehension skills in some upper elementary students in Spanish (Calet, Gutierrez-Palma, & Defior, 2015). A final limitation is that the restriction of range could most likely have influenced the null findings for SES. Ensuring the inclusion of more advantaged and disadvantaged students could enhance our understanding of these phenomena for all kinds of readers, as suggested by the findings of Francis et al. (2018).

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