

Research Article

Teacher Vocabulary Use and Student Language and Literacy Achievement

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ABSTRACT

Purpose: We sought to examine second grade teachers' word use throughout the school day to identify the amount and type of teacher vocabulary use across content areas as well as to examine relationships between this teacher talk and student language and literacy achievement.

Method: Second grade teachers ($n = 64$) and a random sample of half of their students ($n = 619$) participated. Teachers recorded instruction during the school day throughout the year, and students were assessed on vocabulary, grammar, and reading measures in the fall and spring.

Results: Findings reveal second grade students hear thousands of words spoken by the teacher each hour of the school day, including more than a thousand different words per hour on average. The large majority of words were the most common words in the English language. On average, there were few academic or curriculum vocabulary words used, but this varied widely between teachers. The proportion of academic words used by teachers during the school day significantly predicted students' end-of-year vocabulary. Teachers who used more academic words had students with higher vocabulary achievement at the end of the school year. There were no other significant relationships between teachers' language and student achievement.

Conclusions: This correlational evidence adds to the existing knowledge of the importance of academic language to student school outcomes and provides implications for further research in the area of academic language at the early elementary level.

Vocabulary knowledge has an important role in improving academic achievement, particularly in supporting reading development (e.g., August et al., 2005; August & Shanahan, 2006; Baker et al., 2014; Scarborough, 2002). It is well recognized that vocabulary is fundamental to recognizing and comprehending words in print (Ricketts et al., 2007; Scarborough, 2002). Knowledge of the language of text and school, or *academic language*, which refers to the formal and complex oral and written language used in school lessons, textbooks, tests, and assignments (Scarcella, 2003; Schleppegrell, 2012; Uccelli et al., 2015), has an essential role in comprehension of academic texts (Stahl & Nagy, 2006).

For academic language learning, classroom contexts may be critically influential environments because academic language is less likely to occur in informal home contexts. Consistent with the vast majority of theories of oral language development (e.g., social interactionist theory, competition model, connectionist theories, modularity theory, universal grammar, usage-based theory, and semantic bootstrapping), environmental linguistic exposure plays an essential role in acquisition of new language forms. The more students experience language with those that have more language knowledge, the more their own vocabulary and grammatical skills can develop. Increased vocabulary and grammatical skills also contribute to students' ability to recognize and comprehend the academic vocabulary and language of the classroom and in texts, which are known for more complex sentence structures and connectives (Blank, 2002). There is a moderate-to-strong correlation between a person's language abilities

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and their literacy and academic achievement concurrently and longitudinally (e.g., Berninger & Abbott, 2010; Byrnes & Wasik, 2019; Chang & Monaghan, 2019; Lervag et al., 2018; National Early Literacy Panel, 2008). For example, students with better developed oral language skills (e.g., vocabulary and grammar) in the early grades are also better comprehenders (Foorman et al., 2015) and are more likely to read and comprehend at higher levels in the later grades (K. Nation & Snowling, 2004). As such, the classroom also affords a milieu wherein teachers can bridge and scaffold differences in conversational language and the language of text and school, skillfully supporting students' language growth to promote school success (Jones et al., 2019; Nagy & Townsend, 2012; Schleppegrell, 2012; Stahl & Nagy, 2006). Findings of previous studies support the assumption that classroom environments can provide a rich context for language development and key supports for developing linguistic comprehension (Dickinson et al., 2009; Gibbons, 1998). Rich oral language environments may be particularly germane for the language development of students who do not have the necessary skills to read widely, such as beginning readers or students with reading difficulties (Nagy, 2005; Stahl & Nagy, 2006).

Specifically, *academic vocabulary* is a critical aspect of academic language and refers to words that are common to academic textbooks for school age children (Coxhead, 2000), which tend to be abstract and decontextualized. Academic vocabulary includes words that students encounter across multiple academic subjects, such as *contrast*, *draft*, *data*, *analyze*, and *resource*, which are less likely to be used in the home. Proficiency with academic vocabulary, beyond general vocabulary knowledge, is needed to succeed academically throughout the grade levels (Schuth et al., 2017; Wong Fillmore, 2004). As such, exposure and/or instruction to academic language are important to prepare students to deduce meaning and comprehend the language they will encounter in academic texts (Stahl & Nagy, 2006).

Research on Teacher Language

Several studies of preschool teachers suggest that the classroom linguistic environment can be related to language development prior to elementary school. Children's exposure to sophisticated, often less common vocabulary by preschool teachers was related to the children's kindergarten language levels and subsequently predicted their reading comprehension and word reading achievement into fourth grade (Dickinson & Porche, 2011). Similarly, McLeod et al. (2019) found the total number of vocabulary words and vocabulary supports used by preschool teachers during classroom play significantly related to child vocabulary use. Gest et al. (2006) examined teacher

word use in different contexts of the preschool day, noting variations in the sophistication of teacher talk depending on the activity. The richest talk was reported during book reading, a common target of language and vocabulary interventions (Dickinson, 2001; Lonigan et al., 1999; Wasik & Bond, 2001). One preschool study provided enhanced vocabulary models delivered in small group conversations with trained adults (Talking Buddies) as a means to facilitate child language development (Ruston & Schwanenflugel, 2010). Adults trained to use specific and rare words met with children in groups for 25 min twice each week for 10 weeks focusing on using specific terms (rather than basic), atypical variants or rare words, and abstract terms. Children with low initial vocabulary skills who participated in the biweekly conversations with vocabulary-trained adults showed greater growth in expressive vocabulary than children in the comparison group. Children with average initial vocabulary skills did not show substantial benefit. The promising results for children with low initial vocabulary skills provided evidence for teacher vocabulary as a viable malleable factor for impacting children's language development.

Despite the possible impact of the linguistic input from classroom teachers, teachers' language use throughout the elementary years has been examined to a lesser extent than preschool teachers' language. Teachers' language use in school settings from the elementary grades to postsecondary levels has been studied most commonly descriptively and qualitatively for the purposes of explaining discourse frameworks in instruction, language demands for English language learners, or cultural influences in the classroom (e.g., Csomay, 2007; Edelsky et al., 2002; Ernst-Slavit & Mason, 2011; İnceçay, 2010; Poole, 2005). Others have attempted to identify optimal communication characteristics for teachers, in terms of rate, length, complexity, and function (Cazden, 2001; Chilcoat, 1987; Garmston & Wellman, 1998). A recent study examined the effects of teacher talk in the classroom on vocabulary outcomes for university students in China (Zhouhan & Webb, 2020), confirming students increased their vocabulary of targeted words simply from hearing them used during the lecture. Corrigan (2011) noted that teacher's language use in the classroom may be related to their own language/vocabulary levels, suggesting that continued teacher awareness of their role as language teacher, as well as building of teachers' own language knowledge may be important factors in their teaching.

A couple of studies have examined teacher language in specific content areas. Studhalter et al. (2021) examined teacher talk during science instruction in Swiss kindergarten classrooms, reporting the content-specific language of teachers during the instruction was positively related to students' conceptual learning in science. That is, having

more exposure to content-specific vocabulary supported the students' learning of more complex concepts. Gámez and Lesaux (2012) provided evidence that teacher talk may have an impact on students' language development in middle school based on examination of language in 22 sixth-grade classrooms. Although total amount of teacher words during the English language arts (ELA) class period was not related to students' end of year vocabulary skills, teachers' use of sophisticated vocabulary was related to students' vocabulary skills at the end of year even after controlling for student (beginning of the year scores), class (percentage of language minority learners), and school socioeconomic composition (percentage of students eligible for free or reduced-priced lunch). Specifically, a 1 *SD* increase in teachers' use of sophisticated words was associated with a 1.17-point increase in students' end-of-year vocabulary performance. Teachers' language use was not significantly related to the class mean of vocabulary pre-test scores (nor percent of language minority students or percent of students eligible for free or reduced priced lunch). However, teacher use of sophisticated vocabulary was related to an increase in end-of-year vocabulary scores for language minority students.

A few studies have also considered teachers' language use with students of varied language abilities (e.g., Duncan & Lederberg, 2018; Hollo & Wehby, 2017). Hollo and Wehby (2017) examined teacher language between elementary general and special education classes with students with or at-risk for emotional/behavior disorders. Language from three lessons of at least 10 min was coded for each teacher. The authors noted wide variability in the amount of teacher words across classrooms but generally consistent amounts of total words within teacher. There were no differences between general and special education classes in amount, complexity, content, or clarity of the language use. Similarly, there were no differences in these language codes across grade levels. On average, teachers used common words, with 87% of the words used by teachers on the list of the 1,000 most frequently used words in the English language. Academic words were used only 1% of the instructional time on average, suggesting very little input for students for these more school-based words. However, this study did not examine the relationship between teacher language use and student achievement.

In summary, there is limited research on teacher language use in the classroom for school-age children, a context that brings increased requirements for academic language and complexity, and there has been no systematic examination of its relationship with student language and literacy outcomes in the elementary grades. However, pre-school teacher research and some limited school age research does suggest teachers' vocabulary or language input may have influences on students' language and

future reading abilities, although these impacts may differ based on students' initial language levels.

Purpose

The purpose of this study was to examine early elementary (second grade) teachers' word use throughout the school day to identify the amount and type of teacher vocabulary use across content areas as well as to examine relationships between this teacher talk and student language and literacy achievement. We sought to build on the large amount of research demonstrating the important impact of teacher language at the early childhood level by selecting an early elementary grade. We also selected a grade where the intersection of language and reading could be examined as well as where all content areas are regularly taught across districts and schools, so that we could examine the amount and type of teacher vocabulary in these content areas of a school day.

Specifically, we addressed three research questions:

1. What amount and type of teacher vocabulary use occurs in second grade classrooms across content areas?
2. What is the relationship between the amount and type of vocabulary use and student language and literacy outcomes?
3. Does initial student vocabulary level moderate this relationship?

Method

Participants

We conducted this study with the second grade teachers in 28 schools across a total of four school districts across two states in the Southeast United States. Institutional Review Boards from each of the authors' institutions approved the study. We contacted districts with schools in urban, near-urban, suburban, and rural districts for participation in the study. There were a total of 64 teachers teaching 60 second grade classes (average 19 students per class). All of the teachers were certified and held a bachelor's degree and 27 of the teachers also held master's degrees. Teaching experience ranged from 0.5 to 43 years ($M = 11.83$, $SD = 8.88$). All but two of the teachers were female. The racial composition of the teachers was 84.4% White, 12.5% Black, and 3.1% Asian. All of the teachers identified their ethnicity as non-Hispanic.

We randomly sampled half of the students from each class ($n = 619$) to participate in the language and

literacy assessments in the fall and the spring. The sample was 51.8% female. The racial composition of the student sample was 63% White, 24% Black, 5% Asian, and 6% Other. With regards to ethnicity, 11% of the students were identified as Hispanic. Ethnicity or race was not reported for 2% of the sample. Overall, 39.4% of the student participants were eligible for the free or reduced lunch programs. English was reported to be the home language for 87% of students. Of those who spoke another language at home (13%), 53 students spoke Spanish, five spoke Arabic, three spoke Korean, and nine other languages were reported by two or fewer students. Overall, 6% of participants were identified as English learners. In addition, 9% of students were identified with a disability, with the majority identified as noncategorical, speech impaired, or specific learning disability.

Procedures

All student participants were assessed by research staff in the fall (Sept./Oct.). To obtain samples of teacher vocabulary provided to their classes throughout the school day, participating teachers for each second grade classroom recorded a full day of instruction twice per month throughout the school year using a language environment analysis (LENA) digital language processor. Each month, the dates of recording were assigned to teachers randomly with stratification across all 5 days of the week, because type of instruction may vary systematically on different days of the week. A LENA recorder assigned to the teacher was delivered after school the day before a teacher's assigned recording date and picked up from the teacher at the end of the his/her recording day. Classroom teachers wore the LENA throughout the day, turning the recording off only when their students were not with them (e.g., lunch and bathroom). Audio was downloaded into LENA software directly from the device after it was picked up from the teacher. Each audio was then reviewed to identify the start and end times of the content areas (i.e., ELA, math, science, and social studies) or other (e.g., other instruction and transitions) that were provided to the students in the class as amount and type of vocabulary may systematically differ based on the content. Any additional audio (e.g., adult-to-adult talk and students not present) were not labeled and not used in the study. Each audio was then automatically processed in LENA software to estimate the total number of words spoken by adults for each 15-min segment of time in the entire school day. To ensure that we had samples of teacher vocabulary use, any segments with little or no adult talk (fewer than 20 words) were excluded from the language samples. Identifying 15 consecutive minute segments for sampling is in line with language samples used in previous language sampling studies (Dickinson & Porche, 2011;

Huttenlocher et al., 2002). The LENA software provides greater than 92% reliability for identifying number of words spoken by adults (Xu et al., 2009). After these initial screening steps, we had all the language from each teacher for each assigned day divided into 15-min language samples and labeled for each content area.

For each day's set of language recordings for a teacher, we randomly selected one 15-min segment from each of the core content areas taught as well as two 15-min segments from times outside of the core content areas (marked "other" in the initial screening). The "other" segments represented the times during the day that teacher's provided language input outside of the content areas. The selected samples were then transcribed by the Systematic Analysis of Language Transcripts (SALT) software company (SALT Software, LLC) using the standard SALT transcription conventions (Miller et al., 2011) including breaking teachers' utterances into c-units (independent clause with its modifiers; Nippold et al., 2014). Only adult language directed to students was transcribed. Adult conversation between two or more adults (e.g., adult to adult conversation not directed toward students) was omitted from transcription. Aligned with typical expectations for transcription reliability in the literature (Fey et al., 2004; Windsor et al., 2000), the SALT company guarantees a reliability of transcription accuracy of at least 90% when transcription service is provided by the SALT company. All student names, repetitions of words, and unintelligible speech were excluded from the words in the analyses set.

We then analyzed the teacher vocabulary content and use in the transcripts. We used SALT software for standard analysis of lexical productivity and diversity (i.e., number of total words and number of different words). We used custom word list analysis within SALT software to identify the use of less common, academic, and curriculum vocabulary word use. These teacher measures are described further in the measures section.

All student participants were assessed by the research staff in the spring (April/May) with the same measures administered in the fall. We also assessed teacher expressive vocabulary level in May of the school year, so we could examine whether any teacher vocabulary—student outcome relationships were explained only by teacher vocabulary levels (Corrigan, 2011).

Measures

Vocabulary, grammar, and reading achievement were measured in the fall and spring for each student participant using the measures described below. Teachers were also assessed in the spring on the Expressive Vocabulary Test—Second Edition (EVT-2; Williams, 2007).

Research assessment staff was trained to administer and score each assessment prior to each assessment period. Research assistants were hired staff with at least a bachelor's degree or graduate students in education or speech/language master's or doctoral programs. After each training, each research assistant completed a practice administration of each measure. All research assistants obtained 100% reliability agreement on administration of each of the measures at each time point, including correct test/question scripts, materials handling, item scoring/marking, basals, and ceilings during administration. Research assistants independently double cored and double entered all data to ensure scoring and entering reliability. If a discrepancy in the calculation of a score occurred, a third research assistant independently scored the assessment to ensure 100% reliability in the final scoring for each measure at each time point.

Vocabulary

We administered the EVT-2 (Williams, 2007) and the Peabody Picture Vocabulary Test–Fourth Edition (PPVT-4; Dunn & Dunn, 2007) to measure students' expressive and receptive vocabulary. The EVT-2 is an untimed, norm-referenced, individually administered measure of expressive vocabulary (word labeling and word retrieval) designed for children and adults (2–90 years of age). The test takes 10–20 min to complete. Participants are required to verbally label items in response to picture stimuli and to identify synonyms for given words. The EVT-2 is composed of 190 items including a variety of word types (e.g., nouns, verbs, and adjectives). Internal consistency is reported to range from .88 to .98 and test–retest reliability ranges from .77 to .90 for elementary ages. Adjusted correlations between the EVT-2 and the Comprehensive Assessment of Spoken Language (CASL; Carrow-Woolfolk, 1999) range from .50 to .84 for the elementary age group. Internal consistency is reported to range from .89 to .97 for adults.

The PPVT-4 is an untimed, norm-referenced, individually administered measure of receptive vocabulary (normed for individuals 2 to 90 years old). The assessment takes 10–15 min to administer and the student is asked to point to, or say the number that corresponds to, a picture that best fits the meaning of the word given a choice of four. Split half reliability by age for Form A and Form B was $M = .94$ ($SD = 3.6$), and ranges from .90 to .97 for ages 5 to 11 years. Adjusted correlations between the PPVT-4 and the CASL (Carrow-Woolfolk, 1999) range from .41 to .79 for this age group.

Expressive Grammar

We administered the Clinical Evaluation of Language Fundamentals–Fifth Edition (CELF-5; Wiig et al.,

2013) to examine expressive grammar. The CELF-5 is an untimed, norm-referenced, and individually administered assessment of global receptive and expressive oral language skills. Two subtests, Recalling Sentences and Formulating Sentences, were administered. The subtest Formulating Sentences is designed to assess students' ability to generate semantically and grammatically accurate sentences utilizing linguistic forms of increasing complexity. The task, which consists of up to 24 items, asks students to formulate a sentence including a target word in response to a picture as a contextual reference. The Recalling Sentences subtest challenges students to listen to spoken sentences, recall, and reproduce sentence structures of increasing length and syntactic complexity. For this subtest, the student is asked to repeat individual sentences without changing the meaning, word structure, or sentence structure as the 26 sentences are presented orally. Reliability coefficients for selected subtests range from .89 to .95. Adjusted correlations between the CELF-5 and CELF-4 range from .71 to .88 for the Recalling Sentences and Formulating Sentences subtests.

Reading Achievement

We administered the Gates-MacGinitie Reading Tests 4th Edition (GMRT; MacGinitie et al., 2006) and the Woodcock-Johnson IV Tests of Achievement (WJ-IV; Schrank et al., 2014). The GMRT is a group-administered and norm-referenced test. The Reading Comprehension subtest was administered. The assessment consists of expository and narrative passages that increase in length, followed by multiple choice questions. Internal consistency reliability for second grade is .91–.92. Construct validity estimates range from .79 to .81. The WJ-IV is an untimed, norm-referenced, and individually administered test. We administered the Letter Word Identification subtest to assess word reading ability. Letter Word Identification assesses the ability to read real words in a list. Internal consistency is reported to range from .96 for ages 7–8 years. The Passage Comprehension subtest is a cloze measure wherein students are instructed to read 1–2 sentence-length passages and identify a missing key word that would make sense in the context of the passage. Split-half reliability is reported as .93 for ages 7 to 8 years. The reading cluster of the WJ-IV correlates .95 with the Kaufmann Test of Educational Achievement Second Edition for ages 8–12 years (McGrew et al., 2014).

Teacher Vocabulary Use

We analyzed the teacher vocabulary content and use from the transcripts of each language sample. We examined the total number of words, the total number of different words, the proportion of less common word usage, the proportion of academic words, and the proportion of curriculum vocabulary words used.

Total words. The total number of words and the total number of different words were calculated for each teacher to provide information on the quantity and diversity of words provided during student instruction. These words were quantified using automatic calculations from the standard analysis in the SALT software.

Less common words. To further examine the type of vocabulary input students were exposed to during instruction, we also examined less common word use, with a custom loaded word list and code in the SALT software. The number of less common words was calculated by identifying the words teachers used that were not on the Graves et al. (2008) 4,000 most frequently used English words list. We used the proportion of less common words relative to the total number of words in the analyses.

Academic words. Using the transcripts of the teachers' language, we used SALT to aggregate the number of academic vocabulary words used per sample. We calculated the number of high-incidence academic words teachers used using the Coxhead Academic Word List (Coxhead, 2000). Derived from words occurring at least 100 times in a corpus of 3.5 million words in academic texts, the word list consists of 570-word families that account for approximately 10% of the total words in academic texts, outside of the 2,000 most frequently occurring words in English. To ensure the academic word list included words that appear across the various academic subject areas, the selection of the corpus for the Coxhead (2000) academic word list included 28 subject areas organized into seven general areas of four disciplines (resulting in at least 25 words in each discipline) including science, arts, economics, and law. We used the proportion of academic words relative to the total number of words in the analyses.

Curriculum vocabulary. We also gathered a list of the general knowledge vocabulary words identified for direct instruction. For all schools, this instruction was part of their core ELA curriculum. These are the words the students were expected to learn through direct vocabulary instruction during the school year. Across teachers, a variety of curricula were used for language and literacy instruction including: *Wonders* ($n = 44$; McGraw Hill), *Institute for Learning* ($n = 17$; University of Pittsburgh, Learning Research and Development Center); *Journey's* (Houghton Mifflin Harcourt) and *Institute for Learning* ($n = 15$); *Reading Street* ($n = 5$; Savvas Learning Company); *Rooted in Reading* ($n = 3$; Lemons & King, Teachers Pay Teachers), and *Wordly Wise* ($n = 3$; School Specialty Instruction and Intervention). Teachers in seven classrooms reported that they did not use a prescribed curriculum for language or reading instruction, so they were not included in this analysis. We matched the specific

curriculum list to the teacher to calculate the number of vocabulary words from their curriculum that the teacher used with students during the day. We used the proportion of curriculum vocabulary relative to the total number of words in the analyses.

Data Analytic Plan

The data analytic plan was developed to serve the three research questions of the study. First, descriptive information regarding the amount and type of teacher vocabulary use was produced. Second, in order to estimate the relationships between teacher vocabulary and student outcomes, we first conducted an exploratory factor analysis on the child-level language and reading variables assessed at the fall and spring. The factor analytic results informed the creation of composite scores to address multicollinearity, increase reliability, and reduce the number of comparisons we examined. The composite scores were used in a series of two-level Hierarchical Linear Modeling (HLM) models, with students nested within classrooms. In these models, the five different teacher-level vocabulary measures (i.e., total words per hour, number of different words per hour, proportion of less common words, proportion of academic words, and proportion of curriculum vocabulary words) were used as predictors of residualized change in student-level achievement across the year. Finally, we investigated whether initial level of student vocabulary ability moderated any of the relationships between teacher vocabulary and change in student outcomes.

Results

Amount and Type of Teacher Vocabulary

To address the first research question, we examined the amount and type of teacher vocabulary input for these second grade students. We converted samples from minutes to hour for ease of understanding (e.g., each 15-min sample was 0.25 hr) and then calculate the mean number of complete words per hour, total words in utterances per hour (excluding nonmeaningful speech in mazes, fillers, or false starts), and different words per hour. We also examined the average proportion of less common, academic, and curriculum vocabulary words used relative to the total number of teacher words spoken. Table 1 provides these descriptive data.

On average, teachers used approximately 3,764 complete words per hour with students during the school day. They spoke an average of 1,144 different words per hour to students. Approximately, 15% of the words used were less common words and approximately 1% of words were

Table 1. Average teacher vocabulary use across audio segments by content areas.

Variable	All segments combined			English language arts			Math			Science			Social studies			Other		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Total words*	4,453	3,764	1,714	1,176	3,941	1,856	1,084	4,041	1,475	257	4,461	1,646	181	4,807	1,774	1,755	3,265	1,609
Different words*	4,453	1,144	431	1,176	1,087	415	1,084	1,012	270	257	1,294	485	181	1,376	507	1,755	1,216	473
Less common words	4,453	133.66	77.01	1,176	140.87	65.21	1,084	189.68	82.57	257	132.49	59.06	181	143.25	61.32	1,755	93.39	59.10
Less common words ratio	4,453	0.151	0.046	1,176	0.137	0.038	1,084	0.177	0.047	257	0.125	0.039	181	0.125	0.039	1,755	0.152	0.044
Academic words	4,453	7.997	9.467	1,176	9.689	9.135	1,084	11.156	10.977	257	11.097	12.852	181	13.276	11.653	1,755	3.914	5.486
Academic words ratio	4,453	0.009	0.009	1,176	0.010	0.008	1,084	0.011	0.010	257	0.011	0.011	181	0.012	0.008	1,755	0.006	0.007
Curriculum vocabulary	4,226	6.08	8.61	1,100	8.28	10.76	1,006	6.48	7.89	248	11.04	13.32	173	10.13	10.68	1,699	3.28	4.38
Curriculum vocabulary ratio	4,226	0.006	0.007	1,100	0.006	0.007	1,006	0.005	0.007	248	0.005	0.007	173	0.006	0.007	1,755	0.005	0.007

Note. *n* = number of audio segments.

*Values shown represent the number per hour. Ratios reflect value divided by total words. Curriculum vocabulary descriptives were not calculated for classes without an identified vocabulary curriculum.

academic words. Teachers also used words from their grade-level vocabulary curriculum in less than 1% of their words spoken. Thus, on average, teachers used mostly common words (top 4,000 words in English) and very few academic or curriculum vocabulary words in their oral language with students.

Examining the different content areas reveals ELA and math instruction occurring daily and regularly. Science and social studies instruction occurred significantly less across all teachers and schools. Thus, students received language input largely through ELA and math instruction during an average school day. ELA instruction did include some science and social studies text reading, therefore covering some of the science and social studies content, but the focus of instruction was on ELA (e.g., accurate and fluent reading of text and comprehension of text). The total number of spoken words per hour in each content area ranged from an average to 3,265 during other time periods (e.g., transitions) to 4,807 during social studies instruction. The number of different words per hour was lowest during math ($M = 1,012$) and ELA ($M = 1,087$) instruction and highest in social studies ($M = 1,376$) instruction. The average proportion of less common to total words spoken was highest in math (18%) and lowest in science and social studies (13%). The average proportion of academic word use was fairly consistent across all academic content areas (approximately 1% of words used). As would be expected, there was a lower proportion of academic word use during class time that was not part of the core academic subject ($M = 0.60\%$ of total words). Oral use of the curriculum vocabulary words was consistently the lowest proportion of word use by teachers across all content areas ($M = 0.5\%$ to 0.6%).

Teacher Vocabulary Use and Student Outcomes

To answer Research Question 2, examining the relationship between the amount and type of teacher vocabulary use and student language and literacy outcomes, we first conducted an exploratory factor analysis of the spring and fall student achievement variables. Specifically, seven academic achievement standard score variables (i.e., EVT-2, PPVT-4, CELF-5 Recalling Sentences, CELF-5 Formulating Sentences, WJ-IV Letter-Word Identification, WJ-IV Passage Comprehension, and the GRMT) were factor analyzed at both fall and spring using a principal axis factor analysis using maximum likelihood estimation. Fall and spring means and standard deviations on each of the seven variables are provided in Table 2. Following the guidelines for conducting exploratory factor analyses using maximum likelihood that was set forth by Fabrigar et al. (1999), we used multiple indicators (i.e., root-mean-square

error of approximation, parallel analysis, and variance accounted for by the factors) to determine the number of factors to retain. For both fall and spring assessments, three factors emerged. The three-factor solutions at both fall and spring showed the same pattern of loadings, with $RMSEA = .03$ for fall, and $RMSEA = .01$ for spring. In both fall and spring, the three factor solution accounted for over 70% of the variance in the seven measures, and the parallel analysis also indicated a three-factor solution at both time points. The first factor had high loadings from EVT-2 and PPVT-4, and we named this vocabulary. CELF-5 Recalling Sentences and Formulating Sentences subtests loaded on the second factor and was named expressive grammar. The third factor had high loadings from the WJ-IV Passage Comprehension and Word Identification as well as the GMRT Reading Comprehension and was named reading. Based upon the results of the factor analysis, we created three composite scores for both fall and spring by z scoring the subtests that represent the constructs and averaged them. The spring composites were created using the means and standard deviations from their respective fall variables, so that growth information would be preserved.

Next, we fit a series of two-level HLM models to predict change in the three composite variables created from the results of the factor analysis. First, we fit three unconditional models that partitioned the variance into between-classrooms and within-classroom between students. For the vocabulary composite, the classroom-level variance was .149 and the within-classroom variability was .866 with an ICC computed to be 17.1%. For the expressive grammar composite, the classroom-level variance was .091 and the within-classroom between students variance was .744 for an ICC of 10.9%. For reading, the between-classroom variance was .135 and the student-level variance was .563 and the ICC was 19.4%. Finally, we added the fall composite scores to the model and investigated whether the relationship between fall and spring composites varied across classrooms. We found significant variability in this relationship for the vocabulary and reading composite but not for the expressive grammar. The relationships between fall and spring outcomes were allowed to vary in the subsequent models.

We then fit 15 models where each of the five teacher-level vocabulary variables were entered into the HLM models as a predictor of one of the three student-level achievement composite variables after controlling for the respective fall composite variable. The fixed effects for these models are presented in Tables 3, 4, and 5. In these models, we were interested in the relationship between teacher vocabulary used during the instructional day and change in the average level of student achievement. The results indicated two relations below a p value of .05.

Table 2. Descriptive statistics of student vocabulary, expressive grammar, and reading achievement.

Measure	Fall			Spring		
	<i>M</i>	Range	<i>SD</i>	<i>M</i>	Range	<i>SD</i>
EVT-2	99.23	20–139	14.59	100.89	53–152	14.10
PPVT-4	103.08	35–146	15.25	104.72	31–158	15.61
CELF-5 Formulating Sentences	10.42	1–19	3.27	11.00	1–19	4.49
CELF-5 Recalling Sentences	10.06	3–18	3.08	10.80	3–19	3.68
WJ-IV Letter-Word Identification	103.28	48–141	15.55	102.58	40–145	14.17
WJ-IV Passage Comprehension	97.34	40–131	12.46	96.28	38–128	11.86
GMRT Reading Comprehension	428.49	308–540	40.39	449.25	349–540	38.22

Note. EVT = Expressive Vocabulary Test. PPVT = Peabody Picture Vocabulary Test. CELF-5 = Clinical Evaluation of Language Fundamentals–Fifth Edition. WJ-IV = Woodcock-Johnson 4th Edition. GMRT = Gates MacGinitie Reading Tests. All scores are standard scores (mean of 100 and an *SD* of 15 for EVT-2, PPVT-4, and WJ-IV; mean of 10 and *SD* of 3 for CELF), except for GMRT Reading Comprehension which uses a scaled score.

Specifically, the proportion of academic words used by the teacher related to change in the vocabulary and reading variables. After controlling for Type 1 error using the linear step-up procedure only the relation between academic word usage and change in vocabulary remained significant. We then examined whether this relationship continued to hold when teacher EVT was added to the model. The proportion of academic words used by the teacher continued to significantly predict student change in vocabulary after controlling for teacher EVT ($p = .011$).

Finally, to address research Question 3, we fit one more HLM model to investigate whether the relation of teacher academic word use and student vocabulary outcomes was moderated by fall student-level vocabulary. This moderation effect was nonsignificant suggesting no differences in the relationship by a student’s initial vocabulary level.

Discussion

In this study, we sought to examine teachers’ word use across the school day and its relationship with student language and literacy outcomes. Our findings indicate second grade students hear thousands of words from the teacher each hour of the school day, including more than a thousand different words on average. Consistent with previous research (Gámez & Lesaux, 2012; Hollo & Wehby, 2017), the large majority (85%) of the words students heard from teachers were the most common words in the English language. The average vocabulary size for a second grader who is a native speaker is approximately 6,000 words (Biemiller, 2005; P. Nation & Anthony, 2017). Thus, having 85% of the words heard from the classroom teacher be within the 4,000 most common words may mean students are limited in the amount of

Table 3. Parameter estimates examining growth in students’ vocabulary by teacher language.

Effects	Estimate	<i>df</i> numerator	<i>df</i> denominator	<i>t</i> statistic	<i>p</i> value
Intercept	0.004	1	59.21	0.366	.716
Fall Vocab	0.819	1	57.05	21.772	.000
NTW/ph	0.00008	1	59.55	0.254	.800
Intercept	0.003	1	55.99	0.181	.857
Fall Vocab	0.818	1	57.01	21.767	.000
NDW/ph	0.00004	1	55.58	0.275	.784
Intercept	0.215	1	55.29	1.034	.305
Fall Vocab	0.818	1	57.02	21.803	.000
Less Common/NTW	–0.927	1	55.26	–0.674	.503
Intercept	–0.129	1	348.57	–1.548	.122
Fall Vocab	0.853	1	62.57	22.917	.000
ACAD/NTW	23.439	1	348.48	2.544	.011
Intercept	0.092	1	70.90	2.205	.031
Fall Vocab	0.857	1	61.00	22.820	.000
CurricVoc/NTW	–3.314	1	74.10	–0.510	.615

Note. NTW = number of total words; ph = per hour; NDW = number of different words; Less Common = number of less common words; ACAD = number of academic words; CurricVoc = number of curriculum vocabulary words.

Table 4. Parameter estimates examining growth in students' reading by teacher language.

Effects	Estimate	df numerator	df denominator	t statistic	p value
Intercept	0.006	1	41.89	0.668	.508
Fall Reading	0.842	1	62.14	35.911	.000
NTW/ph	-0.000003	1	42.37	-0.124	.902
Intercept	0.047	1	41.08	0.374	.710
Fall Reading	0.842	1	62.16	35.922	.000
NDW/ph	0.000003	1	41.54	0.028	.977
Intercept	0.225	1	42.20	1.358	.182
Fall Reading	0.842	1	62.38	35.797	.000
Less Common/NTW	-1.160	1	41.35	-1.058	.296
Intercept	-0.091	1	49.02	-1.316	.194
Fall Reading	0.838	1	61.54	35.490	.000
ACAD/NTW	16.693	1	44.42	2.122	.039
Intercept	0.024	1	40.48	0.802	.427
Fall Reading	0.841	1	61.76	35.867	.000
CurricVoc/NTW	5.473	1	46.99	1.088	.282

Note. NTW = number of total words; ph = per hour; NDW = number of different words; Less Common = number of less common words; ACAD = number of academic words; CurricVoc = number of curriculum vocabulary words.

higher level vocabulary they are exposed to in oral instruction or discussion. However, on average, students were exposed to greater than 500 less common words per hour of school (not necessarily different words). Of more concern, may be the very limited talk that includes academic words or the vocabulary words students are expected to learn in the curriculum for their grade level. This limited vocabulary use was consistent across each of the core content areas. School is the place where students probably have the greatest opportunity to engage with academic language, and knowledge of academic language is linked to academic success (Schleppegrell, 2012; Schuth et al., 2017).

Our findings demonstrate that, at present, students have only limited access on average to academic language or the grade-level vocabulary in the curriculum, during the oral instruction and discussion from their teachers.

Teacher use of academic words and curriculum vocabulary words also had the widest variation across classrooms with standard deviations larger than the overall means. The proportion of academic words used by teachers during the school day significantly predicted students' end of year vocabulary, even after considering students' initial vocabulary ability. Teachers who used more

Table 5. Parameter estimates examining growth in expressive grammar by teacher language.

Effects	Estimate	df numerator	df denominator	t statistic	p value
Intercept	0.235	1	53.14	1.989	.052
Fall Grammar	0.831	1	549.30	36.386	.000
NTW/ph	-0.00002	1	53.03	-0.755	.454
Intercept	0.167	1	50.64	1.040	.303
Fall Grammar	0.833	1	547.40	36.508	.000
NDW/ph	-0.00002	1	50.70	-0.122	.903
Intercept	0.230	1	46.50	1.112	.272
Fall Grammar	0.833	1	546.83	36.522	.000
Less Common/NW	-0.549	1	46.50	-0.398	.692
Intercept	0.104	1	60.92	1.131	.263
Fall Grammar	0.832	1	548.30	36.39	.000
ACAD/NW	5.092	1	55.47	0.496	.622
Intercept	0.185	1	51.82	4.512	.000
Fall Grammar	0.834	1	542.25	36.631	.000
CurricVoc/NW	-6.876	1	53.75	-1.069	.290

Note. NTW = number of total words; ph = per hour; NDW = number of different words; Less Common = number of less common words; ACAD = number of academic words; CurricVoc = number of curriculum vocabulary words.

academic words had students with higher vocabulary achievement at the end of the school year. Thus, exposure to these words in the classroom linguistic environment is related to student's vocabulary learning as is theorized in Bruner's Language Acquisition Support System (Bruner, 1983). This relation also extends previous findings of Gámez and Lesaux (2012), in which a 1 *SD* increase in teachers' use of sophisticated words was associated with a 1.17 point larger end-of-year vocabulary score for middle school students. Of course, we cannot determine from these data whether this relation is causal. Additionally, although more academic language from the teacher was correlated with higher student vocabulary outcomes, the data do not provide an amount of academic language that is optimal for improved outcomes (e.g., filling instruction with academic words would not necessarily mean even higher vocabulary achievement). However, it is likely that school is an important setting for many students to gain knowledge of academic language (Schleppegrell, 2012), and our findings suggest participating in classrooms where this language is used more frequently may be beneficial to student vocabulary.

Further research on teacher and text inputs into student academic language knowledge could provide needed information on how teachers can best support students in their academics. There has been research to suggest that explicit academic language instruction can help students improve academic language just as direct vocabulary instruction can help students improve their vocabulary (Clarke et al., 2010; Snow et al., 2009). However, less information is available regarding more implicit or indirect instruction such as exposure to the classroom teacher's language during the day. The findings of this study suggest further work examining these more indirect aspects of the classroom environment on student achievement in language and literacy is needed.

Importantly, no aspects of teacher word use during the school day were related to students' end of year expressive grammar (language) or reading achievement once statistical correction for the number of models analyzed was conducted. That is, despite the relation between academic word use in the classroom and student vocabulary outcomes, there was no evidence that student reading achievement or expressive grammar at the end of the school year was related to their teachers' word use during the school day (as measured by total words, different words, less common words, academic words, or curriculum vocabulary). Although academic language has been demonstrated to be related to academic outcomes (Schuth et al., 2017; Wong Fillmore, 2004), it is possible that student differences in vocabulary related to classroom differences in academic language use were not large enough to improve their overall linguistic comprehension and

ultimately their reading achievement as The Simple View of Reading theorizes. Similarly, larger vocabulary differences may be needed before the broader grammatical aspects of language are improved to a significant degree. The student vocabulary measures are the measures most targeted to the teacher's vocabulary examined in this study. Reading or grammar outcomes may first be affected by language targeted to the construct of the measure (e.g., teacher's syntactic complexity).

Examining the significant relationship between academic word use and student vocabulary outcomes further, we also noted two additional findings. First, academic word use by teachers continued to predict student vocabulary outcomes even once teachers' expressive vocabulary was considered. In other words, the relationship is not explained by some students having teachers with a higher overall vocabulary. All teachers who used more academic words in their instruction and discussion had students with higher vocabulary at the end of the school year. Second, the relationship was not different for students of varying incoming vocabulary abilities. Students with lower or higher vocabulary in the fall when they entered these classrooms had higher vocabulary outcomes at the end of the year if they were in classrooms with a teacher using a higher proportion of academic words.

Limitations and Future Research

This study is a correlational study of possible malleable targets of instruction that may be related to student language or literacy outcomes. Although classrooms varied substantially in language used by teachers during the school day, only academic word use was identified as a predictor of student outcomes. Thus, our findings suggest future research to further unpack this relationship including the extent to which the relationship is causal and may allow for intervention. Further study of the relationship between teacher language and student language and literacy outcomes at various grade levels and longitudinally would also help the field further understand this relationship. The data used in this study did not allow for consideration of students' utterances or conversational exchanges between a variety of communication partners which could also be of interest in a future study. Additionally, this study did not measure student outcomes in academic vocabulary specifically, so we cannot specifically identify whether teacher academic language use was related to higher outcomes in academic vocabulary. Further research regarding the variation across classrooms in vocabulary use, including academic vocabulary, is also warranted to better understand classroom and teacher characteristics that may relate to the variation. We examined teacher vocabulary level in the model demonstrating the significant

relationship between academic word use and student vocabulary and found it did not change the relationship. However, further research examining the contexts under which teacher vocabulary or language use differs can provide further information on both the significant and nonsignificant relationships noted in this study.

Summary

Overall, this study provides important information regarding teacher language use across early elementary, second grade classrooms. Our findings suggest students experience a variety of language based on the classroom where they are placed. Variations in academic vocabulary use by teachers in the classroom are related to student vocabulary outcomes at the end of the year. This correlational evidence adds to the existing knowledge of the importance of academic language to student school outcomes and provides implications for further research in the area of academic language at the early elementary level.

Data Availability Statement

Data collected for this study are available on request from the first author.

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