Effects of Classroom Vocabulary and Text Reading Instruction on Student Literacy Growth in Grades 4 and 5

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A thesis
submitted in partial fulfillment of the
requirements for the degree of

Master of Education

University of Washington
2013

Committee:
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Program Authorized to Offer Degree:
College of Education

University of Washington

Abstract

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In this study, we examine the relationship between classroom vocabulary and text reading instruction with student literacy gains. We assessed 473 fourth- and fifth-grade students from 24 classrooms across 16 schools in measures of word reading, vocabulary, and reading comprehension in the fall and spring, and each classroom was observed during their literacy block three times at approximately equidistant occasions. Data from these observations were averaged across time to establish average daily time each teacher spent on literacy block content areas. Multilevel model results suggest that time spent on vocabulary instruction has a positive effect on students' word reading and vocabulary gains. In addition, results imply that vocabulary instruction had a greater effect on students' word reading gains when students also received greater amounts of text reading instruction.

Acknowledgements

Research for this study was supported in part by a grant from U.S. Department of Education the Institute of Education Sciences (Grant # R305A100568). I would like to especially thank Elizabeth Sanders, Patricia Vadasy, and Bob Abbott for their input; their knowledge and advice was invaluable during the writing and revising process of this project. I would also like to thank Becky Logan-Herrera for her work coordinating testing and observations; and I thank all of the testers and observers for their work on this project. Finally, I would like to thank the teachers, staff, and children of the schools for their support and participation in the study.

Effects of Classroom Vocabulary and Text Reading Instruction on Student Literacy Growth in Grades 4 and 5

Reading ability is typically measured across the elementary grades in two broad subcategories: word recognition and reading comprehension. In stage models of reading development, by grade four, students use their word recognition skills for the task of reading to learn (Chall, 1983). Reading comprehension, however, is predicted by multiple constructs, and in the later elementary school years, it is predicted by word recognition, fluency, vocabulary, and semantic skills (Anderson & Freebody, 1981; Baumann, 2009; Vellutino Tunmer, Jackard, & Chen, 2007). As students encounter increased volume of reading in the content areas, for example, fluent word reading becomes an important component of reading comprehension; comprehension suffers when a student struggles with inefficient decoding and a slow rate of reading in fourth-grade texts (Breznitz, 2006; Perfetti, 1985).

Vocabulary knowledge also comes to play an increasingly important role in reading comprehension. In fact, it has been found that early vocabulary knowledge is highly predictive of future reading comprehension. Cunningham and Stanovich (1997) found that vocabulary knowledge in first-grade explained 30% of the variance in reading comprehension in eleventh-grade. In addition, vocabulary knowledge builds upon itself. Neuman and Dwyer (2009) state that vocabulary is "cumulative and interactive" (p. 384), indicating that the more word meanings you know, the easier it is to learn new words and understand text. While it is well established that vocabulary knowledge is a crucial component of reading comprehension, the role that classroom instruction plays in vocabulary acquisition has been greatly debated. For example, research by Morrison, Williams, and Massetti (1998) showed that kindergarteners and first-graders of equivalent ages had similar vocabulary levels, suggesting that school instruction had

little influence on vocabulary growth. Others have reported that students gain up to 7% more in word knowledge between October and April than between April and October (Huttenlocher, Levine, &Vevea, 1998). While instruction may help to bolster children's vocabularies, the nature and extent of its influence remains unclear (e.g., Baumann, Kame'enui & Ash, 2003; Beck & McKeown, 1985; Graves, 1986).

Most recently, Silverman and Crandell (2010) conducted a study using observation data from preschool and kindergarten classrooms in order to determine the predictive utility of teachers' vocabulary instructional techniques on children's reading outcomes. They found that providing explicit vocabulary word definitions in multiple contexts positively predicted vocabulary posttest scores for preschool and kindergarten-aged children. In concert with prior research (e.g., Neuman & Dwyer, 2009), the results suggest that defining words during non-read-aloud time seemed to have a greater effect on vocabulary posttest scores for those with *higher* initial vocabulary, indicating that children's current vocabulary level plays a role in how best to teach them. In contrast, "acting out" and illustrating words was found to be positively related to vocabulary posttest scores for those with *lower* initial vocabularies (it had the opposite relationship for those with high initial vocabularies). While these findings shed light on how vocabulary instruction interacts with background vocabulary knowledge, they are specific to younger children and may not hold with older elementary-aged students.

The recent meta-analysis by Elleman, Lindo, Morphy, and Compton (2009) suggests that vocabulary instruction improves reading comprehension when measured with experimenter-designed measures, and that instruction most benefits students with reading difficulties. Findings on the benefits of various vocabulary approaches are important because reading difficulties for children in fourth-grade and beyond remain a pressing problem, particularly for low-income and

minority children (Daane, Campbell, Grigg, Goodman, & Oranje, 2005). Juel (1988) found that, by the end of fourth-grade, poor readers had not achieved the level of decoding skill that good readers had achieved at the beginning of second-grade. She also found that the probability that a child who was a poor reader at the end of first-grade would remain a poor reader at the end of fourth-grade was .88. Biemiller and Slonim (2001) found that, by the fifth-grade, children in the lowest quartile of vocabulary knowledge only reached an average fourth-grade level due to their low vocabularies in grade two. Furthermore, they found that, while schooling appears to allow some catching up across social classes between grades two and five, the difference between those in the highest and lowest quartiles for vocabulary knowledge remains quite large through grade five. These findings indicate that schooling may not reduce differences between those who started school with large vocabularies and those who did not. Penno, Wilkinson, and Moore (2002) reported similar findings on vocabulary growth for first-grade age children who received repeated storybook reading with or without word explanations: neither intervention was adequate to "catch up" the children with lower levels of vocabulary knowledge; furthermore, higher ability students made greater gains in vocabulary knowledge. This troubling information necessitates research which examines how children's reading ability is developed in the middle elementary years and which instructional techniques are effective or adequate to boost knowledge in the lower skilled students. Unfortunately, this research is currently limited.

The present study aims to investigate how classroom literacy instruction for middle-elementary students is linked to child reading outcomes by adopting an observational approach similar to Silverman and Crandell (2010). Specifically, this study will examine how well time afforded to vocabulary and text reading instruction predicts school-year gains in norm-referenced measures of word reading, vocabulary, and reading comprehension.

Research Questions

This study will use fourth- and fifth-grade student and classroom data to answer the following questions.

1. What are the unique effects of classroom time spent on vocabulary instruction and text reading instruction on fourth- and fifth-grade student gains in word reading, vocabulary, and reading comprehension, after controlling for respective pretests?
2. Do these classroom instruction variables interact with one another on student gains? In other words, is the effect of time spent on vocabulary instruction (e.g., being exposed to new words and word meanings) on children's gains bolstered by time spent on text reading instruction (i.e., multiple and varied exposures to words in texts)?

Methods

Participants

Data for the present study were drawn from a larger, 3-cohort, efficacy trial of a classroom vocabulary intervention for fourth- and fifth-graders. To date, data from two of the cohorts are available for analysis (the third cohort is currently ongoing). For each cohort, teachers from local elementary schools were recruited and randomly assigned in the fall to either treatment (30 min daily classroom instruction vocabulary instruction) or control (business as usual classroom instruction) conditions. Students from participating classrooms with parent consent were included in data collection (no information was collected on students whose parents did not provide active consent). For the purpose of this study, only data from the control condition is examined; data from the control condition specifically allow us to examine the relationships between typical classroom instruction (no intervention) and student outcomes. Control data include 473 students (49% of the total sample) in 24 classrooms (51% of the total sample) across

16 schools. All students were between the ages of 9- and 11-years-old during the time of the pretesting, with 257 (54%) fourth-graders and 216 (46%) fifth-graders. The sample comprised approximately equal proportions of males (48%) and females (52%), and primarily native English speaking students (95% native English speakers).

Classroom Literacy Instruction Observations

Procedures. The instrument used to collect observation data is an adapted version of the *Instructional Content Emphasis-Revised* (ICE-R; Edmonds & Briggs, 2003). Trained observers went onsite to each participating fourth- and fifth-grade classroom three times between fall and spring, at approximately equidistant occasions (after student pretesting in the fall, mid-winter, and before posttesting in the spring). It is important to note that this instrument captures observed time teachers spent on instructional content components (not, for example, overall teaching quality). Specifically, time spent in specific literacy content areas was measured for the entire duration of each teacher's literacy block. Each time a teacher switched content type, the observer recorded the content code and the time at which the content code started. To avoid potential drift, observers used timers so that they were reminded every five minutes to check whether the instructional code had changed.

Content Codes. Specific content codes used for this study included six mutually exclusive instructional areas: *Early Literacy* (e.g., phonological awareness instruction, oral language development), *Word Study* (e.g., word reading, spelling, and letter/sound relationship study), *Writing* (e.g., composition, grammar and punctuation study), *Comprehension* (e.g., comprehension strategy instruction, monitoring of reading or listening comprehension), *Vocabulary* (e.g., defining words, morphological analysis instruction), and *Text Reading* (e.g., independent silent reading, teacher reads aloud). Importantly, the present study examines only

the *Vocabulary* and *Text Reading* instructional codes as predictors of student outcomes. *Vocabulary* instruction was defined as any time that the teacher defines words, morphologically analyzes words (e.g., breaks words down into their parts), analyzes other parts of words (e.g., pointing out relationships between words, multiple meanings, etc.), or contextualizes words. *Text Reading* instruction was defined as any time spent in supported oral reading, choral reading, independent silent reading, independent oral reading, teacher read-aloud (students following along or just listening), or fluency instruction.

There were several reasons for the instructional variable selection decision. First, *Vocabulary* is the primary focus of the larger intervention study, and the ICE-R coding scheme for vocabulary captured widely used intentional and direct practices that teachers use to teach and emphasize vocabulary during the literacy block. *Text Reading* was included because it also captured (to some extent) multiple exposures to words in the context of text reading activities which afford opportunities for implicit vocabulary learning. Both of these variables were employed as predictors. The other four instructional codes were not used in these analyses for several reasons: two codes had little time afforded to them due to the higher elementary grade levels of the students (i.e., *Early Literacy* and *Word Study*), one code was poorly captured due to the constraint of the literacy blocks observed (e.g., "writer's workshop" was conducted separately from the literacy block in most classrooms in this district, so time on the *Writing* code was a weak measurement at best), and *Comprehension* was negatively associated (r = -.36) with *Vocabulary* and positively associated (r = .37) with *Text Reading*, which would have made it difficult to test *Vocabulary*'s unique contribution to student outcomes. Inclusion of these codes would have decreased power for testing the focal instructional codes, particularly with a relatively small sample of N = 24 teachers.

Observer Reliability. Three observers (two certified teachers and the Co-PI of the research project) conducted all classroom observations. For each cohort, prior to the onset of observations, observers studied the coding instructions and participated in two formal training sessions. To establish reliability prior to onsite data collection, each observer independently coded videotapes (9 in the first year, and 10 in the second year) of classroom literacy instruction across grades 2-5 (this provided a range of content to be observed). Data from these videotape codings were entered into a database that automatically calculated time on content codes by videotape, by observer. These data were then used to compute internal consistency across observers (Cronbach's alpha) for each content code. Internal consistency was >.99 each year for *Vocabulary* and >.98 each year for *Text Reading*.

Calculation of Variables. Similar to the observer reliability procedures above, data from observations were entered into a database that automatically calculated time (in minutes) spent on each content code for each teacher, for each observation (recall three observations were conducted). Because preliminary data analyses showed no significant linear change in time spent on content areas, content area times across each of the three observations were averaged together for each teacher. As such, the classroom variables used in the present study represent the mean daily minutes teachers spent on classroom literacy content areas.

Student Assessments

The student outcome measures used for the present study include measures of word reading, reading vocabulary, and reading comprehension. Each year, fall (pretest) scores were collected in September and the spring scores (posttest) were collected in May. Students were tested in whole-class format by trained testers (unaware of experimental group assignment in the larger study). To achieve comparability among fourth- and fifth-graders and to control for

normative age-related changes, norm-referenced standard scores were used at each time point for each of the outcomes.

Word Reading. Word reading accuracy was assessed using the norm-referenced *Woodcock Reading Mastery Test-Revised/Normative Update* (WRMT-R/NU) (Woodcock, 1987/1998), Word Identification subtest. The Word Identification test requires students to identify words by reading them aloud to the tester. This test does not assume that the student knows the definition of the word being read; however, it does require the student to read the word fluently. The words in this measure get increasingly difficult and testing is discontinued after the student provides 6 consecutive incorrect responses. Split-half reliability (alternating items) reported in the test manual averages .99 for third-graders and .91 for fifth-graders.

Vocabulary. Students' vocabulary ability was assessed using the norm-referenced *Iowa Test of Basic Skills* (ITBS) Vocabulary subtest. This test "assesses students' breadth of vocabulary and is a useful indicator of overall verbal ability" (Hoover, Dunbar, and Frisbie, 2007). This test requires students to read a word silently in context and then select a word that is close in meaning to that word from four possible choices. Target and distracter words were drawn from The Living Word Vocabulary (Dale & O'Rourke, 1981). Nouns, verbs, and modifiers are given approximately equal representation in the questions. For the sake of simplicity, only the fifth-grade form was used (Form A, Level 11) with all participants. According to the test manual, KR-20 reliabilities (internal consistencies) for this measure average .90 and .88 for fourth- and fifth-grades, respectively.

Comprehension. Students' reading comprehension ability was assessed using the norm-referenced ITBS Reading Comprehension subtest. This test measures students' capabilities as readers (Hoover, Dunbar, and Frisbie, 2007). It requires students to read 8 passages which vary

in content and genre and answer 43 multiple-choice questions based on those passages. Again, only the fifth-grade form was used in this study. According to the test manual, KR-20 reliabilities (internal consistencies) for this measure average .89 and .90 for fourth- and fifth-grade, respectively.

Analytic Approach

Due to the nesting structures (non-independence of data) present in the research design, a multilevel (hierarchical) modeling approach was adopted for testing the research questions. Preliminary analyses with empty (unconditional) models showed no significant or substantive between-school variance (after accounting for between-classroom variance; note also that most participating teachers in the study were at different schools), so the school level was dropped in favor of more parsimonious and statistically powerful two-level models. Specifically, pretest scores, classroom time spent on vocabulary and text reading instruction (Level 2 predictors) were used to explain variation in student pretest-posttest gains (Level 1). Five models (analogous to sequential predictor entry in multiple regression) were conducted for each of the three student outcomes. The first model was an intercept-only model used to determine the intraclass correlations associated with classrooms. In the second model, the respective pretest (at Level 1) was added in order to determine the degree to which initial skills predicted gains. Preliminary analyses showed no differences between fourth- and fifth-graders in the outcomes so students' grade level was not included as a predictor. The third and fourth models added text reading instruction time and vocabulary instruction time as Level 2 predictors, respectively. Finally, the fifth model added an interaction term between vocabulary and text reading instruction time as a predictor. For all models, full maximum likelihood estimation was used, and for ease of results

interpretation, all predictors in Models 2-5 were standardized (z-scores). The final mixed model is as follows.

$$\textit{Pre-Post Gain} = \gamma_{00} + \gamma_{01}*\text{ZPretest} + \gamma_{10}*\text{ZText} + \gamma_{20}*\text{ZVocab} + \gamma_{30}*\text{ZText}*\text{ZVocab} + U_0 + r$$

In the model above, the gain score for the *i*th student in the *j*th classroom is equal to the conditional mean gain across classrooms (γ_{00}), plus the effect of the student-level pretest (γ_{01}), plus the effect of the classroom instruction variables and their interaction (γ_{10}- γ_{30}), plus the between-classroom residual error (U_0) and the within-classroom residual error (r).

Results

Observed Data

The observed data revealed that students in the study received an average of 74.93 (*SD*=17.37) minutes in literacy block instruction per school day. As shown in Table 1 (representing the disaggregated student level observed descriptive statistics and zero-order correlations), an average of 23.89 minutes of students' literacy block time was spent on text reading (32%), and an average of 8.75 minutes was spent on vocabulary instruction (12% of time). The descriptives also show that the mean gains across the academic year in student outcomes ranged from near zero (an average of 0.98 points gain on word reading) to a high of 8.03 points (gain on reading comprehension), with relatively large standard deviations for each indicating a high variability in gains. At pretest, students in the present study averaged in the 75th percentile in word reading (a mean standard score of 110 on the WRMT-R/NU), and averaged within grade six norms in vocabulary and comprehension (mean grade level norms on the ITBS; ITBS standard scores are grade-normed).

Inspection of the zero-order correlations (again Table 1) shows that student gains had small negative relationships with pretests, and overall had no significant relationships with the

instructional variables. The important exception to this is with student vocabulary gains: vocabulary gains had a small but significant negative relationship with classroom text reading instruction time (r = -0.14), and a small but positive relationship with classroom vocabulary instruction time (r = 0.14). In tandem with this finding, the two instructional variables were substantially negatively correlated with each other (r = -0.58), indicating that students who received more time on vocabulary instruction were likely to receive less time on text reading instruction during their typical literacy blocks.

Intercept-Only Models (Model 1)

Intercept-only models (Model 1) were conducted for each of the gain score outcomes in order to estimate unconditional mean gains, variance components, and intraclass correlations(see first columns in Tables 2-4). Results from these baseline models showed that there was significant between-classroom variance in word reading and vocabulary gains, but not comprehension gains. The intraclass correlations, calculated as classroom variance divided by the total variance (classroom + residual variance), revealed that classroom membership accounted for 12% of the variance in student word reading gains, 5% of the variance in vocabulary gains, and 1% variance in the comprehension gains.

Results for Word Reading Gains (Models 2-5)

Across all models, the students' mean predicted gain for word reading from fall to spring for this sample of fourth- and fifth-graders was approximately one point (see intercept values in Table 2). Across models 2-5, pretest was negatively predictive of gains: for every standard deviation increase in pretest, there was an expected decrease in gains in word reading by approximately two points. This is not surprising given that children who started out higher in the fall would have less room to make gains than children who started out lower. More interestingly,

results showed that classroom time spent on vocabulary instruction positively predicted word reading gains (in the final model, for every standard deviation increase in vocabulary instruction time, there was an expected increase of 0.88 points in word reading gains, holding all else constant). Although results did not show a significant main effect of text reading instruction time on student gains, it did interact with vocabulary instruction. In essence, vocabulary instruction time's effect on student gains was moderated by text reading instruction time. As shown in the Figure 1 (which illustrates the model-implied student gains by levels of text reading and vocabulary instruction time), vocabulary instruction had greater positive effects on student Word Reading gains when students also received higher amounts of text reading instruction.

Results for Vocabulary Gains (Models 2-5)

Across all models, students' mean gain for vocabulary was approximately six points (see intercept values in Table 3). Similar to the results for word reading, across models 2-5, vocabulary pretest was negatively predictive of vocabulary gains: for every standard deviation increase in pretest, there was an expected decrease in gains by approximately two points. These results also showed that classroom time spent on vocabulary instruction positively predicted vocabulary gains (in the final model, for every standard deviation increase in vocabulary instruction time, there was an expected increase of 1.63 points in gains, holding all else constant). We did not, however, see a significant effect of text reading instruction time on student vocabulary gains, nor did it interact with classroom time on vocabulary instruction.

Results for Comprehension Gains (Models 2-5)

Across all models, the mean gain for comprehension was approximately eight points (see intercept values in Table 3). Similar to the results for the previous two outcomes, pretest was negatively predictive of gains: for every standard deviation increase in pretest, there was an

expected decrease in comprehension gains by approximately two points. However, in contrast with the previous two outcomes, we did not find a significant effect of vocabulary instruction on students' comprehension gains.

Discussion

The present study investigated whether two classroom literacy instruction components – time afforded to vocabulary and text reading during the typical classroom literacy block – predicted fall-spring gains in fourth- and fifth-grade students' word reading, vocabulary, and reading comprehension skills. As part of the analysis, pretest (fall) skill levels were found to be significant negative predictors of student growth. One part of the reason behind this may be that standard scores (age-adjusted) were used in the analysis; thus, students who started out with higher skills may not have developed skills at a pace matching their change in age over the course of the study year. Another perhaps more likely reason behind this finding is that students may have had less room to grow since most the students in the current study were above grade level on reading skills. In any case, the finding for vocabulary gains in particular is somewhat inconsistent with the prior research that has indicated that differences between children with high and low vocabulary skills tend to remain constant through fifth grade (e.g. Biemiller & Slonim, 2001).

More interestingly, classroom vocabulary instruction time was in fact found to be significantly (uniquely) predictive of gains in both word reading and vocabulary, even after controlling for classroom text reading time. This is consistent with Silverman and Crandell's (2010) finding in younger classrooms, and suggests that classroom time devoted to vocabulary may very well bolster students' word reading and vocabulary knowledge. Although neither classroom instruction variable predicted comprehension gains, it is well established that gains in

vocabulary eventually predict comprehension gains. As such, perhaps the gains that students in the present study made just were not enough of a gain to trickle into comprehension gains.

While this study is correlational and therefore causal inferences cannot be drawn about the classroom and student relationships findings, the results do suggest that, although vocabulary instruction in middle elementary classrooms is somewhat limited (8.75 minutes per day, on average, for these fourth- and fifth-graders), it does appear to be linked to increases in both word reading and vocabulary skills. It is encouraging that teachers' current vocabulary instruction is effective; however, this also suggests that teachers should be spending more time in this area.

Although no main effects were seen for text reading instruction, it served as a moderator for vocabulary instruction gains in Word Reading. This indicates that while text reading instruction alone is not necessarily beneficial, it can aid in word reading ability when provided in the context of vocabulary instruction, and this is supported by the interrelationships among the semantic, phonological, and orthographic word features of words (Adams, 1990; McClelland & Rumelhart, 1986). One interpretation of this is that children benefit more from vocabulary instruction when they have repeated exposure to these words, their spellings, pronunciations, and meanings in multiple and varied contexts.

Limitations

As with any study, the present study has noteworthy limitations. One such limitation is that classrooms were chosen from a convenience sample with above-average readers, which limits the generalizability of these findings to similar populations. Additionally, the majority of students in this study were native English speakers (95%), giving us little information on how instructional variables may affect gains for English language learners, an extremely vulnerable and growing population. Third, although our student sample size was quite large, the teacher

sample size was relatively small (*N*=24), limiting our power to detect significant effects. Nonetheless, the sample was large enough to identify several interesting effects.

Perhaps the most important limitation (and basis for future research) is that the present study employs classroom observation data focused on time-on-task (or content), rather than teacher-student interactions (or engagement), or other teacher quality indicators (such as content sequencing). For example, Biemiller and Slonim (2001) found that children in the elementary years learn words in roughly the same order. Their finding implies that there are specific words that should be taught in each grade level—words that are on the natural trajectory of what students are learning. The vocabulary words being taught in the classrooms in this study may not have been appropriately chosen. They may have been too simple or too advanced for many of the children. Additionally, the National Reading Panel (NICHD, 2000) identified features of research based vocabulary instruction, including direct instruction of word meanings, effective use of context, repetition and multiple exposures, active student engagement, and instruction that adds to the efficacy of incidental learning. The classroom observation system employed in the present study was not able to identify whether the teachers in this study utilized recommended (effective) vocabulary teaching practices.

This is also true for text reading instruction. For example, during silent reading time, which takes up a large percentage of text reading instruction time, students may or may not actually be reading. Evaluating student engagement in independent activities such as silent reading is a challenge for classroom observation studies. Additionally, the text being read by students during these times may not have been appropriately leveled. The classroom observation measure used in this study had a very narrow focus on teaching dimensions that did not include these possibly important quality and engagement variables. Nevertheless, the present study may

indicate the extent to which good instructional techniques are being used by showing the effects of instruction on student gains.

Conclusion

Researchers have focused increasing attention on how to close the gap in reading ability between skilled and struggling readers. Beginning in the early elementary grades, reading instruction for struggling students, particularly those from minority or low-income households, should include instruction in carefully chosen words. There has been a growing awareness of the importance of vocabulary instruction (NICHD, 2000), and the features of effective vocabulary selection and instruction (McKeown & Beck, 2011; Nagy & Hiebert, 2011). The extent to which this research is being translated into classroom practice is less clear. The present study examined the role of vocabulary instruction and text reading instruction time in the growth of reading skills in fourth- and fifth-grade classrooms. It appears that, while relatively little time was dedicated to vocabulary instruction during these classrooms' literacy blocks, this aspect of literacy instruction uniquely predicted both vocabulary and word reading growth. Further, its effects were bolstered when combined with greater text reading instruction. Future research may examine how balancing and integrating both of these instructional content areas could best impact student reading skills.

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Table 1.

Observed Descriptives and Zero-Order Correlations Disaggregated (Student Level)

Variable	*M*	*(SD)*	*N*	1.	2.	3.	4.	5.	6.	7.	8.
Pre-Post Gains											
1. Word Reading (WR)	0.98	(7.01)	472	--							
2. Vocabulary (Vocab)	6.16	(13.05)	469	.01	--						
3. Comprehension (Comp)	8.03	(16.59)	470	.04	.09	--					
Student Predictors											
4. WR pretest	109.84	(11.32)	472	-.30**	.06	.11*	--				
5. Vocab pretest	221.88	(26.05)	470	-.04	-.10*	.11*	.60**	--			
6. Comp pretest	226.63	(29.62)	471	-.07	.13**	-.12*	.52**	.81**	--		
Classroom Predictors											
7. Text Read Instr Time	23.89	(11.69)	473	.05	-.14**	-.01	-.04	-.01	-.07	--	
8. Vocab Instr Time	8.75	(7.40)	473	-.02	.14**	.02	.13**	.15**	.20**	-.58**	--

Note. N=473 students from *N*=24 teachers. Word Reading = standard score of the Word Identification subtest of the WRMT-R/NU; Vocabulary = standard score of the Vocabulary stubtest of the the Iowa Test of Basic Skills (ITBS); Comprehension = standard score from the ITBS Comprehension subtest; Text Read Instr Time = average daily minutes spent on text reading instruction during literacy block; Vocab = average daily minutes spent on vocabulary instruction during literacy block.

* $p < .05$, ** $p < .01$.

Table 2.

Model Results for Student Word Reading Gains

	Model 1					Model 2					Model 3					Model 4					Model 5				
Fixed Effects	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*
Intercept (Mean Gain)	1.13	0.57	1.93	23	.061	1.09	0.54	2.02	23	.056	1.08	0.53	2.03	22	.055	1.09	0.53	2.06	21	.052	1.54	0.58	2.65	20	.015
Pretest						-2.06	0.31	-6.57	448	<.001	-2.06	0.31	-6.70	448	<.001	-2.08	0.31	-6.73	448	<.001	-2.07	0.31	-6.71	448	<.001
Text Instr Time											0.28	0.40	0.70	22	.493	0.57	0.47	1.22	21	.237	0.60	0.44	1.35	20	.193
Vocab Instr Time																0.54	0.47	1.17	21	.255	0.88	0.42	2.11	20	.048
Text * Vocab																					0.89	0.31	2.59	20	.018
Random Effects	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*
Classrooms	5.90		84.14	23	<.001	4.85		80.25	23	<.001	4.78		79.31	22	<.001	4.61		77.81	21	<.001	3.98		70.59	20	<.001
Residual (Students)	43.52					39.94					39.94					39.93					39.93				
No. Param	2					4					5					6					7				
Deviance (-2LL)	3148					3109					3109					3108					3106				

Note. N=473 students from *N*=24 teachers. Word Reading = standard score of the Word Identification subtest of the WRMT-R/NU; Text Read Instr Time = average daily minutes spent on text reading instruction during literacy block; Vocab = average daily minutes spent on vocabulary instruction during literacy block.

Table 3.

Model Results for Student Vocabulary Gains

	Model 1					Model 2					Model 3					Model 4					Model 5				
Fixed Effects	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*
Intercept (Mean Gain)	6.11	0.82	7.46	23	<.001	6.06	0.90	6.72	23	<.001	6.10	0.80	7.61	22	<.001	6.11	0.77	7.90	21	<.001	5.98	0.82	7.25	20	<.001
Pretest						-1.98	0.79	-2.52	448	.012	-1.84	0.77	-2.39	448	.017	-2.05	0.77	-2.67	448	.008	-2.07	0.77	-2.70	448	.007
Text Instr Time											-1.80	0.93	-1.94	22	.065	-0.86	1.02	-0.84	21	.409	-0.86	1.02	-0.85	20	.406
Vocab Instr Time																1.72	0.60	2.87	21	.009	1.63	0.70	2.33	20	.030
Text * Vocab																					-0.25	0.84	-0.30	20	.771
Random Effects	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*
Classrooms	8.27		46	23.00	.003	11.47		58	23.00	<.001	7.44		46.61	22	.002	8.67		43.55	21	.003	9.45		43.4	20	.002
Residual (Students)	162					157					158					158					158				
No. Param	2					4					5					2					2				
Deviance (-2LL)	3732					3722					3718					3710					3710				

Note. *N*=473 students from *N*=24 teachers. Vocabulary = standard score of the Vocabulary stubtest of the the Iowa Test of Basic Skills (ITBS); Text Read Instr Time = average daily minutes spent on text reading instruction during literacy block; Vocab = average daily minutes spent on vocabulary instruction during literacy block.

Table 4.

Model Results for Student Comprehension Gains

	Model 1					Model 2					Model 3					Model 4					Model 5				
Fixed Effects	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*	*Coeff*	*SE*	*t*	*df*	*p*
Intercept (Mean Gain)	7.99	0.80	9.99	23	<.001	7.95	0.89	8.89	23	<.001	7.95	0.89	8.92	22	<.001	7.97	0.88	9.03	21	<.001	8.16	0.97	8.42	20	<.001
Pretest						-2.27	0.88	-2.57	448	.010	-2.27	0.92	-2.47	448	.014	-2.41	0.90	-2.67	448	.008	-2.40	0.91	-2.65	448	.008
Text Instr Time											-0.28	1.00	-0.28	22	.782	0.29	1.14	0.25	21	.802	0.30	1.12	0.27	20	.790
Vocab Instr Time																1.06	0.77	1.38	21	.182	1.21	0.71	1.71	20	.104
Text * Vocab																					0.35	0.69	0.51	20	.616
Random Effects	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*	*Var*		*chi*	*df*	*p*
Classrooms	2.03		27.63	23	.230	5.54		35.67	23	.044	5.37		35.49	22	.034	5.31		35.12	21	.027	5.15		34.89	20	.021
Residual (Students)	273.35					265.61					265.68					265.21					265.26				
No. Param	2					4					5					6					7				
Deviance (-2LL)	3970					3966					3965					3965					3964				

Note. N=473 students from *N*=24 teachers. Comprehension = standard score from the ITBS Comprehension subtest; Text Read Instr Time = average daily minutes spent on text reading instruction during literacy block; Vocab = average daily minutes spent on vocabulary instruction during literacy block.

Figure 1. Illustration of model-predicted values for interaction between vocabulary instruction time and text reading instruction time on word reading gains.