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Differential effects of a systematic vocabulary intervention on adolescent language minority students with varying levels of English proficiency

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Abstract

The purpose of this study was to understand the reading performance of subgroups of language minority students and examine whether a research-based academic vocabulary intervention, Word Generation, has differential effects on these students' academic vocabulary knowledge. Thirteen middle schools, propensity-score matched based on their achievement and demographic data, were randomly assigned to either treatment (n = 3,539) or control (n = 2,630) conditions. Students in both conditions were classified as either English-only (EO) or language minority students. The language minority students were further grouped as either being initially fluent English proficient (IFEP), redesignated fluent English proficient (RFEP), or limited English proficient (LEP). Multivariate analysis of variance and hierarchical linear models revealed three important findings. First, while LEP students' scores on reading measures were significantly below those of the EO students, RFEP students' scores were comparable to EO students' scores. In addition, IFEP students' scores were higher than those of the EO students. Second, there were variations within the RFEP students when they were disaggregated by time since redesignation; RFEP students' reading scores were positively correlated with time since redesignation. Third, the treatment effect emerged only as an interaction with RFEP status.

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This study suggests that the benefits of a research-based intervention may vary according to students' level of English proficiency.

Keywords
Adolescent, language minority learners, academic vocabulary, reading profiles, vocabulary intervention

Introduction

There is a strong interest in the educational outcome of language minority students in the United States, but the majority of research on these students' educational attainments has focused on one subgroup: those language minority students with limited English proficiency. Much less is known about language minority students who are classified as fully English proficient, either initially (at school entry) or after some period of bilingual or English-as-a-second-language (ESL) education at school. Language minority students qualify as fully English proficient based on test scores, but may still show somewhat different patterns of skills and weaknesses to those of English-only (EO) classmates in mainstream classrooms. This paper examines different performance profiles of students within the language minority population and investigates whether they respond similarly or differently to an academic vocabulary intervention, Word Generation.

Literature review

Heterogeneity of language minority learners

Language minority learners are school-aged students in the United States who hear or speak a language other than English at home (August & Shanahan, 2006) and are classified based on their mastery of English (Ragan & Lesaux, 2006): initially fluent English proficient (IFEP), limited English proficient (LEP), or redesignated fluent English proficient (RFEP). IFEP students are those who have gained full English proficiency by the time they enter school and thus do not qualify for extra language learning support. LEP students are those who are still in the process of developing English proficiency and receive additional support for English language acquisition from their school or school district. RFEP students are students who, after having received support for their English language development for some period, are subsequently redesignated as having achieved a minimum competence in English such that they can continue their school attendance without additional support that targets their English development.

All students are asked to fill out a home language survey when they enter school. Generally, students are classified as language minority students when they report in this home language survey that they speak or hear a language other than English at home. Once they are classified as language minority students, they are then required to take an English proficiency test. Those who pass it are classified as IFEP and those who do not are considered LEP. These LEP students take the English proficiency test annually, and when they do well on that test, state standards test, and teacher interview, they can then be classified as RFEP. If they do not show appropriate performance in these measures, they remain as LEP. With the lack of specific guidance from the federal level, states and districts showed variability on measures they use to (re)classify LEP students, in tracking how reclassified students perform in mainstream classrooms, and so forth (Abedi, 2008; Ragan & Lesaux, 2006).

Although there are large numbers of students in each of these categories in virtually every large urban district in the United States, the English language learner (ELL) category often only includes LEP students. Relatively little is known about the profiles of IFEP and RFEP students. This represents a major weakness in our understanding of ELLs in the United States, especially given the large numbers of students that are currently designated as IFEP and RFEP. Currently, there are approximately 11 million language minority students in the United States, about 5.3 million of whom are classified as LEP (Aud et al., 2011). Although LEP students tend to fall behind their EO peers in reading and writing achievement (National Center for Education Statistics, 2011, 2012), less is known about how the approximately five million IFEP and RFEP students perform in comparison to their EO counterparts.

Language minority learners are a heterogeneous group with respect to their reading achievement (Mancilla-Martinez et al., 2011; August & Shanahan, 2006; Kieffer, 2008, 2011). Kieffer (2008, 2011) contrasted reading growth trajectories of IFEP, RFEP, and LEP students with those of EO students, from kindergarten until fifth or eighth grade. Using the Early Childhood Longitudinal Data-Kindergarten cohort (Tourangeau, Lê, & Nord, 2005), Kieffer found that the average reading growth trajectory of language minority students who entered kindergarten proficient in English (that is, IFEP) was indistinguishable from that of their EO peers. Language minority students who entered school with limited English oral proficiency (that is, LEP) grew more slowly in their reading scores than their EO counterparts on average. The reading achievement gap between these two groups grew larger throughout elementary and middle school. Interestingly, LEP students who were reclassified earlier were less likely to fall behind EO students. Similarly, Mancilla-Martinez and her colleagues (2011) found that the reading achievement of fifth grade language minority students predicted their reading comprehension in seventh grade. Although Mancilla-Martinez and her colleagues classified students according to their baseline reading achievement, we would expect to see similar relationships between early student classification and later reading outcomes if classification processes are related to literacy outcomes (as we would expect).

Importance of academic vocabulary knowledge

Whereas language minority students typically develop basic linguistic skills such as decoding and phonological awareness along a trajectory similar to EO students, the acquisition of higher-level language skills, such as vocabulary knowledge and general language comprehension, tends to lag behind that of their EO counterparts (see August & Shanahan, 2006 for a comprehensive review). This is particularly problematic for adolescent students since the relative importance of higher-order language skills increases as children move from scholastic environments that focus on *learning to read* in elementary school to environments where they are more typically challenged with *reading to learn* about content in math, science, social studies, mathematics and English classes (Chall & Jacobs, 2003).

In order for students to access the curriculum in the different subject areas, students must understand the language that appears in academic texts (Snow & Uccelli, 2009; Nagy & Townsend, 2012; Scarcella, 2003; Schleppegrell, 2001, 2004). Academic language differs from daily, conversational language in various ways (Author, 2010; Collier & Thomas, 1989; Cummins, 1979, 1981). It tends to use complex language structures, has a higher proportion of low frequency vocabulary, includes nominalization of verbs and abstract nouns, and makes less use of personal pronouns (for example, ‘I’ and ‘we’).

All students must develop a stronger capacity to comprehend and use academic language in order to learn new concepts in school. However, previous research has shown that language

minority students, especially those who are still acquiring the English language, struggle at this task. For instance, in a longitudinal analysis of academic English proficiency outcomes for US- and foreign-born adolescent LEP students, Slama (2012) found that both groups of LEPs had relatively low levels (for example, early intermediate) of academic English proficiency when they entered high school and their academic language skills did not reach the proficient level by the end of 11th grade. Considering that US-born LEPs, 60% of the total sample in this study, had received at least nine years of schooling in the United States, the fact that they did not reach proficiency suggests specific interventions that support academic language development are needed for these students. These findings demonstrate that a large number of adolescent language minority learners struggle at acquiring high levels of academic English proficiency, which may prevent them from gaining content-area knowledge and graduating from high school.

Vocabulary skill is a prerequisite to academic language that may be amenable to targeted intervention (National Institute of Child Health and Human Development, 2000). Academic vocabulary encompasses two types of words: general and discipline-specific (Beck, McKeown, & Kucan, 2002; Nagy & Townsend, 2012). General academic vocabulary consists of high-leverage words that appear across multiple disciplines (Beck, McKeown, & Kucan, 2002; Corson, 1997; Coxhead, 2000; Nagy & Townsend, 2012), such as *assess*, *invoke*, and *eliminate*, whereas discipline-specific vocabulary words – for example, *hypotenuse* and *zeitgeist* – are tied to specific disciplines (Chung & Nation, 2003). Unlike discipline-specific words, such as *photosynthesis*, which reference essential concepts that are necessarily taught during relevant content-area instruction, general academic words are abstract and not tied to discipline-specific concepts or constructs.

Though various intervention studies have shown success in supporting students to learn academic words, only a handful have demonstrated effectiveness for language minority students in the middle grades (Carlo et al., 2004; Snow, Lawrence, & White, 2009; Proctor et al., 2001; Lawrence et al., 2012; August, Branum-Martin, Cardenas-Hagan, & Francis, 2009; Lesaux, Kieffer, Faller, & Kelley, 2010; Townsend & Collins, 2009; Vaughn et al., 2009). In their study on the effectiveness of an after-school program for Spanish-speaking middle school LEP students, Townsend and Collins (2009) showed that a well-designed research-based intervention can be beneficial for enhancing academic vocabulary knowledge of language minority students. In other studies (August et al., 2009; Lesaux et al., 2010; Proctor et al., 2011), researchers found that the effects of their treatment did not differ according to the language minority status of the students. Both EO and language minority students benefitted equally from the intervention. However, none of these studies looked extensively at the difference in effectiveness for students classified as IFEP, RFEP, or LEP.

Word Generation. Word Generation is a research-based academic vocabulary intervention for middle school students that explicitly teaches five general academic vocabulary words chosen from the Academic Word List (Coxhead, 2000) each week (Snow et al., 2009). The target words are presented in a context of weekly featured controversial topics. Throughout the week, students are encouraged to read, talk, and write about the weekly topic using the target vocabulary words through the activities that are distributed over the content area classrooms (that is, English language arts, mathematics, science, and social studies) for 15–20 minutes. The weekly topics consist of diverse range of issues that may be of interest to middle school students (for instance, 'Should you be able to rent a pet?', 'Should there be federal funding for stem cell research?'). A sample weekly sequence would look like this: on Monday, the English language arts teacher introduces five target words that are embedded in a passage related to the weekly topic. On Tuesday, students

are asked to calculate math problems that are related to the weekly topic. These word problems have the target words embedded in them. On Wednesday, students are encouraged to think like scientists. They are given scenarios, research questions, and hypotheses to promote their scientific reasoning and are asked to engage in a scientific discussion using the target words. On Thursday, discussion about the weekly topic is held in a social studies classroom. With the social studies teacher as a moderator, students will take a position about the issue and engage in a discussion using the target words. On Friday, students write a short essay about their position in an English language arts class. Word Generation is a free program that is available online and more details about whole program are available at: www.wordgeneration.org.

There were three noteworthy findings from the quasi-experimental and randomized efficacy studies of Word Generation. First, those classes that participated in the Word Generation improved in the quality of their classroom discussion, which in turn positively influenced students' academic vocabulary knowledge (Lawrence, Crosson, Paré-Blagoev, & Snow, in press). Second, researchers found that while all students benefitted from the program, the treatment effects were stronger for language minority than EO students (Snow et al., 2009). Third, although English-proficient language minority students gained more academic vocabulary knowledge compared to their EO peers, limited English-proficient students did not benefit much from the program (Lawrence et al., 2012).

The current study builds on this work using data from a large scale randomized trial to unpack the academic profiles of students in different language groups and how intervention effects vary for students with different levels of skill and schooling histories. The research questions that will be addressed in this paper are the following:

1. What are the reading profiles, as indicated by academic vocabulary and reading comprehension, of EO, IFEP, RFEP, and LEP students?
2. What are the reading profiles, as indicated by academic vocabulary and reading comprehension, of RFEP students at different years since redesignation?
3. Is there a heterogeneous effect of Word Generation on the academic vocabulary knowledge of EO, IFEP, RFEP, and LEP students?
4. Is there a heterogeneous effect of Word Generation for RFEP students' academic vocabulary knowledge depending on the number of years they have been redesignated?

Methods

Participants

Thirteen middle schools in a large urban district in California were randomized to either treatment or control conditions for this study. Before randomization was conducted, schools were ranked on a series of school-level variables: percent minority, percent free and reduced lunch, percent ELLs, and prior mean achievement using state accountability data. We used propensity score matching to form a composite of these variables and then ranked the schools based on that composite. In order to maximize comparability of treatment and control schools each sequential pair of schools formed a dyad within which randomization occurred. The seven schools that were assigned to the treatment condition incorporated Word Generation program in their curriculum and students in the six schools in the control condition continued to receive 'business as usual' instruction. Word Generation was implemented in seven schools in this district during the 2010–2011 academic year.

English proficiency status. The district in this study provided detailed information about participating language minority students, differentiating IFEP (those who had gained full English proficiency by

Table 1. Number of students included in the final model by English proficiency status in treatment and control schools.

Treatment condition	Grade level	English proficiency status				
		EO	IFEP	RFEP	LEP	Total
Treatment schools	6th	441	107	428	202	1,178
	7th	435	128	413	174	1,150
	8th	414	136	485	176	1,211
	All	1,290 (36%)	371 (11%)	1,326 (37%)	552 (16%)	3,539
Control schools	6th	259	71	344	159	833
	7th	219	78	410	142	849
	8th	252	111	431	154	948
	All	730 (28%)	260 (10%)	1,185 (45%)	455 (17%)	2,630
Total		2,020 (33%)	631 (10%)	2,511 (41%)	1,007 (16%)	6,169

Note: EO = English-only; IFEP = Initially fluent English proficient; RFEP = Redesignated fluent English proficient; LEP = Limited English proficient

Table 2. Number of redesignated fluent English proficient students by years of redesignation in treatment and control schools.

Number of years since redesignation	Treatment schools	Control schools	Total
Less than 1 year	237 (21%)	184 (16%)	421 (19%)
Less than 2 years	379 (33%)	374 (33%)	753 (33%)
Less than 3 years	208 (18%)	213 (19%)	421 (19%)
More than 3 years	309 (27%)	352 (31%)	661 (29%)
Total	1,133	1,123	2,256

the time they entered school), RFEP (those originally classified as LEP who attained sufficient English proficiency to be reclassified), and LEP (those whose limited English proficiency continued to qualify them for language support). Those who were not language minority learners were classified as EO students. In California, in order for LEP students to be eligible for redesignation, they need to obtain either *early advanced* or *advanced* on the California English Language Development Test (CELDT), which assesses students' overall English proficiency, and proficient or advanced on the California Standards Test (CST, www.cde.ca.gov) English language arts test. LEP students take the CELDT annually until they are redesignated. All students in California take the CST for the first time at the end of second grade. Thus, LEP students can be reclassified as early as the middle of third grade when the second grade CST scores are available.

Table 1 describes the number of students in each English proficiency status by grade levels in both treatment and control schools. Although a similar number of schools was assigned to treatment ($n = 7$) and control ($n = 6$) conditions, there were more students enrolled in treatment *(*$n = 3,539$) than control ($n = 2,630$) schools. In both conditions, there was a comparable representation of sixth, seventh, and eighth grade students. There were comparable percentages of IFEP and LEP students in both treatment and control schools; however, there was greater representation of EO students in the treatment condition and more RFEP students in the control condition.

Designation year. In addition to information on language minority learners' English proficiency status, the district also provided the specific dates when RFEP students were redesignated. We were able to use these data to identify how long students had been in mainstream classrooms at the start of this study. Table 2 presents the number of RFEP students by years of redesignation in treatment (n = 1,133) and control (n = 1,123) schools. A similar proportion of students were redesigated within two to three years across the treatment condition. While there were higher percentage of RFEP students who were redesignated less than one year ago in the treatment condition, there was a slightly higher proportion of RFEP students reclassified more than three years in the control condition.

Measures

Treatment. A dummy variable for treatment identified students who attended a Word Generation school (TREAT = 1) and those who did not (TREAT = 0). Seven schools in the treatment condition implemented the Word Generation program in their curriculum and six schools in the control condition continued 'business-as-usual' instruction. TREAT is a school-level predictor in our analysis.

English proficiency status. Dummy variables for EO, IFEP, RFEP, and LEP students were used as student-level predictors in our analysis.

Years since redesignation. Dummy variables for RFEP students who were reclassified less than one year ago (REDESIGNATE1), less than two years ago (REDESIGNATE2), less than three years ago (REDESIGNATE3), and more than three years ago (REDESIGNATE4) were created.

Academic vocabulary

Academic vocabulary knowledge (individual score). We measured students' academic vocabulary knowledge with a 50-item multiple-choice test that was developed by the research team. Of the 50 items, 40 were randomly chosen from the words that were taught in that academic year through the Word Generation curriculum. For each item, the target word was embedded in a short sentence and students were asked to choose a synonym for the target from four choices. The same academic vocabulary test form was administered in September/October (pre-test) and May (post-test).[1] The variables (WGV_W1 and WGV_W2 for pre- and post-test, respectively) reflect raw scores based on correct number of items on taught words (n = 40). We used students' total scores on the post-test of this assessment as an outcome variable in our analyses. WGV_W2 scores ranged from 1 to 40 with a mean of 24.77 and standard deviation of 8.91.

Academic vocabulary knowledge (school mean). Mean academic vocabulary test scores for each school were used to create a level-2 pre-test covariate WGV_SM_W1. The variable was created using only the scores of students who completed both pre- and post-test. The WGV_ SM_W1 scores ranged from 16.28 to 24.25.

Academic vocabulary knowledge (school mean centered). School mean centered scores (WGV_SMC_ W1) were created by finding the difference between the individual score of each student and the mean score of the school that the student attended (WGV_SMC_W1 = WGV_ W1 - WGV_SM_ W1). WGV_SMC_W1 ranged from -22.33 to 21.66.

Reading comprehension

Reading comprehension (individual score). The Gates-MacGinitie Reading Test (MacGinitie, MacGinitie, Maria, & Dreyer, 2000) is a group-administered reading assessment that includes comprehension and vocabulary subtests. The level 6 Form T was administered to sixth grade students and the level 7/9 Form T was given to seventh and eighth grade students. The Gates-MacGinitie Comprehension pre-test (GMPC_W1) was administered in September/October. Extended scale scores on comprehension subtest were used for our analysis.

Reading comprehension (school mean). We used mean extended scale scores for each school at pre-test to create a school-level covariate, GMPC_SM_W1. The GMPC_SM_W1 scores ranged from 488.17 to 535.90.

Reading comprehension (school mean centered). School mean centered scores (GMPC_SMC_W1) were created by finding the difference between individual scores of each student and each mean score of the school in which the student attended (GMPC_SMC_W1 = GMPC_W1 - GMPC_SM_W1). GMPC_SMC_W1 scores ranged from -164.33 to 129.94.

Covariates

Grade level. All students were from either sixth, seventh, or eighth grade. To control for different grade levels in the analysis, dummy variables were created for grade seven (GRADE_7) and grade eight (GRADE_8). Sixth grade students were used as the reference group.

Special education status. A dummy variable was created to indicate students who were receiving special education (SPED = 1) and those who were not (SPED = 0).

Gifted and talented education status. A dummy variable was created to indicate students who were receiving gifted and talented education (GATE = 1) and those who were not (GATE = 0).

Analysis plan

To answer our first and second research questions about the different reading profiles of students by English proficiency status, we examined all students' academic vocabulary and reading comprehension pre-test scores, regardless of their treatment status, and conducted a series of multivariate and univariate analysis of variance (ANOVA) to investigate any significant difference in test scores among groups of students. To address our third and fourth research questions about heterogeneous treatment effects of participating in the Word Generation program, we used multilevel regression analyses, regressing students' academic vocabulary post-test scores on (1) treatment condition and students' English proficiency status and the interactions between them and (2) treatment condition and RFEP students' years they have been redesignated and the interactions between them. Our basic hypothesized models are the following:

Level-1:

$$\begin{aligned} WGV\_W2_{ij} = {} & \beta_1 + \beta_2 \mathrm{WGV\_SMC\_W1}_{ij} + \beta_3 \mathrm{GMPC\_SMC\_W1}_{ij} + \beta_4 \mathrm{Grade7}_{ij} + \\ & \beta_5 \mathrm{Grade8}_{ij} + \beta_6 \mathrm{GATE}_{ij} + \beta_7 \mathrm{SPED}_{ij} + \varepsilon_{ij} \end{aligned} \quad (1)$$

Table 3. Means and standard deviations of pre-test scores of academic vocabulary and reading comprehension for all students.

	6th			7th			8th			All		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*N*	*M*	*SD*
Academic vocabulary pre												
EO	700	21.59	8.25	654	23.78	8.76	666	25.85	8.79	2,020	23.71	8.77
IFEP	178	21.7	7.20	206	26.17	6.84	247	27.43	7.33	631	25.40	7.51
RFEP	772	19.67	6.04	823	23.01	6.48	330	25.51	6.08	1,925	22.89	6.84
LEP	361	12.08	4.71	316	13.72	5.82	916	14.85	7.33	1,593	13.50	5.66
Reading comprehension pre												
EO	700	518.93	37.17	654	537.91	39.44	666	546.50	38.38	2,020	534.17	40.02
IFEP	178	523.26	29.08	206	548.31	33.01	247	557.51	33.44	631	544.84	35.03
RFEP	772	516.29	25.21	823	498.14	24.43	330	547.86	27.69	1,925	534.79	29.94
LEP	361	476.58	25.03	316	537.61	27.70	916	504.01	24.41	1,593	492.33	27.39

Note: EO = English-only; IFEP = Initially fluent English proficient; RFEP = Redesignated fluent English proficient; LEP = Limited English proficient. Academic vocabulary is measured by Word Generation Academic Vocabulary Test and reading comprehension by Gates-MacGinitie Reading Test.

Level-2:

$$\beta_1 = \gamma_1 \mathrm{WGV\_TCTR\_SM\_W1}_j + \gamma_2 \mathrm{GMPC\_TE\_SM\_W1}_j + \gamma_3 \mathrm{TREAT}_j + \upsilon_j \quad (2)$$

where $\varepsilon_{ij} \sim \mathrm{N}(0, \sigma_1^2)$, and $\upsilon_j \sim \mathrm{N}(0, \sigma_2^2)$

$\mathrm{WGV\_W2}_{ij}$ is the predicted post-test academic vocabulary score of student i in school j; $\beta_2 \mathrm{WGV\_SMC\_W1}_{ij}$ represents the difference in the predicted post-test academic vocabulary scores associated with the difference in school mean centered academic vocabulary score of student i; β_3 $\mathrm{GMPC\_SMC\_W1}_{ij}$ represents the difference in the predicted post-test academic vocabulary scores associated with the difference in school mean centered comprehension score of student i; β_4 $\mathrm{Grade7}_{ij}$ and β_5 $\mathrm{Grade8}_{ij}$ represent the differences in the predicted post-test academic vocabulary scores associated with students' grade level controlling for other covariates; β_6 GATE_{ij} and β_7 SPED_{ij} represent the differences in the predicted post-test academic vocabulary scores associated with students' designation of gifted and talented education and special education controlling for other covariates; ε_{ij} is the residual error term. β_1 is the adjusted school level average academic vocabulary score in which $\gamma_1 \mathrm{WGV\_TCTR\_SM\_W1}_j$ is the predicted difference in post-test academic vocabulary scores associated with school average pre-test academic vocabulary; $\gamma_2 \mathrm{GMPC\_TE\_SM\_W1}_j$ is the predicted difference in post-test academic vocabulary scores associated with school average pre-test reading comprehension; $\gamma_3 \mathrm{TREAT}_j$ is the predicted difference in post-test academic vocabulary scores between Word Generation and control schools; υ_j is the unexplained variance associated at the second level in the model.

To address our third research question about a heterogeneous effect of Word Generation for students by English proficiency status, we included dummy variables for students' English proficiency status and treatment condition by students' English proficiency status interaction terms. The RFEP students were used as the reference group. To answer our fourth research question about a heterogeneous effect of Word Generation for RFEP students by years since

Table 4. Means and standard deviations of pre-test scores of academic vocabulary and reading comprehension for RFEP students by years since redesignation.

	6th			7th			8th			All		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*N*	*M*	*SD*
Academic vocabulary pre												
Less than 1 year	255	17.72	5.75	113	20.18	6.27	52	21.75	6.12	420	18.88	6.11
Less than 2 years	279	20.35	5.83	300	21.77	6.03	172	22.51	6.24	751	21.41	6.06
Less than 3 years	169	22.49	6.03	83	23.02	5.73	167	24.63	6.11	419	23.45	6.07
More than 3 years	2	18.00	1.41	304	25.71	6.15	355	28.21	5.19	661	27.03	5.79
Reading comprehension pre												
Less than 1 year	255	508.42	24.76	113	525.55	28.23	52	529.62	21.01	420	515.65	26.85
Less than 2 years	279	519.82	24.38	300	532.23	25.02	172	534.96	21.50	751	528.24	24.87
Less than 3 years	169	526.65	24.47	83	541.49	24.10	167	541.57	25.78	419	535.53	25.92
More than 3 years	2	516.50	33.23	304	548.50	26.77	355	559.00	25.29	661	554.04	26.56

Note: Academic vocabulary is measured by Word Generation Academic Vocabulary Test and reading comprehension by Gates-MacGinitie Reading Test.

redesignation, only RFEP students with valid redesignation year data were included in the analysis. We included dummy variables for RFEP students' years since redesignation and treatment by years since redesignation interaction terms instead of students' English proficiency status and its interaction with treatment condition in the model. RFEP students who were redesignated less than 2 years ago were used as the reference group.

Results

Research Question 1: What are the reading profiles of EO, IFEP, RFEP, and LEP students?

Table 3 shows pre-test scores on academic vocabulary and reading comprehension for EO, IFEP, RFEP, and LEP students by their grade level. A one-way multivariate analysis of variance (MANOVA) was calculated using academic vocabulary and reading comprehension scores as the dependent variables and students' English proficiency status as the independent variable. As can be inferred from this descriptive statistics table, students from different English proficiency groups varied in their academic vocabulary and reading comprehension test scores, $F(6, 12328) = 284.08$, $p < .001$, partial $\eta^2 = .12$. The result from this omnibus test indicated that there is a significant main effect of students' English proficiency status on their academic vocabulary and reading comprehension scores. Partial η^2 are reported for all multivariate and univariate ANOVAs and they indicate the amount of variance in each outcome that is accounted for by students' English proficiency designation. In this case, the value of .12 for partial η^2 indicates that 12% of the variance in students' academic vocabulary and reading comprehension scores are explained by English proficiency status. Given the relatively small amount of variance explained by English proficiency status in the MANOVA, we examined group differences in students' academic vocabulary and reading comprehension with separate ANOVAs.

A Bonferroni-adjusted ANOVA confirmed significant main effects of English proficiency group for academic vocabulary ($F(3, 6165) = 530.12$, $p < .001$, partial $\eta^2 = .21$). Further post hoc tests revealed that differences in students' academic vocabulary test scores among groups were all

significant, with IFEPs having the highest academic vocabulary score and LEP students having the lowest. These results also shows that students in higher grades outperform students in lower grades, regardless of their English proficiency status.

Students' reading comprehension scores followed a similar pattern. A Bonferroni-adjusted ANOVA confirmed significant main effects of English proficiency group for reading comprehension ($F(3, 6165) = 483.56$, $p < .001$, partial $\eta^2 = .19$). IFEP students had the highest reading comprehension scores and LEP students had the lowest. Further post hoc tests indicated that all group comparisons but one (between EO and RFEP) were significant. For all English proficiency groups, reading comprehension test scores were positively associated with students' grade levels.

Research Question 2: What are the reading profiles of RFEP students at different post-redesignation intervals?

Table 4 presents RFEP students' pre-test scores on academic vocabulary and reading comprehension by their years since redesignation. A one-way MANOVA was conducted with academic vocabulary and reading comprehension scores as the dependent variables and RFEP students' years since redesignation as the independent variable. Table 4 shows that RFEP students with different years since redesignation varied in their academic vocabulary and reading comprehension test scores, $F(6, 4492) = 115.38$, $p < .001$, partial $\eta^2 = .13$.

A Bonferroni-adjusted ANOVA confirmed significant main effects of years since redesignation for academic vocabulary ($F(3, 2247) = 184.13$, $p < .001$, partial $\eta^2 = .20$). Further post hoc tests revealed that differences in RFEP students' academic vocabulary test scores among different groups were all significant. The positive correlation between test scores and number of years since redesignation shows that recently redesignated students are not yet as proficient in academic English as those who had been redesignated earlier, on average. The pattern of growth after redesignation was present for all grade-level groups.[2]

A similar pattern emerged for reading comprehension scores. A Bonferroni-adjusted ANOVA confirmed significant main effects of years since redesignation for reading comprehension ($F(3, 2247) = 213.56$, $p < .001$, partial $\eta^2 = .22$). Further post hoc tests revealed that differences in RFEP students' reading comprehension test scores among different groups were all significant. RFEP students' reading comprehension scores increased as a function of years since redesignation, suggesting that they were redesignated before having achieved asymptotic competence. Eighth grade students had higher reading comprehension scores than seventh grade students, who also had higher scores than the sixth grade students within each of the redesignation groups.

Research Question 3: Is there a heterogeneous effect of Word Generation on the academic vocabulary knowledge of EO, IFEP, RFEP, and LEP students?

There was no significant difference between the reading comprehension pre-test scores for the treatment ($M = 529.17$, $SD = 38.51$) and control schools ($M = 528.03$, $SD = 36.03$). However, there was a significant difference between the academic vocabulary pre-test score for the treatment and control schools. Students in treatment schools ($M = 22.30$, $SD = 8.4$) had higher pre-test scores than those in the control schools ($M = 21.32$, $SD = 8.2$, $t(6167) = 4.61$, $p < .001$). We took such difference into consideration by including students' academic vocabulary pre-test data as one of the control variables in our regression models that we fit to answer our research question.

Table 5. Multilevel models predicting academic vocabulary post-test for EO, IFEP, RFEP and LEP students.

	Model A	Model B	Model C
	Without covariates	With covariates	With interactions
Treatment	0.60	0.83	1.37*
	(0.51)	(0.63)	(0.67)
Academic vocabulary school mean	1.12***	0.89*	0.86*
	(0.10)	(0.36)	(0.37)
Academic vocabulary school mean centered	0.79***	0.46***	0.46***
	(0.01)	(0.01)	(0.01)
Reading comprehension school mean		0.004	0.01
		(0.07)	(0.07)
Reading comprehension school mean centered		0.07***	0.07***
		(0.003)	(0.003)
7th Grade		−1.03***	−1.02***
		(0.17)	(0.17)
8th Grade		−0.68***	−0.69***
		(0.18)	(0.18)
GATE		1.57***	1.57***
		(0.17)	(0.17)
Special education		−1.82***	−1.82***
		(0.26)	(0.26)
EO		−0.39*	−0.02
		(0.16)	(0.25)
IFEP		0.22	0.71*
		(0.23)	(0.36)
LEP		−2.25***	−1.66***
		(0.22)	(0.31)
Treatment X EO			−0.65*
			(0.32)
Treatment X IFEP			−0.89†
			(0.47)
Treatment X LEP			−1.07**
			(0.39)
Intercept	−0.07	2.9	0.29
	(2.09)	(28.22)	(28.94)
Level 2 Variance	−0.20	−0.14	−0.1
	(0.25)	(0.30)	(0.31)
Residual	1.74***	1.64***	1.64***
	(0.01)	(0.01)	(0.01)
Deviance	38959.96	37811.889	37802.115
N	6,169	6,169	6,169

Note: Standard errors in parentheses. EO = English-only; IFEP = Initially fluent English proficient; RFEP = Redesignated fluent English proficient; LEP = Limited English proficient; GATE = Gifted and talented education. Sixth grade RFEP students who do not receive either GATE or special education were the reference group. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We fit three hierarchical linear models (Raudenbush & Bryk, 2002) to predict students' academic vocabulary post-test scores (Table 5). Model A predicts the academic vocabulary post-test with school mean pre-test scores and school mean centered individual academic vocabulary pre-test scores. Model B includes school and individual level pre-test scores of academic vocabulary and reading comprehension as well as covariates including grade level, students' special education and gifted and talented education status, and students' English proficiency status. Model C introduces interaction terms, which we used to understand the differences in treatment based on students' English proficiency status.

Model A predicts students' academic vocabulary at post-test from treatment (β = 0.60, p = *n.s.)*, school mean scores (β = 1.12, $p < .001$), and school mean centered scores (β = 0.79, $p < .001$). In the second model where grade and English proficiency status are added, the estimate of the effects of program on students' academic vocabulary knowledge remains nonsignificant (β = 0.83, p = *n.s.*).

In order to examine whether participation in the Word Generation program benefitted students with various English proficiency statuses differently, we conducted the analysis including treatment by English proficiency status interaction terms. In Model C, RFEP students comprised the reference group. The treatment coefficient (β = 1.37, p = .041) suggests that RFEP students who participated in this program made significant gains in their academic vocabulary knowledge. Controlling for all other individual and school-level covariates, EO students in the treatment schools had a predicted benefit of the treatment (β = 1.37, p = .041) and a predicted disadvantage associated with being EO in Word Generation schools (β = -.65, p = .043). Taken together, this model suggests that EO students do roughly .7 points better on the post-test than EO students in control schools do controlling for covariates. Controlling for individual and school level information, IFEP students in the treatment schools had a predicted benefit of the treatment (β = 1.37, p = .041) and a predicted disadvantage associated with being IFEP in treatment schools (β = -.89, p = .057). This model suggests that IFEP students in the treatment condition score about .5 points higher on the post-test controlling for individual and school level covariates compared to the IFEP students in the control condition. Controlling for individual and school level information, LEP students in the treatment schools had a predicted benefit of the treatment (β = 1.37, p = .041) and a predicted disadvantage associated with being LEP in treatment schools (β = -1.07, p = .007). This model suggests that LEP students in the treatment condition score about .3 points higher on the post-test controlling for individual and school level covariates compared to the LEP students in the control condition.

Research Question 4: Is there a heterogeneous effect of Word Generation on RFEP students' academic vocabulary knowledge according to the number of years they have been redesignated?

There were significant differences between the academic vocabulary and reading comprehension pre-test scores for the treatment and control schools. At pre-test, RFEP students in the control schools had higher academic vocabulary scores (M = 23.30, SD = 6.71, t (2254) = 2.28, p = 0.022*)* and higher reading comprehension scores (M = 538.15, SD = 29.31, t (2254) = 5.37, $p < .001$) than those in the treatment schools (M = 22.65, SD = 6.65, M = 531.55, SD = 29.11, respectively). We took such difference into consideration by including student pre-test data as our covariates in our analytical models.

We fit three hierarchical linear models to predict RFEP students' academic vocabulary post-test scores (Table 6). Model A predicts RFEP students' academic vocabulary at post-test from

Table 6. Multilevel models predicting academic vocabulary post-test scores for RFEP students with different years since redesignation.

	Model A	Model B	Model C
	Without covariates	With covariates	With interactions
Treatment	1.21**	1.09*	1.61**
	(0.42)	(0.48)	(0.55)
Academic vocabulary school mean	1.11***	0.98***	0.97***
	(0.20)	(0.28)	(0.28)
Academic vocabulary school mean centered	0.69***	0.48***	0.48***
	(0.02)	(0.02)	(0.02)
Reading comprehension school mean		−0.01	−0.01
		(0.05)	(0.05)
Reading comprehension school mean centered		0.05***	0.05***
		(0.01)	(0.01)
7th Grade		−0.73**	−0.73**
		(0.28)	(0.28)
8th Grade		−0.26	−0.29
		(0.31)	(0.31)
GATE		1.50***	1.48***
		(0.23)	(0.23)
Special education		−0.2	−0.13
		(0.88)	(0.88)
Less than 1 Year		−0.62*	−0.09
		(0.30)	(0.43)
Less than 3 Years		−0.2	0.31
		(0.29)	(0.41)
More than 3 Years		0.26	0.54
		(0.20)	(0.38)
Treatment X Less than 1 Year			−1.00†
			(0.58)
Treatment X Less than 3 Years			−1.03†
			(0.58)
Treatment X More than 3 Years			−0.55
			(0.51)
Intercept	1.04	6.58	6.02
	(4.53)	(22.64)	(22.57)
Level 2 Variance	−0.62†	−0.65†	−0.66 †
	(0.331)	(0.34)	(0.34)
Residual	1.60***	1.55***	1.55***
	(0.015)	(0.02)	(0.02)
Deviance	13636.987	13423.016	13418.497
N	2,256	2,256	2,256

Note: Standard errors in parentheses. GATE = Gifted and talented education. Sixth grade RFEP students who were redesignated less than 2 years were the reference group. † p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

treatment ($\beta = 1.18$, $p = .005$), school mean scores ($\beta = 1.08$, $p < .001$), and school mean centered scores ($\beta = 0.69$, $p < .001$). In Model B, the estimate of the effects of program on students' academic vocabulary knowledge ($\beta = 1.09$, $p = .024$) suggests that, controlling for covariates, RFEP

students in treatment schools scored almost a point higher on their post-test than students in control schools on average.

In order to examine whether participating in the Word Generation program affected RFEP students differently depending on their years since redesignation, we fit a hierarchical linear model with appropriate interaction terms. The treatment coefficient (β = 1.61, p = .004) suggests that RFEP students who had been redesignated less than two years earlier made significant gains in their academic vocabulary knowledge when they participated in the Word Generation program. The product terms of treatment and 1) RFEP students who were redesignated less than one year earlier (β = -1.00, p = .083), 2) RFEP students who were redesignated less than three years earlier (β = -1.03, p = .076), and 3) RFEP students who were redesignated more than three years earlier (β = -.55, p = *n.s.*) show that the effect of treatment was not different for RFEP students by years since redesignation. As can be seen from this model, two interaction terms approached significance. However, given that the sample size of each subgroup was large, we interpret these results as a null finding for treatment by redesignation interaction.

Discussion

The findings of the current study highlight how the reading profiles of language minority students differ from those of EO students and demonstrate that there is substantial variation in the reading performance of students in the language minority student population. Furthermore, the findings suggest that the extent to which students benefit from the research-based vocabulary intervention may depend on students' level of English language proficiency. The most striking and educationally relevant finding from this work is the evidence that recently redesignated students still show deficits in their academic vocabulary and reading comprehension performance compared to their EO peers, but that those deficits attenuate with years of exposure to mainstream classrooms. The RFEP students in this study did not differ much from their EO peers in academic vocabulary and reading comprehension performance when they were aggregated as one group; however, there was performance variability according to years since redesignation. More recently redesignated students performed better than their LEP counterparts, but their scores were lower than those of the EO and IFEP students. Thus, while the results could be taken as suggesting that many students are reclassified before they are fully ready for English-only classrooms, they could also be taken as indicating that recently redesignated students make rapid progress in their first years in mainstream classrooms. More research is needed to determine whether recently redesignated students continue to demonstrate growth in these reading measures as they spend more years in mainstream classrooms.

Another major implication of these findings is the degree of heterogeneity among students classified as 'RFEP' in school records. In state and district reporting, RFEPs are now typically included with LEPs or treated as a separate reporting category for two years after redesignation. While that constitutes a small concession to the possibility that they may not be fully English proficient despite reclassification as such, it hardly recognizes the full range of variation within the RFEP group. The categories of LEP and FEP are too simple and undifferentiated to serve as a basis for providing adequate education to all students.

In our sample, the IFEPs had the highest scores on academic vocabulary and reading comprehension pre-test. There have been several research studies that suggest cognitive and linguistic advantages for bilinguals (see, for example, Bialystok, 2002) and our findings also support the suggestion that language minority students who are English proficient at school entry are at an advantage. It is true that EO (61%) and IFEP (71%) students were less likely to be eligible for free and reduced lunch than RFEP (87%) and LEP (90%) in our sample. As eligibility for the free and reduced lunch program depends on household income (students whose parents have low income can apply to school districts to receive free or reduced priced lunch), it is often used as a proxy for

socio-economic status. However, there was a higher percentage of higher income EO than IFEP families in our sample, suggesting that socio-economic advantages cannot fully explain the IFEP advantage.[3]

The overall insignificant treatment effects reported here are not surprising given that the data reported here are but a sub-sample of a larger study; this study is not powered to detect a treatment effect with data from this small number of schools. Previous studies of Word Generation have found significant, though small, treatment effects (Lawrence et al., in press) in students' academic vocabulary knowledge. In this case, the treatment effect emerged only as an interaction with RFEP status. This finding does align with previous reports that Word Generation has greater effects for language minority than for EO students (Snow et al., 2009), and that it shows greater effects for students scoring relatively low and attending schools with overall low achievement. There are two additional reasons why no main effect is evident in the models reported here. First, the pre-test scores of students in the single-district study reported here were relatively high, limiting the room for improvement. Second, although students in the control condition did not receive any instruction or material related to Word Generation, it was reported that schools in the control condition were also incorporating some type of academic vocabulary instruction in their curriculum. This could have influenced detection of the effect of Word Generation in students' post-tests. For more information on the efficacy trial of Word Generation, we refer readers to Lawrence et al. (in press).

Our findings show that Word Generation helped RFEP students learn academic vocabulary; but it does not tell us which elements of Word Generation helped RFEPs. It could have been multiple exposures to target words, learning target words in different content areas, reading and writing about target words, or using target words in discussion that improved RFEPs' academic vocabulary knowledge. On the other hand, it could have been that RFEP students were in an advantageous position for learning academic vocabulary words. For instance, some RFEP students had been recently reclassified and may have been primed to learn new target words in their new, rich, second language environment. We must also consider the possibility that students who returned to school in the Fall (at the start of the study) had artificially low vocabulary scores because they had been in L1 environments during the summer; they may have been primed to learn or relearn L2 words at an accelerated rate (Lawrence, 2012). We intend to use longitudinal models to explore these possibilities in more detail in future analyses. Consistent with a previous study (Lawrence et al., 2012) on Word Generation, LEP students in the current study did not benefit from this intervention. We speculate that the Word Generation materials and activities were too difficult for LEP students to engage fully in the program. However, since RFEP students, by definition, gained sufficient English proficiency to exit from language support services, they may have understood the materials fully and participated in meaningful activities that involved the use of target words. It is possible that many RFEP students did not have access to explicit academic vocabulary instruction in their English language development classes, which may explain their significant growth when they were given such support.

There are several limitations to this study. First, the language proficiency designation of students in our analysis was based solely on the district report. Although efforts are being made to generate consistent and accurate information about the identification and reclassification of LEP students (Linquanti & Cook, 2013), significant variability remains in how districts and schools define the subgroups of language minority students (Abedi, 2008; Bailey & Kelly, 2013; Ragan & Lesaux, 2006). Second, as mentioned earlier, the data for this study come from a larger randomized efficacy trial of Word Generation. Because the efficacy trial was designed to detect effects with 44 schools, there was insufficient power to detect treatment effects in this study. Third, we only used one assessment tool to measure students' academic vocabulary knowledge. The Word Generation Academic Vocabulary Test is a researcher-developed multiple-choice synonym task.

Although this test was developed in accordance with the Academic Word List (Coxhead, 2000), additional measures of academic vocabulary that utilize other types of vocabulary items – such as 'fill-in-the-blank' – could have been used in order to create a composite measure of academic vocabulary knowledge. Fourth, while we consider the differences related to interval since redesignation to be important, it is also important to note that these findings are based on a cross-sectional analysis. In future work, we will seek to replicate this pattern of findings using longitudinal analyses of redesignated students, comparing them in first and second year of exposure to Word Generation.

Conclusion

The current findings suggest that language minority learners are a heterogeneous group with varying levels of English proficiency and reading performance. They also underscore that the extent to which students benefit from an academic vocabulary intervention may vary based on their level of English proficiency. This study identified that the Word Generation program helps language minority students who have been reclassified as being fluent.

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Notes

1. The Word Generation academic vocabulary assessment forms can be accessed at http://www.iris-database.org.
2. Note that the group of sixth graders redesignated more than three years earlier was too small (n = 2, about 1% of the total RFEP sample) to generate a reliable estimate.
3. The models that included free and reduced lunch status were no better than the models without it using the chi-square distribution for models with one additional degree of freedom as a criteria.

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