



Making Connections

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# The correlates of academic performance for English language learner students in a New England district

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## **Summary**

The number of English language learners has grown in the Northeast & Islands Region over the past decade. While the total student population shrank 3.5 percent between 2001/02 and 2009/10, the population of English language learner students grew 7.6 percent and now constitutes 6.1 percent of students in the region, up from 5.5 percent in 2001/02. In Connecticut the shift was even greater. While the student population shrank 1.1 percent, the population of English language learner students grew 39.7 percent and now constitutes 5.3 percent of Connecticut's student population, up from 3.8 percent in 2001/02 (National Center for Education Statistics, n.d.). While the percentage of English language learner students may be small in some districts, these students often fail to meet state proficiency standards.

The English Language Learners Alliance (ELLA) of the Regional Educational Laboratory Northeast & Islands is interested in making better use of district data to inform policy for English language learner students. The ELLA research agenda includes investigating the impact of English language learner programs on student achievement (Regional Education Laboratory Northeast & Islands, 2012). ELLA enumerated two goals for this study: first, to clarify the relationships among English language learner student characteristics, English language learner programs, and student performance in order to support decisionmaking that meets the diverse needs of English language learner students; and second, to identify the methodological challenges in analyzing data for subgroups with small sample sizes and to develop strategies that address these challenges. While the district had access to the data used in this study, it had limited resources for conducting analyses of the relationships among student characteristics, programs, and performance.

### **Research questions and analysis**

A large urban district in Connecticut with a share of just over 10 percent of English language learner students in its student population was selected as the site for this study. The researchers used cross-sectional data from the Language Assessment Systems Links (LAS Links) assessment, which measures English proficiency in grades K–12; the Connecticut Mastery Test (CMT) of math and reading in grades 3–8; and the Connecticut Achievement and Performance Test (CAPT) of math and reading in grade 10 to address three research questions:

- What were the characteristics of English language learner students and of the English language learner programs and schools they attended in 2010/11?
- Which student characteristics, types of English language learner programs, and school characteristics were most closely related to English language learner students' English proficiency scores in 2010/11?
- Which student characteristics, including English proficiency levels, and which types of English language learner programs were most closely related to English language learner students' math and reading performance?

### **Key findings**

*Characteristics of English language learner students and of the programs and schools these students attended in 2010/11.*

- More than 90 percent of English language learner students were Spanish-speaking and Hispanic.

- The percentage of English language learner students in special education (15.9 percent) was higher than the district average for all students (12.0 percent).
- Participation in English language learner programs varied across grade spans. English as a second language services were provided in all grade levels, while transitional bilingual and dual language bilingual programs were provided in grades K–8, and language transition support services were provided in grades 3–12.
- English language learner students in grades K–8 attended schools with a higher percentage of English language learner students than did English language learner students in grades 9–12.
- English language learner students in grades K–1 attended schools in which 79.3 percent of English language learner students were taught by English language learner–certified teachers, while those in grades 9–12 attended schools in which 31.4 percent were taught by such certified teachers.

*Student characteristics, types of English language learner programs, and school characteristics most closely related to English language learner students’ English proficiency scores in 2010/11.*

- In all grade spans, being in special education was associated with significantly lower English proficiency scores than the average for all English language learner students.
- In grades K–8 attending a transitional bilingual education program was associated with significantly lower English proficiency scores than the average for the grade span.
- In analyses of grade spans that included the school proficiency rate, attending a higher performing school was associated with higher English proficiency scores.
- In all grade spans the variables associated with English proficiency scores explained similar percentages of variance in those scores.

*Student characteristics and types of English language learner programs most closely related to English language learner students’ math and reading performance.*

- The student characteristics associated with math and reading scores varied by grade span and content area.
- English proficiency scores were associated with both math and reading performance in all grade spans.
- There were no clear patterns in math and reading scores across English language learner programs.
- In most grade spans the variables associated with math and reading scores explained similar percentages of variance in those scores.

Because the analyses were descriptive and correlational, they do not support causal claims about how student, program, and school characteristics are related to English language learner students’ performance.

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## Why this study?

While the total student population in the Northeast & Islands Region shrank 3.5 percent between 2001/02 and 2009/10, the population of English language learner students grew 7.6 percent and now constitutes 6.1 percent of students in the region, up from 5.5 percent in 2001/02.<sup>1</sup>

In Connecticut the shift was even greater. Although the student population shrank 1.1 percent, the population of English language learner students grew 39.7 percent and now constitutes 5.3 percent of Connecticut's student population, up from 3.8 percent in 2001/02 (National Center for Education Statistics, n.d.). While the percentage of English language learner students may be small in some districts, these students often fail to meet state proficiency standards. For example, while 52.5 percent of native English speakers scored proficient or above on the grade 8 Connecticut Mastery Test (CMT) math assessment in 2010/11, only 26.8 percent of English language learner students did. And while 41.1 percent of native English speakers scored proficient or above on the grade 9 reading assessment in 2010/11, just 12.4 percent of English language learner students did (Connecticut State Department of Education, n.d. a). Nationally, more English language learner students have been moving to districts that have not historically had English language learner students, and administrators face the challenge of providing programs and services to meet their needs (Wainer, 2004; Zehler et al., 2008).

### Study motivation

Making better use of district data to inform policy for English language learner students is an interest of the English Language Learners Alliance (ELLA), a research alliance of the Regional Educational Laboratory Northeast & Islands. The ELLA research agenda includes investigating the impact of English language learner programs on student achievement (Regional Education Laboratory Northeast & Islands, 2012). This study was designed to address that interest, focusing on two goals: to clarify the relationships among English language learner student characteristics, English language learner programs, and student performance, in order to support decisionmaking that meets the diverse needs of English language learner students, and to identify the methodological challenges in analyzing data for subgroups with small sample sizes (box 1) and develop strategies that address the challenges. While the district had access to the data used in this study, it had limited resources for conducting analyses of the relationships among student characteristics, programs, and performance.

The analysis is restricted to English language learner students, rather than comparing them with non-English language learner students, to focus on understanding patterns in English language learner programs attended and student performance on the English proficiency assessment.

A large urban district in Connecticut with a share of just over 10 percent of English language learner students in its student population was selected as the site for this study. Supporting the district's selection were its willingness to participate, its access to data on student assignment to English language learner programs, and an adequate number of English language learner students to study.

***The analysis is restricted to English language learner students, rather than comparing them with other students, to focus on patterns in English language learner programs attended and student performance on the English proficiency assessment***

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**Box 1. The challenges of studying English language learner students in a single district**

The small size of student subgroups such as English language learner students can make data analysis at the district level difficult. English language learner students are diverse in language background, immigrant status, English proficiency level, and individual characteristics such as gender, race/ethnicity, and special education status. With so much diversity, district leaders need to consider which program characteristics can best meet the needs of different students. The task becomes even more demanding because of the small number of students in each subgroup. Although the study district is one of the larger districts in the region, the number of English language learner students was under 3,000, and school and student sample sizes by grade span were even smaller. The small sample sizes limited the statistical power of the analyses and the complexity of the regression models that could be formulated (Raudenbush & Bryk, 2002).

*The analyses are descriptive and correlational, so no causal inferences can be drawn*

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**Research questions**

The study addresses three research questions:

- What were the characteristics of English language learner students and of the English language learner programs and schools they attended in 2010/11?
- Which student characteristics, types of English language learner programs, and school characteristics were most closely related to English language learner students' English proficiency scores in 2010/11?
- Which student characteristics, including English proficiency levels, and which types of English language learner programs were most closely related to English language learner students' math and reading performance?

The analyses are descriptive (research question 1) and correlational (research questions 2 and 3), so no causal inferences can be drawn about how student, program, and school characteristics are related to student performance.

Appendix A briefly reviews the literature on student and school characteristics associated with the academic performance of English language learner students. Box 2 summarizes the data and methods used in the study.

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**Box 2. Data and methods****Sample**

This study examines data for all English language learner students in grades K–12 in the study district who took the Language Assessment Systems Links (LAS Links) English language proficiency assessment in spring 2011 (see appendix B for more detail on the assessment). The analyses for research questions 1 and 2 used grade spans K–1, 2–3, 4–5, 6–8, and 9–12. The analyses for research question 3 were conducted for grades 3, 4–5, and 6–8 for the Connecticut Mastery Test (CMT) and grades 9–12 for the Connecticut Achievement and Performance Test (CAPT; see appendix C for more detail on these assessments). The analysis sample for research questions 1 and 2 included all students who took the LAS Links; the analysis sample for research question 3

*(continued)*

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## Box 2. Data and methods *(continued)*

was limited to the subset of students who also took the state math or reading assessments (the CMT is administered in grades 3–8 and the CAPT in grade 10) in 2010/11 (see appendix D). The sample sizes and average number of students per school were smaller for research question 3 than for the first two. Student data, including English language learner program enrollment, were obtained from the district, and school data from the state website.

### Research question 1

To address the question on the characteristics of English language learner students and of the English language learner programs and schools they attended in 2010/11, frequencies and percentages were calculated for the following student, program, and school characteristics:

- *Student characteristics:* student special education status, immigrant status, gender, race/ethnicity, home language, school attendance rate, and English language learner program.
- *Types of English language learner programs:* transitional bilingual education, dual language bilingual education, English as a second language (not in transitional bilingual education due to parent request), high school English as a second language services, language transition support services, English as a second language services for students speaking a language other than Spanish, or eligible for an English language learner program but not served due to parent request (box 3).
- *School characteristics:* school size, percentage of English language learner students, percentage of students in special education, percentage of racial/ethnic minority students, percentage of students eligible for free or reduced-price lunch, percentage of English language learner students taught by English language learner–certified teachers, percentage of students scoring proficient or higher on the state math assessment, and percentage of students scoring proficient or higher on the state reading assessment.

### Research questions 2 and 3

To address the questions on which student, English language learner program, and school characteristics were most closely related to English language learner students' English proficiency and math and reading performance, regression models examined the association between student outcomes and student characteristics, types of English language learner programs, and school characteristics. The student, program, and school characteristics were the same as for research question 1. The outcome was students' overall LAS Links English proficiency scores for research question 2 and math and reading performance on the CMT (grades 3–8) and CAPT (grades 9–12) for research question 3. Analyses were conducted separately for each grade span.

The small number of schools available in the datasets was a concern because a small sample size limits the statistical power of the analyses and the complexity of the regression models that can be formulated (Raudenbush & Bryk, 2002). To increase statistical power, the regression models were constructed in stages by sequentially adding the types of English language learner programs along with blocks of related student and school characteristics. Types of English language learner programs were retained in all models, but only the student and school characteristics that were most closely associated with the dependent variables were retained. The parsimonious models included only the subset of the student and school characteristics that met at least one of the following criteria:

- Using the adjusted standard error, the regression coefficient had to be statistically significantly different from 0.

*(continued)*

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## Box 2. Data and methods (continued)

- The regression coefficient had to be equivalent to a standardized difference of 0.25 or greater (the What Works Clearinghouse guideline on what constitutes a substantively important effect; U.S. Department of Education, 2008).

Two types of regression models were used. For research question 2, multilevel regression modeling was used for grades K–8 and ordinary least squares for grades 9–12. For question 3, ordinary least squares regression modeling was used for all grades. In both cases using ordinary least squares regression analysis meant that no school characteristics were included in the regression model, and the standard errors associated with the coefficients had to be adjusted to account for the clustering of students in schools.

All continuous characteristics were grand mean–centered, and all dichotomous or categorical characteristics were coded using weighted effects coding. The regression coefficients associated with the continuous characteristics represent the expected change in the dependent variable for every one unit increase in the characteristic above the grand mean across all students and schools. The regression coefficients associated with the dichotomous or categorical characteristics represent the expected difference between the mean for the group being compared (for example, students in special education) and the weighted grand mean (the intercept). A group of students is expected to have lower or higher scores than the grand mean when that characteristic’s coefficient meets one of the two criteria for inclusion, while holding all other characteristics constant.

The box table summarizes the dependent variables, predictor variables, and analysis procedures for research questions 2 and 3 by grade span. See appendix E for more detail on the analytic methods.

### Dependent variables, predictor variables, and analysis procedures for research questions 2 and 3, by grade span

Research question	Grade span	Dependent variables	Predictor variables	Analysis procedure
2. Which student characteristics, types of English language learner programs, and school characteristics were most closely related to English language learner students’ English proficiency scores in 2010/11?	K–8	Overall LAS Links scores	<ul style="list-style-type: none"> <li>• Student characteristics</li> <li>• Type of English language learner program</li> <li>• School characteristics</li> </ul>	Multilevel regression modeling
	9–12	Overall LAS Links scores	<ul style="list-style-type: none"> <li>• Student characteristics</li> <li>• Type of English language learner program</li> </ul>	Ordinary least squares regression modeling
3. Which student characteristics, including English proficiency levels, and which types of English language learner programs were most closely related to English language learner students’ math and reading performance?	3–8	CMT math scores CMT reading scores	<ul style="list-style-type: none"> <li>• Student characteristics</li> <li>• Type of English language learner program</li> <li>• Student LAS Links scores</li> </ul>	Ordinary least squares regression modeling
	9–12	CAPT math scores CAPT reading scores	<ul style="list-style-type: none"> <li>• Student characteristics</li> <li>• Type of English language learner program</li> <li>• Student LAS Links scores</li> </ul>	Ordinary least squares regression modeling

LAS Links is Language Assessment Systems Links. CMT is Connecticut Mastery Test. CAPT is Connecticut Achievement and Performance Test.

Source: Authors.

## Key findings

The descriptive findings for research question 1 detail the demographic characteristics of the students in the study and the English language learner programs and schools they attended. The findings for research questions 2 and 3 describe the associations among the characteristics and English language learner students' performance on assessments (table 1).

### Characteristics of English language learner students and of the English language learner programs and schools they attended

*While more than 90 percent of English language learner students were Spanish-speaking and Hispanic, the percentage of those born in the United States varied by grade span.* The percentage of English language learner students born in the United States was higher in early grades than in later grades (table 2). For example, 17.7 percent of English language learner students in grades K–1 were born outside the United States, compared

**Table 1. Summary of key findings by research question**

Research question	Key findings
1. What were the characteristics of English language learner students and of the English language learner programs and schools they attended in 2010/11?	<ul style="list-style-type: none"> <li>• More than 90 percent of English language learner students were Spanish-speaking and Hispanic.</li> <li>• The percentage of English language learner students in special education (15.9 percent) was higher than the district average for all students (12.0 percent).</li> <li>• Participation in English language learner programs varied across grade spans. English as a second language services were provided in all grade levels, while transitional bilingual and dual language bilingual programs were provided in grades K–8, and language transition support services were provided in grades 3–12.</li> <li>• English language learner students in grades K–8 attended schools with a higher percentage of English language learner students than did English language learner students in grades 9–12.</li> <li>• English language learner students in grades K–1 attended schools in which 79.3 percent of English language learner students were taught by English language learner–certified teachers, while those in grades 9–12 attended schools in which 31.4 percent were taught by such certified teachers.</li> </ul>
2. Which student characteristics, types of English language learner programs, and school characteristics were most closely related to English language learner students' English proficiency scores in 2010/11?	<ul style="list-style-type: none"> <li>• In all grade spans being in special education was associated with significantly lower English proficiency scores than the average for all English language learner students.</li> <li>• In grades K–8 attending a transitional bilingual education program was associated with significantly lower English proficiency scores than the average for the grade span.</li> <li>• In analyses of grade spans that included the school proficiency rate, attending a higher performing school was associated with higher English proficiency scores.</li> <li>• In all grade spans the variables associated with English proficiency scores explained similar percentages of variance in those scores.</li> </ul>
3. Which student characteristics, including English proficiency levels, and which types of English language learner programs were most closely related to English language learner students' math and reading performance?	<ul style="list-style-type: none"> <li>• The student characteristics associated with math and reading scores varied by grade span and content area.</li> <li>• English proficiency scores were associated with both math and reading performance in all grade spans.</li> <li>• There were no clear patterns in math and reading scores across English language learner programs.</li> <li>• In most grade spans the variables associated with math and reading scores explained similar percentages of variance in those scores.</li> </ul>

**Source:** Authors.

**Table 2. English language learner student characteristics, by grade span, 2010/11**

Characteristic	English language learner students												All students in district	
	Grades K–1 (n = 566)		Grades 2–3 (n = 490)		Grades 4–5 (n = 345)		Grades 6–8 (n = 406)		Grades 9–12 (n = 344)		Total (n = 2,151)		(n = 19,875)	
	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number
Categorical characteristics														
Home language														
Spanish	93.3	528	94.9	465	92.2	318	91.6	372	86.6	298	92.1	1,981	na	na
Immigrant status (born outside the United States)	17.7	100	25.9	127	45.2	156	54.2	220	64.2 <sup>a</sup>	163	39.8	856	na	na
In special education	7.8	44	13.1	64	23.2	80	24.1	98	16.0	55	15.9	341	12.0	2,385
Male	51.6	292	54.5	267	56.2	194	51.7	210	52.3	180	53.1	1,143	50.2	9,975
Race <sup>b</sup>														
American Indian/ Alaskan Native	0.7	4	0	0	0	0	0.7	3	0.9	3	0.5	10	0.25	50
Asian	3.0	17	1.8	9	2.6	9	2.5	10	3.2	11	2.6	56	2.1	422
Black	1.6	9	2.4	12	2.6	9	4.4	18	7.3	25	3.4	73	45.9	9,125
Hispanic	91.8	520	93.3	457	91.6	316	90.6	368	86.0	296	91.0	1,957	37.3	7,421
White	2.8	16	2.4	12	3.2	11	1.7	7	2.6	9	2.6	55	14.4	2,857
	Mean (standard error)	Standard deviation	Mean (standard error)	Standard deviation	Mean (standard error)	Standard deviation	Mean (standard error)	Standard deviation	Mean (standard error)	Standard deviation	Mean (standard error)	Standard deviation	Mean	
Continuous characteristics														
Mean attendance rate	93.3 (.002)	.054	94.3 (.002)	.053	93.9 (.003)	.058	92.1 (.004)	.078	87.2 (.006)	.120	93.4 (.001)	.061	92.6	

na is not applicable because the characteristic does not apply to non-English language learner students.

a. Data on immigration status was missing for 26.2 percent of students (90) in grades 9–12, so the denominator for this calculation was 254.

b. Percentages may not sum to 100 because of rounding.

Source: Connecticut State Department of Education n.d. a.

with 54.2 percent in grades 6–8. Some 64.2 percent of English language learner students in grades 9–12 for which data on immigrant status were available were born outside the United States; 26.2 percent of students in grades 9–12 were missing information about their immigrant status.<sup>2</sup>

*The percentage of English language learner students in special education (15.9 percent) was higher than the district average for all students (12.0 percent).* The percentage of English language learner students in special education also varied by grade span, with the highest percentage in grades 6–8 (24.1 percent) and 4–5 (23.2 percent) and the lowest in grades K–1 (7.8 percent).

*Participation in English language learner programs varied across grade spans.* The district provided a range of English language learner programs: transitional bilingual education, dual language bilingual, English as a second language, and targeted services for students in English language learner programs for longer than 30 months (language transition support services; see box 3 for information on eligibility criteria, program descriptions, and exit criteria). Participation varied across grade spans in grades K–12 (table 3). About 5 percent of eligible students were not enrolled in any English language learner program due to parent request.

### Box 3. Programs for English language learner students in the district

**Eligibility criteria.** All parents registering children in the district complete a home language survey, which asks about the child’s first spoken language and the primary language spoken in the home by adults and by the child. If answers to two of the three questions are a language other than English, students are administered the Language Assessment Systems Links assessment to measure their English language oral, reading, and writing skills. Students who score below an English language proficiency level of 4 are eligible for bilingual (Spanish) or English as a second language options.

**Program options.** The English language learner programs in the district follow state guidelines (box table 1). Parents of Spanish-speaking students may request the bilingual program (transitional or dual language) or English as a second language services or refuse services. Parents of students speaking another language may enroll their student in English as a second language services or refuse services. Spanish-speaking students enrolling in grades 10–12 are offered high school English as a second language services but not bilingual services. Students who have been in transitional bilingual education programs for 30 months but do not meet the exit criteria (see below) are enrolled in language transition support services. All students are either enrolled in one of the state-designated programs or identified as not served due to parent request.

**Table 1. Types of English language learner programs, state definitions, and district descriptions**

Type of programs	State definition	District description	Student and school characteristics
For Spanish-speaking English language learners only			
Transitional bilingual education	Spanish (decreasing over time) and English instruction that aims for students to ultimately attain English language proficiency; limited to 30 months.	Students instructed in both Spanish and English for up to 30 months. Time taught in English increases every year to have students ready to exit the program after 30 months. (Grade 9 in sheltered content with bilingual support.)	Offered in all grades at 8 of 31 K–8 schools; sheltered content with bilingual support provided at 4 of 11 high schools.
Dual language bilingual education	Spanish and English instruction that aims for students to ultimately attain proficiency in both languages.	Available to all students whose parents are committed to the goals of bilingualism and biliteracy in English and Spanish. No 30 month limit.	Offered in grades K–8 at two schools.
English as a second language services (not in transitional bilingual education due to parent request)	English as a second language pull-out or push-in/co-teaching.	Parent refuses transitional bilingual education for any reason and approves child placement in an all-English classroom, receiving English as a second language support services given by an English as a second language tutor or teacher.	Offered in all grades at 30 of 31 K–8 schools and 10 of 11 high schools.
High school English as a second language services	English as a second language services provided to high school students with fewer than 30 months until graduation.	Eligible for bilingual program but with fewer than 30 months before high school graduation; receive sheltered content classes with English as a second language support services.	Offered in grades 10–12 at 6 of 11 high schools.
Language transition support services	English as a second language services (pull-out, push-in, sheltered English instruction, other) provided to students who have been in transitional bilingual education for more than 30 months and have not yet met exit criteria.	English as a second language services (pull-out, push-in, sheltered English instruction, other) provided to students who have been in transitional bilingual education for more than 30 months and have not yet met exit criteria.	Offered in grades 3–8 at 20 of 31 K–8 schools and in all grades at all 11 high schools.

(continued)

**Box 3. Programs for English language learner students in the district** *(continued)*

Type of programs	State definition	District description	Student and school characteristics
For English language learners speaking a language other than Spanish			
English as a second language services	English as a second language pull-out or push-in: Teachers of English to Speakers of Other Languages–certified teacher provides English as a second language instruction in small groups in or out of the regular classroom.	Students receive English as a second language support in a mainstream setting by a certified English as a second language teacher or tutor.	Offered in all grades at 21 of 31 K–8 schools and 7 of 11 high schools.
For all English language learners			
Eligible but not served due to parent request	Eligible for English as a second language or bilingual services but not served due to parent request.	Parent refuses all types of English language support programs or academic program options and chooses to have their child in an all-English immersion classroom.	Students attend 24 of 31 K–8 schools and 5 of 11 high schools.

**Source:** Adapted from Connecticut State Department of Education (n.d. e,f).

**Exit criteria.** Students in transitional bilingual education programs who do not meet the state-determined exit criteria after 30 months are moved to language transition support services (box table 2). Students in dual language bilingual programs may stay in those programs more than 30 months. Students receiving English as a second language services who do not meet the exit criteria after 30 months continue to receive those services.

**Table 2. State criteria for exiting English language learner student programs**

Grade span	Academic standard	English language standard
K–2	Developmental Reading Assessment <ul style="list-style-type: none"> <li>• 4 or higher for kindergarten</li> <li>• 18 or higher for grade 1</li> <li>• 28 or higher for grade 2</li> </ul>	
3–8	Connecticut Mastery Test <ul style="list-style-type: none"> <li>• Math and reading: level 3 or higher</li> <li>• Writing: level 2 or higher</li> </ul>	Language Assessment Systems Links: level 4 or 5
9	Connecticut Mastery Test Form-M <ul style="list-style-type: none"> <li>• Math and reading: level 3 or higher</li> <li>• Writing: level 2 or higher</li> </ul>	
10–12	Connecticut Academic Performance Test <ul style="list-style-type: none"> <li>• Math and reading: level 2 or higher</li> <li>• Writing: level 2 or higher</li> </ul>	

**Source:** Adapted from Connecticut State Department of Education (2010).

**Some school characteristics varied by grade span.** The greatest variations among school characteristics were in the percentage of English language learner students enrolled and the percentage of English language learner students taught by English language learner–certified teachers (table 4). Students in grades 9–12 attended schools with a lower percentage of English language learner students: 11.6 percent, compared with 28.2–30.2 percent in grades K–8. English language learner students in grades K–1 attended schools in which 79.3 percent of English language learner students were taught by English language learner–certified teachers, while those in grades 9–12 attended schools in which 31.4 percent were taught by such certified teachers.

**Table 3. Percentage and number of students served, by type of English language learner program and grade span, 2010/11**

Type of program	Grades K–1 (n = 566)		Grades 2–3 (n = 490)		Grades 4–5 (n = 345)		Grades 6–8 (n = 406)		Grades 9–12 (n = 344)		Total (n = 2,151)	
	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number
Transitional bilingual education	50.7	287	26.7	131	14.5	50	19.0	77	1.7	6	25.6	551
Dual language bilingual education	8.7	49	16.7	82	15.4	53	12.6	51	na	na	10.9	235
English as a second language services (not in transitional bilingual education due to parent request)	27.9	158	25.5	125	22.6	78	15.8	64	16.6	57	22.4	482
High school English as a second language services	na	na	na	na	na	na	na	na	18.6	64	3.0	64
Language transition support services	na	na	20.8	102	34.8	120	38.4	156	32.0	110	22.7	488
English as a second language services (for students speaking a language other than Spanish)	7.6	43	4.9	24	8.4	29	8.6	35	27.3	94	10.5	225
Eligible but not served due to parent request	5.1	29	5.3	26	4.3	15	5.7	23	3.8	13	4.9	106

na is not applicable because the type of program is not offered at that grade level.

**Note:** Percentages may not sum to 100 because of rounding.

**Source:** Authors' calculations based on data from the Connecticut State Department of Education.

**Table 4. Average school characteristics, by grade span, 2010/11 (percent unless otherwise indicated)**

Characteristic	Grades K–1 (n = 28)		Grades 2–3 (n = 27)		Grades 4–5 (n = 24)		Grades 6–8 (n = 28)		Grades 9–12 (n = 11)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
School size (number of students)	499.4	88.0	515.0	74.0	532.7	74.7	533.3	87.3	950.1	376.6
English language learner students	28.2	15.3	30.2	15.2	29.8	16.4	30.1	16.4	11.6	5.0
Students in special education	10.8	3.0	11.4	2.4	11.4	2.5	11.5	3.2	12.5	3.2
Racial/ethnic minority students	92.8	11.2	93.5	9.0	91.8	11.4	93.3	8.8	87.8	12.4
Students eligible for free or reduced-price lunch	82.4	10.9	84.4	7.2	83.0	8.2	83.0	7.1	78.5	7.9
English language learner students taught by English language learner-certified teachers	79.3	40.5	55.1	49.8	55.4	49.8	50.0	50.1	31.4	46.5
Students scoring proficient or higher on the state math assessment	66.8	11.4	68.2	10.4	68.6	10.9	67.4	10.5	55.0	14.5
Students scoring proficient or higher on the state reading assessment	53.3	11.3	53.8	10.1	55.3	11.8	54.0	10.6	62.9	14.7

SD is standard deviation.

**Source:** Authors' calculations based on data from the Connecticut State Department of Education.

**Relationships between student characteristics, types of English language learner programs, and school characteristics and English proficiency scores**

This section describes the findings from the multilevel and ordinary least squares regression models for research question 2 on the association between individual characteristics and students' English proficiency scores, holding all other characteristics at the weighted grand mean. Table 5 presents the regression coefficients for the final parsimonious models as standardized differences and their associated statistical significance. See table G1 in

**Table 5. English proficiency score regressed on student characteristics, types of English language learner programs, and school characteristics, by grade span (coefficients in standard deviation units)**

Characteristic	Grades K-1	Grades 2-3	Grades 4-5	Grades 6-8	Grades 9-12
<b>Student characteristics (compared to grand mean)</b>					
Home language not Spanish	1.04**				
Immigrant status (born outside United States)				0.10**	
In special education	-0.42**	-0.94***	-0.56***	-0.57	-0.75**
Gender (female)			0.12*		
Race/ethnicity not Hispanic				-0.54	
Attendance rate	0.17***				
<b>Types of English language learner programs (compared to grand mean)</b>					
<i>Grades K-8</i>					
Transitional bilingual education	-0.28***	-0.34***	-0.63***	-0.95***	
Dual language bilingual education	0.36	-0.06	-0.06	1.82	
Language transition support services	na	0.30***	0.20**	-0.06	
English as a second language services (for students speaking a language other than Spanish)	-0.59*	-0.20	-0.28	-0.24	
Eligible but not served due to parent request	0.73***	0.14	0.38	-0.02	
<i>Grades 9-12</i>					
Transitional bilingual education					-0.06
High school English as a second language service					-0.17
Language transition support services					0.27
English as a second language (for students speaking a foreign language other than Spanish)					-0.49*
Eligible but not served due to parent request					0.59
<b>School characteristics</b>					
School size					
Percentage of English language learner students					
Percentage of students in special education					
Percentage of racial/ethnic minority students					
Percentage of students eligible for free or reduced-price lunch					
Percentage of English language learner students taught by English language learner-certified teachers					
School math proficiency rate (10 percent increment)	-0.33		0.02**	0.24**	
School reading proficiency rate (10 percent increment)	0.39*				

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

LAS Links is Language Assessment Systems Links assessment.

na is not applicable because the type of program is not offered at that grade level.

**Source:** Authors' calculations based on data from the Connecticut State Department of Education.

appendix G for the regression coefficients in their original metrics. The discussion is limited to regression coefficients that are either statistically significantly different from 0 or equivalent to a standardized difference of 0.25 or greater (the What Works Clearinghouse guideline on what constitutes a substantively important effect; U.S. Department of Education, 2008).

***Across all grade spans being in special education was associated with significantly lower English proficiency scores than the average for all English language learner students.*** The characteristics used in the model differed by grade span, but the gap was smallest in grades K–1 (0.42 standard deviation below the average for all English language learner students) and greatest in grades 2–3 (0.94).

***The differences in English proficiency for students enrolled in each English language learner program varied by grade span.*** Enrollment in transitional bilingual education programs in grades K–8 was associated with lower English proficiency scores than the average for each grade span, as was participation in English as a second language services (for students speaking a language other than Spanish) in grades K–1, 4–5, and 9–12. Enrollment in dual language bilingual education programs in grades K–1 and 6–8 was associated with higher English proficiency scores than the average, as was enrollment in language transition support services in grades 2–3, 4–5, and 9–12. Being eligible for an English language learner program but not served due to parent request was associated with higher English proficiency scores than the average in grades K–1, 4–5, and 9–12.

***Across all grade spans being in special education was associated with significantly lower English proficiency scores than the average for all English language learner students***

***In some grade spans attending a higher performing school was associated with higher English proficiency scores.*** In grades 4–5 and 6–8 attending a school with a higher overall math proficiency rate was associated with higher English proficiency scores than the average for the grade span. Similarly, in grades K–1 attending a school with a higher overall reading proficiency rate was associated with higher English proficiency scores. However in grades K–1 attending a school with a higher overall math proficiency rate was associated with lower English proficiency scores than the average for the grade span.

***In all grade spans the variables associated with English proficiency scores explained similar percentages of variance in those scores.*** The variables associated with English proficiency scores explained 20.0–21.2 percent of the variance in those scores in grades K–1, 2–3, and 6–8 and 17.2 percent of the variance in grades 9–12. In grades 4–5 the retained variables explained the largest percentage of the variance in scores, 31.2 percent (see table G1 in appendix G).

### **Relationship between student characteristics, types of English language learner programs, and English proficiency scores and math and reading performance**

This section describes the findings from the ordinary least squares regression models for research question 3 on the association between individual characteristics and student math and reading performance, holding all other characteristics in the model at the weighted grand mean. Table 6 presents the regression coefficients for the final parsimonious models for math as standardized differences and their associated statistical significance; table 7 presents the results for reading. Appendix G provides the regression coefficients in their original metrics and the percentage of variance explained by the subset of characteristics in the models. As in the previous section, the discussion is limited to regression coefficients

**Table 6. CMT and CAPT math scores regressed on student characteristics, English proficiency scores, and types of English language learner programs, by grade span (coefficients in standard deviation units)**

Characteristic	Grade 3	Grades 4–5	Grades 6–8	Grades 9–12
Student characteristic (compared to grand mean)				
Home language not Spanish		0.42	-0.29	
Immigrant status (born outside the United States)	0.31*			
In special education	-0.36			-0.67
Gender (female)	-0.20*			
Race/ethnicity not Hispanic				0.36
Attendance rate		0.14**		
LAS Links English proficiency score	0.46***	0.69***	0.63***	0.63***
Types of English language learner programs (compared to grand mean)				
Grades K–8				
Transitional bilingual education	0.06	0.17	0.15	
Dual language bilingual education	-0.51**	0.24	0.10	
Language transition support services	0.14	0.06	-0.21*	
English as a second language services (for students speaking a language other than Spanish)	-0.47	-0.25	0.39	
Eligible but not served due to parent request	-0.01	0.09	0.01	
Grades 9–12				
Transitional bilingual education				-0.13
High school English as a second language				-0.01
Language transition support services				-0.51
Eligible but not served due to parent request				0.07

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

CMT is Connecticut Mastery Test. CAPT is Connecticut Achievement and Performance Test. LAS Links is Language Assessment Systems Links assessment.

**Source:** Authors' calculations based on data from the Connecticut State Department of Education.

that are either statistically significantly different from 0 or equivalent to a standardized difference of 0.25 or greater (the What Works Clearinghouse guideline on what constitutes a substantively important effect; U.S. Department of Education, 2008).

*The student characteristics associated with math and reading scores varied by grade span and content area.* In each grade span different student characteristics were associated with math and reading scores; students' home language and special education status were retained in more models than were the other student characteristics. Speaking a language other than Spanish was associated with higher math scores than the average for the grade span in grades 4–5 and higher reading scores in grades 3, 4–5, and 9–12 but lower math and reading scores in grades 6–8. Being in special education was associated with math scores lower than the average in grades 3 and 9–12 and reading scores lower than the average in all grade spans except grades 6–8.

*In all grade spans students' English proficiency scores were associated with math and reading performance.* In all grade spans higher English proficiency scores were associated with higher math and reading scores. Previous studies have shown that English proficiency scores, as measured by large-scale English proficiency assessments, are associated with student performance on large-scale content assessments (Parker, Louie, & O'Dwyer, 2009). The results presented here confirm that finding across all grade spans. Students' English

**Table 7. CMT and CAPT reading scores regressed on student characteristics, English proficiency scores, and types of English language learner programs, by grade span (coefficient in standard deviation units)**

Characteristics	Grade 3	Grades 4–5	Grades 6–8	Grades 9–12
Student-level characteristics (compared to grand mean)				
Home language not Spanish	0.56	0.28	-0.38	0.27
Immigrant status (born outside United States)				
In special education	-0.71	-0.43		-0.31
Gender (female)				
Race/ethnicity not Hispanic		0.24		-0.50
Attendance rate				
LAS Links English proficiency score	0.52***	0.63***	0.65***	0.55***
Types of English language learner programs (compared to grand mean)				
<i>Grades K–8</i>				
Transitional bilingual education	-0.20	-0.19	0.20	
Dual language bilingual education	-0.04	0.32*	0.18	
Language transition support services	-0.04	0.00	-0.24*	
English as a second language services (for students speaking a language other than Spanish)	-0.08	-0.37	0.50	
Eligible but not served due to parent request	0.34	-0.06	0.04	
<i>Grades 9–12</i>				
High school English as a second language				-0.24
Language transition support services				-0.07
English as a second language (for students speaking a foreign language other than Spanish)				0.13
Eligible but not served due to parent request				0.06

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

CMT is Connecticut Mastery Test. CAPT is Connecticut Achievement and Performance Test. LAS Links is Language Assessment Systems Links assessment.

**Source:** Authors' calculations based on data from the Connecticut State Department of Education.

proficiency was the only characteristic consistently associated with math and reading scores across all grades and grade spans.

*There were no clear patterns in the differences in math and reading scores across types of English language learner programs.* At each grade span in math, at least one type of English language learner program was associated with scores that differed from the average for the grade span. In reading this was the case in grades 4–8 but not in grades 3 and 9–12. Students participating in a particular type of English language learner program had scores above the average in some grade spans and below the average in other grade spans. For example, students receiving English as a second language services (for students speaking a language other than Spanish) in grades 4–5 had lower math and reading scores than the average for the grade span, while those in grades 6–8 had higher math and reading scores than the average for the grade span. Students receiving language transition support services in grades 6–8 had lower math and reading scores than the average for the grade span. These were the only cases in which the outcomes were similar for both math and reading scores; in all other cases there was no clear pattern.

*In most grade spans the variables associated with math and reading scores explained similar percentages of variance in math and reading performance.* In grades 3, 4–5, and

6–8 the variables associated with math and reading scores explained similar percentages of variance in these scores, although the variance differed across grade spans. In grades 4–5 the retained variables explained 51.0 percent of the variance in math scores and 48.0 percent in reading scores, compared with 34.4 percent and 33.0 percent in grade 3 and 39.5 percent and 40.7 percent in grades 6–8. In grades 9–12 the retained variables explained 41.8 percent of the variance in math scores and 29.4 percent in reading scores (see tables G2 and G3 in appendix G).

## **Discussion**

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Two areas merit discussion: the role of the LAS Links English proficiency assessment as both a dependent variable and a predictor of content assessment scores, and the association between special education status and both English proficiency scores and content assessment scores.

When LAS Links English proficiency score was used as the dependent variable in research question 2, the results showed that some student characteristics, types of English language learner programs, and school characteristics were retained in the models in various grade spans, indicating that English proficiency was associated with these characteristics. However, when English proficiency score was used as a predictor for math and reading assessment scores (research question 3), far fewer student characteristics and types of English language learner programs were associated with math and reading scores. This suggests that students' English proficiency levels were more closely and consistently related to performance on the state assessments in math and reading than were other student characteristics or types of English language learner programs. While it may seem intuitive that English proficiency scores were associated with content assessment scores, the subset of student characteristics and types of English language learner programs may be related to performance on the content assessments through their association with English proficiency scores, underlining the importance of looking at the results of both models in understanding English language learner student performance.

***Students' English proficiency levels were more closely and consistently related to performance on the state assessments in math and reading than were other student characteristics or types of English language learner programs***

The percentage of English language learner students in special education (15.9 percent) was higher than the overall district percentage of students in special education (12.0 percent). Being in special education was associated with English proficiency scores lower than the average at all grade spans and math and reading scores lower than the average in many grade spans. English language learner students in special education face unique challenges: There are risks of both over- and underidentification of disabilities among English language learner students because of the difficulty of distinguishing English language development from learning disabilities (Klingner, Artiles, & Barletta, 2006; Salend, 2008); there are risks of receiving inadequate or inappropriate services if there is insufficient collaboration between English language learner staff and special education staff; and English language learner students in special education run the risk of remaining indefinitely in English language learner programs and becoming “long-term English language learner students” with low academic performance and limited progress.

## **Recommendations for future research**

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This study's results suggest several areas for further research to better understand English language learner achievement patterns in the district and beyond.

While there are differences in performance on both the LAS Links and CMT/CAPT assessments by type of English language learner program, the differences do not have a clear pattern. Further research should prioritize looking at English language learner achievement longitudinally, in part because students' assignments to English language learner programs are determined partially by time (such as moving to language transition support services after 30 months). The results of longitudinal research would provide more information on language acquisition patterns and could help policymakers identify indicators to show when students diverge from those patterns and could benefit from additional or different interventions. The value of the studies depends on the availability of more variables than were available for this study, including a baseline measure of English proficiency, annual scores on English proficiency assessments, shifts in enrollment in English language learner programs over time, and other services provided (such as special education services and disability designations, as appropriate).

More research should also be done to better understand the relationship between English language proficiency and special education status. Previous research has noted that the identification of learning disabilities among English language learner students can be challenging and is handled differently from district to district (Sánchez, Parker, Akbayin, & McTigue, 2010), as are policies about services provided to dually identified students. This study's findings indicate that being in special education was associated with lower scores on almost every assessment in almost every grade span. Future research should include more information about the students, including disability designation, time in district, and services received.

### **Study limitations**

This study has several limitations.

First, the findings reported here do not support any conclusions about causality. The multi-level regression analyses and ordinary least squares analyses describe statistical associations rather than causal relationships between English proficiency and math and reading performance and student and school characteristics. Second, the student and school characteristics described in this report were collected by the school district and the Connecticut Department of Education and do not represent all possible characteristics associated with students' English proficiency scores or math and reading performance. For example, individual or family factors such as student motivation, parental involvement, parental education expectations, or household income may be related to education outcomes for English language learner students. It was also not possible to include a measure of the amount of time that students had been exposed to English.

Third, there may be systematic differences between students attending different types of English language learner programs. Parents of children eligible for bilingual education can choose transitional bilingual education, dual language bilingual education, or English as a second language services. Parents can also request that their children not receive any English language learner services at all. There may be systematic differences between parents who make one choice over another. In addition, students are eligible for bilingual education (whether dual language or transitional) only if 20 or more students have the same language background, and there may be systematic differences between students from high- and low-incidence language backgrounds.

***Further research should prioritize looking at English language learner achievement longitudinally, which would provide more information on language acquisition patterns and could help policymakers identify indicators to show when students diverge from those patterns***

Fourth, the conclusions that can be drawn from the study results are limited by the cross-sectional nature of the data and because there are no baseline or prior achievement assessment measures available for English language learner students. A longitudinal study would contribute to an understanding of patterns of English language acquisition.

Fifth, since this study used data from a student subgroup in a single school district, small sample sizes created challenges for the analyses. For example, the small sample sizes limited the type of regression analyses that could be used and the number of predictors included in the regression models. The ordinary least squares models used to address research question 2 for grades 9–12 and research question 3 for all grades did not include school characteristics and thus provide limited information. With more schools and students, other predictors of students' English proficiency scores and math and reading performance might have been identified. Also, since the subset of retained predictors for addressing research questions 2 and 3 varied across grades, the model results could not be compared. Readers are cautioned not to compare the coefficients across grades.

Finally, the results from this study may not be generalizable to English language learner students in other school districts in the region or to English language learner students in other regions. The results of the current study can be generalized only to English language learner students in the study district.

The statistical limitations and challenges described here are commonplace when conducting research on subgroups and in a single school district. The approaches used in this report may provide a model for how other school districts can analyze their data.

***The approaches used in this report may provide a model for how other school districts can analyze their data***

## **Appendix A. Literature review**

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English language learner students are one of the fastest growing subgroups in America's schools (Bos et al., 2012). Gaps between English language learner students and their native English-speaking peers in academic and achievement outcomes remain large in most districts and states (Simon et al., 2011). Federal regulations require that districts educate all students and close achievement gaps between English language learner students and native English-speaking students (No Child Left Behind Act of 2001). Current research on English language learner students highlights multiple factors that may influence their academic outcomes, including English language learner program pathways (for example, two-way bilingual, structured English immersion), English language learner student characteristics, the demographic characteristics of the schools that English language learner students attend, and English proficiency levels.

Understanding the potential effect of different English language learner programs on student outcomes is important for informing policy and program decisions at the state, district, and school levels. Numerous studies have examined the impact of English language learner programs and teaching strategies on English language acquisition and content learning (August, Branum-Martin, Cardenas-Hagan, & Francis, 2009; Edvantia, 2009; Francis, Rivera, Lesaux, Kieffer, & Rivera, 2006; Francis & Vaughn, 2009; Goldenberg, 2008; Goldenberg & Coleman, 2010; Kamps et al., 2007; Lindholm-Leary & Hernandez, 2011; López & Tashakkori, 2006; Northwest Regional Education Laboratory, 2004; Reardon, Khanna, Donovan, Marice, & Valentino, 2012; Rivera et al., 2010; Rolstad, Mahoney, & Glass, 2005; Short & Boyson, 2012; Slavin, Madden, Calderón, Chamberlain, & Hennessy, 2011; Snow, Lawrence, & White, 2009; Umansky, 2012; Vaughn et al., 2009). Some studies support the use of bilingual or dual language programs (where at least some content is taught in the students' native language) for English language learner students (Lindholm-Leary & Hernandez, 2011; Slavin et al., 2011), including two meta-analyses that report overall support for dual language programs in the studies reviewed (Northwest Regional Education Laboratory, 2004; Rolstad et al., 2005). Positive effects of English-only programs have also been found in earlier grades on reclassification rates of English language learner students, but overall reclassification rates were better for students enrolled in bilingual programs (Reardon et al., 2012; Umansky, 2012).

While the studies cited above support the use of particular programs with all English language learner students, other studies have found differential effects of programs depending on additional instruction characteristics. Calderón, Slavin, and Sanchez (2011) and Slavin et al. (2011) established that instruction quality matters more than type of program. Jepsen and de Alth (2005) found a significant, though small, positive association between English language learner–authorized teachers and growth in English language proficiency in California.<sup>3</sup> However, in that study student results were not connected to their specific teachers, only to their schools. In a different study of California schools, Williams et al. (2007) found no association—that the numbers of teachers with a California certificate to teach English language learner students was not associated with differences in school-level achievement scores. Likewise, two studies looking at the effect of professional development on teaching English language learner students found no effect of the professional development programs on student outcomes (Arens et al., 2012; Bos et al., 2012). While some studies show little or no relationship between teacher certification or professional development and English language learner student outcomes, other studies support the use of

teaching strategies such as tiered interventions with small group instruction (Kamps et al., 2007) and explicit instruction (Edvantia, 2009) with English language learner students. In addition, other studies suggest that teacher characteristics such as content knowledge (Cirino, Pollard-Durodola, Foorman, Carlson, & Francis, 2007) and proficiency in the student's first language (Dixon et al., 2012) may be related to student outcomes. Samson and Collins (2012) suggest that teachers should have a working knowledge of oral language development, teach academic language, and support cultural diversity when working with English language learner students.

Many studies, including those cited above, have found that student characteristics predict academic outcomes more accurately than program or teacher characteristics and that particular programs are more effective for particular groups of English language learner students. Using a nationally representative sample of high school language minority sophomores from the Educational Longitudinal Study, Callahan, Wilkinson, and Muller (2010) found that participation in English as a second language classes was associated with positive math outcomes for recent immigrants with low English language proficiency but not for students with greater English proficiency or students who were not recent immigrants. Similarly, English proficiency at program entry (López & Tashakkori, 2006) was found to be more predictive of later school success than was the type of program. A study of three New England states found that English language learner students' reading and writing sub-scores on an English proficiency assessment were the strongest correlates of their performance on state-level content assessments (Parker et al., 2009).

Additional student demographic characteristics such as immigrant status, race/ethnicity, and family socioeconomic status have been found to be related to various student outcomes. The Center for Public Education (Edvantia, 2007) found that for English language learner students both nonimmigrant status and the absence of learning disabilities were associated with English language acquisition. New immigrants must learn English, make cultural adjustments, and learn academic content in a new language simultaneously (Francis et al., 2006; Gándara, Rumberger, Maxwell-Jolly, & Callahan, 2003; Short & Fitzsimmons, 2007). Similarly, Parker, O'Dwyer, and Schamberg (2011) found that immigrant English language learner students and English language learner students in special education in Rhode Island were more likely to have lower English proficiency scores than were nonimmigrant English language learner students and English language learner students not in special education.

Immigrant students' standardized test scores in vocabulary and reading are generally lower than those of nonimmigrants (Hernandez & Charney, 1998; Leventhal, Xue, & Brooks-Gunn, 2006). In a study of early education, Glick and Hohmann-Marriott (2007) found that immigrant students had lower performance than nonimmigrant students did, though this varied by national origin. In a national longitudinal study of English language learner students in grades K–8, Hispanic students in grade 8 had lower English, math, and science scores than their non-Hispanic peers, and students living in poverty had lower scores than students not living in poverty (Mulligan, Halle, & Kinukawa, 2012). The scores were lower among students who had not attained English proficiency by the end of kindergarten than among students who were proficient at the beginning or by the end of kindergarten. The socioeconomic status of student households, particularly levels of parent education (Abedi & Dietel, 2004), is also related to English language acquisition rates (Capps et al., 2005; Jepsen & de Alth, 2005; Krashen & Brown, 2005). Not only are students from

lower socioeconomic backgrounds likely to perform below their more advantaged peers, but English language learner students are more likely to come from disadvantaged backgrounds than their native English-speaking peers (Flores, Batalova, & Fix, 2012; Simon et al., 2011), further confounding the problem.

School characteristics, including aggregated information about students, have also been found to be associated with English language learner students' English language acquisition and their state-level content assessment performance. Hakuta, Butler, and Witt (2000) found that in California and Canada, English language learner students attending schools with a higher percentage of students eligible for free or reduced-price lunch, on average, had lower English proficiency scores than similar students attending schools with a lower percentage of students eligible for free or reduced-price lunch. Parker et al. (2009) found that the percentage of students eligible for free or reduced-price lunch and the percentage of racial/ethnic minority students in New Hampshire, Rhode Island, and Vermont schools were associated with English language learner students' grade 8 state assessment scores in math.

Similar results were found in a study of English language learner and non-English language learner grade 10 Hispanic students in Massachusetts, where a higher percentage of students from low-income households or a higher percentage of English language learner students was associated with lower assessment scores (Sánchez, Ehrlich, Midouhas, & O'Dwyer, 2009). And in Rhode Island the percentage of English language learner students (grades 1, 3, 5, and 6–8), the percentage of students eligible for free or reduced-price lunch (grade 4), and whether a school met adequate yearly progress in math (grade 4) were statistically significant predictors of English proficiency assessment scores (Parker et al., 2011). Finally, in a longitudinal study using data from the Early Childhood Longitudinal Study, school factors were found to account for a third of the reduction in differences in performance between white English monolingual students and Hispanic English language learner students in grades K–5 (Han, 2012).

While little research has been conducted on the association between attendance rates and academic performance for English language learner students, a strong association has been found between attendance rates and academic performance in urban settings for all students at the elementary, middle, and secondary levels in Philadelphia (Gottfried, 2010). Given the high percentage of English language learner students in urban settings (Simon et al., 2011), the association found by Gottfried may be relevant for research on English language learner students.

## Appendix B. About the Language Assessment Systems Links assessment

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This study uses data on students' English language proficiency as measured by the Language Assessment Systems Links (LAS Links) assessment, which is administered to English language learner students in grades K–12 in Connecticut each spring to measure English proficiency. LAS Links was developed by CTB/McGraw-Hill in response to Title III of the No Child Left Behind Act of 2001, which requires assessment of students' progress toward English language proficiency. LAS Links assessments are aligned with CTB/McGraw-Hill's English Language Proficiency Assessment Standards, which include key standards from the national English as a second language and Teachers of English to Speakers of Other Languages standards for preK–12 students as well as the English as a second language standards from several states (CTB/McGraw-Hill, 2006).

Based on research in language acquisition, the LAS Links assessments combine English proficiency with content-area knowledge by using engaging, culturally relevant, and grade-appropriate content; realistic illustrations and contextualized reading passages; and a variety of test formats (for example, multiple-choice and constructed response questions) (CTB/McGraw-Hill, 2006).

LAS Links assessments include summative tests, a placement component, and benchmark materials (CTB/McGraw-Hill, 2006). Assessment scores are provided in four domains: reading, writing, speaking, and listening. In addition, composite scores for comprehension (listening and reading) and oral skills (listening and speaking) are provided, as well as an overall score that is the average of reading, writing, speaking, and listening. This project uses overall LAS Links English language proficiency scores for five grade spans: K–1, 2–3, 4–5, 6–8, and 9–12.<sup>4</sup>

- *Reading.* The reading component requires students to demonstrate that they can recognize letters and words, analyze words, complete sentences for meaning, understand synonyms and antonyms, and read a passage and then respond to reading comprehension questions.
- *Writing.* The writing component requires students to demonstrate that they can select appropriate words and mechanics to complete sentences, identify correct grammar, and write short sentences and respond to picture or writing prompts to produce longer writing samples.
- *Speaking.* The speaking component requires students to respond to picture prompts to demonstrate that they can identify, define, compare, and classify objects; describe locations and give directions; request and provide clarification; explain and give preferences; and talk in depth by telling a story while looking at a series of pictures.
- *Listening.* The listening component requires students to demonstrate that they can identify a letter, number, word, picture, and so forth; listen for information and follow directions; and listen to passages and answer comprehension questions.

Students' ability estimates in each domain are calculated using item response theory. Specifically, CTB/McGraw-Hill uses the three-parameter logistic model for the multiple-choice items and the two-parameter partial-credit model for the open-response items to place the individuals and items on the same scale with a mean of 500 and a standard deviation of 50. Students' overall LAS Links scores were calculated from the unweighted average of the scores across the reading, writing, speaking, and listening domains.

CTB/McGraw-Hill conducted extensive studies to ensure that the assessment items and the test as a whole were valid and reliable. Specifically, they documented the extensive steps they undertook to ensure that the items on the LAS Links are aligned to their English Language Proficiency Assessment Standards, have difficulty levels appropriate for the grade spans and for the purpose of the test, have appropriate distracters for the multiple-choice questions, and provide opportunities for appropriate responses to the constructed response questions. In addition, individual items and the test as a whole were reviewed for the elements of universal design (for example, simple and intuitive use, tolerance for error, low physical effort), bias and sensitivity, and inclusion and fairness (CTB/McGraw-Hill, 2006). Item difficulties and reliability estimates were estimated using item response theory, the procedure used to estimate students' English proficiency. In addition, interrater reliability for the constructed response questions was estimated using intraclass correlations and weighted Kappa coefficients, and differential item functioning analyses were conducted for gender and ethnicity. The results of these analyses are presented in the LAS Links Technical Manual (CTB/McGraw-Hill, 2006). Table B1 presents a summary of the statistics (lowest–highest possible scale scores, average item difficulty level, and reliability estimate) for the reading, writing, listening, and speaking portions of the LAS Links assessment.

**Table B1. Summary of the statistics for the LAS Links assessment domains**

Statistic	Grades K–1	Grades 2–3	Grades 4–5	Grades 6–8	Grades 9–12
<b>Reading</b>					
Lowest–highest possible scale scores	240–550	300–610	360–680	380–690	390–700
Average item difficulty level <sup>a</sup>	0.64	0.66	0.60	0.59	0.60
Reliability estimate <sup>a</sup> ( $\alpha$ )	0.86	0.88	0.89	0.87	0.88
<b>Writing</b>					
Lowest–highest possible scale scores	200–630	270–640	290–680	300–690	310–700
Average item difficulty level <sup>a</sup>	0.46	0.60	0.68	0.70	0.71
Reliability estimate <sup>a</sup> ( $\alpha$ )	0.89	0.89	0.90	0.89	0.89
<b>Listening</b>					
Lowest–highest possible scale scores	300–530	310–560	350–630	360–640	370–650
Average item difficulty level <sup>a</sup>	0.68	0.79	0.67	0.68	0.66
Reliability estimate <sup>a</sup> ( $\alpha$ )	0.82	0.83	0.80	0.82	0.82
<b>Speaking</b>					
Lowest–highest possible scale scores	300–580	310–600	320–635	325–645	330–650
Average item difficulty level <sup>a</sup>	0.65	0.73	0.65	0.64	0.65
Reliability estimate <sup>a</sup> ( $\alpha$ )	0.95	0.94	0.93	0.94	0.93

LAS Links is Language Assessment Systems Links.

a. Values are the averages across Forms A and B of the LAS Links assessments.

**Source:** CTB/McGraw-Hill, 2006.

## **Appendix C. Measures of academic achievement**

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Scores on the Connecticut Mastery Test (CMT), fourth generation, and the Connecticut Academic Performance Test (CAPT), third generation, were used as estimates of students' academic achievement in math and reading. This appendix summarizes the characteristics of each assessment, the scores reported, and information about the psychometric properties of the assessments.

The CMT and CAPT are administered in the spring semester to students in all public schools in Connecticut; the CMT is administered to students in grades 3–8, and the CAPT is administered to students in grade 10. These criterion-referenced assessments are aligned with the content standards outlined in the Connecticut Curriculum Frameworks (Connecticut State Department of Education n.d. a,b) and are used to meet federal testing and reporting requirements.

The development of the CMT and CAPT is overseen by the Connecticut State Department of Education's Bureau of Student Assessment, as well as by curriculum, content, and assessment specialists. In addition, a Fairness Committee monitors test validation. According to the technical manuals available from the Connecticut State Department of Education, the test development process for both assessments follows the *Standards for Educational and Psychological Testing* described in 1999 by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education (Hendrawan & Wibowo, 2012a,b). Specifically, the process begins with the formulation of the test specifications and blueprints (that is, the determination of the most important concepts to be assessed and the test format), and items are subsequently developed to align with the specifications and blueprints. This pool of items is then used to create multiple equivalent assessment forms for each domain, and the equivalence of the test forms is established empirically through an equating process (Hendrawan & Wibowo, 2012a,b).

Evidence on the content, criterion, and construct validity of the CMT and CAPT has been gathered for each generation of the assessments since their inception. The test items undergo extensive field testing during which quality control procedures are developed for scoring the constructed response test items. Item statistics are used to guide the development of the final forms, thereby ensuring that the tests provide reliable information about individual students across a range of possible scores. Item difficulty, item discrimination, and differential item functioning statistics are calculated, and only items with optimal psychometric characteristics are considered for inclusion on the tests. Optimal psychometric characteristics include item difficulty values greater than or equal to 0.25 (for multiple-choice items only), item discrimination values greater than or equal to 0.20, and nonsignificant differential item functioning statistics (Hendrawan & Wibowo, 2012a,b). The following sections provide specific information about the domains assessed on the CMT and CAPT.

### **The Connecticut Mastery Test, fourth generation**

The CMT, first administered in 1985, is now in its fourth generation (introduced in spring 2006). The criterion-referenced CMT assesses students' mastery of the content standards outlined in the Connecticut Curriculum Frameworks in math, language arts, and science (Connecticut State Department of Education n.d. b,c,d). Specifically, the CMT assesses students in math, reading comprehension, and writing in grades 3–8 and in science in

grades 5 and 8. In assessing these domains, the CMT includes performance tasks that require students to apply what they know to solve everyday problems. CMT scores are used to diagnose individual students, make student placement decisions, guide curriculum and instruction, and meet federal testing and reporting requirements.

Because English language learner students' scale scores on the math and reading portions of the CMT assessments in grades 3–8 for the 2010/11 school year were used to address the research questions, only these two CMT domains are described in detail here.

***The CMT Mathematics Assessment.*** The CMT math assessment measures mastery of grade-appropriate skills and concepts and students' ability to solve real-world math problems. Twenty-five topics are assessed, organized under the following four content standards outlined in the Mathematics Curriculum Frameworks:

- Numerical and proportional reasoning.
- Geometry and measurement.
- Working with data: probability and statistics.
- Algebraic reasoning: patterns and functions.

Students' total CMT math scores are calculated from the items representing each of the four content standards. Students receive scale scores ranging from 100 to 400, and to allow comparisons across grades, vertical scale scores are reported on a scale from 200 to 700. Scale scores are used to classify students into one of five performance levels: below basic, basic, proficient, goal, or advanced. Table C1 presents the overall scale score summary statistics and reliability estimates (Cronbach's  $\alpha$ ) for the CMT math assessment by grade level (Hendrawan & Wibowo, 2012a).

***The CMT Reading Assessment.*** The CMT reading assessment is mandated for all English language learner students in grades 3–8 who have been registered at a school in Connecticut for more than 10 months. The CMT reading assessment is composed of the Degrees of Reading Power test<sup>5</sup> (administered in one session) and a reading comprehension test (administered over two sessions). The Degrees of Reading Power test is a multiple-choice test that measures students' ability to read and understand nonfiction English prose using passages of graduated difficulty on various topics. Students' scores are reported as a norm-referenced score (providing national percentile rank information).

The reading comprehension portion of the CMT measures students' ability to read and understand fiction and nonfiction. It presents students with narrative and informational passages on various topics, and students respond to multiple-choice and open-ended questions after reading each passage. The topics assessed on the reading comprehension test are organized under the following four content standards outlined in the Language Arts Curriculum Frameworks:

- Forming a general understanding.
- Developing an interpretation.
- Demonstrating a critical stance.
- Examining content and structure.

The passages selected for inclusion on the assessments at each grade level represent three contexts for reading: reading for literary experience, reading for information, and reading to perform a task (in grades 5–8 only).

Students' total CMT reading score is calculated from the items representing each of the four content standards. Students receive scale scores ranging from 100 to 400. To allow comparisons across grades, vertical scale scores are reported on a scale from 200 to 700. Students' scale scores are used to classify students into one of five performance levels: below basic, basic, proficient, goal, or advanced. Table C1 presents the overall scale score summary statistics and reliability estimates (Cronbach's  $\alpha$ ) for the CMT reading assessment by grade level (Hendrawan & Wibowo, 2012a).

### The Connecticut Academic Performance Test, third generation

The CAPT was first administered to grade 10 students in math, science, reading, and writing in 1995 and is currently in its third generation. The Connecticut General Statutes (section 10–14n) require that all grade 10 public school students be assessed using a state-wide assessment, the CAPT. Students' scores on the criterion-referenced CAPT are not used as the only criterion for graduation, but they are used to evaluate whether individual students are eligible to graduate and are included in school records and official transcripts. The CAPT assesses grade 10 students' performance in math, reading, science, and writing and is focused on whether students can apply what they have learned in school to real-world situations. The CAPT is aligned with the content standards outlined in the Connecticut Curriculum Frameworks, and scores are used to meet federal testing and reporting requirements. All English language learner students take the math and science assessments regardless of the number of months in a program. Reading is administered only to English language learner students enrolled more than 10 months in a program.

Students receive an overall scale score on each of the math, science, reading, and writing portions of the CAPT, and scores for the math and science content strands and reading and writing language arts subtests. Because English language learner students' scores on the math and reading portions of the CAPT assessments in grade 10 for the 2010/11 school year were used to address the research questions, only those two CAPT domains are discussed here.

**The CAPT Mathematics Assessment.** The CAPT math assessment measures mastery of grade-appropriate skills and concepts and students' ability to solve real-world math problems that draw on everyday experiences and workplace needs. The topics assessed are organized under the following four content standards outlined in the Mathematics Curriculum Frameworks:

- Numerical and proportional reasoning.

**Table C1. Summary of Connecticut Mastery Test overall scale score statistics and reliability estimates, by grade and subject**

Grade	Math			Reading		
	Mean	Standard deviation	Reliability estimate ( $\alpha$ )	Mean	Standard deviation	Reliability estimate ( $\alpha$ )
3	258.93	51.35	0.94	241.12	41.77	0.94
4	266.81	50.38	0.95	255.36	43.46	0.94
5	273.27	49.99	0.96	242.66	44.22	0.94
6	267.74	45.06	0.96	266.78	43.50	0.94
7	268.66	45.51	0.97	255.95	46.89	0.95
8	263.78	44.13	0.97	261.37	44.88	0.95

Source: Hendrawan & Wibowo, 2012a.

- Geometry and measurement.
- Working with data: probability and statistics.
- Algebraic reasoning: patterns and functioning.

Students' overall CAPT math score and their scores on each of the four content standards are calculated from open-ended and multiple-choice items. Specifically, an overall math scale score ranging from 100 to 400 is calculated and subsequently used to classify students into one of five performance levels: below basic, basic, proficient, goal, or advanced. Scores in each content standard are weighted equally for the calculation of students' overall math score. In addition, scores are reported for the numerical and proportional reasoning, geometry and measurement, working with data, and algebraic reasoning strands. Table C2 presents the overall scale score summary statistics and reliability estimates (Cronbach's  $\alpha$ ) for the CAPT math assessment (Hendrawan & Wibowo, 2012b).

**The CAPT Reading Assessment.** The CAPT reading assessment is made up of the Response to Literature test and the Reading for Information test. Using different formats, both assessments measure students' ability to understand, interpret, and evaluate written text.

On the Response to Literature test, students are asked to read a short published story and then respond to four open-ended writing questions. Two trained and independent raters provide scores for each response (on a scale from 1 to 6) based on how well students' responses form an initial understanding of the text, develop an interpretation of the text, make connections between the text and other texts or experiences, and demonstrate a critical position supported by the text.

On the Reading for Information portion of the test, students are asked to read two non-fiction articles taken from published sources (for example, magazines, newspapers, or journals) and then respond to 12 multiple-choice and 6 open-ended, short-answer questions. This portion of the reading assessment measures how well students can interpret or explain each article and evaluate the authors' writing.

Students' overall CAPT reading score and their scores on the Reading for Information test and Response to Literature test are calculated from open-ended and multiple-choice items. An overall scale score ranging from 100 to 400 is calculated by combining scores on the Response to Literature and Reading for Information tests and subsequently used to classify students into one of five performance levels: below basic, basic, proficient, goal, or advanced. In addition, students' raw scores are reported for the Reading for Information test, and holistic scores are reported for the Response to Literature test. Table C2 presents the overall scale score summary statistics and reliability estimates (Cronbach's  $\alpha$ ) for the CAPT reading assessment (Hendrawan & Wibowo, 2012b).

**Table C2. Summary of Connecticut Academic Performance Test overall scale score statistics and reliability estimates**

	Mean	Standard deviation	Reliability estimate ( $\alpha$ )
Math	255.59	45.87	0.94
Reading	244.78	45.50	0.83

Source: Hendrawan & Wibowo, 2012b.

## **Appendix D. Analysis sample**

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For research questions 1 and 2, as many English language learner students as possible were retained in the analysis sample by removing only English language learner students who were missing an overall Language Assessment Systems Links (LAS Links) English proficiency score and information on immigrant status (whether they were born in the United States). No other variables had missing values. Missing data were not imputed because no other data were deemed appropriate for this purpose. For example, students who were missing an overall LAS Links score were also missing each of the subdomain scores from which the overall score was calculated. Likewise, immigrant status was not highly correlated with any other available variables in the dataset.

For the analyses conducted for question 3, students with missing Connecticut Mastery Test (CMT) or Connecticut Academic Performance Test (CAPT) math scores were not included in the analysis sample for math, and students with missing CMT or CAPT reading scores were not included in the analysis sample for reading. Allowing the samples to vary for math and reading allowed as much of the original data as possible to be retained in the analysis samples.

Table D1 summarizes the analysis samples for each research question and grade span.

**Table D1. Summary of the analysis samples by research question and by grade**

Grade	Original sample size	Missing LAS Links score	Missing immigrant status	Percentage missing one or both variables	Sample size for research question 1	Sample size for research question 2	Sample size for research question 3	
							Math	Reading
K	348	20	17	10.6	311	566	na	na
1	284	11	18	10.2	255		na	na
2	290	12	18	10.3	260	490	na	na
3	259	8	21	11.2	230		207 <sup>a</sup>	197 <sup>b</sup>
4	209	11	26	17.7	172	345	288 <sup>c</sup>	256 <sup>d</sup>
5	204	8	23	15.2	173			
6	190	15	23	20.0	152	406	321 <sup>e</sup>	282 <sup>f</sup>
7	130	6	9	11.5	115			
8	174	11	24	20.1	139			

  

Grade	Original sample size	Missing LAS Links score <sup>g</sup>	Percentage missing	Sample size for research question 1	Sample size for research question 2	Sample size for research question 3	
						Math	Reading
9	158						
10	115						
11	89	82	19.2	344	344	112 <sup>h,i</sup>	100 <sup>j</sup>
12	64						
Total	2,514	363	14.4	2,151	2,151	928	835

na is not applicable because students in grades K–2 do not take CMT or CAPT.

LAS Links is Language Assessment Systems Links assessment.

- a.** Of the 230 students in grade 3 with LAS Links scores and immigrant status information, 16 (7.0 percent) took the Modified Assessment System (MAS) in math, and 7 (3.0 percent) had a score of 0 or were missing scores. These 23 students were not included in the analysis sample.
- b.** Of the 230 students in grade 3 with LAS Links scores and immigrant status information, 20 (8.7 percent) took the MAS in reading, 7 (3.0 percent) were exempt from the reading portion of the CMT, and 6 (2.6 percent) had a score of 0 or were missing scores. These 33 students were not included in the analysis sample.
- c.** Of the 345 students in grades 4–5 with LAS Links scores and immigrant status information, 47 (13.6 percent) took the MAS in math, and 10 (2.9 percent) had a score of 0 or were missing scores. These 57 students were not included in the analysis sample.
- d.** Of the 345 students in grades 4–5 with LAS Links scores and immigrant status information, 54 (15.7 percent) took the MAS in reading, 26 (7.5 percent) were exempt from the reading portion of the CMT, and 9 (2.6 percent) had a score of 0 or were missing scores. These 89 students were not included in the analysis sample.
- e.** Of the 406 students in grades 6–8 with LAS Links scores and immigrant status information, 73 (18.0 percent) took the MAS in math, and 12 (3.0 percent) had a score of 0 or were missing scores. These 85 students were not included in the analysis sample.
- f.** Of the 406 students in grades 6–8 with LAS Links scores and immigrant status information, 79 (19.5 percent) took the MAS in reading, 36 (8.9 percent) were exempt from the reading portion of the CMT, and 9 (2.2 percent) had a score of 0 or were missing scores. These 124 students were not included in the analysis sample.
- g.** In grades 9–12 the only exclusionary criteria for research questions 1 and 2 was LAS Links score. Since immigrant status was not included in the model, students with missing immigrant status were not excluded.
- h.** Of the 344 students in grades 9–12 with LAS Links scores, 11 (3.2 percent) took the MAS in math, and 25 (7.3 percent) had a score of 0. These 36 students were not included in the analysis sample. Nor were the 196 students who did not take the math CAPT at all because it is usually administered only to students in grade 10.
- i.** The CAPT is typically administered to students in grade 10. However, in the analyses sample, 2 grade 9 students, 30 grade 11 students, and 1 grade 12 student completed the CAPT. These 33 students were retained in the analysis sample.
- j.** Of the 344 students in grades 9–12 with LAS Links scores, 12 (3.5 percent) took the MAS in reading, and 36 (10.5 percent) had a score of 0. These 48 students were not included in the analysis sample. No information was available about students' exempt status at these grade levels. Also excluded were another 196 students who did not take the reading CAPT at all because it is usually administered only to students in grade 10.

**Source:** Authors' calculations based on data from the Connecticut State Department of Education.

## **Appendix E. Analysis methods**

Descriptive analysis, multilevel regression analysis, and ordinary least squares (OLS) regression analysis were used to address the research questions. The purposes of the analyses were descriptive and correlational, describing either single characteristics or associations among characteristics. As such, causal inferences are not possible, and the analyses conducted to address the research questions do not support causal claims about how student, program, and school demographic characteristics are related to English language learner students' performance on the LAS Links assessment or their performance in math and reading.

This appendix describes the multilevel regression analysis and OLS analysis conducted to address research questions 2 and 3, describes the types of information provided by each analysis, and provides guidance on interpreting the reported findings. Prior to describing the analysis procedures, the analytic consequences associated with analyzing small sample sizes are discussed.

### **Sample size considerations**

This study required analysis of data from a subgroup of the population (English language learner students) and used data from a single school district. Small sample sizes created challenges for the analysis and had two important consequences. First, the sample sizes available at each grade span limited the type of regression analyses that could be used. Second, the small samples limited the number of predictors that could be included in the regression models. The ways in which each challenge was addressed are discussed in turn.

Since English language learner students are nested in schools, it was appropriate to consider using multilevel regression modeling for analyzing the data. Multilevel regression is used to model the statistical dependency among observations and allows individual and group characteristics to be included in a single model while maintaining correct standard errors (Raudenbush & Bryk, 2002). The nonzero intraclass correlations presented in tables E1 and E2 indicate a statistical dependency among the English language learner students in the sample and suggest that multilevel regression modeling would be an appropriate analysis method. However, tables E1 and E2 also indicate that the number of schools available for analysis for grades 9–12 for research question 2 was small (11 schools) and that the average number of students within schools for research question 3 was small (8–12 students).<sup>6</sup> Due to these small samples, multilevel regression modeling was not an appropriate analysis method. Instead, OLS regression was used to address research question 2 for grades 9–12 and research question 3 for all grades (3–12).

Despite the small sample sizes, the nonzero intraclass correlation coefficients suggest that statistical dependency remained for these data. Without any adjustment for the degree of nesting within schools, the standard errors associated with the OLS regression coefficients were likely to be artificially small, thereby increasing the Type I, false positive error rate. To account for this, the standard errors associated with the regression coefficients from the OLS regression models were adjusted using the square root of the design effect (*DEFF*), which is the ratio of the sampling variability for this study compared with the sampling variability that would be expected if the study used a simple random sample and

was calculated using the unconditional intraclass correlation coefficient (*ICC*) and the average number of students in the schools ( $\bar{n}_j$ ) as follows:

$$DEFF = 1 + ICC(\bar{n}_j - 1).$$

The square root of the design effect was subsequently multiplied by the standard error produced by the OLS model.

$$\text{Adjusted standard error} = (\text{Original standard error})(\sqrt{DEFF}).$$

Only the adjusted standard errors are reported and interpreted in the body of this report.

The small sample sizes also limited the number of predictors that could be included in the regression models. Table E1 presents estimates of the minimum detectable standardized difference for each grade span for the question 2 analysis in which students' LAS Links English proficiency scores were regressed on student characteristics, types of English language learner programs, and school characteristics. The minimum detectable effects range from 0.40 in grades 2–3 to 0.73 in grades 9–12.

Table E2 presents the same information for the outcomes and grade spans used to address research question 3. The minimum detectable effects range from 0.50 to 0.74 for math and from 0.43 to 0.98 for reading.

The estimated minimum detectable standardized differences in tables E1 and E2 indicate that the models were limited in their ability to detect small effects and would not support the inclusion of all available student and school characteristics. In an effort to maximize statistical power, the regression models were constructed in stages by sequentially adding types of English language learner programs along with blocks of related student and school characteristics. Types of English language learner programs were retained in all models, but only the student and school characteristics that were most closely associated with the dependent variables (overall LAS Links English proficiency score for research question 2,

**Table E1. Minimum detectable standardized difference (for  $\alpha = .05$  and power = 0.80) for analysis of research question 2: overall LAS Links English proficiency score regressed on student characteristics, types of English language learner programs, and school characteristics**

Grade span	Number of schools	Average number of English language learner students per school	Intraclass correlation coefficient (percent) <sup>a</sup>	Minimum detectable standardized difference (for $\alpha = .05$ and power = 0.80) <sup>b</sup>
K-1	28	20.21	22.6	0.57
2-3	27	18.15	7.6	0.40
4-5	24	14.38	27.0	0.68
6-8	28	14.50	19.2	0.54
9-12	11	31.27	12.4	0.73

a. From table G1 in appendix G.

b. Estimated using Optimal Design Software (Raudenbush et al., 2011).

Source: Authors' calculations based on data from the Connecticut State Department of Education.

**Table E2. Minimum detectable standardized difference (for  $\alpha = .05$  and power = 0.80) for analysis of research question 3: math and reading scores regressed on student characteristics, overall LAS Links English proficiency scores, types of English language learner programs, and school characteristics**

Subject and grade span	Number of schools	Average number of English language learner students per school	Intraclass correlation coefficient (percent) <sup>a</sup>	Minimum detectable standardized difference (or $\alpha = .05$ and power = 0.80) <sup>b</sup>
<b>Math</b>				
3	25	8.28	11.22	0.55
4–5	24	12.00	9.97	0.50
6–8	26	12.35	15.73	0.55
9–12	11	10.18	5.56	0.74
<b>Reading</b>				
3	23	8.57	5.05	0.48
4–5	24	10.67	4.21	0.43
6–8	26	10.85	7.67	0.46
9–12	11	9.09	16.77	0.98

a. From table G2 in appendix G.

b. Estimated using Optimal Design Software (Raudenbush et al., 2011).

Source: Authors' calculations based on data from the Connecticut State Department of Education.

and math and reading scores for research question 3) were retained. In this way, parsimonious models were created at each grade span that included type of English language learner program and a subset of the available student and school characteristics and were reported as the final model in the body of this report. For each model, the association between the predictors and the dependent variable, represented by the magnitude and size of the regression coefficient, was evaluated using two criteria:

- Using the adjusted standard error, the regression coefficient had to be statistically significantly different from 0.
- The regression coefficient had to be equivalent to a standardized difference of 0.25 or greater. The choice of 0.25 was based on the What Works Clearinghouse guidelines constituting substantively important effects (U.S. Department of Education, 2008).

Based on the findings from the literature review (see appendix A), student and school characteristics were grouped as follows:

- Student characteristics: student special education status, immigrant status,<sup>7</sup> gender, race/ethnicity, home language, and school attendance rate.
- Types of English language learner programs: transitional bilingual education, dual language bilingual education, English as a second language (not in transitional bilingual education due to parent request), high school English as a second language services, language transition support services, English as a second language services for students speaking a language other than Spanish, or eligible for an English language learner program but not served due to parent request.
- School characteristics: school size, percentage of English language learner students, percentage of students in special education, percentage of racial/ethnic minority students, percentage of students eligible for free or reduced-price lunch, percentage of English language learner students taught by English language learner–certified teachers, percentage of students scoring proficient or higher on the state math

assessment, and percentage of students scoring proficient or higher on the state reading assessment.

All continuous student and school characteristics were centered around the grand mean across all students and schools within each grade span, and all dichotomous and multicategory characteristics were coded using weighted effects coding. Weighted effects coding was deemed appropriate because it allowed the regression coefficients in the models to be interpreted as the deviation of the mean for the group being compared (for example, students in special education) from the weighted grand mean (that is, the intercept in the model). Weighting was used because the group sizes were unequal. Additional information about how the intercept and regression coefficients are interpreted with weighted effects coding is provided in the discussion that follows, and appendix F provides a description of the variables in each category and describes how each was coded for the analyses.

### Multilevel regression models

To address research question 2 for grades K–8, multilevel regression modeling procedures were used. Students' LAS Links English proficiency scores were regressed on student characteristics, types of English language learner programs, and school characteristics, and analyses were conducted and reported separately for each grade span.

Following the procedures described above, intercept-only two-level regression models were formulated sequentially for each grade span, K–1, 2–3, 4–5, and 6–8. In these models students were nested within schools. This two-level model assumed a random sample of  $i$  students within  $j$  schools in order to examine the association between students' LAS Links English proficiency scores ( $Y_{ij}$ ) and a linear combination of  $K$  student demographic characteristics,  $L$  types of English language learner programs, and  $W$  school characteristics. A parsimonious model was created by retaining only a subset of the student characteristics, types of program, or school characteristics that met the study's criteria. The general form of the student-level model used to address research question 2 in grade spans K–1, 2–3, 4–5, and 6–8 was:

$$\text{LAS Links}_{ij} = \beta_{0j} + \sum_{k=1}^K \beta_{kj}(\text{Student characteristics})_{kij} + \sum_{l=1}^L \beta_{lj}(\text{ELL program type})_{lij} + r_{ij}$$

This model states that the expected LAS Links English proficiency score is composed of a unique intercept  $\beta_{0j}$  and regression coefficients for each student characteristic ( $\beta_{kj}$ ) and type of program ( $\beta_{lj}$ ), as well as a random student effect ( $r_{ij}$ ).

Except for the continuous attendance rate predictor, which was centered around the grand mean across all students and schools within each grade span, the dichotomous and multicategory  $K$  student characteristics and  $L$  types of English language learner programs were coded using weighted effects coding procedures (see appendix F). With this coding scheme, the intercept in this model ( $\beta_{0j}$ ) is the expected weighted grand mean, and the level 1 regression coefficients for the dichotomous and multicategory student characteristics ( $\beta_{kj}$ ) and types of programs ( $\beta_{lj}$ ) are the deviation of the mean for the group represented by the contrast and the weighted grand mean. Examples of how the regression coefficients for the dichotomous and multicategory predictors follow.

- The coefficient associated with the dichotomous home language variable (table F1 in appendix F) is the expected difference between the mean LAS Links English

proficiency score for students who speak a language other than Spanish and the weighted grand mean LAS Links score. The difference for students who speak Spanish is not directly observed from the regression coefficients in the model but can be calculated using  $-\frac{N_{\text{Other than Spanish}}}{N_{\text{Spanish}}} b_{\text{Other}}$ , where  $b_{\text{Other}}$  is the regression coefficient associated with the home language variable (that is, the students that speak a language other than Spanish).

- The coefficients associated with the  $L$  multicategory types of English language learner programs (table F2 in appendix F) are the expected differences between the mean LAS Links English proficiency score for students in each type of English language learner program and the weighted grand mean LAS Links score. Students receiving English as a second language services (not in transitional bilingual education due to parent request) are the comparison group (see table F2 in appendix F), so the difference for students receiving English as a second language services (not in transitional bilingual education due to parent request) is not directly observed from the regression coefficients in the model. However, it can be calculated using the weighted sum of the regression coefficients for the type of English language learner program included in the model using  $-\sum_{i=1}^L \frac{N_i}{N_{\text{Other}}} b_i$ , where  $b_i$  are the regression coefficients associated with the  $L$  types of English language learner programs.

As these were intercept-only models, the variation in the student-level intercept, the weighted grand mean LAS Links English proficiency score, was modeled at the school level as the dependent variable. The level 1 regression coefficients for the student characteristics ( $\beta_{kj}$ ) and types of programs ( $\beta_{lj}$ ) were fixed at level 2 because the small number of schools precluded the reliable estimation of any variation in the student-level regression coefficients across schools. The general form of the school-level models used to address research question 2 for grades K–1, 2–3, 4–5, and 6–8 was as follows, where  $W_1$  is school demographic characteristics (school size, percentage of students in special education, percentage of racial/ethnic minority students, percentage of students eligible for free or reduced-price lunch),  $W_2$  is school performance measures (percentage of students scoring proficient or higher on the state math assessment and percentage of students scoring proficient or higher on the state reading assessment), and  $W_3$  is school characteristics related to English language learner students (percentage of English language learner students and percentage of English language learner students taught by English language learner-certified teachers):

$$\beta_{0j} = \gamma_{00} + \sum_{w1=1}^{W1} \gamma_{0w1} (\text{School characteristics})_{w1j} + \sum_{w2=1}^{W2} \gamma_{0w2} (\text{School performance measures})_{w2j} + \sum_{w3=1}^{W3} \gamma_{0w3} (\text{School characteristics related to English language learner students})_{w3j} + u_{0j}$$

and

$$\begin{aligned} \sum_{k=1}^K \beta_{kj} &= \gamma_{k0} \\ \sum_{l=1}^L \beta_{lj} &= \gamma_{l0} \end{aligned}$$

These models provided the regression coefficients, associated standard errors, and the significance of the coefficients (from zero) used to address research question 2 for grades K–1, 2–3, 4–5, and 6–8. These elements of the model results are reported in the body of this

report. Descriptions of the methods used for reporting the findings from the models are presented later in this appendix.

### Ordinary least squares regression models

To address research question 2 for grades 9–12 and research question 3 for all grade spans, OLS regression was used. For research question 2, the association between students' overall LAS Links English proficiency scores and student characteristics and type of English language learner program attended was examined. For research question 3 the association between students' math and reading Connecticut Mastery Test (CMT) and Connecticut Academic Performance Test (CAPT) scores and student characteristics, type of English language learner program attended, and students' LAS Links scores was examined. Analyses were conducted and reported separately for each grade span and separately for math and reading. For the OLS analyses only student predictors were evaluated for inclusion in the models.

Following the procedures used for the multilevel regression analyses, the continuous student characteristics were centered around the grand mean across all students and schools within each grade span, and the dichotomous and multicategory variables were coded using weighted effects coding procedures (see appendix F).

To address research question 2 for grades 9–12, the association between student  $i$ 's LAS Links English proficiency score and a linear combination of  $K$  student characteristics and  $L$  types of English language learner programs was examined. A parsimonious OLS model was created by retaining only a subset of the available student characteristics. The general form of the OLS model used to address research question 2 for grades 9–12 was:

$$LAS\ Links_i = a_i + \sum_{k=1}^K \beta_k (Student\ characteristics)_{ki} + \sum_{l=1}^L \beta_l (ELL\ program\ type)_{li} + e_i.$$

This model states that the expected LAS Links score is composed of a unique intercept ( $a_i$ ), and regression coefficients for each student characteristic ( $\beta_{kj}$ ) and type of program ( $\beta_{lj}$ ), as well as a random student effect ( $e_i$ ). The regression coefficients for the weighted effects coded dichotomous and multicategory variables were interpreted in the same way as described for the multilevel regression models.

This model provided the regression coefficients, associated standard errors (adjusted), and the significance of the coefficients (from zero) used to address research question 2 for grades 9–12. These elements of the model results are reported in the body of this report. Descriptions of the methods used for reporting the findings from the models are presented in the next section.

To address research question 3 for all grade spans, the association between students' scores on the math and reading state assessments and student characteristics, type of English language learner program attended, and students' LAS Links English proficiency scores was examined. Depending on the grade span, students' CMT or CAPT scores were analyzed (see appendix C). For grades 3–8 the dependent variables in the regression analyses were students' vertically scaled math and reading scores on the CMT. For grades 9–12 the dependent variables were students' math and reading scores on the CAPT. Analysis of the CMT in grades 3–8 was conducted separately for grade 3 and by grade span in grades

4–8 (4–5 and 6–8). Analysis of the CAPT was conducted separately for students in grades 9–12.<sup>8</sup>

The association between student  $i$ 's CMT and CAPT scores (in math or reading) and a linear combination of  $K$  student characteristics, students' LAS Links English proficiency scores, and  $L$  types of English language learner programs was examined. The general form of the OLS model used to address research question 3 was:

$$\text{CMT/CAPT scores}_i = a_i + \sum_{k=1}^K \beta_k (\text{Student characteristics})_{ki} + \beta_q (\text{LAS Links score})_i + \sum_{l=1}^L \beta_l (\text{ELL program type})_{li} + e_i$$

This model states that the expected CMT or CAPT score is composed of a unique intercept ( $a_i$ ), and regression coefficients for each student characteristic ( $\beta_{kj}$ ), students' LAS Links score ( $\beta_q$ ), and type of program ( $\beta_l$ ), as well as a random student effect ( $e_i$ ).

This model provided the regression coefficients, associated standard errors (adjusted), and the significance of the coefficients (from zero) used to address research question 3 at all grade spans. These elements of the model results are reported in the body of this report. Descriptions of the methods used for reporting the findings from the models are presented in the next section.

### Model reporting procedures

The coefficients associated with the subset of predictors retained in the regression models are reported in two ways. First, they are presented in the units of the dependent variable: LAS Links English proficiency score for research question 2 and CMT or CAPT score for research question 3. The dichotomous and categorical predictors were coded using weighted effects coding (see appendix F), so the regression coefficients for these predictors are the expected difference in scale score points between the mean for the group being compared and the weighted grand mean, holding all other predictors in the model constant. For the continuous predictors, each of which was centered around the grand mean, the regression coefficients represent the expected change in the dependent variable for every one unit increase in the predictor above the grand mean, holding all other predictors in the model constant. The significance of the regression coefficients (from zero) is also reported.

Second, the regression coefficients were converted to standardized differences. For the categorical and dichotomous predictors, the regression coefficients were standardized by dividing the coefficient by the standard deviation of the dependent variable, calculated at the student level within each grade span. The following equation was used to standardize the regression coefficients associated with the dichotomous and categorical predictors:

$$\text{Standardized coefficient} = \frac{\text{Regression coefficient}}{\text{Dependent variable standard deviation}}$$

For the continuous predictors, the regression coefficients were standardized by dividing the product of the regression coefficient and the standard deviation of that predictor by the standard deviation of the dependent variable. Both standard deviations were calculated at

the student level within each grade span. The following equation was used to standardize the regression coefficients associated with the continuous predictors:

$$\text{Standardized coefficient} = \frac{(\text{Regression coefficient})(\text{Predictor standard deviation})}{\text{Dependent variable standard deviation}}.$$

For example, the regression coefficient representing the association between students' dominant home language and LAS Links English proficiency scores (research question 2) in grades K–1 is interpreted as follows: Holding all other predictors in the model constant, students whose home language was not Spanish were expected, on average, to have LAS Links scores that were approximately 1.04 standard deviations (or 49.95 scale score points) higher than the weighted grand mean.

The standardized coefficients are presented in the body of the report and in the metric of the dependent variable in appendix G.

To provide additional information about the association between the subset of predictors in the models and the dependent variables, the percentages of variance explained are reported in appendix G. For the analysis of research question 2 for grades K–8, the percentage of variance in overall LAS Links English proficiency scores available to be explained within and among schools was calculated from the null or unconditional model that contains no predictors (model not shown). Subsequently, the percentages of variance explained within schools, between schools, and in total were calculated as follows:

$$\text{Percentage explained within schools} = \left( \frac{\text{Available within-school variance} - \text{Residual within-school variance}}{\text{Available within-school variance}} \right) \times 100,$$

$$\text{Percentage explained between schools} = \left( \frac{\text{Available between-school variance} - \text{Residual between-school variance}}{\text{Available between-school variance}} \right) \times 100,$$

and

$$\text{Total percentage explained} = \left( \frac{\text{Total available variance} - \text{Total residual variance}}{\text{Total available variance}} \right) \times 100.$$

As an example, for research question 2 for grades K–1, the percentage of variance explained by the predictors in the model is interpreted as follows: The student-level predictors retained in the model explained 16.4 percent of the available variance in LAS Links scores within schools. The school-level predictors retained in the model explained 32.7 percent of the available variance in LAS Links scores between schools. Overall, the student- and school-level predictors explained 20.1 percent of the total variance in students' LAS Links scores (16.4 percent of 77.4 percent + 32.7 percent of 22.6 percent).

For the ordinary least squares models formulated for grades 9–12 for research question 2 and for all grade spans for research question 3, the percentage of variance explained was represented by the adjusted  $R^2$ , analogous to the total percentage of variance explained by the predictors in the multilevel model. As an example, for research question 2 for grades 9–12, the adjusted  $R^2$  is interpreted as follows: In total, the student-level predictors in the model explained 17.2 percent of the total variance in students' LAS Links scores.

## Appendix F. Description of variable coding schemes for models

All continuous student and school predictors were centered around the grand mean across all students and schools within each grade span, and all dichotomous and multicategory predictors were coded using weighted effects coding. Effects coding was deemed appropriate as it allowed the regression coefficients in the models to be interpreted as the deviation of the mean for the group being compared from the weighted grand mean. Moreover, weighted effects coding was used because the group sizes were unequal. Tables F1–F5 describe the variables and coding schemes for the models.

**Table F1. Description of student demographic variables and coding schemes for models**

Variable label	Variable coding for regression analyses	Notes
Home language	1 = language other than Spanish $-\frac{N_{Other}}{N_{Spanish}} = \text{Spanish}^a$	The student's home language, as recorded in the home language survey, was used to identify students whose home language is Spanish and those whose home language is other than Spanish.
Immigrant status	1 = born outside the United States (including Puerto Rico) $-\frac{N_{Non-US}}{N_{US}} = \text{born in the United States}^a$	The student's country of origin, as recorded in the home language survey, was used to identify students who were born in the United States and those born outside the United States (including Puerto Rico). <sup>b</sup>
Special education status	1 = in special education $-\frac{N_{IEP}}{N_{No IEP}} = \text{not in special education}^a$	A student with an Individualized Education Plan was classified as in special education, and a student without one was classified as not in special education.
Gender	1 = Female $-\frac{N_{Female}}{N_{Male}} = \text{male}^a$	
Race/ethnicity	1 = non-Hispanic Asian/Pacific Islander, Black, American Indian/Alaskan Native, White $-\frac{N_{Other}}{N_{Hispanic}} = \text{Hispanic (of any race)}^a$	A student's racial/ethnic classification was used to identify Hispanic and non-Hispanic students. Students who were classified as Hispanic White, Hispanic Black, or Hispanic Native American were classified as Hispanic. All other students were classified as non-Hispanic.
Attendance rate	Continuous, centered around grade span mean	A student's total days in attendance were divided by the possible days of attendance (to account for students enrolled in school less than a full academic year) to determine the attendance rate. The variable was centered around the grade span mean for modeling.

**a.** The deviation for students in the comparison groups is not directly observed from the regression coefficients in the model but can be calculated using  $\left(-\frac{N_{Target Group}}{N_{Comparison Group}}\right) b_{Target Group}$ , where  $b_{Target}$  is the regression coefficient associated with the variable in the model (that is, the target group).

**b.** Students born in Puerto Rico are included in the “born outside the United States” category because of the effects of mobility on achievement. While students born in Puerto Rico do not face the challenges of undocumented status that some immigrant children face, they do face the same challenges of moving from one country, speaking one language, to another country speaking a second language.

**Source:** Authors.

**Table F2. Description of English language learner student and types of English language learner program variables and coding schemes for models**

Variable label	Variable coding for regression analyses	Notes
Transitional bilingual education (TBE)	1 = TBE $-\frac{N_{TBE}}{N_{Other}} =$ receiving English as a second language services (not in transitional bilingual education due to parent request) <sup>a</sup> 0 = all other groups	Grades K–8 For Spanish-speaking students
Dual language immersion (DLB)	1 = DLB $-\frac{N_{DLB}}{N_{Other}} =$ receiving English as a second language services (not in transitional bilingual education due to parent request) <sup>a</sup> 0 = all other groups	Grades K–8 For Spanish-speaking students
Language transition support services (LTSS)	1 = LTSS $-\frac{N_{LTSS}}{N_{Other}} =$ receiving English as a second language services (not in transitional bilingual education due to parent request) <sup>a</sup> 0 = all other groups	Grades 2–12
High school English as a second language services (HS ESL)	1 = HS ESL $-\frac{N_{HS\ ESL}}{N_{Other}} =$ receiving English as a second language services (not in transitional bilingual education due to parent request) <sup>a</sup> 0 = all other groups	Grades 10–12 For Spanish-speaking students not eligible for transitional bilingual education because they have less than 30 months until graduation
Eligible but not served due to parent request	1 = Eligible not served $-\frac{N_{Eligible\ not\ served}}{N_{Other}} =$ receiving English as a second language services (not in transitional bilingual education due to parent request) <sup>a</sup> 0 = all other groups	Grades K–12
Receiving English as a second language services (not in transitional bilingual education due to parent request) (ESL support)	1 = ESL support $-\frac{N_{ESL\ Support}}{N_{Spanish}} =$ receiving English as a second language services (not in transitional bilingual education due to parent request) <sup>a</sup> 0 = all other groups	Grades K–12

a. The “English as a second language services (not in transitional bilingual education due to parent request)” group is the comparison group and so the deviation for students receiving English as a second language services (not in transitional bilingual education due to parent request) is not directly observed from the regression coefficients in the model. However, it can be calculated using the weighted sum of the regression coefficients for the type of English language learner program included the model using  $-\sum_{i=1}^L \frac{N_i}{N_{Other}} b_i$ , where  $b_i$  are the regression coefficients associated with the  $L$  English language learner program characteristics.

Source: Authors.

**Table F3. Description of school-level variables and coding schemes for models**

Variable label	Variable coding for regression analyses	Notes
School percent in special education	Continuous, centered around the mean for the grade span	Defined as the percentage of students who were categorized as in special education in the school. The variable was centered on the mean for the grade span.
School percent non-White	Continuous, centered around the mean for the grade span	Defined as the percentage of students who were categorized as non-White in the school. The variable was centered on the mean for the grade span.
School percent free or reduced-price lunch	Continuous, centered around the mean for the grade span	Defined as the percentage of students who were categorized as eligible for free or reduced-price lunch in the school. The variable was centered on the mean for the grade span.
Total students in school	Continuous, centered around the mean for the grade span	Defined as the total number of students in the school. The variable was centered on the mean for the grade span.

Source: Authors.

**Table F4. Description of school proficiency rate variables and coding schemes for models**

Variable label	Variable coding for regression analyses	Notes
CMT or CAPT math proficiency	Continuous, centered around the mean for the grade span	Defined as the percentage of students in the school who scored proficient or above on the large-scale math assessment in 2010/11. The variable was centered on the mean for the grade span.
CMT or CAPT reading proficiency	Continuous, centered around the mean for the grade span	Defined as the percentage of students in the school who scored proficient or above on the large-scale reading assessment in 2010/11. The variable was centered on the mean for the grade span.

CMT is Connecticut Mastery Test. CAPT is Connecticut Achievement and Performance Test.

Source: Authors.

**Table F5. Description of school English language learner variables and coding schemes for models**

Variable label	Variable coding for regression analyses	Notes
School percent English language learner students	Continuous, centered around the mean for the grade span	Defined as the percentage of students who were categorized as being English language learner students in the school. The variable was centered on the mean for the grade span.
School percentage students taught by a certified English as a second language or bilingual teacher	Continuous, centered around the mean for the grade span	Defined as the percentage of students in each school taught by a certified teacher. Calculated by identifying the certification status of the primary language teacher for each student, and then aggregating the data to the school level to find the percentage of English language learner students in each school taught by teachers certified in English as a second language or bilingual education. The variable was centered on the mean for the grade span.

Source: Authors.

**Table G1. LAS Links English proficiency score regressed on student characteristics, types of English language learner programs, and school characteristics**

Unconditional model	Grades K-1		Grades 2-3		Grades 4-5		Grades 6-8		Grades 9-12	
	Residual	Percentage	Residual	Percentage	Residual	Percentage	Residual	Percentage	Residual	Percentage
Available within schools	1,990.37	77.4	1,445.74	92.4	1,583.27	73.0	1,668.17	80.8	2,232.83	87.7
Available between schools	579.70	22.6 (ICC)	118.98	7.6 (ICC)	584.38	27.0 (ICC)	395.13	19.2 (ICC)	314.66	12.4
Total	2,570.07		1,564.72		2,167.66		2,063.30		2,547.49	
Unconditional model	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units
Intercept	418.23 (5.02)***		497.17 (2.87)***		5.17.12 (4.30)***		542.91 (12.29)***		525.19 (5.210)***	
<b>Student characteristics</b>										
Home language not Spanish	49.95 (14.55)**	1.04								
Immigrant status (born outside the United States)							4.56 (1.64)**	0.10		
In special education	-20.25 (6.18)**	-0.42	-37.28 (4.06)***	-0.94	-26.13 (3.67)***	-0.56	-26.31 (3.45)	-0.57	-36.72 (12.404)**	-0.75
Gender (female)					5.58 (2.27)*	0.12				
Race/ethnicity not Hispanic							-24.74 (15.8)	-0.54		
Attendance rate	1.49 (.37)***	0.17								
<b>Type of English language learner program (compared to grand mean)</b>										
<i>Grades K-8</i>										
Transitional bilingual education	-13.36 (2.49)***	-0.28	-13.54 (2.85)***	-0.34	-29.51 (6.10)***	-0.63	-43.84 (13.90)**	-0.95		
Dual language bilingual education	17.26 (8.92)	0.36	-2.29 (5.38)	-0.06	-3.02 (9.72)	-0.064	84.11 (89.15)	1.82		
Language transition support services	na		11.96 (3.28)***	0.30	9.65 (3.54)**	0.20	-2.66 (13.06)	-0.06		
Eligible but not served due to parent request	35.16 (7.88)***	0.73	5.49 (6.60)	0.14	17.67 (9.36)	0.38	-0.88 (14.01)	-0.02		
English as a second language services (not in transitional bilingual education due to parent request)	-28.54 (14.20)*	-0.59	-8.11 (7.20)	-0.20	-13.30 (7.43)	-0.28	-11.11 (21.65)	-0.24		

(continued)

**Table G1. LAS Links English proficiency score regressed on student characteristics, types of English language learner programs, and school characteristics** (continued)

	Grades K–1		Grades 2–3		Grades 4–5		Grades 6–8		Grades 9–12	
	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units
<b>Unconditional model</b>										
<i>Grades 9–12</i>										
Transitional bilingual education									-2.74 (39.19)	-0.06
High school English as a second language services									-8.25 (10.92)	-0.17
Language transition support services									13.03 (.773)	0.27
Eligible but not served due to parent request									28.63 (26.39)	0.59
English as a second language services (not in transitional bilingual education due to parent request)									-23.65 (8.67)*	-0.49
<b>School characteristics</b>										
School size									na	
Percent in special education in school									na	
Percent non-White in school									na	
Percent of students receiving free or reduced-price lunch in school									na	
School math proficiency rate (10 percent increment)	-14.1 (8.0)	-0.33			10.66 (3.4)**	0.02	10.53 (3.7)**	0.24	na	
School reading proficiency rate (10 percent increment)	16.6 (7.6)*	0.39							na	
Percent English language learner students taught by teachers certified in English as a second language or bilingual education									na	
Percent English language learner students in school									na	

(continued)

**Table G1. LAS Links English proficiency score regressed on student characteristics, types of English language learner programs, and school characteristics** (continued)

	Grades K-1		Grades 2-3		Grades 4-5		Grades 6-8		Grades 9-12	
	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units
<b>Unconditional model</b>										
Random components										
Residual within schools	1,663.005		1,145.20		1,248.99		1,343.64			
Residual between schools	390.141		88.56		242.37		306.82			
Total residual	2,053.146		1,233.76		1,491.36		1,650.46			
Percent variability explained within schools	16.4		20.8		21.1		19.5			
Percent variability explained between schools	32.7		25.6		58.5		22.3			
Total percent variability explained	20.1		21.2		31.2		20.0			
$R^2$ (as a percentage)									18.60	
Adjusted $R^2$ (as a percentage)									17.20	

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

na is not applicable because no school characteristics were included at this grade span.

ICC is intraclass correlation coefficient.

**Source:** Authors' calculations based on data from the Connecticut State Department of Education.

**Table G2. Connecticut Mastery Test and Connecticut Academic Performance Test math scores regressed on student characteristics and types of English language learner programs**

Unconditional model	Grade 3 (n = 207)		Grades 4–5 (n = 288)		Grades 6–8 (n = 321)		Grades 9–12 (n = 112)	
	Residual	Percentage	Residual	Percentage	Residual	Percentage	Residual	Percentage
Available within schools	1,354.81	88.78	1,886.30	90.03	1,535.48	84.27	1,594.17	94.44
Available between schools	171.19	11.22	208.93	9.97	286.69	15.73	93.77	5.56
Total available	1,526.00		2,095.23		1,822.17		1,687.94	
Intraclass correlation coefficient (percent)		11.22		9.97		15.73		5.56
Design effect		1.35		1.45		1.67		1.23
Unconditional model	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units
Intercept	425.66 (2.95)***		469.72 (2.74)***		450.68 (2.71)***		182.11 (3.68)***	
<b>Student characteristics</b>								
Home language not Spanish			19.00 (25.28)	0.42	-12.02 (23.72)	-0.29		
Immigrant status (born outside the United States)	11.94 (5.14)*	0.31						
In special education	-14.14 (13.68)	-0.36					-27.98 (15.93)	-0.67
Gender (female)	-7.91 (3.06)*	-0.20						
Race/ethnicity not Hispanic							15.08 (9.44)	0.36
Attendance rate			1.27 (0.55)**	0.14				
<b>Type of English language learner program and overall LAS Links English proficiency score</b>								
Overall LAS Links English proficiency score	0.66 (0.12)***	0.46	0.72 (0.07)***	0.69	0.59 (0.07)***	0.63	0.632 (0.10)***	0.63
<b>Grades K–8 type of English language learner program (compared to grand mean)</b>								
Transitional bilingual education	2.40 (9.24)	0.06	7.78 (8.95)	0.17	6.24 (6.13)	0.15		
Dual language bilingual education	-19.93 (6.67)**	-0.51	10.84 (6.92)	0.24	4.27 (6.41)	0.10		

(continued)

**Table G2. Connecticut Mastery Test and Connecticut Academic Performance Test math scores regressed on student characteristics and types of English language learner programs** (continued)

Unconditional model	Grade 3 (n = 207)		Grades 4–5 (n = 288)		Grades 6–8 (n = 321)		Grades 9–12 (n = 112)	
	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units
Language transition support services	5.34 (3.63)	0.14	2.52 (4.36)	0.06	8.78 (3.73)*	-0.21		
Eligible but not served due to parent request	-0.53 (12.02)	-0.01	3.96 (12.44)	0.09	0.57 (8.04)	0.01		
English as a second language services (not in transitional bilingual education due to parent request)	-18.199 (24.494)	-0.47	-11.29 (24.72)	-0.25	16.26 (20.15)	0.39		
<i>Grades 9–12 type of English language learner program (compared to grand mean)</i>								
High school English as a second language services							-5.40 (8.72)	-0.13
Language transition support services							-0.53 (8.72)	-0.01
Eligible but not served due to parent request							-21.04 (15.89)	-0.51
English as a second language services (not in transitional bilingual education due to parent request)							2.77 (22.37)	0.07
$R^2$ (as a percentage)	37.2		52.4		41.0		45.5	
Adjusted $R^2$ (as a percentage)	34.4		51.0		39.5		41.8	

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

**Source:** Authors' calculations based on data from the Connecticut State Department of Education.

**Table G3. Connecticut Mastery Test and Connecticut Academic Performance Test reading scores regressed on student characteristics and types of English language learner programs**

Unconditional model	Grade 3 (n = 197)		Grades 4–5 (n = 256)		Grades 6–8 (n = 282)		Grades 9–12 (n = 100)	
	Residual	Percentage	Residual	Percentage	Residual	Percentage	Residual	Percentage
Available within schools	1,245.72	94.95	1,336.74	95.79	1,098.56	92.33	749.96	83.23
Available between schools	66.25	5.05	58.82	4.21	91.311	7.67	151.10	16.77
Total available	1,311.97		1,395.56		1,189.87		901.06	
Intraclass correlation coefficient (percent)		5.05		4.21		7.67		16.77
Design effect		1.17		1.19		1.33		1.54
Unconditional model	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units
Intercept	369.84 (2.48)***		411.81 (1.99)**		454.20 (2.09)***		185.47 (3.83)***	
<b>Student characteristics</b>								
Home language not Spanish	20.25 (35.00)	0.56	10.50 (28.0)	0.28	-12.93 (19.12)	-0.38	7.95 (24.14)	0.27
<b>Immigrant status (born outside the United States)</b>								
In special education	-25.57 (14.31)	-0.71	-16.15 (7.64)*	-0.43			-9.20 (17.54)	-0.31
<b>Gender (female)</b>								
Race/ethnicity not Hispanic			8.95 (21.32)	0.24			-17.20 (22.60)	-0.50
<b>Attendance rate</b>								
<b>Type of English language learner program and overall LAS Links English proficiency score</b>								
Overall LAS Links score	0.83 (0.12)***	0.52	0.66 (.06)***	0.63	0.60 (.05)***	0.65	0.50 (0.13)***	0.55
<b>Grades K–8 type of English language learner program (compared to grand mean)</b>								
Transitional bilingual education	-7.34 (7.15)	-0.20	-6.91 (7.29)	-0.19	6.90 (5.76)	0.20		
Dual language bilingual education	-1.37 (5.59)	-0.04	11.92 (4.75)*	0.32	6.27 (5.78)	0.18		
Language transition support services	-1.33 (2.96)	-0.04	0.06 (2.79)	0.00	-8.08 (3.10)*	-0.24		

(continued)

**Table G3. Connecticut Mastery Test and Connecticut Academic Performance Test reading scores regressed on student characteristics and types of English language learner programs (continued)**

	Grade 3 (n = 197)		Grades 4–5 (n = 256)		Grades 6–8 (n = 282)		Grades 9–12 (n = 100)	
	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units	Coefficient in scale-score points (adjusted standard error)	In standard deviation units
<b>Unconditional model</b>								
Eligible but not served due to parent request	12.10 (9.78)	0.34	-2.27 (8.22)	-0.06	1.35 (7.24)	0.04		
English as a second language services (not in transitional bilingual education due to parent request)	-2.78 (42.51)	-0.08	-13.95 (17.49)	-0.37	17.05 (18.71)	0.50		
<i>Grades 9–12 type of English language learner program (compared to grand mean)</i>								
High school English as a second language services							-7.19 (11.07)	-0.24
Language transition support services							-2.14 (5.89)	-0.07
Eligible but not served due to parent request							1.75 (19.06)	0.06
English as a second language services (not in transitional bilingual education due to parent request)							3.94 (10.75)	0.13
R <sup>2</sup> (as a percentage)	35.8		49.9		42.2		35.1	
Adjusted R <sup>2</sup> (as a percentage)	33.0		48.0		40.7		29.4	

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

**Source:** Authors' calculations based on data from the Connecticut State Department of Education.

## Notes

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1. The Regional Educational Laboratory Northeast & Islands states are Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. Puerto Rico and the Virgin Islands were not included in this calculation.
2. Because of the large percentage of students in grades 9–12 with missing data on immigrant status, this variable was not included in the analyses for research questions 2 and 3.
3. In California, teachers are authorized to teach English language learners if they have a cross-cultural language and academic development (CLAD) certificate or a Bilingual-CLAD (or BCLAD) certificate, which authorizes them to deliver content instruction in the student's primary language (Williams et al., 2007).
4. Two parallel forms of the LAS Links, Form A and Form B, are available from CTB/McGraw-Hill (2006). Form A was administered.
5. Degrees of Reading Power is a registered trademark of Questar Assessments, Inc.
6. The sample size for research question 3 was smaller than for question 2 because these assessments are administered only in grades 3–8 and 10 and because some students did not have math or reading assessment scores.
7. Some 26 percent of students in grades 9–12 did not have information about immigrant status. This student-level variable was not used in models for grades 9–12.
8. The CAPT is typically administered to students in grade 10. However, in the analyses sample, 2 grade 9 students, 30 grade 11 students, and 1 grade 12 student completed the CAPT. These students were retained in the analysis sample (appendix D).

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## The Regional Educational Laboratory Program produces 7 types of reports



### **Making Connections**

Studies of correlational relationships



### **Making an Impact**

Studies of cause and effect



### **What's Happening**

Descriptions of policies, programs, implementation status, or data trends



### **What's Known**

Summaries of previous research



### **Stated Briefly**

Summaries of research findings for specific audiences



### **Applied Research Methods**

Research methods for educational settings



### **Tools**

Help for planning, gathering, analyzing, or reporting data or research