Making Connections

# Teacher certification and academic growth among English learner students in the Houston Independent School District

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## Key findings

This study examined the relationship between teacher certification—both type and route—and growth in academic achievement and English proficiency among English learner students in grades 4 and 5 in the Houston Independent School District. Key findings include:

- For math, having a teacher with bilingual certification was associated with higher student growth in achievement in grade 4 but lower growth in achievement in grade 5 compared with having a teacher without bilingual or English as a second language certification. Having a teacher with bilingual certification through the alternative route was associated with the highest growth in achievement in grade 4.

- For reading, having a teacher with bilingual certification was associated with higher student growth in achievement in grade 4 compared with having a teacher without bilingual or English as a second language certification. Having a teacher with bilingual certification through the traditional route was associated with the highest growth in achievement in grade 4.

- For English proficiency, having a teacher with bilingual certification through the postbaccalaureate route was associated with the highest student growth in grade 4. Having a teacher with bilingual certification through the alternative route was associated with the highest growth in English proficiency in grade 5.

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# Summary

From 2004/05 to 2014/15 the number of English learner students in bilingual or English as a second language programs in Texas increased 47 percent (Texas Education Agency, 2007, 2016). In the Houston Independent School District—the largest district in Texas and the seventh largest in the United States—30 percent of students are English learner students, and 92 percent of these students have Spanish as their home language. The number of students in bilingual or English as a second language programs in the district grew more than twice as fast as total enrollment during the 2014/15 school year (Houston Independent School District, 2015a). The number of first-year immigrants in the district has more than doubled since 2011/12, and these newcomers lag behind other English learner students in English proficiency (Houston Independent School District, 2016). The district has faced a critical shortage of teachers with bilingual certification for more than 10 years (Houston Independent School District, 2014; U.S. Department of Education, 2015b).

Aware of these challenges, the members of Regional Educational Laboratory Southwest's English Learners Research Alliance sought information that districts can use when recruiting teachers and assigning them to schools and classrooms that serve large numbers of English learner students. To respond to this need, this study examined the relationships between teacher certification and growth in math and reading achievement and English proficiency among English learner students using data from the Houston Independent School District and the Texas Education Agency. The main analysis explores math and reading achievement among four cohorts of grade 4 students and four cohorts of grade 5 students between 2011/12 and 2014/15 and English proficiency among ten cohorts of grade 4 students and nine cohorts of grade 5 students between 2005/06 and 2014/15. A supplementary analysis explores math and reading achievement on a different assessment among six cohorts of grade 4 students and five cohorts of grade 5 students between 2005/06 and 2010/11.

The study assessed whether a teacher's certification type—bilingual or English as a second language—and certification route—additional exam (adding a certification area to an existing classroom teaching certificate by completing an exam), alternative (receiving certification through a nontraditional route that allows one to teach while completing the requirements), postbaccalaureate (completing a university program offered to people with a bachelor's degree or higher), or traditional (obtaining a bachelor's degree in education from an accredited university)—were correlated with growth in math achievement, reading achievement, and English proficiency (as measured by the most recent Texas state standardized exams) among English learner students whose home language is Spanish.

Key findings from the main analysis include:
- For math, having a teacher with bilingual certification was associated with higher student growth in achievement in grade 4 but lower growth in achievement in grade 5 compared with having a teacher without bilingual or English as a second language certification. Having a teacher with bilingual certification through the alternative route was associated with the highest growth in achievement in grade 4. Having a teacher with bilingual certification through the additional exam route and having a teacher with English as a second language certification through the traditional route were both associated with lower growth in achievement in grade

5 compared with having a teacher with bilingual or English as a second language certification through other routes.

- For reading, having a teacher with bilingual certification was associated with higher student growth in achievement in grade 4 compared with having a teacher without bilingual or English as a second language certification. Having a teacher with bilingual certification through the traditional route was associated with the highest growth in achievement in grade 4. There was no association between teacher bilingual certification or certification route and growth in achievement in grade 5, nor was there an association between teacher English as a second language certification or certification route and growth in achievement in either grade.

- For English proficiency, having a teacher with bilingual certification through the postbaccalaureate route was associated with the highest student growth in English proficiency in grade 4. Having a teacher with bilingual certification through the alternative route was associated with the highest growth in English proficiency in grade 5.

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# Why this study?

English learner students make up more than 18 percent of the Texas public school population, and that percentage is growing rapidly. From 2004/05 to 2014/15 the number of English learner students in bilingual or English as a second language programs in Texas increased 47 percent (Texas Education Agency, 2007, 2016). In the Houston Independent School District—the largest district in Texas and the seventh largest in the United States—30 percent of students are English learner students, and 92 percent of these students have Spanish as their home language. The number of students in bilingual or English as a second language programs in the district grew more than twice as fast as total enrollment during the 2014/15 school year (Houston Independent School District, 2015a). The number of first-year immigrants in the district has more than doubled since 2011/12, and these newcomers lag behind other English learner students in English proficiency (Houston Independent School District, 2016).

The Houston Independent School District employs approximately 660 teachers with bilingual or English as a second language certification to teach English learner students (Houston Independent School District, 2015b). The annual turnover rate among all teachers in the district was more than 17 percent in 2011/12–2014/15 (Texas Education Agency, 2012, 2013, 2014, 2015). The district has faced a critical shortage of teachers with bilingual certification for more than 10 years (Houston Independent School District, 2014; U.S. Department of Education, 2015b). And the growing enrollment of English learner students and high teacher turnover in recent years have exacerbated the shortage.

Adding to these challenges is the achievement gap between English learner students and non–English learner students in the Houston Independent School District. Between 2009 and 2015 the difference in average scale score on the National Assessment of Educational Progress Trial Urban District Assessment between English learner students and non–English learner students in grade 4 in the district widened from 8 points to 17 points in math and from 21 points to 29 points in reading (U.S. Department of Education, 2015a). This widening is due to falling scores among English learner students and rising scores among non–English learner students.

Identifying the characteristics of teachers who are most successful at promoting growth in achievement among English learner students is critical for the Houston Independent School District in view of the achievement gap with non–English learner students, high teacher turnover rates, shortage of teachers with bilingual certification, and steady increase in English learner student enrollment. This study responds to the needs related to preparing educators for English learner student populations shared by members of the English Learners Research Alliance.[1] Specifically, alliance members are aware that teachers with specialized skills and preparation are essential to promoting academic growth among English learner students, but there is little empirical evidence on what teacher certification characteristics are linked to positive outcomes among English learner students.

Most research on the effects of specialized certification on teaching English learner students uses school-level teacher certification rates and has yielded mixed results (see appendix A for a review of the literature). This study examines the association between teacher certification characteristics at the classroom level and student growth in math achievement, reading achievement, and English proficiency among English learner students whose

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home language is Spanish to generate hypotheses about what is working and what is not in classrooms serving English learner students (see box 1 for definitions of key terms used in the report).

Stakeholders may find the results of the study useful for understanding the teacher factors related to English learner student achievement, assigning teachers to English learner student classrooms at the school level, recruiting teachers at the school or district level, and developing standards for teachers of English learner students at the state level.

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### Box 1. Key terms

*Certification types.* A teacher's certification type determines the grade and subject that he or she is assigned to teach. This study covers two types of teacher certification:

- *Bilingual.* When a teacher meets all requirements for teacher certification and holds a standard bilingual certification that has been issued since September 1, 1999, and renewed every five years. In this study, teachers with a probationary certificate, one-year certificate, temporary certificate, emergency permit, nonrenewable permit, or emergency certificate in bilingual education were not considered fully certified (Texas Administrative Code, Section 230; State Board for Educator Certification).
- *English as a second language.* When a teacher meets all requirements for teacher certification and holds a standard English as a second language certification that has been issued since September 1, 1999, and renewed every five years. In this study, teachers with a probationary certificate, one-year certificate, temporary certificate, emergency permit, nonrenewable permit, or emergency certificate in English as a second language education were not considered fully certified (Texas Administrative Code, Section 230; State Board for Educator Certification).

*Certification routes.* The way in which teacher candidates complete an educator preparation program, which is required in order to become a teacher in Texas. This study covers four routes to teacher certification:

- *Additional exam route.* Also known as "additional certification by exam," a route in which a teacher who holds a valid Texas classroom teaching certificate and a bachelor's degree adds a classroom certification in a new area by completing the appropriate examination.
- *Alternative route.* A nontraditional route that entails enrolling in an alternative certification program, which may allow an individual to teach while completing the requirements. Programs are located in universities, school districts, education service centers, community colleges, and private entities. Only programs approved by the State Board for Educator Certification may recommend an individual for a Texas educator certificate.
- *Postbaccalaureate route.* A route in which an individual with a bachelor's degree or higher completes the requirements for an educator certificate with university coursework. In some cases an advanced degree can be earned while completing the requirements for a certificate.
- *Traditional route.* A route in which an individual who has obtained a bachelor's degree in education from an accredited university and completed all student teaching requirements applies for a teaching certificate in Texas.

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**Box 1. Key terms** *(continued)*

*Effect size.* The magnitude of the difference in an outcome between interventions as the proportion of a standard deviation.

*English learner student.* A student whose primary language is not English and whose English language skill level makes performing ordinary classwork in English difficult (Texas Education Code §29.052).

*Value-added model.* A method of analysis that uses a regression model to estimate a teacher's contribution to students' growth in achievement taking into account students' prior characteristics and other factors that affect student achievement, such as individual ability, family environment, past schooling, and peer influence. Value-added models typically measure correlation, not causation.

## What the study examined

The study addressed two research questions:

1. What are the value-added contributions of teachers with bilingual and English as a second language certifications to growth in math achievement, reading achievement, and English proficiency among English learner students whose home language is Spanish?

2. What are the value-added contributions of different routes to teacher bilingual and English as a second language certification to growth in math achievement, reading achievement, and English proficiency among English learner students whose home language is Spanish?

The study used multilevel regression modeling and data from the Houston Independent School District and the Texas Education Agency. The main analysis explores math and reading achievement on the State of Texas Assessments of Academic Readiness (STAAR) among four cohorts of grade 4 students and four cohorts of grade 5 students between 2011/12 and 2014/15 and English proficiency on the Texas English Language Proficiency Assessment System (TELPAS) among ten cohorts of grade 4 students and nine cohorts of grade 5 students between 2005/06 and 2014/15. A supplementary analysis explores math and reading achievement on the Texas Assessment of Knowledge and Skills (TAKS) among six earlier cohorts of grade 4 students and five earlier cohorts of grade 5 students, between 2005/06 and 2010/11.

To report concise and practical findings and because the STAAR is the state assessment currently used in Texas, the main text reports findings based on STAAR data only and mentions only findings based on TAKS data that differ from those based on STAAR data. Inconsistency between the two assessments is unsurprising for two reasons. First, STAAR was a new test in 2011/12, while TAKS had been in use since 2003, so teachers and students had had more time to become familiar with it by 2005/06–2010/11. Second, STAAR is conceptually different from TAKS in that STAAR has more questions on most subject areas, fewer multiple-choice questions, a shorter time limit (four hours versus all day for TAKS), and a focus on what the student was expected to learn during the current school

*The study used multilevel regression modeling to explore value-added contributions of teachers with bilingual and English as a second language certifications and the route to those certifications to growth in math achievement, reading achievement, and English proficiency among English learner students whose home language is Spanish*

year (compared with the TAKS, which focused on what the student had learned over several years).

The findings may not be generalizable to other school districts in the state or region. And the findings show only correlations; no causal inferences can be drawn from the results. Box 2 summarizes the data and methodology of the report, and appendix B provides details.

## Box 2. Data and methods

### Data

The data for the study were obtained from the Houston Independent School District and the Texas Education Agency and were accessed through the University of Texas Education Research Center. The study team used rosters provided by the Houston district that matched students with teachers, and student and teacher data provided by the Texas Education Agency. The student and teacher data included student assessment scores, student demographic information (race/ethnicity, age, gender, English learner student status, and eligibility for the federal school lunch program), teacher certification and demographic information, and school characteristics. All assessment scores were standardized to a mean of zero and a standard deviation of one within each grade–year combination (so the unit for effect sizes is the standard deviation).

The student sample for the main analysis consisted of four grade 4 cohorts and four grade 5 cohorts of English learner students in the Houston Independent School District between the 2011/12 and 2014/15 school years who had data on math and reading achievement from the State of Texas Assessments of Academic Readiness (STAAR) and ten cohorts of grade 4 students and nine cohorts of grade 5 students in the Houston Independent School District between the 2005/06 and 2014/15 school years who had data on English proficiency from the Texas English Language Proficiency Assessment System (TELPAS). The average cohort size in the student sample for the main analysis was about 4,800 students in grade 4 and about 3,700 students in grade 5.

The student sample for the supplementary analysis consisted of six grade 4 cohorts of English learner students in the Houston Independent School District between the 2005/06 and 2010/11 school years and five grade 5 cohorts of English learner students in the district between the 2006/07 and 2010/11 school years who had data on math and reading achievement from the Texas Assessment of Knowledge and Skills (TAKS). The average cohort size in the student sample for the supplementary analysis was about 3,800 students in grade 4 and about 2,700 students in grade 5.

The size of the student samples ranged from 9,850 to 38,716 students, depending on grade and assessment (STAAR, TELPAS, or TAKS; see table B3 in appendix B). Data from grade 3 were used in measuring growth in achievement for the grade 4 cohorts, and data from grade 4 were used in measuring growth in achievement for the grade 5 cohorts.

All students in the samples had participated in the district's bilingual or English as a second language program in grade 4 or 5 and had designated Spanish as their home language. Students were from 156 elementary schools.

*(continued)*

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

The teacher sample consisted of Houston Independent School District teachers who taught math or reading to at least 10 Spanish-speaking English learner students across each study period. Reading teachers were used in the analysis of English proficiency (as well as in the analysis of reading achievement) because the the TELPAS reading scale was used to measure growth in English proficiency. Teachers did not have to be fully certified to be included in the sample: in fact, the majority of bilingual teachers in the sample were not fully certified (see tables B5 and B7 in appendix B). The size of the teacher samples ranged from 302 to 809 teachers, depending on grade and assessment (STAAR, TELPAS, or TAKS; see table B4 in appendix B).

**Methods**

Student achievement models (value-added models), with teacher certification characteristics as predictors, were formulated to predict student achievement growth. These models calculated coefficients on certification type and route variables; included student, teacher, and school demographic covariates (see table B1 in appendix B); and were estimated using the study samples by grade (4 or 5), subject (math, reading, or English proficiency), and assessment (STAAR, TELPAS, or TAKS).

The study team then examined (by grade, subject, and state assessment) whether having a teacher with a particular certification type (research question 1) or route (research question 2) was associated with growth in student achievement. For research question 1 the reference group was teachers without full bilingual or English as a second language certification. Because some teachers had bilingual certification and some teachers had English as a second language certification, an indicator of certification type was included in the model for research question 2 to account for both certification type and route and thus obtain an accurate estimate of the contribution of teacher certification route to growth in student achievement. For research question 2 the reference group was teachers with certification through the alternative route for the analysis of bilingual certification and teachers with certification through the additional exam route for the analysis of English as a second language certification.

Teachers with certification through the alternative route were selected as the reference group for the analysis of bilingual certification because teachers with bilingual certification through that route accounted for at least 59 percent of teachers with bilingual certification in grades 4 and 5 in the Houston Independent School District and because an increasing proportion of teachers in Texas public schools are choosing that route. Teachers with certification through the additional exam route were selected as the reference group for the analysis of English as a second language certification because teachers with English as a second language certification through that route were the largest group among teachers with English as a second language certification in the study sample (teachers with certification through the alternative route were the second largest).

To calculate the total effect of a certification type and route, the coefficient of each type by route indicator was added to the coefficient of the certification type indicator. To make pairwise comparisons, effect sizes for the certification routes being compared were subtracted from one another (see appendix B for details and appendix C for results of the main analysis and appendix D for results of the supplementary analysis).

The assessments and methodologies used in each analysis are described in appendix B.

## What the study found

The study identified several associations between teacher certification and growth in math achievement, reading achievement, and English proficiency among English learner students in grades 4 and 5 whose home language is Spanish.

**Having a teacher with bilingual certification was associated with higher growth in math and reading achievement among English learner students in grade 4 but lower growth in math achievement among English learner students in grade 5 compared with having a teacher without bilingual or English as a second language certification**

Having a teacher with bilingual certification was associated with higher growth in STAAR math achievement in grade 4 (effect size = 0.12 standard deviation) compared with having a teacher without bilingual or English as a second language certification (figure 1 and table 1). Having a teacher with bilingual certification was also associated with higher growth in STAAR reading achievement in grade 4 (effect size = 0.04 standard deviation) compared with having a teacher without bilingual or English as a second language certification (see figure 1 and table 1). The supplementary analysis using TAKS data from earlier cohorts also found that having a teacher with bilingual certification was associated with higher growth in grade 4 math achievement (see table D1 in appendix D) but was not associated with higher or lower growth in grade 4 reading achievement compared with having a teacher without bilingual or English as a second language certification (see table D3 in appendix D).

*Having a teacher with bilingual certification was associated with higher growth in STAAR math achievement and reading achievement in grade 4 compared with having a teacher without bilingual or English as a second language certification*

**Figure 1. Having a teacher with bilingual certification was associated with growth in math and reading achievement among English learner students in grade 4 in the Houston Independent School District between 2011/12 and 2014/15**
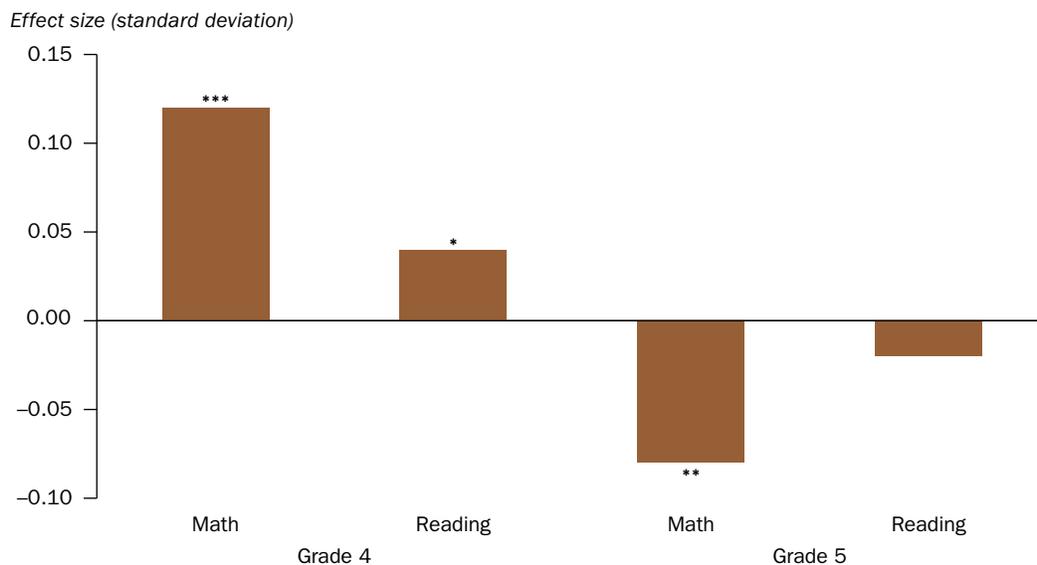


* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

**Note:** The effect size measures the effect on the State of Texas Assessments of Academic Readiness *z*-score in math or reading. The reference group for teachers with bilingual certification is teachers without bilingual or English as a second language certification.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

**Table 1. Effect on growth in math and reading achievement and English proficiency among English learner students in the Houston Independent School District, by grade and teacher certification type between 2011/12 and 2014/15**

| Grade | Student growth outcome | Having a teacher with bilingual certification | | Having a teacher with English as a second language certification | |
|---|---|---|---|---|---|
| | | Direction of effect | Effect size (standard deviation) | Direction of effect | Effect size (standard deviation) |
| 4 | Math achievement[a] | + | 0.12*** | ns | −0.01 |
| | Reading achievement[a] | + | 0.04* | ns | −0.03 |
| | English proficiency[b] | ns | −0.01 | ns | 0.00 |
| 5 | Math achievement[a] | − | −0.08** | ns | 0.02 |
| | Reading achievement[a] | ns | −0.02 | ns | 0.01 |
| | English proficiency[b] | ns | 0.01 | ns | 0.00 |

\* Significant at $p < .05$; \*\* significant at $p < .01$; \*\*\* significant at $p < .001$.

\+ is significant positive effect; − is significant negative effect; ns is not significant.

**Note:** The effect size measures the effect on the State of Texas Assessments of Academic Readiness *z*-score in math and reading and on the Texas English Language Proficiency Assessment System *z*-score in reading. The reference group is teachers without bilingual or English as a second language certification.

**a.** Measured by achievement on the State of Texas Assessments of Academic Readiness.

**b.** Measured by achievement on the Texas English Language Proficiency Assessment System.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

*Having a teacher with bilingual certification was associated with lower growth in STAAR math achievement in grade 5 compared with having a teacher without bilingual or English as a second language certification*

Having a teacher with bilingual certification was associated with lower growth in STAAR math achievement in grade 5 (effect size = −0.08 standard deviation) compared with having a teacher without bilingual or English as a second language certification (see figure 1 and table 1). The supplementary analysis using TAKS data found that having a teacher with bilingual certification was not associated with higher or lower growth in math achievement in grade 5 compared with having a teacher without bilingual or English as a second language certification (see table D4 in appendix D).

Having a teacher with bilingual certification was not associated with higher or lower growth in reading achievement among English learner students in grade 5 assessed with either the STAAR or TAKS compared with having a teacher without bilingual or English as a second language certification.

**Having a teacher with bilingual certification was associated with higher or lower growth in English proficiency among English learner students in grade 4 or 5 compared with having a teacher without bilingual or English as a second language certification**

There was no evidence that having a teacher with bilingual certification was not associated with higher or lower growth in English proficiency among English learner students in grade 4 or 5 compared with having a teacher without bilingual or English as a second language certification (see table 1).

Having a teacher with English as a second language certification was not associated with higher or lower growth in math achievement, reading achievement, or English proficiency among English learner students in grade 4 or 5 compared with having a teacher without bilingual or English as a second language certification

Having a teacher with English as a second language certification was not associated with higher or lower growth in math or reading achievement on the STAAR among English learner students in grade 4 or 5 compared with having a teacher without bilingual or English as a second language certification (see table 1). Likewise, having a teacher with English as a second language certification was not associated with higher or lower growth in English proficiency among students in grade 4 or 5 compared with having a teacher without bilingual or English as a second language certification (see table 1).

Having a teacher with bilingual certification through the alternative route was associated with the highest growth in math achievement among English learner students in grade 4

Two of the four routes to bilingual certification were associated with higher growth in math achievement on the STAAR among English learner students in grade 4 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher without bilingual or English as a second language certification: the alternative route (effect size = 0.17 standard deviation) and the traditional route (effect size

*Having a teacher with bilingual certification through the traditional route was associated with higher growth in math achievement on the STAAR among English learner students in grade 4 but lower growth among students in grade 5*

**Figure 2. Having a teacher with bilingual certification through the alternative route was associated with the highest growth in math achievement among English learner students in grade 4 in the Houston Independent School District between 2011/12 and 2014/15**



*Effect size (standard deviation)*

*** Significant at $p < .001$.

**Note:** The effect size measures the effect on the State of Texas Assessments of Academic Readiness *z*-score in math. The reference group for bilingual certification is teachers certified through the alternative route. The reference group for English as a second language certification is teachers certified through the additional exam route.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

**Table 2. Effect on growth in math and reading achievement and English proficiency among English learner students in the Houston Independent School District, by grade, teacher certification type, and teacher certification route between 2011/12 and 2014/15 (standard deviation units)**

| Grade | Student growth outcome | Route to bilingual certification | | | | Route to English as a second language certification | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Additional exam route | Alternative route | Postbaccalaureate route | Traditional route | Additional exam route | Alternative route | Postbaccalaureate route | Traditional route |
| 4 | Math achievement[a] | 0.01 | 0.17*** | 0.06 | 0.12*** | 0.01 | –0.04 | –0.05 | 0.02 |
| | Reading achievement[a] | –0.01 | 0.03 | 0.00 | 0.08** | –0.00 | –0.05 | [b] | –0.06 |
| | English proficiency[c] | –0.03* | –0.01 | 0.12*** | –0.03* | –0.03* | 0.06* | [b] | 0.09* |
| 5 | Math achievement[a] | –0.19*** | 0.03 | –0.07 | –0.15** | 0.05 | –0.00 | –0.09 | –0.19* |
| | Reading achievement[a] | –0.01 | –0.02 | –0.15 | –0.03 | 0.01 | –0.01 | [b] | –0.11 |
| | English proficiency[c] | –0.02 | 0.04* | 0.10 | –0.02 | –0.00 | 0.00 | [b] | 0.05 |

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$

**Note:** The effect size measures the effect on the State of Texas Assessments of Academic Readiness *z*-score in math and reading and on the Texas English Language Proficiency Assessment System *z*-score in reading. The reference group for bilingual certification is teachers certified through the alternative route. The reference group for English as a second language certification is teachers certified through the additional exam route.

**a.** Measured by achievement on the State of Texas Assessments of Academic Readiness.

**b.** Effect could not be calculated because of the small sample size.

**c.** Measured by achievement on the Texas English Language Proficiency Assessment System.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

= 0.12 standard deviation; figure 2 and table 2). Having a teacher with bilingual certification through the additional exam route or postbaccalaureate route was not associated with higher or lower growth in math achievement on the STAAR among students in grade 4 compared with having a teacher without bilingual or English as a second language certification.

The difference in the effect size on growth in math achievement among English learner students in grade 4 between having a teacher with bilingual certification through the alternative route and having a teacher with bilingual certification through the traditional route is 0.05 standard deviation (0.17 – 0.12; see figure 2 and table 2).

The main analysis using STAAR data found that no route to English as a second language certification was associated with higher or lower growth in math achievement among English learner students in grade 4 compared with having a teacher without bilingual or English as a second language certification. But the supplementary analysis using TAKS data found that having a teacher with English as a second language certification through the traditional route was associated with higher growth in math achievement among students in grade 4 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher without bilingual or English as a second language certification (see table D2 in appendix D).

**Having a teacher with bilingual certification through the additional exam route and having a teacher with English as a second language certification through the traditional route were associated with the lowest growth in math achievement among English learner students in grade 5**

Two of the four routes to bilingual certification and one of the four routes to English as a second language certification were associated with lower growth in math achievement on

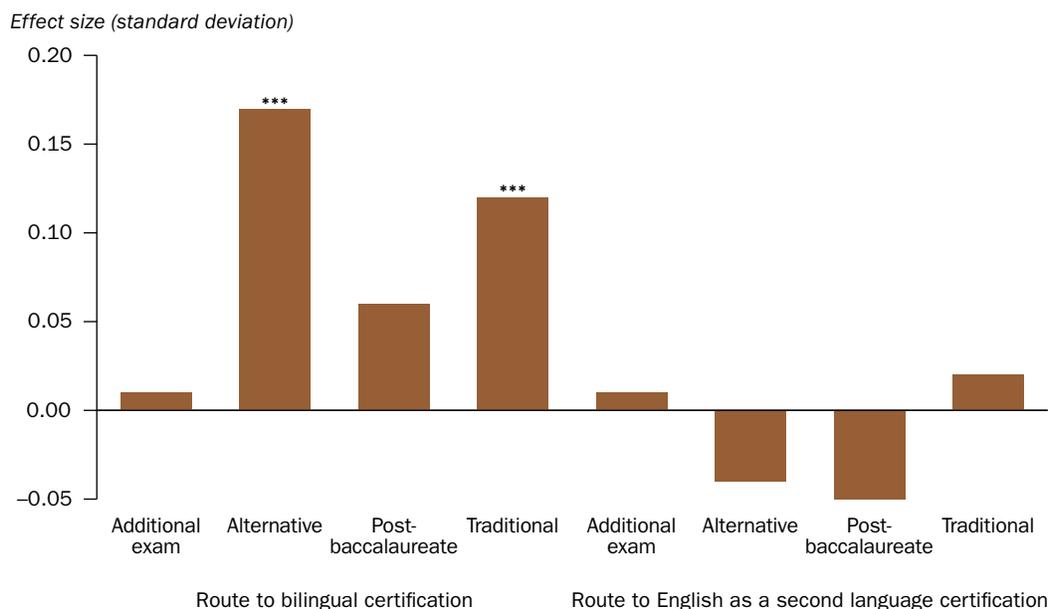the STAAR among English learner students in grade 5 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher with no bilingual or English as a second language certification: bilingual certification through the traditional route (effect size = –0.15 standard deviation), bilingual certification through the additional exam route (effect size = –0.19 standard deviation), and English as a second language certification through the traditional route (effect size = –0.19 standard deviation; figure 3; see also table 2). Having a teacher with bilingual certification through the alternative route or the postbaccalaureate route was not associated with higher or lower growth in math achievement among students in grade 5 compared with having a teacher without bilingual or English as a second language certification. Having a teacher with English as a second language certification through the alternative route, the additional exam route, or the postbaccalaureate route was not associated with higher or lower growth in math achievement on the STAAR among students in grade 5 compared with having a teacher without bilingual or English as a second language certification.

The supplementary analysis, which used TAKS data from earlier cohorts, yielded different findings for grade 5 growth in achievement in math. Having a teacher with bilingual certification through the additional exam route was associated with lower growth in math achievement among English learner students in grade 5 compared with having a teacher with bilingual or English as a second language certification through other routes

**Figure 3. Having a teacher with bilingual certification through the additional exam route and having a teacher with English as a second language certification through the traditional route were associated with the lowest growth in math achievement among English learner students in grade 5 in the Houston Independent School District between 2011/12 and 2014/15**



*Effect size (standard deviation)*

* Significant at $p < .05$; **significant at $p < .01$; ***significant at $p < .001$.

**Note:** The effect size measures the effect on the State of Texas Assessments of Academic Readiness *z*-score in math. The reference group for bilingual certification is teachers certified through the alternative route. The reference group for English as a second language certification is teachers certified through the additional exam route.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

and having a teacher without bilingual or English as a second language certification (see table D2 in appendix D).

**Having a teacher with bilingual certification through the traditional route was associated with the highest growth in reading achievement among English learner students in grade 4**

One of the four routes to bilingual certification was associated with higher growth in reading achievement among English learner students in grade 4 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher with no bilingual or English as a second language certification: the traditional route (effect size = 0.08 standard deviation). Having a teacher with bilingual certification through the alternative route, the additional exam route, or the postbaccalaureate route and having a teacher with English as a second language certification through other routes were not associated with higher or lower growth in reading achievement among students in grade 4 compared with having a teacher without bilingual or English as a second language certification (figure 4; see also table 2).

The supplementary analysis using TAKS data yielded different findings. Having a teacher with bilingual certification through the traditional route was associated with lower growth

*Having a teacher with bilingual certification through the traditional route was associated with the highest growth in reading achievement among English learner students in grade 4 but not in grade 5*

**Figure 4. Having a teacher with bilingual certification through the traditional route was associated with the highest growth in reading achievement among English learner students in grade 4 in the Houston Independent School District between 2011/12 and 2014/15**



*Effect size (standard deviation)*
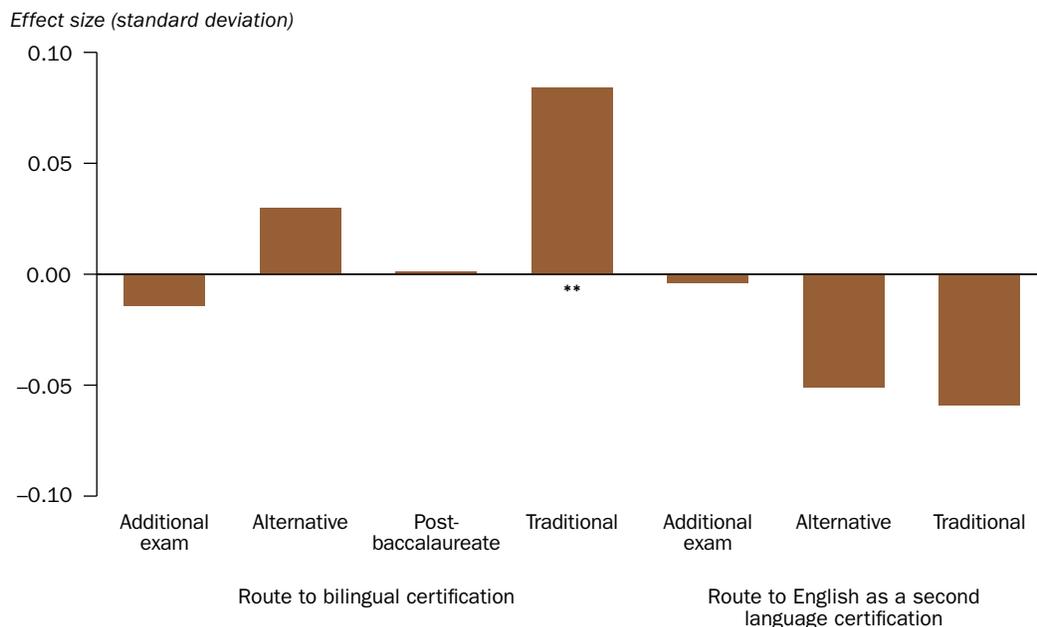
** Significant at $p < .01$.

**Note:** The effect could not be calculated for English as a second language certification through the postbaccalaureate route because of the small sample size. The effect size measures the effect on the State of Texas Assessments of Academic Readiness $z$-score in reading. The reference group for bilingual certification is teachers certified through the alternative route. The reference group for English as a second language certification is teachers certified through the additional exam route.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

in reading achievement among English learner students in grade 4 compared with having a teacher with bilingual certification through another route and having a teacher with English as a second language certification through any route (see table D2 in appendix D).

### No route to bilingual or English as a second language certification was associated with higher or lower growth in reading achievement among English learner students in grade 5 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher with no bilingual or English as a second language certification

The main analysis using STAAR data found that no route to bilingual or English as a second language certification was associated with higher or lower growth in reading achievement among English learner students in grade 5 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher with no bilingual or English as a second language certification (see table 2). However, the supplementary analysis using TAKS data found that having a teacher with bilingual or English as a second language certification through the alternative route was associated with higher growth in reading achievement among students in grade 5 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher without bilingual or English as a second language certification (see table D2 in appendix D).

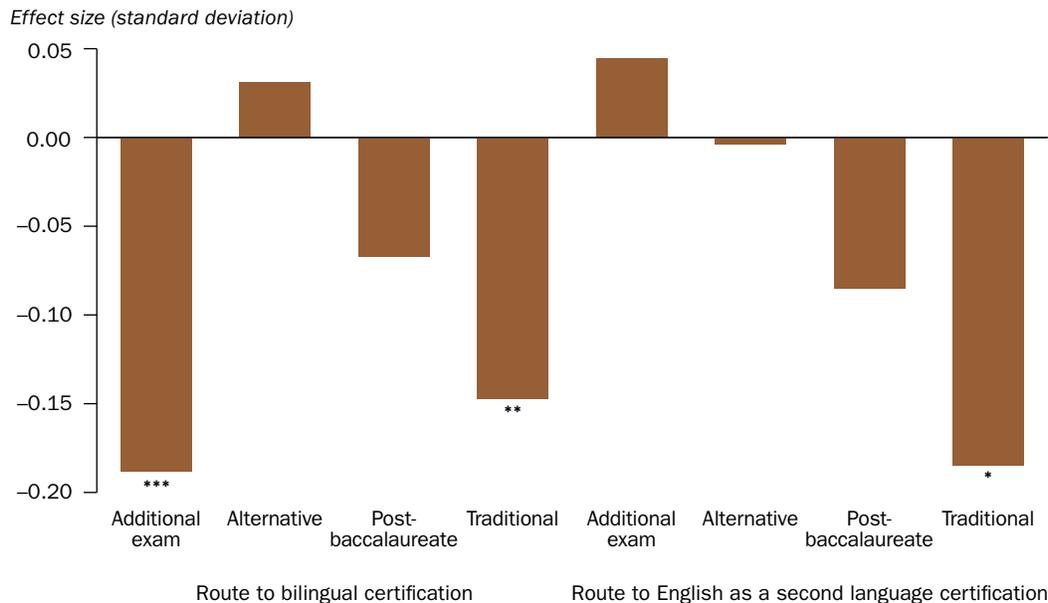*Having a teacher with bilingual certification through the traditional route was associated with lower growth in English proficiency among English learner students in grade 4, but having a teacher with English as a second language certification through the traditional route was associated with the highest growth*

### Having a teacher with bilingual certification through the postbaccalaureate route was associated with the highest growth in English proficiency among English learner students in grade 4

One of the four routes to bilingual certification was associated higher growth in English proficiency among English learner students in grade 4 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher with no bilingual or English as a second language certification: the post-baccalaureate route (effect size = 0.12 standard deviation; figure 5; see also table 2). Two routes to bilingual certification were associated with lower growth: the traditional route and the additional exam route. Having a teacher with bilingual certification through the alternative route was not associated with higher or lower growth in English proficiency among students in grade 4 compared with having a teacher without bilingual or English as a second language certification.

### Having a teacher with English as a second language certification through the traditional route was associated with the highest growth in English proficiency among English learner students in grade 4

Two of the three routes to English as a second language certification were associated with higher growth in English proficiency among English learner students in grade 4 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher with no bilingual or English as a second language certification: the traditional route (effect size = 0.09 standard deviation) and the alternative route (effect size = 0.06 standard deviation; see figure 5 and table 2). One route to English as a second language certification was associated with lower growth in English proficiency among students in grade 4: the additional exam route (see figure 5 and table 2).

**Figure 5. Having a teacher with bilingual certification through the postbaccalaureate route was associated with the highest growth in English proficiency among English learner students in grade 4 in the Houston Independent School District between 2005/06 and 2014/15**

*Effect size (standard deviation)*



* Significant at *p* < .05; *** significant at *p* < .001.

**Note:** The effect could not be calculated for English as a second language certification through the postbaccalaureate route because of the small sample size. The effect size measures the effect on the Texas English Language Proficiency Assessment System *z*-score in reading. The reference group for bilingual certification is teachers certified through the alternative route. The reference group for English as a second language certification is teachers certified through the additional exam route.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

### Having a teacher with bilingual certification through the alternative route was associated with the highest growth in English proficiency among English learner students in grade 5

One of the four routes to bilingual certification was associated with higher growth in English proficiency among English learner students in grade 5 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher with no bilingual or English as a second language certification: the alternative route (effect size = 0.04 standard deviation; figure 6; see also table 2). Having a teacher with bilingual certification through the traditional route, the additional exam route, or the postbaccalaureate route was not associated with higher or lower growth in English proficiency among students in grade 5 compared with having a teacher without bilingual or English as a second language certification. No route to English as a second language certification was associated with higher or lower growth in English proficiency among students in grade 5.

*Having a teacher with bilingual certification through the traditional route, the additional exam route, or the postbaccalaureate route was not associated with higher or lower growth in English proficiency among students in grade 5 compared with having a teacher without bilingual or English as a second language certification*

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**Figure 6. Having a teacher with bilingual certification through the alternative route was associated with the highest growth in English proficiency among English learner students in grade 5 in the Houston Independent School District between 2005/06 and 2014/15**
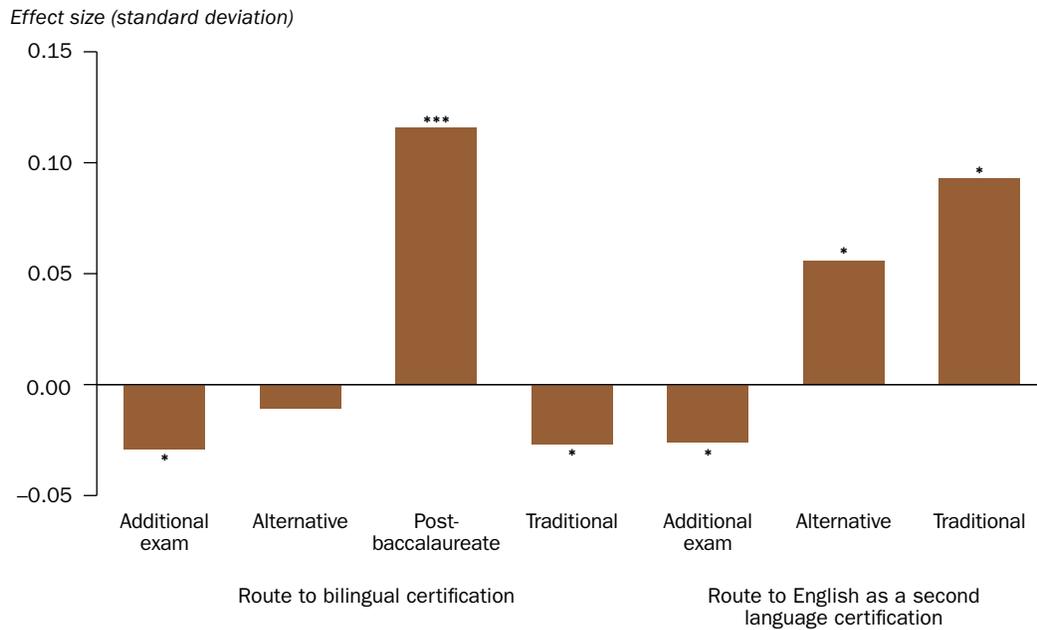


Effect size (standard deviation)

## Implications of the study findings

The findings from this study yielded inconsistent results between assessments, subject, and grade levels. When the analysis used the most recent assessment program in Texas, STAAR, having a teacher with bilingual certification was associated with higher growth in grade 4 math achievement but lower growth in grade 5 math achievement compared with having a teacher without bilingual or English as a second language certification. Having a teacher with bilingual certification was also associated with higher growth in grade 4 reading achievement but not with higher or lower growth in grade 5 reading achievement. Having a teacher with English as a second language certification was not associated with higher or lower achievement growth in either grade or subject using the STAAR or TAKS data. Finally, having a teacher with bilingual or English as a second language certification was not associated with higher or lower growth in English proficiency among English learner students in grade 4 or 5 compared with having a teacher without bilingual or English as a second language certification. Findings by certification route were also inconsistent across grade levels and subjects.

Given the inconsistent results, there are no clear implications for practice. However, policymakers might use the information from this study as baseline information to investigate

*Given the inconsistent results, there are no clear implications for practice. However, policymakers might use the information from this study as baseline information to investigate how the recent changes in bilingual educator certification could be associated with growth in math and reading achievement among grade 4 and grade 5 students*

how the recent changes in bilingual educator certification could be associated with growth in math and reading achievement among grade 4 and grade 5 students. Effective October 31, 2017, bilingual and English as a second language certification in Texas became supplemental certificates that attach to a base-level certification area. So teachers who have obtained certification in a core subject area and grade level can obtain a bilingual or English as a second language supplemental certificate. Additional research might also investigate alternate methods for identifying which teachers are effective, given the recent changes in certification, and whether having a teacher with both math and bilingual or English as second language certification could influence teacher effectiveness with English learner students.

A possible next step for research is to expand the findings of this study to kindergarten through grade 3 to identify the teacher characteristics best correlated with larger teacher value-added contributions to academic achievement among English learner students. K–3 students account for 40 percent of English learner students in Texas public schools (Texas Education Agency, 2017). So such research could help school leaders allocate teachers in a way that maximizes growth in achievement among beginning English learner students in the early grades.

## Limitations of the study

This study has four main limitations.

First, the results are not necessarily generalizable to other school districts in the state or region. The study was conducted in the Houston Independent School District, the largest of 11 major urban school districts in Texas.[2] Because of its size, location, and context, the Houston Independent School District attracts and retains teachers with bilingual and English as a second language certification whose backgrounds do not necessarily match those of the average teacher with bilingual or English as a second language certification in the state. For example, in the Houston Independent School District, teachers with bilingual and English as a second language certification may be certified through programs that serve only the greater Houston area.

Second, the student and teacher characteristics analyzed in the study do not represent all characteristics that may be associated with student math achievement, reading achievement, and English proficiency. The study team did not have access to data on individual or family factors such as student motivation, parent involvement, parent education expectations, or household income, all of which may be related to education outcomes among English learner students. The analyses did not include measures of the instruction time in English that English learner students received each year, the structure of services provided in bilingual and English as a second language classrooms, or data on teacher fluency in Spanish, which other studies have found to be positively associated with math and reading achievement among English learner students (Loeb, Soland, and Fox, 2014).

Third, the associations between teacher certification characteristics (type and route) and growth in math achievement, reading achievement, and English proficiency are based on correlation analysis, so causal inferences cannot be made. The value-added models used in the analyses included most teacher and student characteristics that previous research has shown to be associated with achievement growth among English learner students, which

*The student and teacher characteristics analyzed in the study do not represent all characteristics that may be associated with student math achievement, reading achievement, and English proficiency*

greatly reduces the estimate bias that can occur when such characteristics are omitted. Most recently, Chetty, Friedman, and Rockoff (2014) found that value-added models that control for a student's prior test scores provide unbiased estimates of teachers' impacts on student achievement. Therefore, the student and teacher characteristics included in this study's value-added models greatly reduce the bias of the estimates.

Fourth, the study was unable to examine English learner students separately by English proficiency level—specifically beginning and nonbeginning English learner students —because the proportion of English learner students at the beginning level of English proficiency in the original samples was too small (3–5 percent in grade 4 and less than 1 percent in grade 5) for analysis.

# Appendix A. Literature review

This appendix summarizes the research literature on teacher bilingual and English as a second language certification, especially research that addresses how teacher certification characteristics are associated with growth in academic achievement and English proficiency among English learner students.

## Teacher characteristics and student academic achievement

Research on the relationship between teacher characteristics (teaching experience, education, content knowledge, certification type, certification route, race/ethnicity, and sex) and student academic achievement has a rich history. A substantial body of research has shown that teaching is the most important school-based factor affecting growth in student academic achievement (Aaronson, Barrow, & Sander, 2007; Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004). Although several studies have analyzed the association between teacher-related factors and student performance, evidence of which teacher characteristics best predict classroom effectiveness is elusive (Clotfelter, Ladd, & Vigdor, 2007). A growing body of literature uses value-added models to identify the contributions of individual teachers to student gains (Aaronson et al., 2007). The few studies that have analyzed the relative effectiveness of teachers with different types of students have found that teacher effects vary depending on the types of students a teacher serves (Aaronson et al., 2007; Lockwood & McCaffrey, 2009; Loeb & Candelaria, 2013; Stacy, Reckase, Wooldridge, & Guarino, 2013).

Although a large body of research has studied programmatic approaches to instructing English learner students (Barac & Bialystok, 2011; Greene, 1997; Slavin & Cheung, 2005; Valentino & Reardon, 2015), most of those studies have not analyzed teacher characteristics, so their results may be biased. Moreover, research on teacher preparation and certification suggests that developing teacher skills in areas specific to English language instruction may require additional coursework and certification (Bridges & Dagys, 2012; López, Scanlan, & Gundrum, 2013; Sehlaoui & Shinge, 2013).

In summary, the research base on effective teachers for English learner students remains weak. Most studies do not have the data needed to identify the teacher characteristics associated with classroom effectiveness for English learner students.

## Bilingual and English as a second language certification and English learner student achievement

An analysis of student outcomes that includes the certification held by each classroom teacher and that can match students to teachers could associate each classroom's outcomes with the certification held by each classroom's teacher. But an analysis that includes teacher characteristics only at the school level does not provide insight into whether the characteristics matter at the classroom level. Because of limitations in data availability and access, most research on the effects of specialized certification to teach English learner students has used school-level teacher certification rates rather than data that match teachers and students. These studies have yielded mixed results. López et al.'s (2013) analysis of grade 4 reading achievement data from the National Assessment of Educational Progress found that states that require teachers to hold a bilingual or English as a second language certification to teach English learner students have higher reading achievement among

English learner students. Parker, O'Dwyer, and Irwin (2014) included the percentage of English learner students taught by teachers with bilingual or English as a second language certification as a school-level variable and found that the percentage of certified teachers in the school was not a significant predictor of students' English proficiency. Because these two studies did not match students to teachers, they do not associate each classroom's teacher certification with the corresponding student outcomes.

Studies that have used teacher-level data rather than school-level aggregates have found more positive correlations between bilingual and English as a second language certification and student outcomes among English learner students. Loeb et al. (2014) found that bilingual certification was a positive and significant predictor of elementary teachers' effectiveness in math and reading among English learner students. Master, Loeb, Whitney, & Wyckoff (2012) found that for teachers with three or fewer years of experience, English as a second language certification was statistically significant in explaining English learner student achievement in grades 4 and 5.

In summary, studies using data that match English learner students and their teachers have found a positive relationship between teachers with bilingual and English as a second language certification and student achievement.

### Certification route and English learner student achievement

An increasing body of research describes the characteristics of teachers certified through the alternative route and compares the effectiveness of different certification routes on value-added student outcomes (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009). Goldhaber and Brewer (1999) found that high school students of math teachers certified in math through any route (standard, alternative, or other) outperformed students whose teachers had no certification or were certified in a different subject area. A comparison of alternatively and traditionally certified teachers found no statistically significant difference in student performance (Constantine et al., 2009). Boyd et al.'s (2011) study using New York City data found that mean value added was similar for traditionally certified teachers and teachers certified as New York City Teaching Fellows but slightly higher for teachers certified through Teach For America.

Research on the relationship between teacher certification route and performance among English learner students is extremely limited. The only study identified found that having a Teach for America–certified teacher was positively associated with student math achievement and that having a New York City Teaching Fellows–certified teacher was associated with a reduced, within-classroom learning gap in math between English learner students and non–English learner students in the elementary grades (Master et al., 2012).

### English language proficiency and English learner student academic achievement

Few studies have investigated whether the association between teacher value added and growth in achievement among English learner students varies by students' English proficiency, and the results are mixed. One study found that bilingual programs in elementary grades had positive effects on English proficiency among English learner students with high prior English listening and speaking proficiency and negative effects among English learner students with low prior proficiency (Jepsen, 2010). Another study found that the

effects of four English learner instructional models on math and reading achievement were similar for English learner students at all levels of initial English proficiency (Valentino & Reardon, 2015). Parker et al. (2014) found a positive relationship between English learner students' English proficiency and their math and reading performance. Valentino and Reardon (2015) also found that English proficiency among English learner students in a rural district in California predicted performance in English language arts and math and that by the time English learner students were proficient in English, they had usually attained proficiency in those two subject areas. Valentino and Reardon also used Early Childhood Longitudinal Study–Kindergarten data to show that Hispanic students who start kindergarten with the lowest levels of English proficiency have the highest achievement gains in the early years of schooling.

## Appendix B. Data, sample, and methodology

This appendix describes the data and variables used in the analysis, outlines the construction of the student and teacher samples, and details the study methodology.

### Data

The data used for the study are from two sources. Student test scores, student demographics, teacher certification and demographic information, and school characteristics are from the Texas Education Research Center. Rosters of English learner students in grades 3–5 and their math and English language arts teachers are from the Houston Independent School District. Rosters were generated for each year covered in the study so that students could be matched to teachers.[3] The Houston Independent School District submitted the information directly to the Texas Education Agency using unique teacher and student identification numbers that match those used by the Texas Education Agency. The Texas Education Agency then sent the data to the Texas Education Research Center.

### Variables

This section describes the measures of math and reading achievement and English proficiency as well as other covariates used in the analyses.

*Measures of math and reading achievement.* For the main analysis the study team used the State of Texas Assessments of Academic Readiness (STAAR) scale score (a derived score used to maintain similar standards across test administrations) to generate a standard score that could be used to compare student achievement across grade levels. The study team calculated this standardized score—or z-score—for each student and for every testing occasion and content area by subtracting the sample mean grade-level scale score from each student's scale score and dividing by the standard deviation of the sample scale score. Thus, a student who scores at the sample mean will have a STAAR z-score of 0, a student who scores one deviation above the sample mean will have a STAAR z-score of 1, and a student who scores one standard deviation below the sample mean will have a STAAR z-score of –1. The z-score allows for growth in STAAR scores to be measured across grade levels and testing years. The study team followed the same procedure with the Texas Assessment of Knowledge and Skills (TAKS) scale scores for the supplementary analysis. Scale scores from both the English and Spanish version of the STAAR and TAKS assessment were used.

*Measure of English proficiency.* To measure English proficiency, the study team used each English learner student's scale score from the reading component of the Texas English Language Proficiency Assessment System (TELPAS). The TELPAS reading component for grades 2–12 consists of a multiple-choice test for six two-grade clusters; grades 4 and 5 are in a cluster. The tests are designed specifically for English learner students, whose ability to demonstrate general reading skills is often obscured by their emerging understanding of the English language. The tests measure English reading ability according to the TELPAS English language proficiency continuum, which is based on the stages of second language acquisition of English learner students. The TELPAS reading component has a weight of 75 percent in the calculation of the TELPAS composite rating, which ranges from 1.0 to 4.0 and corresponds to one of four proficiency levels (beginning, intermediate, advanced, or advanced high).

A vertical scale system was developed for the revised grade 2–12 TELPAS reading tests using a spring 2008 vertical scaling study, and the proficiency-level standards established in summer 2008 were mapped onto the vertical scale score system. The TELPAS reading scale score ranges from 306 (corresponding to a raw score of 0 in grade 2) to 1007 (corresponding to a raw score of 64 in grades 10–12; Texas Education Agency, 2011) and can measure growth in English proficiency even when a student stays at the same TELPAS proficiency level. The study team also calculated z-scores for the TELPAS reading component scale scores using the procedure described above for math and reading achievement.

*Other covariates.* Several student-, teacher-, and school-level predictors were included in the two models used to explain growth in student achievement by teacher certification type and route (table B1). Student-level predictors were prior achievement, student race/ethnicity, gender, eligibility for the federal school lunch program, grade retention, and whether the student was in special education or a gifted and talented program. Teacher-level predictors were certification type, certification route, teaching experience, gender, Hispanic race/ethnicity, and education level. School-level predictors were proportion of

**Table B1. Predictors of student achievement included in the study models**

| Predictor | Equation B1 (research question 1, teacher certification type) | Equation B2 (research question 2, teacher certification type and route) |
|---|:---:|:---:|
| Student level | | |
| English proficiency rating in previous grade | ✔ | ✔ |
| Math and reading achievement in previous grade | ✔ | ✔ |
| Race/ethnicity | ✔ | ✔ |
| Gender | ✔ | ✔ |
| Eligibility for federal school lunch program | ✔ | ✔ |
| Student was retained | ✔ | ✔ |
| Student in special education program | ✔ | ✔ |
| Student in gifted and talented program | ✔ | ✔ |
| Grade dummy variables | ✔ | ✔ |
| Cohort dummy variables | ✔ | ✔ |
| Teacher level | | |
| Teacher has standard bilingual certification | ✔ | ✔ |
| Teacher has standard English as a second language certification | ✔ | ✔ |
| Teacher certification route dummy variables | na | ✔ |
| Teacher experience | ✔ | ✔ |
| Teacher gender | ✔ | ✔ |
| Teacher is Hispanic | ✔ | ✔ |
| Teacher has a graduate degree | ✔ | ✔ |
| School level | | |
| Proportion of students eligible for the federal school lunch program | ✔ | ✔ |
| Proportion of students in special education | ✔ | ✔ |
| Proportion of English learner students | ✔ | ✔ |

na is not applicable.

**Source:** Authors' compilation.

students eligible for the federal school lunch program, proportion of students in special education, and proportion of English learner students in the school.

## Student sample

The student samples consisted of English learner students in the Houston Independent School District who were in grade 4 or 5 between 2005/06 and 2014/15, whose home language was Spanish, and who participated in the district's bilingual education or English as a second language program. Only students with valid test scores for the test year and the previous year (that is, from grade 3 for the grade 4 cohorts and from grade 4 for the grade 5 cohorts) who could be linked to teachers with certification type and route data were included.

The student sample for the main analysis consisted of four grade 4 cohorts and four grade 5 cohorts of students between the 2011/12 and 2014/15 school years who had STAAR data and ten grade 4 cohorts and nine grade 5 cohorts of students between the 2005/06 and 2014/15 school years who had TELPAS data. The student sample for the supplementary analysis consisted of six grade 4 cohorts of students between the 2005/06 and 2010/11 school years and five grade 5 cohorts of students between the 2006/07 and 2010/11 school years who had TAKS data (tables B2 and B3).

## Teacher sample

The teacher sample consisted of teachers in the Houston Independent School District assigned to students in the sample described in the previous section who taught math or reading to at least 10 Spanish-speaking English learner students (table B4). For each subject, grade 3 scores were used as a baseline for grade 4 outcomes, and grade 4 scores were used as baseline for grades 5 outcomes.

**Table B2. Student cohorts included in the study, by school year, assessment, and grade**

| School year | Assessment | Cohort number | |
| --- | --- | --- | --- |
| | | Grade 4 | Grade 5 |
| 2005/06 | TAKS and TELPAS | 1 | na |
| 2006/07 | TAKS and TELPAS | 2 | 1 |
| 2007/08 | TAKS and TELPAS | 3 | 2 |
| 2008/09 | TAKS and TELPAS | 4 | 3 |
| 2009/10 | TAKS and TELPAS | 5 | 4 |
| 2010/11 | TAKS and TELPAS | 6 | 5 |
| 2011/12 | STAAR and TELPAS | 7 | 6 |
| 2012/13 | STAAR and TELPAS | 8 | 7 |
| 2013/14 | STAAR and TELPAS | 9 | 8 |
| 2014/15 | STAAR and TELPAS | 10 | 9 |

na is not applicable. TAKS is Texas Assessment of Knowledge and Skills. TELPAS is Texas English Language Proficiency Assessment System. STAAR is State of Texas Assessments of Academic Readiness.

**Source:** Authors' compilation.

**Table B3. Number of students in the Houston Independent School District population and study sample, by grade, analysis, and subject**

| Grade and analysis | Math | | Reading | | English proficiency | |
|---|---|---|---|---|---|---|
| | Houston Independent School District population | Study sample | Houston Independent School District population | Study sample | Houston Independent School District population | Study sample |
| Grade 4 | | | | | | |
| Main analysis (cohorts 7–10) | 25,976 | 20,505 | 18,326 | 15,888 | 43,996 | 38,716 |
| Supplementary analysis (cohorts 1–6) | 33,714 | 24,722 | 26,821 | 21,646 | na | na |
| Grade 5 | | | | | | |
| Main analysis (cohorts 6–9) | 18,495 | 15,093 | 11,461 | 9,850 | 25,189 | 21,796 |
| Supplementary analysis (cohorts 1–5) | 19,072 | 14,616 | 13,728 | 10,875 | na | na |

na is not applicable.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin.

**Table B4. Number of teachers in the Houston Independent School District population and study sample, by grade, analysis, and subject**

| Grade and analysis | Math | | Reading | | English proficiency | |
|---|---|---|---|---|---|---|
| | Houston Independent School District population | Study sample | Houston Independent School District population | Study sample | Houston Independent School District population | Study sample |
| Grade 4 | | | | | | |
| Main analysis (cohorts 7–10) | 1,298 | 611 | 727 | 443 | 1,510 | 809 |
| Supplementary analysis (cohorts 1–6) | 1,596 | 630 | 1,053 | 521 | na | na |
| Grade 5 | | | | | | |
| Main analysis (cohorts 7–10) | 933 | 435 | 561 | 323 | 1,024 | 532 |
| Supplementary analysis (cohorts 1–6) | 1,034 | 415 | 641 | 302 | na | na |

na is not applicable.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin.

*Certification type.* The majority of bilingual teachers were not fully certified throughout the period analyzed. For both math and reading the percentage of teachers with full bilingual certification was higher in the sample for the main analysis (which covered 2011/12–2014/15) than in the sample for the supplementary analysis (which covered 2005/06–2010/11) and for grade 4 than for grade 5 (table B5). More than half of English as a second language teachers in the sample for the main analysis were fully certified. The percentage of teachers with full English as a second language certification was higher in the sample for the main analysis than in the sample for the supplementary analysis, except for grade 5 math.

*Certification route.* For both math and reading more than half of the grade 4 and 5 teachers with bilingual certification in the study samples were certified through the alternative route (table B6). The lowest proportion were certified through the postbaccalaureate route. Between 2005/06–2010/11 and 2011/12–2014/15 the proportion of grade 4 math and reading teachers with bilingual certification through each route changed little. But between 2006/07–2010/11 and 2011/12–2014/15 the proportion of grade 5 math teachers

**Table B5. Percentage of teachers in the analysis of math and reading achievement who were fully certified and percentage who were not fully certified, by certification type, subject, grade, and analysis**

| Certification type and subject | Grade 4 | | Grade 5 | |
| --- | --- | --- | --- | --- |
| | Main analysis (cohorts 7–10) | Supplementary analysis (cohorts 1  6) | Main analysis (cohorts 7–10) | Supplementary analysis (cohorts 1–6) |
| Bilingual | | | | |
| *Math* | | | | |
| Fully certified | 41.2 | 39.6 | 36.6 | 33.2 |
| Not fully certified[a] | 58.8 | 60.4 | 63.4 | 66.8 |
| *Reading* | | | | |
| Fully certified | 43.2 | 39.3 | 39.1 | 34.5 |
| Not fully certified[a] | 56.8 | 60.7 | 60.9 | 65.5 |
| English as a second language | | | | |
| *Math* | | | | |
| Fully certified | 56.8 | 51.1 | 56.7 | 57.0 |
| Not fully certified[a] | 43.2 | 48.9 | 43.3 | 43.0 |
| *Reading* | | | | |
| Fully certified | 57.6 | 52.7 | 58.5 | 48.7 |
| Not fully certified[a] | 42.4 | 47.3 | 41.5 | 51.3 |

a. Includes emergency, probationary, and one-year credentials.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin.

with bilingual certification through the traditional route decreased from 29 percent to 19 percent, the proportion with bilingual certification through the postbaccalaureate route increased from 1 percent to 6 percent, and the proportion with bilingual certification through the alternative route increased from 54 percent to 64 percent.

For both math and reading the most common English as a second language certification route for grade 4 and 5 teachers in the study samples was the additional exam route (see table B6). The second most common route was the alternative route except for reading teachers in grade 4 in 2005/06–2010/11. In both grades, less than 1 percent of teachers with English as a second language certification in 2005/06–2010/11 were certified through the postbaccalaureate route. Between 2005/06–2010/11 and 2011/12–2014/15 the proportion of grade 4 teachers with English as a second language certification through the additional exam route decreased from 63 percent to 55 percent in math and from 70 percent to 52 percent in reading, and the proportion with English as a second language certification through the alternative route increased from 20 percent to 31 percent in math and from 13 percent to 36 percent in reading. Between 2006/07–2010/11 and 2011/12–2014/15 there was relatively little or no change in the proportion of grade 5 teachers with English as a second language certification through the additional exam route for math (from 71 percent to 66 percent) or for reading (61 percent in both periods).

Reading teachers were used in the analyses of English proficiency because the analyses used the reading section of the TELPAS to measure English proficiency. The percentage of teachers with bilingual certification and English as a second language certification in the English proficiency sample resemble an average of the percentage of teachers with those certifications in 2005/06–2010/11 and 2011/12–2014/15 (table B7).

**Table B6. Percentage of teachers in the study sample, by certification type, subject, certification route, grade, and year**

| Certification type, subject, and certification route | Grade 4 | | Grade 5 | |
| --- | --- | --- | --- | --- |
| | 2005/06–2010/11 | 2011–12/2014–15 | 2006/07–2010/11 | 2011/12–2014/15 |
| **Bilingual** | | | | |
| *Math* | | | | |
| Additional exam route | 9.3 | 8.4 | 16.5 | 12.0 |
| Alternative route | 65.8 | 64.7 | 54.1 | 63.9 |
| Postbaccalaureate route | 3.3 | 4.2 | 0.6 | 5.6 |
| Traditional route | 21.6 | 22.7 | 28.8 | 18.5 |
| *Reading* | | | | |
| Additional exam route | 9.3 | 9.2 | 16.1 | 8.5 |
| Alternative route | 65.8 | 63.7 | 54.4 | 62.3 |
| Postbaccalaureate route | 3.7 | 3.6 | 1.3 | 3.8 |
| Traditional route | 21.2 | 23.5 | 28.2 | 25.5 |
| **English as a second language** | | | | |
| *Math* | | | | |
| Additional exam route | 63.1 | 54.8 | 71.3 | 65.5 |
| Alternative route | 20.4 | 30.8 | 18.3 | 23.0 |
| Postbaccalaureate route | 0.0 | 2.1 | 0.0 | 1.4 |
| Traditional route | 16.5 | 12.3 | 10.4 | 10.1 |
| *Reading* | | | | |
| Additional exam route | 70.1 | 51.8 | 60.5 | 60.5 |
| Alternative route | 13.4 | 36.0 | 24.7 | 24.8 |
| Postbaccalaureate route | 0.0 | 0.0 | 0.0 | 0.8 |
| Traditional route | 16.4 | 12.3 | 14.8 | 14.0 |

| | Grade 4 | Grade 5 |
| --- | --- | --- |
| | 2005/06–2014/15 | 2005/06–2014/15 |
| **Bilingual** | | |
| *English proficiency* | | |
| Additional exam route | 9.5 | 12.8 |
| Alternative route | 65.3 | 57.8 |
| Postbaccalaureate route | 3.3 | 2.8 |
| Traditional route | 22.0 | 26.5 |
| **English as a second language** | | |
| *English proficiency* | | |
| Additional exam route | 56.5 | 60.8 |
| Alternative route | 28.6 | 24.3 |
| Postbaccalaureate route | 0.0 | 0.5 |
| Traditional route | 14.9 | 14.3 |

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

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin.

**Table B7. Percentage of teachers in the analysis of English proficiency who were fully certified and who were not fully certified, by certification type and grade**

| Certification type | Grade 4 | Grade 5 |
|---|---|---|
| Bilingual | | |
| Fully certified | 41.1 | 36.4 |
| Not fully certified[a] | 58.9 | 63.6 |
| English as a second language | | |
| Fully certified | 55.2 | 56.1 |
| Not fully certified[a] | 44.8 | 43.9 |

**a.** Includes emergency, probationary, and one-year credentials.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin.

## Methodology

To answer the research questions, the study team first built one analytic data file for each subject (math, reading, and English proficiency) and grade (4 and 5) by using unique student IDs to merge demographic data with assessment data on math and reading achievement (from STAAR and TAKS) and English proficiency (from TELPAS). The study team also built a teacher file for each subject (math and reading)[4] and grade (4 and 5). This file included teacher demographic characteristics (teaching experience, gender, race/ethnicity, and education level) and certification information (bilingual and English as a second language certification and certification route). For each grade and subject the study team merged the student and teacher files. In each merged file, each student had one record, and each record included the previous and current year's assessment score and the current year's teacher.

*Regression models.* The variables and procedure used to address each research question are summarized in table B8.

First, all test scores were standardized to have a mean of zero and a standard deviation of one within each grade–year combination for the sample. The unit for all figures that illustrate assessment scores is thus standard deviation units. Individual teacher certification characteristics were regressed on student test performance to understand their contribution to growth in student math achievement, reading achievement, and English proficiency. The analysis focused on two teacher characteristics:
- Certification type (bilingual and English as a second language; research question 1).
- Certification route (additional exam, alternative, postbaccalaureate, and traditional; research question 2).

The study team estimated the models specified in equations B1 and B2. Because the goal was to determine the contribution of teachers with full bilingual and English as a second language certification by certification type and route, the analyses used two specifications: one included controls for certification type, and one included controls for both certification type and certification route. Specifically, the study team estimated two student achievement models that predicted the test score in year $t$ for student $i$ in grade $g$ with teacher $j$ in school $s$ as a function of student ($X_{ijst}$), teacher demographic ($T_j$), and school ($S_{st}$) characteristics. Both models, also known as value-added specifications, included a

**Table B8. Dependent variables, predictor variables, and analysis procedures for research questions 1 and 2, by research question**

| Research question | Dependent variables | Predictor variables | Analysis procedure |
|---|---|---|---|
| 1. What are the value-added contributions of teachers with bilingual and English as a second language certification to growth in math achievement, reading achievement, and English proficiency among English learner students whose home language is Spanish? | STAAR and TAKS math and reading scores | • Student characteristics<br>• Student prior-year assessment score<br>• Language of testing<br>• School characteristics | Multilevel regression modeling, with year fixed effects and terms to control for teacher certification type, run separately by grade for math, reading, and English proficiency (TELPAS) |
| | TELPAS reading component scores | • Student characteristics<br>• Student prior-year assessment score<br>• School characteristics | |
| 2. What are the value-added contributions of different routes to teacher bilingual and English as a second language certification to growth in math achievement, reading achievement, and English proficiency among English learner students whose home language is Spanish? | STAAR and TAKS math and reading scores | • Student characteristics<br>• Student prior-year assessment score<br>• Teacher characteristics<br>• School characteristics | Multilevel regression modeling, with year fixed effects, and interactions of teacher certification route and type, run separately by grade for math, reading, and English proficiency |
| | TELPAS reading component scores | • Student characteristics<br>• Student prior-year assessment score<br>• Teacher characteristics<br>• School characteristics | |

STAAR is State of Texas Assessments of Academic Readiness. TAKS is Texas Assessment of Knowledge and Skills. TELPAS is Texas English Language Proficiency Assessment System.

**Source:** Authors' compilation.

vector of prior-year student test scores ($A_{igjs(t-1)}$) in math and reading as the dependent variable instead of analyzing $A_{it}-A_{i(t-1)}$.[5] The model in equation B1 included teacher certification type, $CT_j$ as predictors of interest. The model in equation B2 included teacher certification type, $CT_j$, and certification route, $CR_j$, as predictors of interest.

$$A_{igjst} = A_{igjs(t-1)}\beta_1 + X_{it}\beta_2 + S_{st}\beta_3 + T_j\beta_4 + \beta_{5kj}CT_j + \gamma_t + \alpha_g + \varepsilon_{igjst} \qquad (B1)$$

$$A_{igjst} = A_{igjs(t-1)}\beta_1 + X_{it}\beta_2 + S_{st}\beta_3 + T_j\beta_4 + \beta_{5kj}CT_j + \beta_{6kj}CT_j * CR_j + \gamma_t + \alpha_g + \varepsilon_{igjst} \quad (B2)$$

Equation B1 yielded estimates of the average effect on achievement growth of teachers with bilingual certification or English as a second language certification. Equation B2 provided the average effect on achievement growth of teachers with bilingual certification through each of the four certification routes and of teachers with English as a second language certification through each of the four certification routes. To obtain the estimate of the effect of a certification route on achievement growth, the estimated parameter for the corresponding certification type, $\beta_{5kj}$, was added to the estimated parameter for the interaction term of certification type and certification route, $\beta_{6kj}$. Since the analyses included four certification routes for each certification type, equation B2 included three interaction terms for each certification type and used the fourth one as the reference route. Therefore, the total effect of the omitted route was the parameter estimate for certification type, $\beta_{5kj}$, and the total effect of each of the other routes was $\beta_{5kj} + \beta_{6kj}$. For example, to estimate the net effect of teachers with bilingual certification through the traditional route, the parameter for bilingual certification was added to the parameter for the interaction term bilingual certification * traditional route. The statistical significance of these total estimates was determined by reparametrizing equation B2 to make each certification route the reference.

With these four estimates of certification route for each certification type, six unique pair-wise comparisons of certification type and route could be made:

- Traditional relative to alternative.
- Traditional relative to postbaccalaureate.
- Traditional relative to additional exam.
- Alternative relative to postbaccalaureate.
- Alternative relative to additional exam.
- Postbaccalaureate relative to additional exam.

Because an interaction term was not included in the model for bilingual certification through the alternative route, the coefficients on the interaction terms of bilingual certification through the additional exam, postbaccalaureate, and traditional routes needed to be subtracted from the coefficient on bilingual certification to obtain an estimate of the effect of each route relative to the alternative route. To make the pairwise comparisons between the additional exam, postbaccalaureate, and traditional routes, the total effects by certification route were subtracted from one another.

Similarly for English as a second language certification, because an interaction term was not included in the model for English as a second language certification through the additional exam route, the coefficients on the interaction terms of English as a second language certification through the alternative, postbaccalaureate, and traditional routes needed to be subtracted from the coefficient on English as a second language certification to obtain an estimate of the effect of each route relative to the additional exam route. To make the pairwise comparisons between the alternative, postbaccalaureate, and traditional routes, the total effects by certification route were subtracted from one another.

Both models included year fixed effects to control for unobservable differences in test score distributions from year to year. The models enabled the study team to identify which teacher certification characteristics[6] were correlated with higher student scores in math achievement, reading achievement, and English proficiency. The study team ran each model five times for each grade: twice for reading (once using STAAR scores and once using TAKS scores), twice for math (once using STAAR scores and once using TAKS scores), and once using TELPAS scores.

Because the study team could not randomly assign students to teachers to avoid any bias from unobserved omitted variables, the study team included a set of covariates at each level—student, teacher, and school (see table B1).

The analysis of English proficiency used TELPAS data from all 10 cohorts in one regression for grade 4 and all nine cohorts for grade 5.

# Appendix C. Detailed results

This appendix reports parameter estimates for selected predictors included in model 1 (certification type) and model 2 (certification route; see appendix B) using data from the State of Texas Assessments of Academic Readiness (STAAR) and the Texas English Language Proficiency Assessment System (TELPAS). Specifically, parameter estimates on certification type and certification route predictors are reported in tables C1 and C2. These models also included student-, teacher-, and school-level covariates.

Parameter estimates on certification type and certification route predictors from estimating models 1 and 2 to measure the association between teacher certification types and routes and growth in math achievement, reading achievement, and English proficiency among English learner students in grade 4 are presented in table C1. Though not reported below, parameter estimates on some teacher and student covariates were significant. For teachers, experience and being Hispanic were positively and significantly associated with growth in math and reading achievement, being female was negatively associated with growth in math achievement but positively associated with growth in English proficiency, and having a graduate degree was negatively associated with growth in English proficiency. For students, scores on the previous year's assessment and being in a gifted and talented program were positively and significantly associated with growth in math achievement, reading achievement, and English proficiency; English proficiency was positively and significantly

**Table C1. Selected parameter results of regressions using teacher characteristics to predict growth among English learner students in grade 4 in the Houston Independent School District, by model and subject**

| Model and variable | Math[a] (n = 20,505) | | Reading[a] (n = 15,888) | | English proficiency[b] (n = 38,716) | |
|---|---|---|---|---|---|---|
| | Parameter estimate | Standard error | Parameter estimate | Standard error | Parameter estimate | Standard error |
| Model 1—Certification type | | | | | | |
| Standard bilingual | 0.123*** | 0.015 | 0.036* | 0.017 | −0.010 | 0.007 |
| Standard English as a second language | −0.009 | 0.020 | −0.028 | 0.021 | 0.001 | 0.011 |
| Model 2—Certification route | | | | | | |
| *Bilingual* | | | | | | |
| Standard certification | 0.168*** | 0.020 | 0.030 | 0.022 | −0.011 | 0.009 |
| Additional exam route for standard certification | −0.150*** | 0.034 | −0.044 | 0.037 | −0.019 | 0.016 |
| Postbaccalaureate route for standard certification | −0.109 | 0.059 | −0.029 | 0.068 | 0.127*** | 0.025 |
| Traditional route for standard certification | −0.046 | 0.028 | 0.053 | 0.030 | −0.016 | 0.014 |
| *English as a second language* | | | | | | |
| Standard certification | 0.005 | 0.022 | −0.004 | 0.024 | −0.026* | 0.012 |
| Additional exam route for standard certification | −0.043 | 0.357 | −0.048 | 0.039 | 0.082** | 0.025 |
| Postbaccalaureate route for standard certification | −0.057 | 0.232 | c | c | c | c |
| Traditional route for standard certification | 0.009 | 0.060 | −0.055 | 0.070 | 0.119** | 0.040 |

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

**a.** Measured by achievement on the State of Texas Assessments of Academic Readiness.

**b.** Measured by achievement on the Texas English Language Proficiency Assessment System.

**c.** Effect could not be calculated because of the small sample size.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

**Table C2. Selected parameter results of regressions using teacher characteristics to predict growth among English learner students in grade 5 in the Houston Independent School District, by model and subject**

| Model and variable | Math[a] (n = 15,093) Parameter estimate | Standard error | Reading[a] (n = 9,850) Parameter estimate | Standard error | English proficiency[b] (n = 21,796) Parameter estimate | Standard error |
|---|---|---|---|---|---|---|
| **Model 1—Certification type** | | | | | | |
| Standard bilingual | −0.080** | 0.028 | −0.021 | 0.027 | 0.009 | 0.012 |
| Standard English as a second language | 0.018 | 0.021 | 0.005 | 0.023 | 0.002 | 0.012 |
| **Model 2—Certification route** | | | | | | |
| *Bilingual* | | | | | | |
| Standard certification | 0.031 | 0.040 | −0.020 | 0.038 | 0.039* | 0.015 |
| Additional exam route for standard certification | −0.219*** | 0.060 | −0.010 | 0.062 | −0.060** | 0.023 |
| Postbaccalaureate route for standard certification | −0.097 | 0.101 | −0.128 | 0.106 | 0.064 | 0.062 |
| Traditional route for standard certification | −0.178** | 0.058 | −0.006 | 0.050 | −0.057* | 0.024 |
| *English as a second language* | | | | | | |
| Standard certification | 0.045 | 0.023 | 0.014 | 0.025 | −0.002 | 0.013 |
| Additional exam route for standard certification | −0.049 | 0.051 | −0.022 | 0.043 | 0.003 | 0.024 |
| Postbaccalaureate route for standard certification | −0.130 | 0.132 | c | c | c | c |
| Traditional route for standard certification | −0.230** | 0.081 | −0.123 | 0.079 | 0.057 | 0.056 |

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

**a.** Measured by achievement on the State of Texas Assessments of Academic Readiness.

**b.** Measured by achievement on the Texas English Language Proficiency Assessment System.

**c.** Effect could not be calculated because of the small sample size.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

associated with growth in math and reading achievement; and being in special education and being economically disadvantaged were negatively and significantly associated with growth in English proficiency.

Parameter estimates on certification type and certification route predictors from estimating models 1 and 2 to measure the association between teacher certification types and routes and growth in math and reading achievement and English proficiency among English learner students in grade 5 are presented in table C2. Though not reported below, parameter estimates on some teacher and student covariates were significant. For teachers, experience and being Hispanic were positively and significantly associated with growth in math achievement, being female was positively associated with growth in English proficiency, and having a graduate degree was negatively associated with growth in math achievement but positively associated with growth in reading achievement and in English proficiency. For students, scores on the previous year's assessment and being in a gifted and talented program were both positively and significantly associated with growth in math achievement, reading achievement, and English proficiency; English proficiency was positively and significantly associated with growth in math and reading achievement; and being in special education was negatively and significantly associated with growth in English proficiency.

This appendix reports parameter estimates for selected predictors included in model 1 (certification type) and model 2 (certification route; see appendix B) using data from the Texas Assessment of Knowledge and Skills (TAKS) assessment program.

Having a teacher with bilingual certification was associated with higher math achievement among English learner students in grade 4 compared with having a teacher without bilingual or English as a second language certification (table D1). The effect size was 0.04 standard deviation, which suggests that the mean TAKS score among students in grade 4 who had a teacher with bilingual certification was at the 52nd percentile of students who had a teacher without bilingual or English as a second language certification.

Having a teacher with English as a second language certification was not associated with growth in math achievement on the TAKS among English learner students in grade 4. This result is consistent with the findings of the main analysis, which are based on STAAR data.

Having a teacher with bilingual certification through the additional exam route or through the postbaccalaureate route was associated with higher growth in math achievement on the TAKS compared with having a teacher with bilingual certification through the alternative route (table D2). The effect size of having a teacher with bilingual certification

**Table D1. Selected parameter results of regressions using teacher characteristics to predict growth in math achievement on the Texas Assessment of Knowledge and Skills among English learner students in grade 4 in the Houston Independent School District between 2005/06 and 2010/11**

| Model and variable | Parameter estimate | Standard error |
|---|---|---|
| Model 1—Certification type | | |
| Standard bilingual | 0.044** | 0.013 |
| Standard English as a second language | −0.041 | 0.022 |
| Model 2—Certification route | | |
| *Bilingual* | | |
| Standard certification | 0.050** | 0.017 |
| Additional exam route for standard certification | 0.037 | 0.028 |
| Postbaccalaureate route for standard certification | 0.078 | 0.042 |
| Traditional route for standard certification | −0.074** | 0.025 |
| *English as a second language* | | |
| Standard certification | −0.050* | 0.024 |
| Additional exam route for standard certification | −0.109 | 0.065 |
| Postbaccalaureate route for standard certification | a | a |
| Traditional route for standard certification | 0.266* | 0.108 |

\* Significant at $p < .05$; ** significant at $p < .01$.

**a.** Effect could not be calculated because of the small sample size.

**Note:** Number of observations is 24,722. For model 1 the comparison group is teachers without bilingual or English as a second language certification. For model 2 the comparison group for bilingual certification is all teachers certified through the alternative route, and the comparison group for English as a second language certification is all teachers certified through the additional exam route.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

**Table D2. Effect on growth in achievement among English learner students in the Houston Independent School District between 2005/06 and 2010/11, by grade, subject, teacher certification type, and teacher certification route (standard deviation units)**

| Grade | Subject[a] | Route to bilingual certification | | | | Route to English as a second language certification | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Additional exam | Alternative | Postbacca-laureate | Traditional | Additional exam | Alternative | Postbacca-laureate | Traditional |
| 4 | Math | 0.09** | 0.05** | 0.13** | –0.02 | –0.05* | –0.16** | b | 0.22* |
| | Reading | 0.02 | –0.02 | 0.15** | –0.07** | –0.04 | –0.03 | b | –0.20 |
| 5 | Math | –0.06* | –0.03 | –0.03 | 0.02 | 0.02 | 0.03 | b | a |
| | Reading | –0.06 | 0.05* | 0.20 | 0.09 | 0.01 | 0.14* | b | a |

* Significant at *p* < .05; ** significant at *p* < .01; *** significant at *p* < .001.

**Note:** The comparison group was teachers without bilingual or English as a second language certification.

**a.** Measured by achievement on the Texas Assessment of Knowledge and Skills.

**b.** Effect could not be calculated because of the small sample size.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

through the additional exam route was 0.04 standard deviation (0.09 – 0.05) compared with having a teacher with bilingual certification through the alternative route. The effect size of having a teacher with bilingual certification through the postbaccalaureate route was 0.13 standard deviation compared with having a teacher without bilingual or English as a second language certification.

Having a teacher with English as a second language certification through the traditional route was associated with higher growth in math achievement on the TAKS among students in grade 4 compared with having a teacher with English as a second language certification through other routes and having a teacher with bilingual certification through any route. These results differ from those in the main analysis, which are based on STAAR data and show that having a teacher with bilingual certification through the alternative route was associated with the highest growth in math achievement and that having a teacher with English as a second language certification through any route was not associated with growth in math achievement.

There was no association between having a teacher with bilingual or English as a second language certification and growth in reading achievement on the TAKS among English learner students in grade 4 (table D3).

Having a teacher with bilingual certification through the postbaccalaureate route was associated with higher growth in reading achievement on the TAKS among English learner students in grade 4 compared with having a teacher with bilingual certification through other routes, having a teacher with English as a second language certification through any route, and having a teacher without bilingual or English as a second language certification (effect size = 0.15 standard deviation; see table D2). These results differ from those in the main analysis, which are based on STAAR data and show that having a teacher with bilingual certification through the traditional route was associated with the highest growth in reading achievement.

**Table D3. Selected parameter results of regressions using teacher characteristics to predict growth in reading achievement on the Texas Assessment of Knowledge and Skills among English learner students in grade 4 in the Houston Independent School District between 2005/06 and 2010/11**

| Model and variable | Parameter estimate | Standard error |
|---|---|---|
| **Model 1—Certification type** | | |
| Standard bilingual | −0.010 | 0.014 |
| Standard English as a second language | −0.036 | 0.028 |
| **Model 2—Certification route** | | |
| *Bilingual* | | |
| Standard certification | −0.016 | 0.019 |
| Additional exam route for standard certification | 0.031 | 0.033 |
| Postbaccalaureate route for standard certification | 0.168** | 0.047 |
| Traditional route for standard certification | −0.050 | 0.028 |
| *English as a second language* | | |
| Standard certification | 0.043 | 0.030 |
| Additional exam route for standard certification | 0.009 | 0.115 |
| Postbaccalaureate route for standard certification | a | a |
| Traditional route for standard certification | −0.161 | 0.118 |

** Significant at $p < .01$.

**Note:** Number of observations is 21,646. For model 1 the comparison group is teachers without bilingual or English as a second language certification. For model 2 the comparison group for bilingual certification is all teachers certified through the alternative route, and the comparison group for English as a second language certification is all teachers certified through the additional exam route.

**a.** Effect could not be calculated because of the small sample size.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

No route to English as a second language certification was associated with growth in reading achievement on the TAKS (see table D2). This result is consistent with the findings of the main analysis, which are based on STAAR data.

Having a teacher with bilingual certification was not associated with higher growth in math achievement on the TAKS among English learner students in grade 5 compared with having a teacher without bilingual or English as a second language certification (table D4). Having a teacher with English as a second language certification was not associated with growth in math achievement on the TAKS among students in grade 5.

Having a teacher with bilingual certification through the additional exam route was associated with lower growth in math achievement on the TAKS among English learner students in grade 5 compared with having a teacher with bilingual or English as a second language certification through other routes and having a teacher without bilingual or English as a second language certification (effect size = −0.06 standard deviation; see table D2). These results are consistent with the findings of the main analysis, which are based on STAAR data and show that having a teacher with bilingual certification through the additional exam route was associated with the lowest growth in math achievement.

No route to English as a second language certification was associated with growth in math achievement on the TAKS among English learner students in grade 5 (see table D2). This

**Table D4. Selected parameter results of regressions using teacher characteristics to predict growth in math achievement on the Texas Assessment of Knowledge and Skills among English learner students in grade 5 in the Houston Independent School District between 2006/07 and 2010/11**

| Model and variable | Parameter estimate | Standard error |
|---|:---:|:---:|
| **Model 1—Certification type** | | |
| Standard bilingual | −0.033 | 0.020 |
| Standard English as a second language | 0.019 | 0.022 |
| **Model 2—Certification route** | | |
| *Bilingual* | | |
| Standard certification | −0.031 | 0.026 |
| Additional exam route for standard certification | −0.032 | 0.037 |
| Postbaccalaureate route for standard certification | −0.003 | 0.165 |
| Traditional route for standard certification | 0.049 | 0.044 |
| *English as a second language* | | |
| Standard certification | 0.018 | 0.023 |
| Additional exam route for standard certification | 0.011 | 0.061 |
| Postbaccalaureate route for standard certification | a | a |
| Traditional route for standard certification | a | a |

**Note:** Number of observations is 14,616. None of the parameter estimates was significant at the $p < .05$ level. For model 1 the comparison group is teachers without bilingual or English as a second language certification. For model 2 the comparison group for bilingual certification is all teachers certified through the alternative route, and the comparison group for English as a second language certification is all teachers certified through the additional exam route.

**a.** Effect could not be calculated because of the small sample size.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

result differs from the findings of the main analysis, which are based on STAAR data and show that having a teacher with English as a second language certification through the traditional route was associated with the lowest growth in math achievement.

There was no association between having a teacher with bilingual or English as a second language certification and growth in reading achievement on the TAKS in grade 5 (table D5).

Having a teacher with bilingual certification through the alternative route was associated with higher growth in reading achievement on the TAKS among English learner students in grade 5 compared with having a teacher with bilingual certification through other routes and having a teacher without bilingual or English as a second language certification (effect size = 0.05 standard deviation; see table D2).

Having a teacher with English as a second language certification through the alternative route was associated with higher growth in reading achievement on the TAKS compared with having a teacher with English as a second language certification through other routes, having a teacher with bilingual certification through any route, and having a teacher without bilingual or English as a second language certification. The effect size was 0.14 standard deviation (see table D2), which is almost three times the effect size of having a teacher with bilingual certification through the alternative route. These results differed from those in the main analysis, which were based on STAAR data and found no association between certification type or route and growth in reading achievement in grade 5.

**Table D5. Selected parameter results of regressions using teacher characteristics to predict growth in reading achievement on the Texas Assessment of Knowledge and Skills among English learner students in grade 5 in the Houston Independent School District between 2006/07 and 2010/11**

| Model and variable | Parameter estimate | Standard error |
|---|---|---|
| Model 1—Certification type | | |
| Standard bilingual | 0.014 | 0.020 |
| Standard English as a second language | 0.031 | 0.024 |
| Model 2—Certification route | | |
| *Bilingual* | | |
| Standard certification | 0.051* | 0.026 |
| Additional exam route for standard certification | −0.109** | 0.037 |
| Postbaccalaureate route for standard certification | 0.152 | 0.156 |
| Traditional route for standard certification | 0.034 | 0.047 |
| *English as a second language* | | |
| Standard certification | 0.010 | 0.026 |
| Additional exam route for standard certification | 0.132* | 0.058 |
| Postbaccalaureate route for standard certification | a | a |
| Traditional route for standard certification | a | a |

\* Significant at $p < .05$; \*\* significant at $p < .01$.

**Note:** Number of observations is 10,875. For model 1 the comparison group is teachers without bilingual or English as a second language certification. For model 2 the comparison group for bilingual certification is all teachers certified through the alternative route, and the comparison group for English as a second language certification is all teachers certified through the additional exam route.

**a.** Effect could not be calculated because of the small sample size.

**Source:** Authors' analyses of data from the Houston Independent School District and the Texas Educational Research Center at the University of Texas at Austin (see appendix B).

# Notes

1. Members of the English Learners Research Alliance include representatives from the Austin Independent School District, the Brownsville Independent School District, the Edinburg Consolidated Independent School District, the Fabens Independent School District, the Harlingen Consolidated Independent School District, the Houston Independent School District, the Texas Education Agency, and the Vaughn Gross Center for Reading and Language Arts at the University of Texas at Austin.

2. A district is classified as major urban if it is located in a county with a population of at least 950,000, its enrollment is the largest in the county or at least 70 percent of the largest district enrollment in the county, and at least 35 percent of enrolled students are eligible for the federal school lunch program.

3. Most classrooms in the elementary grades are self-contained; that is, the same teacher teaches all academic subjects to the students in a classroom. However, when the data from the Houston Independent School District indicated departmentalized assignments, the analysis used the correct student–teacher matches for each subject.

4. The study used the student's TELPAS reading score as the indicator of English proficiency, so it matched reading teachers to students for the analyses on English proficiency.

5. There are three reasons for using the prior-year student test scores instead of analyzing $A_{it} - A_{i(t-1)}$: empirically, $A_{it}$ and $A_{i(t-1)}$ may be different tests with different scaling, levels of starting achievement, $A_{i(t-1)}$, may influence achievement gain, and correlated errors in achievement measurement may suggest such a formulation (Hanushek, 1979).

6. Although not a focus of the study, equations B1 and B2 included four additional teacher characteristics: teaching experience, gender, race/ethnicity, and education level.

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