Title: Are there Peer Effects Associated with Having English Language Learner (ELL) Classmates?: Evidence from the Early Childhood Longitudinal Study Kindergarten Cohort (ECLS-K)

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Abstract

Over the past decade, several state and federal policies have directed schools to mainstream English Language Learner (ELL) students into English-only instruction classrooms. While there is mixed evidence on the effects of these immersion policies on the ELL students, research examining potential peer effects on their non-ELL classmates is non-existent. This paper begins to fill in this gap by using a nationally representative longitudinal sample of children in early elementary grades. Results indicate that having an ELL classmate during kindergarten and first grade is associated with lower test score gains in reading but not necessarily in math for non-ELL students whose primary language is English, controlling for unobserved fixed school characteristics as well as individual characteristics. The negative peer effects on reading test score gain are sensitive to the frequency of within classroom ability grouping usage and household income level of non-ELL children.

Introduction

Over the past decade, the population of school-age English language learner (ELL) students in the US has rapidly increased and projections indicate that this trend will continue (Fry 2008). While the overall school population has grown by less than 8.5 percent between academic years 1997-2007, the number of ELL students has increased by more than 53 percent in that same period and represents slightly more than 10 percent of the total public school student population in 2007-2008 (National Center for English Language Acquisition (NCELA) 2010). The issue has become more complex as patterns of migration among ELL students and families show substantial change. Although ELL students are still heavily concentrated in a few coastal states, the largest increase (100 percent or more) has been occurring in many Midwestern and Southeastern states which have not traditionally had large ELL student populations (NCELA 2010). In many of these states, while ELL students are typically enrolled in some type of language service program (such as English as Second Language (ESL)) in their schools, the majority of their time at school is spent in mainstream classrooms with native English-speaking peers and teachers (Berube 2000). Specifically, Zheler et al. (2003) find that about 60 percent of ELLs receive instruction only in English, whereas only about 20 percent of them receive at least 25 percent of instruction in their native language.

The rapid growth and wide dispersion of ELL students across the US impacts the exposure that primarily English speaking students have to children with diverse linguistic needs. In recent years the immersion of ELL students into English-only instruction classrooms has become more rapid with certain states (e.g. California, Arizona, and Massachusetts) enacting

policies to greatly curtail bilingual education.[1] At the federal level in 2002, the Bilingual Education Act of 1968 was repealed and replaced with the English Acquisition Act, which emphasizes English rather than bilingual instruction and encourages a rapid transition to English-only instruction (Farver, Lonigan, and Eppe 2009). National estimates indicate that LEP students were enrolled in about 43 percent of all school districts and in about half of all public schools in the US during 2001-2002 (Zehler et al. 2003). In the ten year period 1991-2001, the proportion of teachers who taught at least one ELL or more almost tripled from 15 to 43 percent of all teachers in grades K-12 (Zehler et al. 2003). In the nationally representative data used in the present analyses, about 45 percent of the schools reported having ELL students and about 19 percent of the primarily English speaking students in kindergarten and first grade are estimated to have a classmate who is considered limited English proficient.[2]

[1] There are a handful of states such as Illinois and Texas that mandate the use of a student's native language until the English language learner is ready to transition to an all-English curriculum.

[2] The 19 percent estimate is quite low given the high representation of ELL students in national estimates (10 percent of all K-12 students). If ELL students were distributed randomly across states and schools, all children should have two ELL classmates since the average class size is around 20 students. However, this is clearly not the case. More than 60 percent of all ELL students are reported to be concentrated in six states (AZ, CA, FL, IL, NY, TX) (Office of English Language Acquisition 2008), and even within those states there is considerable variation in the level of ELL student concentration across schools and districts (De Cohen, Deterding, and Clewell 2005).

Despite the growing amount of research examining the effects of mainstreaming ELL students in English-only instruction classrooms on their academic achievement (Farver, Lonigan, and Eppe 2009; Francis, Lesaux, and August 2006; Gordon and Hoxby 2004; Greene 1997; Jepsen 2010; Pappamihiel 2002; Slavin and Cheung 2005), no study has looked at the impact of mainstreaming ELL students on the achievement of primarily English speaking students who remain in the classrooms. This is quite surprising given that the classroom dynamic as well as teacher instructional practices and curriculum choices may well vary by the inclusion of ELL students (Curtin 2005). Since most teachers in these mainstream classrooms are largely untrained to work with ELLs (only 12.5 percent of US teachers have received 8 or more hours of recent training to teach students of limited English proficiency), it seems plausible that the inclusion of ELL students may present additional challenges to many teachers (Reeves 2006).

The present study uses the nationally representative Early Childhood Longitudinal Study, Kindergarten Cohort (ECLS-K) data to investigate the peer effects of immersing ELL students in all-English classes by examining reading and math test score gains for children in kindergarten and first grade who share classrooms with ELL students. This paper focuses on the years between kindergarten and first grade as the study period for the following reasons. First, a number of studies have identified this period as critical for children's long-term achievement as well as for later life outcomes (Pianta and Walsh 1996). Second, studies examining the relationship between early and later reading achievement have demonstrated remarkable stability in reading skills across time (Juel 1988; Smith 1997; Spira, Bracken , and Fischel 2005). For example, Spira, Bracken , and Fischel (2005) find that improvement in reading achievement through elementary school (i.e. up to fourth grade) was strongly related to individual linguistic and behavioral attributes that were measured in kindergarten and first grade. They also find that

children's ability to make significant progress in reading after early difficulties is correlated with linguistic and behavioral attributes identified as early as kindergarten. And finally, by design of the ECLS-K survey, there is a two year gap between the first and third grade waves as well as between the third and fifth grade waves. As a result, it is not possible to control for second and fourth grade characteristics making the comparison of models using lagged test scores less straightforward.

Results indicate that having a classmate with limited English proficiency during kindergarten and first grade is associated with lower test score gains in reading but not necessarily in math for students whose primary language is English, controlling for unobserved fixed school characteristics as well as unobserved fixed individual characteristics. The negative effects on reading test score gains are largest for low-income students. These findings suggest that there may be important hidden costs associated with mainstreaming ELL students in classrooms with little linguistic support. The study presents some evidence on using within classroom ability grouping as an instructional strategy to mitigate the negative peer effects of ELL students in mainstream English only instruction classrooms.

Background

The education of ELL students in the US has a long and varied history. Prior to the passage of the Bilingual Education Act in 1968 (Title VII of the Elementary and Secondary Education Act), there were no federal policies regarding the unique needs of language minorities. These students were placed in English immersion or "sink-or-swim" programs with very little support (Wiley and Wright 2004). The passage of the Bilingual Education Act of 1968 established federal funding for school districts to support bilingual education programs and all children whose native tongue was not English were eligible. Overall, during the 1970s and 1980s, policies and

practice favored bilingual education in which children were taught partially or entirely in their native language and then transitioned at some point during the elementary grades to English-only instruction (Slavin and Cheung 2005). Shortly after the passage of the Bilingual Education Act of 1968, several states adopted similar policies and by the late 1990s, 30 states had statutes allowing native language instruction, 9 states mandated it, and 7 others stopped enforcing their laws that prohibited native language instruction (Wiley and Wright 2004).

However, since the late 1990s and early 2000s, the political tide turned against bilingual education both at the state and federal levels. Specifically, states such as California, Arizona, and Massachusetts (Propositions 227, 203, and Question 2) explicitly banned bilingual education and imposed English-only instruction unless language-minority parents requested a waiver. Even if parents were to make such a request, there is no guarantee that their children will receive bilingual instruction because schools must receive enough waivers to fill a classroom at each grade level. The passage of the No Child Left Behind (NCLB) Act of 2002 at the federal level has also been an influential factor in immersing students in English-only instruction classrooms by only allowing *transitional* bilingual education programs but not allowing maintenance bilingual programs. Moreover, NCLB's requirement to include limited English proficient students in statewide high-stakes testing steered more districts to include their ELL students in English-only instruction classrooms from the beginning of elementary school (Wiley and Wright 2004).[3] These students may receive ESL courses, but they are mainstreamed for most, if not all, of the school day.

[3] Although I use the term Limited English Proficient (LEP) students interchangeably with English Language Leaner (ELL) students in this paper, usually a subset of ELLs who have not

Since the past several decades, numerous studies have attempted to identify which program best serves the instructional needs of school-aged ELL children. Results from these earlier studies were generally mixed and poor in quality (Slavin and Cheung 2005; Willig 1985). Many of the studies failed to control for individual demographic factors that can influence children's test scores and few employed random assignment to bilingual and English-only instruction groups (Farver, Lonigan, and Eppe 2009). In recent years, several studies employed rigorous methodology to identify the *casual* impact of receiving bilingual education as opposed to English-only instruction on ELLs, but results are still quite mixed (Farver, Lonigan, and Eppe 2009; Francis, Lesaux, and August 2006; Gordon and Hoxby 2004; Jepsen 2010). Nonetheless, these findings have sparked considerable controversy, among policymakers, researchers, and educators about the appropriate role of the native language in the instruction of ELL students.

Although research on the impact on the ELL student immersed in regular English-only instruction classrooms are not as conclusive as one may hope, research on the effect of mainstreaming ELL students on their non-ELL classmates is nonexistent. Even in the education literature, studies examining peer effects have centered on issues such as having higher/lower quality peers, the inclusion of students with special needs (i.e. disability), or the increase in the proportion of black and/or female students (Angrist and Lang 2004; Fletcher 2010; Hanushek, Kain, and Rivkin. 2002; Hanushek et al. 2003; Hoxby 2000), but none have paid attention to the peer effects of having ELL students as classmates.

Despite the lack of extant research, there are reasons why examining the peer effects of ELL students is important. First, although research on teacher attitudes toward including ELL

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passed their state English Language Proficiency exams are referred to as LEP students (Ballantyne, Sanderman, and Levy 2010).

students in mainstream classrooms has been mixed (Reeves 2006), several of the qualitative studies have reported that teachers constantly struggle to balance the needs of ELL students against those of other students in the class possibly resulting in inequities in educational opportunities for all students (Haworth 2009). They were also found to voice concern about the possibility that ELLs will slow the class progression (Schmidt 2000). Second, the curriculum choice of teachers may differ for teachers with and without ELL students simply because the latter does not have to accommodate for students with unique needs. Teachers with ELL students may not be able to cover material as quickly or have time to cover certain topics as in depth as teachers without ELL students since they may be spending part of their time providing individual assistance to the ELL students (Haworth 2009; Karabenick and Noda 2004). Third, the inclusion of ELL students may also influence the teachers' decisions about how to teach particular lessons or the availability of the teacher for individualized instruction especially for students who are having difficulties. With lesser workload, teachers in classrooms without ELL students may engage students in richer, more complex activities or provide more variety in learning experiences (Karabenick and Noda 2004). And finally, the high concentration of ELL students in low-income urban districts has raised concerns about inequities in resources and school quality for both ELL students and their non-ELL classmates (De Cohen, Deterding, and Clewell 2005). Specifically, a recent report examining states with high concentrations of ELL students (at least 10 percent or more of the total student population) found that the majority of those states provided lower average state and local revenues per student to districts with higher concentrations of ELL students compared to districts with lower concentrations of ELL students within that state (Arroyo 2008).

The objective of the paper is to identify the peer effects of mainstreaming ELL students into English-only classrooms by using the repeated observations of primarily English speaking students in kindergarten and first grade and controlling for unobserved fixed individual level characteristics. The impact is identified by the average difference in academic performance associated with one's probability of having ELL classmates between kindergarten and first grade. Additional analyses examine the heterogeneity of effects across various teacher and classroom level characteristics as well as children's race, gender, and annual household income. This paper would be the first attempt to directly address this question using a nationally representative sample with longitudinal student-level data. In addition to providing valuable information in policy debates about the optimal instructional settings for ELL students, findings from the study may shed light on more general questions regarding the school environment and peer effects.

Data

This paper utilizes the restricted Early Childhood Longitudinal Study kindergarten cohort (ECLS-K) to shed new light on the peer effects of ELL students. ECLS-K is a nationally representative survey that covers a sample of more than 17,000 children entering kindergarten in the fall of 1998. The survey contains extensive information on children's family background, teacher and school characteristics as well as on their test scores. Although children in the original sample are followed from the fall of 1998 (when the students were in kindergarten) through the latest release of data collected in the spring of 2007, the present study only uses data from the kindergarten and first grade levels.

Although there are more than 17,000 children in the original sample, when we limit the sample to students who have valid information on reading and math test scores at the entry of

kindergarten as well as at the spring of kindergarten and first grade, the sample size reduces significantly to about 14,000 children. Given that the objective of the paper is to examine the peer effects of mainstreaming ELL students in English-only instruction classrooms, information on classroom language of instruction is obtained from the restricted-use files of ECLS-K since the information is suppressed in the public-use data files. The sample is further restricted to 11,634 students who have non-missing data on race, gender, age, language of instruction as well as on whether they have any ELL classmates during kindergarten and first grade. To prevent any confounding effects from ELL students or from non-ELL students receiving bilingual education, 1,865 ELL students who report their primary language to be a language other than English and 1,090 non-ELL students receiving instruction in a language other than English either during kindergarten or first grade are dropped from the analytic sample. This will allow the model to focus on the peer effects from mainstreaming ELL students to their primarily English speaking classmates in English only instruction classrooms. The final sample consists of 8,667 children and 8,679 children for the reading and math test score analyses, respectively. Children who repeated kindergarten in the fall of 1999 were not included in the main analytic sample – results do not change when they are included in the analyses.

Summary statistics for the variables used in the model specifications are displayed for all children in Table 1. The primary outcome variables are math and reading test scores taken at the spring of kindergarten and first grade. The values reported in the table are raw item response theory (IRT) scale scores provided in ECLS-K. In all following analyses, the test scores are transformed to have mean 0 and standard deviation 1 for the overall sample on each of the tests and time periods. In all instances, sample weights provided in ECLS-K are used. Covariates include child's age, gender, race, disability status, socio-economic status, income, poverty status,

participation in Head start, receipt of WIC benefits, parental involvement in school, number of books in home, maternal education level and age, number of siblings, family type, and region. Classroom characteristics include percent black, percent Hispanic, class size, number of boys, and whether there are students with serious emotional problems. Teacher characteristics include teacher's race, education, experience, certification, and access to paid aide. Lastly, school characteristics include an indicator for public schools and the overall percentage of minority students.

In the spring of each year, teachers are asked if they have any limited English Proficient (LEP) students, i.e. English Language Learner (ELL) students, in the classroom. If the answer is yes, they are further asked about the total number of ELL students in the class. As is shown in Table 1, about 19 percent of students whose primary language is English have at least one classmate who is not proficient in English.[4] To address concerns about high concentrations of ELL students in relatively few schools (De Cohen, Deterding, and Clewell 2005), the number of ELL students in each classroom is also presented. Among classrooms that have ELL classmates, the average number of ELL students is about 2.6 students, while the median is roughly 2 students. The conditional distribution of the number of ELL students shows that the distribution is indeed skewed to the right and that that in the majority of classrooms there are no more than one or two ELL students. As such, the primary variable of interest is created as a binary variable indicating whether a student has an ELL classmate or not. Results using the number of ELL classmates as a continuous variable are also presented. The average class size is about 20 students and the

[4] This is partly due to the high concentration of ELL students in few schools. That is, about 10 percent of elementary schools are estimated to educate about 70 percent of all LEP students (Cohen, Deterding, and Clewell 2005).

majority of non-ELL students are in public schools taught by white teachers with an average of 14 years of experience.

Estimation Strategy

I estimate the impact of having an ELL classmate on children's kindergarten and first grade academic achievement growth using the following value-added model:

(1) $Testscore_{icsj} = \alpha Testscore_{ics(j-1)} + \beta X_{icsj} + \theta ELLclassmate_{csj} + \gamma C_{csj} + \delta S_{sj} + \varepsilon_{icsj}$

, where $Testscore_{icsj}$ is the standardized reading and math test score of student *i* in classroom *c* in school *s* at *j* year/grade and $Testscore_{ics(j-1)}$ is the corresponding lagged test score, X is a vector of both time-varying and fixed child and family characteristics, $ELLclassmate_{csj}$ is a dummy variable indicating whether there is an ELL student in the classroom, C_{csj} is a vector of additional classroom level characteristics, S_{sj} is a vector of school level characteristics, and ε_{icsj} is an idiosyncratic error term accounting for any correlation across students in the same classroom. The coefficient θ captures the effect of having an ELL classmate on the reading and math test score gains of non-ELL students.

I re-estimate Model (1) considering the possibility that children's sorting behavior into certain schools may be correlated with their chances of having an ELL classmate. The OLS estimates will be positively (or negatively) biased if, for example, more motivated parents send their children to more diverse (or less diverse) schools.[5] The direction of the bias is unclear and must be determined using data. I define the error term ε_{icsj} as $\varepsilon_{icsj} = b_s + \nu_{icsj}$, where b_s is a school-

[5] Prior research suggests that whites who go to school with more minorities (i.e. blacks) actually achieve at a slightly higher level than do those who attend all-white schools (Fryer and Levitt 2004).

specific error component that captures unobserved fixed characteristics of the school children attend. The variable ν_{icsj} is assumed to be independently distributed and stationary conditional on observed characteristics.

Even in the school fixed effect model, however, θ may be biased if school administrators and/or teachers send ELL students to certain *types* of classrooms or if parents influence the type of classroom their child gets placed in. For example, it is possible for the school principal to selectively send ELL students to classrooms with veteran teachers or with well-behaved peers in hopes that it will help the ELL student's adjustment. On the other hand, ELL students may be placed in classrooms with relatively low-performing or struggling peers under the belief that this kind of ability grouping will allow teachers to customize children's learning environment and use level-appropriate material. In the former scenario, the OLS estimate of peer effects (θ) will be positively biased, whereas in the latter case, it will be negatively biased.

To address the concern about individual sorting across classrooms within schools, Model (1) will also be re-estimated controlling for child level fixed characteristics. The error term in Model (1) will be re-defined as $\varepsilon_{icsj} = w_i + \eta_{icsj}$, where w_i is an individual-specific error component that captures unobserved fixed characteristics of the child. Time-invariant variables in the vector X will no longer be estimated in the child fixed effect model. The removal of child fixed effects means that θ is identified by the difference in the chance of having any ELL classmates between kindergarten and first grade. The fact that among students with ELL classmates the majority do not have ELL classmates during both grade levels strengthens the estimation. Specifically, among the 2,431 students observed to have an ELL classmate during either kindergarten or first grade, only 785 (about 32 percent) of them are estimated to have ELL classmates in both kindergarten and first grade.

Although the estimation using a child fixed effect model will prevent any pre-existing child-level trait from biasing the results, it does not account for the possibility of teacher nonrandom sorting across classrooms. Specifically, if high (or low) quality teachers are more likely to be assigned to classrooms with greater numbers of ELL students, the child fixed effect estimate will still be positively (or negatively) biased. Since the majority of teachers (98 percent) in the sample are only observed in one classroom or in classrooms with no variation in the number of ELL students, estimating a teacher fixed effect model is not an option. Instead, the paper proposes to identify schools that attempt to spread ELL students as uniformly as possible across classrooms. In these schools, small differences in the number of ELL students per classroom could be attributed to indivisibility and are more plausibly orthogonal to teacher quality. As presented in Figure 1, among schools reporting to have at least one ELL student, there is relatively high variation in the number ELL students across classrooms. Specifically, among the 465 schools with at least one ELL student (out of 1,051), about 74 schools (16 percent) reported no difference in ELL student allocation across classrooms and 331 schools (71 percent) reported a difference of 3 or less students. Child fixed effect models are re-estimated on schools with relatively low variation in the number of ELL students across classrooms to account for any nonrandom sorting of ELL students. The peer effects of ELL students are examined by including a variable indicating the presence of ELL classmate(s) as well as by including a continuous variable denoting the total number of ELL students in the classroom.

Results

The results from the OLS regressions as well as the school fixed effect models examining standardized reading and math test scores are presented in Table 2. Column (1) shows the effect of having an ELL classmate on non-ELL students' reading and math test score gains during

kindergarten and first grade controlling for all observed characteristics. I find that primarily English speaking students with ELL classmates experience approximately a 2.7 percent and a 2.4 percent of a standard deviation decrease in reading and math test score gains, respectively, compared to other non-ELL students who do not have ELL students as classmates. The estimate for reading is statistically significant at the 5 percent level, while the estimate for math is significant at the 10 percent level.

In terms of magnitude, the effect on reading test score gains is almost 33 percent of the adjusted black-white achievement gap and is slightly more than 20 percent of the adjusted gap between disabled and non-disabled children. The effect size is also equivalent to the spillover effects of having a classmate with serious emotional problems (Fletcher 2010). ELL peer effects on math test score gains are slightly smaller in magnitude compared to that of reading – it is only 16 percent of the adjusted black-white achievement gap and is about 24 percent of the adjusted gap between disabled and non-disabled children.

Results using school fixed effects appear in column (2) of Table 2. Controlling for unobserved fixed school characteristics, the negative association between having an ELL classmate and test score gain increases significantly to 5.2 percent of a standard deviation for reading and 3.9 percent of a standard deviation for math. The coefficient for reading is statistically significant at the 1 percent level, whereas the coefficient for math is statistically significant at the 5 percent level. Although the magnitude of the impact is larger for reading than on math, the estimated peer effects are not statistically significantly different from each other. On the other hand, in comparison to the adjusted black-white achievement gap in each subject matter, the association between having an ELL classmate and test score gain is equivalent to slightly

more than 70 percent of the adjusted gap for reading but only about 27 percent of the corresponding gap for math.

Results from the OLS and school fixed effect specifications provide a useful indication of the relationship between unobserved school characteristics and the probability of having an ELL classmate. In other words, the fact that the coefficient, θ, becomes more negative once school fixed effects are controlled for in both reading and math suggests that the OLS regression estimate of θ is biased upward. This indicates that schools in which non-ELL students have greater probability of having an ELL classmate possess an unobserved propensity to attract higher quality students or that they are higher quality schools. Further examination of the data reveals that non-ELL students enrolled in schools with relatively large numbers of ELL students are indeed more disadvantaged in terms of observed characteristics than non-ELL students in schools with fewer ELL students – e.g. they are less likely to be non-Hispanic white, have mothers with a college or graduate degree, have higher income, and attend schools that have fewer minority students. This implies that even though schools with more advantaged students (or high quality schools) are generally less likely to have many ELL students, the way they allocate their students across classrooms increases the probability that non-ELL students will have an ELL classmate. For example, high quality schools may be more likely to *evenly* distribute ELL students across classrooms and hence increase the chance of non-ELL students having at least one ELL student as a classmate compared to low quality schools. Preliminary examination of the data reveals suggestive evidence towards a positive correlation between average school quality and even distribution of ELL students across classrooms. Specifically, among non-ELL students in schools with at least one ELL student, those attending schools with little difference in the number of ELL students across classrooms were more likely to come from

two parent households with higher income levels and attend schools with smaller fraction of minority students compared to non-ELL students attending schools with large differences in the number of ELL students across classrooms.

Despite the improvement in estimation associated with accounting for unobserved differences across schools, results from the school fixed effect model may still suffer from biases related to differential sorting of students across classrooms within a school. Preliminary analyses using the baseline reading and math test scores measured at the beginning of kindergarten reveal some interesting patterns of student sorting (*results available upon request*). Specifically, students with ELL classmates are found to have lower levels of reading and math baseline test scores even after controlling for school fixed effects. This suggests that students with ELL peers may have been lower quality students compared to students without ELL peers even before having any exposure to ELL classmates. Although the inclusion of lagged test scores as a covariate in the regression prevents any difference in baseline test scores from directly biasing the impact estimate, it may still pose a problem if students with lower baseline test scores, for example, are also more likely to experience slower or delayed *growth* in test scores across grade levels.

To account for all time-invariant individual differences across students, the model specification fully takes advantage of the longitudinal nature of ECLS-K and estimates a child fixed effect model. Table 3 presents results from the child fixed effect models. As is observed in column (1), controlling for unobserved individual fixed characteristics slightly reduces the negative association between having an ELL classmate and test score gain for reading, while completely eliminating it for math. Specifically, having an ELL classmate is estimated to statistically significantly reduce non-ELL students' reading test score gains by 4.2 percent of a

standard deviation. On the other hand, exposure to an ELL classmate is estimated to have no impact on math test score gains as is indicated by the small magnitude of the coefficient (-0.005) and its statistical insignificance (p-value≈ 0.79). Although traditionally researchers have found schools (or characteristics of schools) to exert a larger and more precise impact on math test scores than on reading test scores (Fletcher 2010; Hanushek, Kain, and Rivkin 2002; Hanushek et al. 2003), this is not the case in the present study. Perhaps instruction of math to mainstreamed ELL students is associated with fewer disruptions or less challenges than the instruction of reading, at least in early elementary grades, given the use of *symbols*, a universal language involved in mathematical problem solving.

The estimates hardly change when school fixed effects are controlled for by including school dummy variables in the child fixed effect model in column (2) of Table 3 – the coefficient (θ) is -0.042 for reading and -0.008 for math. Compared to estimates obtained from the school fixed effect model in Column (2) of Table 2, these estimates are still smaller in absolute value. The fact that the negative association between exposure to ELL peers and test score gain decreases once unobserved individual fixed characteristics are controlled for indicates that the earlier school fixed effect estimates are biased downward. It also provides some evidence that students with an unobserved propensity to do worse on tests are more likely to have ELL students as classmates within a given school. These results are consistent with scenarios such as principals deliberately placing ELL students in classrooms with lower quality peers or more motivated parents placing their children in classrooms without ELL students.

To check if the estimated peer effects associated with having ELL peers is not primarily driven by having low quality (i.e. low performing) peers, teacher reports on the total number of students each failing reading or math in the classroom is included as an additional regressor in

the regressions for reading and math test scores, respectively. As is reported in column (3) of Table 3, although the coefficient on the number of failing students is highly statistically significant for both reading and math test scores, the estimated peer effects associated with having an ELL peer remains essentially unchanged. This indicates that the ELL peer effect is not mainly driven by the ELL students being low quality peers to their non-ELL classmates.

Lastly, to account for the possibility of teachers sorting across classrooms within schools, results from the child fixed effect model on a sample that only includes schools with low variation in the number of ELL students across classrooms is reported in Table 4. To prevent differences in school unobserved characteristics from biasing the results, school dummy variables are included in all estimations. In columns (1), (2), and (3), respectively, peer effects of ELL students are estimated for schools in which the difference in the maximum and minimum number of ELL students per classroom is 2 or less, 3 or less, or 4 or less. Interestingly, results indicate that the negative peer effects associated with having ELL peers on reading test scores is slightly higher for students attending these subgroups of schools. Specifically, the estimated coefficient θ ranges between -0.053 and -0.064 for reading and between -0.013 and -0.027 for math. All estimates on reading test score gains are statistically significant at the 5 percent level, while estimates on math test score gains are not. When a continuous variable denoting the total number of ELL students per classroom is included instead of the dummy variable indicating the presence of any ELL classmate, results show that an additional ELL student decreases non-ELL students' reading test score gains by about 2 to 4 percent of a standard deviation. Given that the median number of ELL students in a classroom that has any ELL students is 2, the median non-ELL student with ELL peers should experience a decrease in reading test score gains by about 4

to 6 percent of a standard deviation, which is consistent with prior findings using a dummy variable indicating the presence of ELL peers.

Heterogeneity in Peer Effects

To better understand how different educational contexts promote or hinder the negative peer effects of ELL peers on reading test score gains, the final component of this analysis considers the heterogeneity in peer effects by several teacher and classroom level characteristics as well as by child level characteristics. Research on student learning and effective instructional techniques has indicated that within-classroom ability grouping in which teachers organize their students of various achievement levels into several smaller groups of similar-ability students is very effective in improving reading test scores in general and especially for elementary school-aged low ability group students as well as for ELL students (Lou et al. 1996; Robinson 2008). If within-classroom ability grouping leads to the use of more level-appropriate material, greater interaction between students and teachers, and/or greater student participation, it may alleviate any negative effects associated with having ELL peers. Therefore, heterogeneity in peer effects is examined by the level of usage of within-classroom ability grouping during reading instruction. In the spring of each data collection year, teachers were asked, “How often do you divide your class(es) into achievement groups for reading activities or lessons?” Possible responses were never, less than once a week, once or twice a week, three or four times a week, and daily. Among the non-ELL students in the sample, about 1 percent of them are missing information on this question, about 22 percent had teachers who responded as never using ability grouping, and about 52 percent had teachers reporting to use ability grouping three or four times a week or daily. Children are regarded to be in classrooms that frequently use within-classroom ability

groups if their teachers reported to use ability grouping three or four times a week or daily for reading instruction (Robinson 2008).

Next, researchers on early education have argued that time spent "on task" (engaging in learning activities) and exposure to higher quality instruction lead to academic gains (Phillips & Chin, 2004). Since studies suggest that early elementary classrooms vary widely along these important dimensions (Hamre & Pianta, 2005) and since classrooms with and without ELL peers may vary in terms of these traits, sensitivity of the negative peers effects are examined by the amount of time teachers spend on reading and language arts instruction as well by teacher experience and availability of teacher aide. In the spring of each data collection year, teachers were asked, "How how much time do children in your class(es) usually work on lessons or projects in reading and language arts?" There were four response categories measured in 30 minute increments, ranging from '1 to 30 minutes' to 'more than 90 minutes'. The median level of reading instruction is 61 to 90 minutes a day, and thus low levels of reading instruction are defined as 61 to 90 minutes a day or less of this activity. Although the average number of years of experience for teachers is around 14 years (as is shown in Table 1), since literature on teacher quality indicates that most of the gain in quality occurs during the first couple of years of teaching (Hanushek et al. 2005), sensitivity of peer effects is examined for students in classrooms with novice (i.e. less than 5 years of experience) versus more experienced (i.e. 5 or more years of experience) teachers. In the spring of each data collection year, teachers are asked about the number of paid aide(s) assisting them in the class. About 54 percent of teachers in the sample responded to a positive number (as is shown in Table 1) and the median number is 1.

Third, an important strand of literature on ELL instruction comes from research on teacher education and preparation. For many years now, researchers have emphasized the

importance of incorporating issues related to ELL children in professional educator curricula to better prepare future teachers for challenges in current day classrooms (Goodwin, 2002; Meskill, 2005). As such, the study examines whether obtaining more teacher training in this area helps mitigate any negative peer effects associated with mainstreaming ELL students. Using information on the number of college courses a teacher completed in the area of English as a Second Language (ESL), differences in the peer effects of ELL classmates are examined separately for students whose teachers took any ESL courses and those whose teachers did not. About 14 percent of teachers were missing information on ESL course-taking and 72 percent of them responded to not having taken such a course.

Lastly, in addition to the above mentioned teacher/classroom characteristics, the study examines heterogeneity in peer effects by child characteristics such as race, gender, and household income. ELL peer effects are examined separately for non-Hispanic white versus non-Hispanic black children, for girls versus boys, and for households with annual income of $25,000 or less versus more than $25,000.

Child fixed effect models of reading test scores controlling for school fixed effects are estimated separately by each subgroup and the results are presented in Table 5. Results indicate that non-ELL students in classrooms that frequently use within classroom ability grouping do not experience any negative peer effects associated with having ELL peers, whereas those in classrooms that infrequently use ability grouping experience large negative effects by about 14 percent of a standard deviation. Although this does not establish any causal relationship between frequent ability grouping usage and reading test score gain, it does provide suggestive evidence that ability grouping may moderate the negative effects associated with having ELL peers. Findings on reading instruction time indicate that the negative peer effects are more than double

in magnitude in classrooms with high levels (versus low levels) of reading instruction time. However, the estimated peer effect in classrooms with high levels of reading instruction time are not statistically significantly different from zero and is not statistically significantly different from the estimated peer effects in classrooms with low levels of reading instruction time. When the ELL peer effect is estimated separately by teachers' preparation in college on ESL courses, availability of teacher aide, and teacher experience, results indicate little empirical evidence towards any differential effects. Lastly, the ELL peer effect does not vary by non-ELL students' race, but it does vary by their gender and household income level. Specifically, girls and low income non-ELL students suffer from larger negative peer effects compared to boys and non-low income non-ELL students. On average, non-ELL students in households with annual income of $25,000 or less appear to experience a loss in reading test score gains by about 12 percent of a standard deviation from having ELL peers. Interestingly, non-ELL students in households with annual income of more than $25,000 do not display any significant negative peer effects on reading test score gains despite the fact that the level of exposure to ELL classmates do not vary much across the two groups – about 22 and 21 percent of low income and non-low income students are in classrooms with ELL students, respectively.

Conclusion

Rising enrollments of linguistically and culturally diverse immigrant and refugee students in the US present local district administrators and teachers with new challenges to the delivery of quality instruction. Rapidly changing patterns of migration and student demographics as well as the confusion surrounding the benefits of using the native language in classroom instruction have contributed to these challenges faced by educators in meeting the needs of this student population. In recent years, several changes in education policy at both the state and federal level

have encouraged the quick immersion of ELL students into English-only instruction classrooms with little known about the costs and benefits of this policy both for ELL students and for their English proficient non-ELL classmates. Using a nationally representative dataset of students in early elementary grades, this paper presents new evidence on the potential costs of the policy to the classmates of ELL students in terms of academic achievement.

The effects of mainstreaming ELL students into regular classrooms will likely vary by a school's ability to recruit bilingual/ESL teachers or teachers who are prepared to work with ELL students. The use of a nationally representative dataset is particularly beneficial in this respect since considerable variation exists in the supply and demand of bilingual and ESL teachers across geographic regions in the US (American Association for Employment in Education (AAEE) 2008). Not surprisingly, the greatest shortage in the supply of bilingual and ESL teachers are occurring in areas that have recently experienced a large influx of ELL students such as the Great Lakes, Northwest, and Northeast regions (AAEE 2008). This implies that findings from existing studies that focus on one state (usually California) or one region may misrepresent the true costs and benefits associated with mainstreaming ELL students into regular English-only classrooms. A more basic but equally important benefit of using ECLS-K as the sample data is the availability of repeated student level observations across years. This allows one to use within-student variation in exposure to ELL classmates to identify the peer effects of ELL students and control for many confounding time-invariant factors at the child level.

The findings from the study suggest that having an ELL classmate decreases non-ELL students' reading test score gains on average by about 4-6 percent of a standard deviation. Although the average effect may not be extremely large in magnitude, it is important to keep in mind that this effect is experienced by *all* non-ELL classmates possibly rendering large

aggregate total effects. In addition, as is shown in Table 5, the negative effects on reading are concentrated on and especially large (up to 12 percent of a standard deviation) for disadvantaged students whose annual household income is $25,000 or less. This indicates that the inclusion of ELL students in mainstream English-only instruction classrooms may be a source of further disadvantage for one of the most vulnerable non-ELL student populations.

Employing child fixed effect models definitely has its advantage in terms of mitigating bias from the sorting of non-ELL students across classrooms. However, a weakness of this approach is that peer effects can only be identified for students with varying levels of ELL exposure across the two year sampling period. As a result, the findings of the study may not be generalizeable to non-ELL students in schools with extremely high concentrations of ELL students who are guaranteed to have a fixed number of ELL classmates.

A second limitation of the study is that it is unable to control for teacher sorting across classrooms within schools. If poor quality teachers are more likely to be in classrooms with ELL students or if poor quality teachers are more likely to report the presence of students with limited English proficiency, then the association of having an ELL classmate and test scores will be biased upward due to the omitted effects of having a poor quality teacher. The paper, however, shows that the basic results are robust to the inclusion of several measures of teacher characteristics. In addition, the study attempts to address this concern by examining the peer effects for schools with little variation in the number of ELL students across classrooms assuming that teacher sorting is more likely to occur in schools where large numbers of ELL students are present in one classroom and not in others. Further consideration of the bias of teacher sorting within (and across) schools should be the subject of future work.

These results suggest that the policy of immersing ELL students into mainstream English-only instruction classrooms may need to be reevaluated. The benefits and costs of immersion must be considered for both ELL and non-ELL children. Findings from the study suggest that certain instructional techniques may help mitigate the negative effects associated with having mainstreamed ELL peers. Specifically, non-ELL students in classrooms with frequent usage of within classroom ability grouping for reading instruction do not display any negative effects, whereas those in classrooms with infrequent usage of ability grouping suffered large negative effects. Given that research suggests that ELL students make larger positive gains on reading test scores when ability grouping is used (Robinson 2008), it may be an instructional technique that is beneficial to all students in mainstream English-only instruction classrooms. Finally, in light of the accountability provisions of the NCLB, many schools experiencing growth in their ELL student population may be at increased risk of failure if appropriate measures to dampen the negative peer effects are not taken. Further consideration of effective practices for accommodating the needs of ELL students and their non-ELL classmates in mainstream classrooms should be the subject of future research.

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Table 1. Summary statistics of Students in Kindergarten and First grade (ECLS-K): Children Whose Primary Language is English

Variables	Mean	Standard Deviation
Child Characteristics		
Test Scores [a]:		
Fall kindergarten reading	23.67	8.47
Fall kindergarten math	20.75	7.08
Spring kindergarten reading	33.97	10.50
Spring kindergarten math	29.05	8.47
Spring first grade reading	57.56	12.71
Spring first grade math	44.66	8.50
Race:		
Non-Hispanic white	0.69	0.46
Non-Hispanic black	0.15	0.36
Hispanic	0.09	0.28
Asian	0.02	0.15
Other	0.05	0.22
Female	0.50	0.50
Disabled	0.15	0.35
Age at spring of kindergarten (months)	81.06	7.40
Mother's education level:		
Ed $\leq 8^{th}$ grade	0.01	0.10
9^{th} grade$\leq$ Ed < 12^{th} grade	0.07	0.26
High school diploma	0.31	0.46
Vocational/technical program	0.06	0.23
Some college	0.29	0.45
College (BA) degree	0.17	0.37
Graduate School	0.08	0.28
Missing	0.01	0.12
Mother's age fall kindergarten (years)	32.32	8.91
Mother's age missing	0.04	0.19
N of siblings	1.40	1.11
Family type:		
2 parents & siblings	0.66	0.47
2 parents & no sibling	0.08	0.27
1 parent & siblings	0.14	0.35
1 parent & no sibling	0.05	0.22
Other	0.02	0.13
Parents visit school (open house, PTA, conference etc.)	0.92	0.28
Region:		
Northeast	0.20	0.40
Midwest	0.28	0.45
West	0.16	0.37
South	0.36	0.48
# of books at kindergarten	80.73	60.55
Socio-economic status:		
1^{st} quintile	0.12	0.32
2^{nd} quintile	0.19	0.39
3^{rd} quintile	0.21	0.41
4^{th} quintile	0.22	0.42

5th quintile	0.24	0.43
Income:		
Inc ≤ $15,000	0.12	0.32
$15,000< Inc ≤$25,000	0.11	0.31
$25,000< Inc ≤$50,000	0.32	0.47
$50,000< Inc ≤$75,000	0.20	0.40
$75,000< Inc ≤$100,000	0.12	0.33
Inc >$100,000	0.13	0.33
Ever participated in Head start	0.14	0.34
Mother received WIC benefits	0.39	0.49
Teacher/classroom characteristics		
% black in classroom	8.78	19.63
% Hispanic in classroom	4.27	10.70
Class size	19.85	5.73
Class size missing	0.04	0.19
N of boys	10.03	3.43
N of boys missing	0.03	0.18
Have students with serious emotional problem	0.08	0.27
Have students who are limited English proficient (LEP)	0.19	0.39
# of LEP students (cond'l on having LEP)	2.58	2.81
5th percentile	1	
25th percentile	1	
50th percentile	2	
75th percentile	3	
95th percentile	8	
Teacher is Non-Hispanic white	0.87	0.34
Teacher education level:		
BA or less	0.15	0.36
At least 1 yr beyond BA	0.31	0.46
MA	0.29	0.46
Beyond MA	0.22	0.42
Missing	0.03	0.17
Teacher experience	14.44	9.79
Teacher has regular/highest certification	0.86	0.34
Teacher has paid aide	0.54	0.50
School characteristics		
Public	0.78	0.41
% of minorities:		
Minorities<10%	0.40	0.49
10%≤Minorities<25%	0.20	0.40
25%≤Minorities<50%	0.15	0.36
50%≤Minorities<75%	0.08	0.27
Minorities≥75%	0.15	0.35
Total N of observations	17,358	

[a] Information on reading test scores are based on 8,667 children and a total of 17,334 observations, while math test scores are based on 8,679 children and a total of 17,358 observations.

Table 2. Peer Effects of ELL Students on Non-ELL Students' Standardized Reading and Math Test Scores: Estimates from OLS and School Fixed Effect Regressions

	(1) OLS		(2) School FE	
Outcome	Reading	Math	Reading	Math
ELL Classmate	-0.027**	-0.024*	-0.052***	-0.039**
	(0.012)	(0.013)	(0.017)	(0.017)
Lagged test score	0.733***	0.727***	0.706***	0.702***
	(0.006)	(0.006)	(0.006)	(0.006)
Non-Hispanic black	-0.082***	-0.149***	-0.074***	-0.144***
	(0.019)	(0.019)	(0.022)	(0.022)
Hispanic	-0.000	-0.055***	-0.006	-0.052***
	(0.019)	(0.019)	(0.021)	(0.020)
Asian	0.083**	-0.043	0.077**	-0.018
	(0.035)	(0.033)	(0.038)	(0.035)
Other	-0.018	-0.063***	0.018	-0.053**
	(0.021)	(0.023)	(0.027)	(0.026)
Female	0.049***	-0.037***	0.051***	-0.043***
	(0.009)	(0.009)	(0.010)	(0.009)
Disabled	-0.132***	-0.102***	-0.134***	-0.096***
	(0.013)	(0.014)	(0.014)	(0.014)
Age (months)	0.001	0.001*	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Mother's ed level:				
Ed $\leq 8^{th}$ gr	-0.135***	-0.063	-0.108**	-0.023
	(0.051)	(0.051)	(0.052)	(0.053)
9^{th} gr$\leq$ Ed < 12^{th} gr	-0.088***	-0.046**	-0.077***	-0.040*
	(0.021)	(0.022)	(0.022)	(0.023)
Voc/tech prog	0.015	0.017	0.003	-0.003
	(0.022)	(0.021)	(0.023)	(0.023)
Some college	0.022	0.028*	0.016	0.025*
	(0.014)	(0.014)	(0.015)	(0.015)
College (BA)	0.048***	0.039**	0.040**	0.039**
	(0.019)	(0.018)	(0.019)	(0.019)
Graduate School	0.022	0.047*	0.029	0.063**
	(0.024)	(0.024)	(0.025)	(0.025)
Missing	-0.113*	-0.102	0.129**	-0.069
	(0.061)	(0.059)	(0.057)	(0.057)
Mother's age (years)	-0.002**	-0.000	-0.002***	0.005
	(0.001)	(0.001)	(0.001)	(0.001)
Mother's age missing	-0.141**	0.021	-0.165***	0.001
	(0.055)	(0.055)	(0.047)	(0.049)
N of siblings	0.002	0.006	0.000	0.003
	(0.005)	(0.005)	(0.005)	(0.006)
2 parents & no sibling	0.003	-0.018	-0.017	-0.036*
	(0.019)	(0.019)	(0.020)	(0.020)
1 parent & siblings	-0.016	0.019	-0.015	0.026
	(0.016)	(0.016)	(0.016)	(0.016)
1 parent & no sibling	0.001	0.018	-0.018	-0.002
	(0.025)	(0.025)	(0.025)	(0.025)

Other	0.004	0.004	0.010	0.027
	(0.037)	(0.037)	(0.039)	(0.038)
Parents visit school	0.056***	0.067***	0.063***	0.055***
	(0.019)	(0.019)	(0.019)	(0.020)
Northeast	-0.057***	-0.082***	–	–
	(0.014)	(0.014)		
Midwest	-0.052***	-0.036***	–	–
	(0.013)	(0.013)		
West	0.018	-0.034**	–	–
	(0.016)	(0.015)		
# of books	0.000	0.000***	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Socio-economic status:				
1st quintile	-0.090***	-0.096***	-0.100***	-0.104***
	(0.031)	(0.031)	(0.032)	(0.032)
2nd quintile	-0.046**	-0.057**	-0.040*	-0.040*
	(0.023)	(0.023)	(0.024)	(0.024)
3rd quintile	-0.028	-0.023*	-0.031**	-0.011
	(0.019)	(0.019)	(0.019)	(0.019)
4th quintile	-0.022	-0.018	-0.027	-0.004
	(0.016)	(0.016)	(0.017)	(0.016)
Inc ≤ $15,000	-0.022	-0.012	-0.012	-0.023
	(0.019)	(0.029)	(0.031)	(0.031)
$15,000< Inc ≤$25,000	-0.025	-0.024	-0.022	-0.038
	(0.025)	(0.025)	(0.027)	(0.027)
$25,000< Inc ≤$50,000	-0.008	-0.019	-0.018	-0.039*
	(0.019)	(0.019)	(0.021)	(0.021)
$50,000< Inc ≤$75,000	0.019	0.007	0.012	-0.008
	(0.018)	(0.018)	(0.020)	(0.020)
$75,000< Inc ≤$100,000	0.011	-0.004	-0.002	-0.018
	(0.020)	(0.019)	(0.020)	(0.020)
Participate in Head start	-0.033**	-0.038**	-0.031*	-0.030*
	(0.016)	(0.016)	(0.017)	(0.017)
Receive WIC benefits	-0.012	-0.032**	-0.012	-0.030**
	(0.012)	(0.013)	(0.013)	(0.014)
% black in class	0.001***	0.000	0.002***	0.001
	(0.000)	(0.000)	(0.000)	(0.000)
% Hispanic in class	0.003***	0.002***	0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.001)
Class size	0.001	-0.001	0.003	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Class size missing	0.026	0.005	0.069	0.005
	(0.044)	(0.043)	(0.059)	(0.058)
N of boys in class	-0.007***	-0.001	-0.005*	0.002
	(0.002)	(0.002)	(0.003)	(0.003)
N of boys missing	-0.087**	-0.046	-0.093*	0.013
	(0.038)	(0.038)	(0.048)	(0.047)
Classmate w/	-0.036**	-0.062***	-0.044**	-0.057***
serious emotional problem	(0.017)	(0.018)	(0.020)	(0.020)
White teacher	0.012	0.012	-0.011	-0.010
	(0.016)	(0.016)	(0.020)	(0.020)

Teacher education level:				
BA or less	0.001	0.016	-0.023	0.016
	(0.016)	(0.015)	(0.019)	(0.019)
At least 1 yr beyond BA	-0.013	-0.008	-0.006	-0.005
	(0.012)	(0.012)	(0.014)	(0.014)
Beyond MA	0.051***	0.024	0.069***	0.049***
	(0.014)	(0.014)	(0.016)	(0.016)
Missing	0.027	0.005	-0.001	-0.026
	(0.029)	(0.029)	(0.033)	(0.033)
Yrs of Teacher exp	0.001**	-0.000	0.001**	-0.001
	(0.001)	(0.000)	(0.001)	(0.001)
Teacher is certified	-0.014	-0.009	0.002	-0.021
	(0.015)	(0.014)	(0.018)	(0.018)
Teacher has paid aide	-0.010	0.002	-0.004	0.035**
	(0.010)	(0.010)	(0.017)	(0.017)
Public school	-0.023*	0.019	-0.081	0.126
	(0.012)	(0.012)	(0.317)	(0.595)
10%≤Minority<25%	-0.044***	-0.018	0.086***	0.084**
	(0.013)	(0.013)	(0.032)	(0.034)
25%≤Minority<50%	-0.049***	-0.012	0.031	0.035
	(0.016)	(0.016)	(0.050)	(0.052)
50%≤Minority<75%	-0.071***	-0.030	-0.023	0.039
	(0.021)	(0.021)	(0.060)	(0.058)
Minority≥75%	-0.139***	-0.090***	-0.060	0.092
	(0.022)	(0.022)	(0.064)	(0.066)
N of observations	17,334	17,358	17,334	17,358

* indicates p-value<0.1; ** indicates p-value<0.05; *** indicates p-value<0.01. Robust standard errors are in parentheses.

Note: The omitted categories are Non-Hispanic white, mother has high school diploma, 2 parents and siblings, south, SES 5th quintile, income is greater than $100,000, teacher has M.A. degree, and has less than 10% minority in school.

Table 3. Peer Effects of ELL Students on Non-ELL Students' Standardized Reading and Math Test Scores: Estimates from Child Fixed-Effect Regression

	(1)		(2)		(3)	
Outcome	Reading	Math	Reading	Math	Reading	Math
School FE [b]	No	No	Yes	Yes	Yes	Yes
ELL Classmate	-0.042**	-0.005	-0.042**	-0.008	-0.040**	-0.008
	(0.018)	(0.017)	(0.019)	(0.018)	(0.019)	(0.018)
N of failing students	–	–	–	–	-0.008***	-0.006***
					(0.002)	(-0.002)
Lagged test score	-0.243***	-0.306***	-0.247***	-0.308***	-0.247***	-0.308***
	(0.015)	(0.012)	(0.016)	(0.013)	(0.016)	(0.013)
Disabled	-0.034*	-0.000	-0.032	-0.012	-0.032	-0.009
	(0.019)	(0.019)	(0.020)	(0.017)	(0.020)	(0.020)
Age (months)	0.005***	0.003***	0.005***	0.002**	0.006***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N of siblings	0.008	-0.006	0.016	-0.012	0.016	-0.012
	(0.014)	(0.017)	(0.014)	(0.017)	(0.014)	(0.017)
2 parents & no sibling	0.060	0.001	0.057	-0.027	0.058	-0.027
	(0.052)	(0.047)	(0.053)	(0.049)	(0.053)	(0.049)
1 parent & siblings	-0.015	-0.031	-0.031	-0.035	-0.032	-0.035
	(0.030)	(0.030)	(0.033)	(0.032)	(0.032)	(0.032)
1 parent & no sibling	0.109*	0.008	0.077	-0.028	0.075	-0.030
	(0.058)	(0.056)	(0.061)	(0.058)	(0.061)	(0.058)
Other family type	0.062	-0.013	0.077	-0.033	0.093	-0.032
	(0.092)	(0.071)	(0.061)	(0.076)	(0.099)	(0.076)
Parents visit school	0.030	0.038	0.028	0.041	0.028	0.041
	(0.026)	(0.026)	(0.027)	(0.027)	(0.027)	(0.027)
Socio-economic status:						
1st quintile	0.085*	0.037	0.059	0.028	0.058	0.029
	(0.045)	(0.043)	(0.047)	(0.045)	(0.047)	(0.045)
2nd quintile	0.072**	0.044	0.073*	0.032	0.073*	0.032
	(0.036)	(0.035)	(0.038)	(0.036)	(0.038)	(0.036)
3rd quintile	0.033	0.037	0.032	0.023	0.030	0.022
	(0.031)	(0.030)	(0.033)	(0.031)	(0.033)	(0.031)
4th quintile	0.027	0.021	0.020	0.010	0.020	0.010
	(0.027)	(0.025)	(0.028)	(0.026)	(0.028)	(0.026)
Inc ≤ $15,000	-0.054	0.011	-0.032	0.036	-0.032	0.034
	(0.047)	(0.044)	(0.048)	(0.046)	(0.048)	(0.046)
$15,000< Inc ≤$25,000	-0.053	-0.013	-0.041	0.005	-0.040	0.004
	(0.042)	(0.039)	(0.044)	(0.041)	(0.044)	(0.041)
$25,000< Inc ≤$50,000	-0.062	-0.031	-0.056	-0.013	-0.057	-0.015
	(0.034)	(0.032)	(0.035)	(0.033)	(0.035)	(0.033)
$50,000< Inc ≤$75,000	0.005	0.015	0.010	0.031	0.011	0.030
	(0.032)	(0.028)	(0.033)	(0.031)	(0.033)	(0.031)
$75,000< Inc ≤$100,000	-0.006	0.012	-0.006	0.016	-0.007	0.016
	(0.029)	(0.026)	(0.030)	(0.027)	(0.030)	(0.027)
% black in class	0.003***	0.001***	0.003***	0.001***	0.003***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
% Hispanic in class	0.001**	-0.001	0.001***	-0.000	0.001***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)

Class size	-0.001	-0.006***	-0.001	-0.007***	-0.001	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Class size missing	-0.019	-0.113**	-0.049	-0.129**	-0.036	-0.123**
	(0.056)	(0.054)	(0.059)	(0.056)	(0.059)	(0.056)
N of boys in class	-0.007**	0.002	-0.007**	0.002	-0.007**	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
N of boys missing	-0.118***	-0.015	-0.122**	-0.003	-0.132***	-0.007
	(0.048)	(0.044)	(0.050)	(0.046)	(0.050)	(0.047)
Classmate w/	-0.037**	-0.070***	-0.060**	-0.069***	-0.057***	-0.066***
serious emotional problem	(0.017)	(0.019)	(0.020)	(0.020)	(0.020)	(0.020)
White teacher	-0.026	-0.025	-0.015	-0.028	-0.012	-0.025
	(0.018)	(0.019)	(0.021)	(0.020)	(0.021)	(0.020)
Teacher education level:						
BA or less	-0.011	0.004	-0.006	0.009	-0.005	0.009
	(0.020)	(0.018)	(0.020)	(0.019)	(0.020)	(0.019)
At least 1 yr beyond BA	-0.010	-0.011	-0.014	0.010	-0.014	-0.009
	(0.019)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)
Beyond MA	0.034**	0.036**	0.043***	0.037**	0.042***	0.036**
	(0.015)	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)
Missing	0.018	-0.024	-0.006	0.023	0.010	-0.016
	(0.033)	(0.032)	(0.034)	(0.033)	(0.034)	(0.033)
Yrs of Teacher exp	0.000	-0.001	0.001	-0.001	0.001	-0.001
	(0.001)	(0.006)	(0.001)	(0.001)	(0.001)	(0.001)
Teacher has certification	0.025	-0.018	0.025	-0.016	0.025	-0.016
	(0.017)	(0.017)	(0.018)	(0.017)	(0.018)	(0.017)
Teacher has paid aide	0.056***	0.065***	0.057***	0.061***	0.059***	0.063***
	(0.019)	(0.017)	(0.020)	(0.018)	(0.020)	(0.018)
Public school	-0.012	0.017	-0.285	-0.018	-0.335	-0.046
	(0.067)	(0.060)	(0.207)	(0.538)	(0.207)	(0.539)
10%≤Minority<25%	0.032	0.061**	0.046	0.046	0.043	0.044
	(0.027)	(0.026)	(0.026)	(0.028)	(0.028)	(0.028)
25%≤Minority<50%	0.023	0.030	0.009	0.016	0.004	0.014
	(0.039)	(0.039)	(0.043)	(0.043)	(0.043)	(0.043)
50%≤Minority<75%	-0.015	0.060	-0.012	0.056	-0.023	0.047
	(0.044)	(0.043)	(0.049)	(0.047)	(0.049)	(0.048)
Minority≥75%	-0.024	0.053	-0.007	0.069	-0.014	0.067
	(0.046)	(0.048)	(0.053)	(0.054)	(0.053)	(0.053)
N of observations	17,334	17,358	17,334	17,358	17,334	17,358

* indicates p-value<0.1; ** indicates p-value<0.05; *** indicates p-value<0.01. Robust standard errors are in parentheses.

Note: The omitted categories are 2 parents and siblings, SES 5th quintile, income is greater than $100,000, teacher has M.A. degree, and has less than 10% minority in school.

[a] Restricted sample includes students with teachers that can only speak English.

[b] School fixed effects are controlled for by including 1,051 school dummy variables. Coefficients for the school dummy variables are not reported in the above table.

Table 4. Peer Effects of ELL Students on Non-ELL Students' Standardized Reading and Math Test Scores: Estimates from Child Fixed-Effect Regression for Schools with Random ELL Student Sorting Across Classrooms

Difference in Number of ELL students across classrooms:	(1) 2 or fewer students [a]				(2) 3 or fewer students [b]				(3) 4 or fewer students [c]			
	Reading	Math	Reading	Math	Reading	Math	Reading	Math	Reading	Math	Reading	Math
Have ELL Classmate	-0.057**	-0.015	–	–	-0.064***	-0.027	–	–	-0.053***	-0.013	–	–
	(0.024)	(0.022)			(0.022)	(0.021)			(0.021)	(0.020)		
Number of ELL Classmate	–	–	-0.038**	0.007	–	–	-0.034**	-0.006	–	–	-0.023***	-0.007
			(0.018)	(0.017)			(0.014)	(0.013)			(0.011)	(0.011)
N of Schools	868				917				956			
N of Observations	14,506	14,509	14,506	14,509	15,363	15,363	15,363	15,363	16,025	16,028	16,025	16,028

* indicates p-value<0.1; ** indicates p-value<0.05; *** indicates p-value<0.01. Robust standard errors are in parentheses.

Note: All of the above regressions control for the same covariates as specified in Table 3 in addition to the school dummy variables. There are a total of 1,051 schools in the full sample.

[a] This sample captures about 60.7 percent of student observations originally reporting to have an ELL classmate.

[b] This sample captures about 71.2 percent of student observations originally reporting to have an ELL classmate.

[c] This sample captures about 79.6 percent of student observations originally reporting to have an ELL classmate.

Table 5. Heterogeneity in Effects by Race, Gender, Income, Teacher Aide, and Class Size: Estimates from Child Fixed-Effect Regression controlling for School Fixed Effects

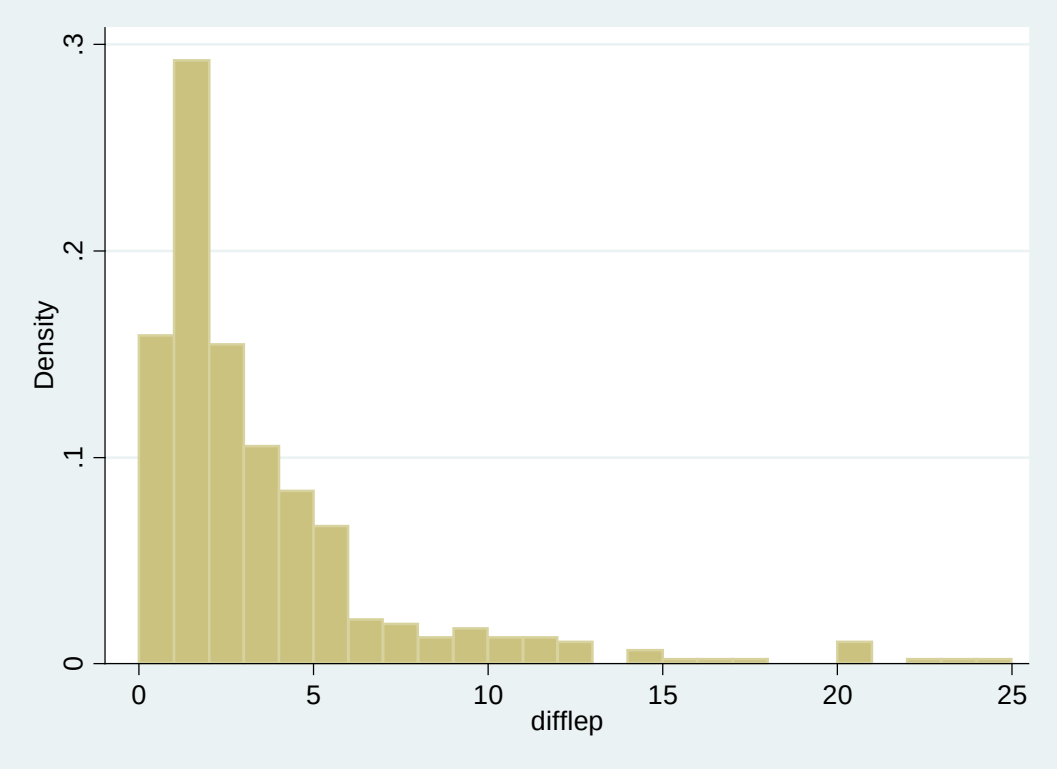
	Reading	N. of Observation
Baseline [a]	-0.042**	17,334
	(0.019)	
By Frequency in ability grouping:		
Frequent Ability Grouping	-0.005	9,091
(3 or more times per week)	(0.051)	
Non-frequent Ability Grouping	-0.143**	8,058
(2 or fewer times per week)	(0.071)	
By Instruction time per day:		
High levels	-0.171	6,342
(More than 90 minutes a day)	(0.107)	
Low levels	-0.065	10,120
(90 minutes or less a day)	(0.050)	
By ESL course preparation:		
Took ESL course during college	0.051	2,314
	(0.111)	
No ESL course during college	-0.010	12,535
	(0.030)	
By Teacher aide:		
No Aide	-0.038	7,765
	(0.038)	
Have Aide	-0.014	9,390
	(0.031)	
By Teacher experience:		
Less than 5 years of experience	-0.062	3,607
	(0.143)	
5 years or more experience	-0.031	13,727
	(0.026)	
By Race:		
Non-Hispanic white	-0.037	11,934
	(0.023)	
Non-Hispanic black	-0.043	2,668
	(0.044)	
By Gender:		
Girls	-0.060**	8,710
	(0.024)	
Boys	-0.024	8,624
	(0.027)	
By Income:		
Income $25,000 or less	-0.124***	3,926
	(0.045)	
Income more than $25,000	-0.014	13,408
	(0.023)	

* indicates p-value<0.1; ** indicates p-value<0.05; *** indicates p-value<0.01. Robust standard errors are in parentheses.

Note: All of the above regressions control for the same covariates as specified in Table 3 in addition to the school dummy variables.

[a] θ (ELL peer effects) estimated from column (2) of Table 3.

Figure1. Distribution of the difference in number of ELL students across classrooms within schools with at least one ELL student



Note: There are a total of 465 schools reporting to have at least one ELL student. This comprises roughly 44 percent of the total number of schools (1,051) in the sample.