Does Bilingual Education Improve Peruvian Indigenous Students' Academic Achievement?

Abstract

This paper uses the Young Lives International Study of Childhood Poverty's School Level data collected in Peru 2011 to investigate whether indigenous children who attend *Educación Intercultural Bilingüe* (EIB) schools have higher academic achievement than indigenous children who attend Spanish-medium schools. I use Ordinary Least Squares to estimate an education production function and find that indigenous children who attend EIB schools achieve 0.48 standard deviations higher scores in mathematics, but not significantly higher scores in language, compared to indigenous children who attend Spanish-medium schools. Indigenous children who attend schools whose teachers are trained in EIB teaching, which is a subset of the EIB schools, achieve 0.73 standard deviations higher scores in mathematics, and 0.35 standard deviations higher scores in language, compared to indigenous children who attend Spanish-medium schools or EIB schools where teacher are not trained in EIB teaching. There is no evidence that the effect of attending an EIB school, or a school whose teachers are trained in EIB teaching, would be caused by quantitative or language achievement acquired prior to entering school. The results for mathematics achievement are not sensitive to the specification of the control variables, and are robust. The results for language achievement are somewhat sensitive to the specification of the control variables and robustness controls taking account of community, parent and state support.

1. Introduction

Despite the number of people belonging to language minorities worldwide[1], and the relationship between human capital and national (Hanushek and Woessmann 2012) and individual (Cawley, Heckman and Vytlacil 2001) wealth accumulation, the economic literature largely ignores how instructional language affects schooling outcomes. In Latin America, over 30 million people speak a total of more than five hundred native languages. This population has traditionally only had access to education mediated through the dominant European language of their respective country (Enrique López 2014). Western languages' dominance in developing countries' educational systems has recently received increased attention (Watson 2007). Academics discuss indigenous-medium education as a means to secure linguistic rights and preserve indigenous languages and identities[2] and international organizations promote education mediated through local languages (Champagne 2009; Crouch 2007). Educational literature argues that children learn better if they are taught in their mother tongue, at least during primary education (Latin America: Benson 2010; Patrinos and Velez 2009; Africa: Trudell 2005; Hovens 2002; Truong 2012) but robust quantitative analysis of instructional language's effect on schooling outcome is scarce. This paper uses the Young Lives International Study of Childhood Poverty's unusually detailed school level data and investigates whether Peru's *Educación Intercultural Bilingüe* (EIB)[3] program affects indigenous students' mathematics and language achievement. Inconclusive evidence from Guatemala suggests that being taught by a teacher who sometimes speaks in a Mayan language

[1] The United Nations estimate that there are about 370 million people who identify as indigenous in the world, many of whom speak indigenous languages (United Nations 2009).
[2] See for example Watson (2007) Skutnabb-Kangas, (1994) and Trudell (2005).
[3] Intercultural Bilingual Education (IBE) in English.

increases mathematics scores (Marshall 2009), but, to my knowledge, the economic literature has not yet considered the effects of a state-led bilingual education program in Latin America.

Groups with limited access to resources, who are often also speakers of minority languages, achieve lower scores on academic and cognitive tests, as compared to more privileged groups, in developed (Patacchini and Zenou 2009; Kertesi and Kézdi 2011; Bradley et al. 2007; Leigh and Gong 2009; Fryer and Levitt 2004, 2006; Hanushek and Rivkin 2009; Clotfelter et al. 2009; Fischer and Stoddard 2013), as well as in developing countries (McEwan 2004; 2008; Paxson and Shady 2007; Borooah 2012; McEwan and Trowbridge 2007) including in Peru (Sakellariou 2008). Academic and cognitive test scores explain part of the racial wage gap in the United States (Blackburn 2004). Increasing minorities' achievement thus has the potential to contribute to a decrease in racial wealth differentials. Children's achievement gap increases with age in the United States (Fryer and Levitt 2004, 2006; Hanushek and Rivkin 2009), Canada (Friesen and Krauth 2010) and Australia (Bradley et al. 2007; Leigh and Gong 2009), suggesting that the educational system does not adequately meet the needs of indigenous and minority children. Similar research from developing countries is lacking, but inconclusive evidence suggests that school level variables, and instructional language in particular, could play a role in reversing such trends (McEwan 2008). Being instructed in a Mayan language, and having access to bilingual education, is associated with higher probability of school enrolment in Guatemala and Mexico, respectively (Marshall 2011; Parker et al. 2005), while no such effect was found in Peru[4] (Rodriguez Lozano 2012).

[4] This research did not guarantee that children with access to bilingual education actually attended bilingual schools, source: Communication with Rodriguez Lozano 09/05/2013.

This paper proceeds as follows. The following section outlines the Peruvian context, in terms of indigenous people and bilingual education. Section three presents the methodology, including the theoretical framework and estimation strategy. Section four presents the data, and section five the analysis, including results and robustness. Section six concludes.

2. Context: Indigenous People and Bilingual Education in Peru

The most common definition of indigenous status in Peruvian censuses (Kudó 2004), and in academic literature concerning Latin America (McEwan 2008; 2004, Parker et al. 2005), is if a person speaks a native language. By this definition, four million Peruvians, or about 16 percent of the population (Census Naciónal 2007), are indigenous, and speak any of the country's 43 native languages (DIGEIBIR 2013). The greatest part, 3.4 million, of Peru's indigenous population speaks Quechua, while almost half a million speak Aymara, and about 240,000 speak a wide range of other native languages (Census Naciónal 2007). As in the rest of Latin America, this part of the population fare worse both economically and socially than the majority population (Cortina 2014). In Peru, about 80 percent of the indigenous population is poor, and almost half extremely poor. Indigenous Peruvians have higher rates of child malnutrition and infant mortality, and tend to live in more isolated communities with poorer access to services (Kudó 2004). Indigenous children are more likely to work, repeat grades in school or leave school prematurely (Rodriguez Lozano 2012; Kudó 2004).

Peruvian indigenous children's low educational achievement is therefore no surprise. These results are exacerbated by the fact that the country as a whole lags behind in international comparisons of academic achievement, and has among the highest internal inequalities of performance in the world[5] (Crouch 2007). The Peruvian government presents EIB education not only as a means to increase indigenous children's educational opportunities but also as a departure from the tradition of homogenization and forced hispanization. The official vision of the EIB is to have a school that recognizes Peru as a multilingual and multicultural society, and which is informed by, and informs about, native languages and cultures[6] (DIGEIBIR 2013). Bilingual education was instituted during the 1970's but grew significantly during the past 20 years (DIGEIBIR 2013; Rodriguez Lozano 2012). Today, over 1,200 schools implement the EIB program (Rodriguez Lozano 2012), and serve about half of the country's indigenous children (Kudó 2004). The EIB program does not constitute an alternative to the national curriculum, all Peruvian children are expected to study the same subjects. Rather, the curriculum has been diversified to include culturally sensitive and indigenous-medium materials, to be implemented in regions with indigenous populations specifically (Garcia 2010, DIGEIBIR 2005).

Peru's EIB program emphasizes indigenous-medium classes in the lower grades of primary school, while all children are expected to eventually be sufficiently proficient in Spanish to study in Spanish. The rate at which instructions shift from the native language to Spanish should depend on the child's initial Spanish proficiency. For example, indigenous children who enter school as monolingual in a native language should learn all subjects in their mother tongue in grades one and two, including Spanish as a second language. In 3rd grade, 20 percent of the classes should

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5 Peru performed worst of all participating countries in the *Programme for International Student Assessment* (PISA) in 2000, and had the second highest internal inequality of performance in both PISA 2000 and in *Trends in International Mathematics and Science Study* (TIMSS) 1999 and 2003, respectively (Crouch 2007).
6 In addition to EIB education for all children who speak a native language, the Education Ministry has a vision of an Educación Intercultural (Intercultural Education) where all Peruvian children learn a native language as a second language, even if it is not spoken in the family (DIGEIBIR 2013).

be taught in Spanish, and this share should increase by 10 percentage units each year, to reach 50 percent by grade six (DIGEIBIR 2013).

The Peruvian government's vision of the EIB program is ambitious, but its implementation faces several obstacles: some schools lack bilingual educational materials (Garcia 2010; Montoya Rojas 2001; DIGEIBIR 2005); the instructional-medium guidelines are difficult to follow in multigrade schools (Rodriguez Lozano 2012); teachers with adequate language knowledge are sometimes not available (Montoya Rojas 2001; Kudó 2004); teacher-training sessions are insufficient (Garcia 2010; Montoya Rojas 2001; Trapnell 2003) and, the 'intercultural' aspect of the program is difficult to implement (Kudó 2004, DIGEIBIR 2005). Although the government emphasizes the importance of collaborating with communities (DIGEIBIR 2013; 2005), many indigenous parents reject bilingual education since they fear that it may interfere with Spanish acquisition (Garcia 2010; Montoya Rojas 2001; Kudó 2004).

3. Methodology

3.1 Theoretical Framework

In presenting a theoretical framework, I follow the majority of the test score literature which adapts a version of Todd and Wolpin's (2003) education production framework to guide the empirical specification. For simplicity, I consider a household with one child[7]. The theory assumes that each household i is both a consuming and a producing unit, with a joint household utility function defined as

[7] The argument for a household with several children would be identical, but I would consider a joint household utility function of the form $U(A_{1it}, A_{2it}, A_{3it}, \ldots\ldots, C_{it}, L_{it})$, where A_{nit} is child n in household i's achievement at time t. Each child n would have identical achievement production functions f, where the additional constraint of having to share resources with sibling(s) could enter the vector Q, and where the values of each input vector

$$U(A_{it}, C_{it}, L_{it}), \quad (1)$$

where A_{it} is the child's achievement, L_{it} is leisure, and C_{it} is consumption of all other goods, at time t. The child's cognitive development is a cumulative process and its achievement depends on the sum of inputs into the achievement production function up until, and including, time t (Todd and Wolpin 2003),

$$A_{it} = \sum_{j}^{t} f\left(B_{ij}, X_{ij}, Q_{ij}, R_{ij}, \mu_i, \epsilon\right), \quad (2)$$

where, B indicates whether the child attends a bilingual school, X is a vector of child characteristics, and Q and R are vectors of household and school characteristics, respectively. The child's innate ability is modeled by μ, ϵ, is random variation in children's achievement not captured by the model. Assuming that all households face the same prices, the time and budget constraints are modeled by

$$T = H_{it} + L_{it}, \quad (3)$$

and

$$P^s A_{it} + P^c C_{it} = wH_{it} + Y_{it}, \quad (4)$$

respectively, where T is total quantity of time available, H_{it} is hours working, P^s is the cost of the child's achievement, P^c is the price of the consumption good, w is wage, and Y_{it} is household wealth. Although most education in Peru is public (Guerrero et al. 2012), it is necessary to price A, as parents ultimately bear the cost of both the school and the home's inputs.

Since prices are exogenous, the child's achievement at time t ultimately depends on the parents' taste for achievement and their input into (2) at all time periods $j \leq t$. The equation we wish to estimate is therefore (2).

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could be unique to that child. The budget constraint would be in the form $P^s A_{1it} + P^s A_{2it} + \cdots + P^c C_{it} = wH_{it} + Y_{it}$.

The total effect of bilingual education is the sum of the direct effect, in the form of the child's learning at school, and the indirect effect, in the form of parents' response to the direct effect, (Glewwe and Kremer 2005). If the home educational environment is a complement to the learning that happens at school, the total effect will be greater than the direct effect. The opposite is true if the home educational environment is a substitute to the learning that happens at school. Due to limited data about the home environment, this paper estimates the total effect of bilingual education.

The education literature argues that children learn better if the language of instruction is their native language (Benson 2010; Trudell 2005; Hovens 2002; Truong 2012). I therefore expect $\partial A/\partial B$ to be positive, but may differ according to how achievement is measured. Both the mathematics and language achievement tests used for the purpose of this research were administered in Spanish. The fact that the indigenous children did not take the tests in their mother tongue may affect their results. In particular, it is possible that the language scores relate more closely to indigenous students' knowledge of Spanish as a second language, rather than their communication abilities, since their understanding of the test depends on how well they master Spanish. To the extent that the children's ability to understand the mathematics test depends less on their Spanish proficiency, it is possible that the effect of bilingual education on indigenous children's mathematics achievement is larger than the effect on language achievement. This since, indigenous children who attend Spanish-medium schools would be expected to have learnt some Spanish from communicating with teachers and other students.

Factors that are associated with high socioeconomic status (SES) and parental investment in the child's educational outcomes, such as parents' level of education, having attended pre-school and the household's wealth, are expected to affect academic achievement positively (McEwan and Trowbridge 2007; McEwan 2004; 2008; Marshall 2009; Sakellariou 2008). In Latin America, indigenous status, having several siblings, and having repeated grades in school tend to affect academic achievement negatively. Being female is typically associated with lower mathematics scores, but the effect on language achievement is ambiguous (McEwan and Trowbridge 2007; Marshall 2009; Sakellariou 2008). The negative effect of taking a test in something other than one's native language presumably is larger if the test assesses language ability, as opposed to mathematics ability. The negative effect of indigenous status identified in this research may therefore be larger for language than for mathematics achievement. Theoretically, schools with more resources and better educated and more experienced teachers and principals would be expected to affect academic achievement positively.

3.2 Empirical Strategy

3.2.1 Specification of the Achievement Production Function

The majority of the test score literature estimates the achievement production function by using the cumulative, value-added, or contemporaneous specification, as elaborated by Todd and Wolpin (2003). The cumulative specification corresponds best to the theory as it relates academic achievement to historic and contemporaneous variables. Due to data restrictions, several economists implement the value-added specification instead, which relies on contemporary variables, but uses lagged test scores as a proxy for historic inputs (Todd and Wolpin 2003). In this paper, I use the contemporaneous specification, since neither historic variables, nor lagged test scores, are available. This specification relates academic achievement to contemporaneous school and family inputs only. It assumes either that inputs do not change over time, or that only contemporaneous inputs matter for current achievement. In addition, contemporaneous inputs are assumed to be unrelated to innate ability. Although some of these assumptions may not hold (Todd and Wolpin 2003), several researchers use it when estimating the contributions of historic inputs is not of primary interest (Fischer and Stoddard 2013; McEwan 2008).

3.2.2 Identification Strategy

The goal is to estimate the coefficient on bilingual education, for indigenous children. The comparison of primary interest is the academic achievement of indigenous children in EIB schools, and of indigenous children in Spanish-medium schools. The ideal dataset for this purpose would be a large sample of Peru's indigenous population specifically. This is not available. As presented in the data section, only 197 of the 1077 children in the final sample are indigenous. A reasonable approach would be to estimate a model using an interaction term between EIB schools and indigenous status. However, this might result in biased coefficients, since only fifteen non-indigenous children attend EIB schools. The interaction term would therefore be collinear with the main effect of attending an EIB school[8]. Estimating the effect of bilingual education by including EIB school as a dummy variable, but including the non-indigenous students who attend EIB schools, would bias the coefficient of interest downward. This since, for non-indigenous children, we would not expect the EIB program to be advantageous compared to any other school with similar characteristics. Therefore, I exclude the non-indigenous children who attend EIB schools. To identify the effect of attending an EIB school for indigenous

[8] As I explain below, I use two definitions of 'bilingual education'. The first is 'EIB School', which indicates whether the school implements the EIB program, and the second is 'Teachers Are Trained in EIB Teaching', which indicates whether the school's teachers have received training in bilingual teaching methods. Pearson's r is 92 for 'EIB School' with the interaction term, and 98 for 'Teachers Are Trained in EIB Teaching' with the interaction term.

children, it then suffices to include one dummy variable for indigenous status, and one for whether the child attends an EIB school. Since there are only indigenous children in the latter group, this identification strategy is equivalent to an interaction term between indigenous status and EIB education, apart from the fact that any constant effect of attending an EIB school is not accounted for.

The fifteen excluded observations score about one standard deviation lower on both the mathematics and language achievement tests compared to the other Hispanic children in the sample. The difference in achievement between the excluded observations and the indigenous children is not significant. Excluding the non-indigenous children who attend EIB schools might therefore bias the coefficient on indigenous status downward, while it should not affect the coefficient on EIB school.

3.2.3 Estimation Equation

The test score literature generally assumes that there is a linear relationship between the inputs into the academic achievement production function and academic achievement (Todd and Wolpin 2007). There is no serious multicollinearity between the main explanatory variable and any of the control variables, and I account for heteroskedasticity by reporting robust standard errors. The appropriate estimator is therefore Ordinary Least Squares (OLS). The data set I use does not include any proxy for μ. Variation in children's innate ability is therefore absorbed by the error term. As I explain in the Endogeneity Issues section, I do not expect this to bias the results. Given the contemporaneous specification outlined above and the identification strategy, the equation I will estimate is

$$A_i = \beta_0 + \beta_1 B_i + \beta_2 X_i + \beta_3 Q_i + \beta_4 R_i + \epsilon_i \quad (5)$$

where academic achievement, A, depends on the contemporary vectors bilingual education, B, child characteristics, X, school characteristics, R, and household characteristics, Q, and a random component ϵ.

The outcome variable of interest is B, which indicates whether a child attends a school that uses the EIB methodology. Considering the difficulties of implementing this program, it is possible that some EIB institutions are more committed to providing bilingual education than others. Therefore, I consider two different measures of B: 'EIB School', which is a dummy variable equal to one if the school's principal reported that the school implements the EIB program, and zero otherwise, and, 'Teachers are Trained in EIB Teaching', which is equal to one if the principal reported that the school's teachers have received training in EIB methodology. The latter is a subset of the first. The data section presents the distribution of indigenous and non-indigenous children in EIB schools, schools whose teachers are trained in EIB teaching, and Spanish-medium schools.

I include indigenous status, gender, grade repetition, number of siblings, and pre-school attendance in the vector X, which is in line with the test-score literature investigating Latin America (Marshall 2007; McEwan 2008; 2004; Sakellariou 2008; Meade 2012)[9]. I define a child as indigenous if both its parents speak an indigenous language. Child's health is potentially an important input into X in developing countries (Glewwe et al. 2001). No health information is available for the majority of the children in the dataset, creating a potential for omitted variable bias. However, analysis of the subset of children for which such information is available suggests that this does not affect the main results[10] [11].

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9 I do not include age, since it is collinear with grade repetition

10 The subset of children for whom additional household level data are available took part in Young Lives' household survey rounds, prior to the school level survey that I use in the main

The most important aspect of the vector Q, household characteristics, in both developed and developing countries are typically controls for SES, including parents' education, income and wealth (Hanushek 1986; McEwan and Trowbridge 2007; Marshall 2007; McEwan 2008; 2004). I control for both father's and mother's education, but the data include further household information only for a subset of the observations. Instead of limiting the sample size, I control for wealth effects by including all available information on school infrastructure and several of the school's material resources, as well as the school-level averages of wealth and housing quality indices obtained from the subset of children for whom additional information is available. Thus, I control for wealth on the school-level, as opposed to on the individual level. Given that indigenous children attend schools with worse infrastructure and fewer resources, as presented in Table 1, I expect school-level variables to capture indigenous children's higher rates of poverty, and thus the effect of wealth on academic achievement. Agricultural assets (Parker et al. 2005), and proxies for the quality of the home educational environment (Todd and Wolpin 2007; Fischer and Stoddard 2013; McEwan 2004; Sakellariou 2008), may be important inputs into Q. Such information is only available for the subset of children with additional household information. Analysis on that subset reveals that none of the main results change when introducing individual-level wealth and housing quality

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analysis. These children were in either of the six grades of primary school at the time of the school survey and each grade was administered different mathematics and language tests. To investigate the effect of including additional variables in the estimation, I only use the grades between which there was no significant difference in the results of each respective test. This to avoid the fact that scores obtained on the different tests may not comparable, and could confound the results if they differ greatly. In the estimation with mathematics scores, I use the 448 children who were in grades four or five. In the estimation on language scores, I use the 327 children who were in grades four or three.

[11] Specifically, including children's bmi at ages one, five and eight does not influence the coefficients on 'EIB School' or 'Teachers are Trained in EIB Teaching', on the subset of children for whom this information is available.

indices and access to land and animals, or controls for the home educational environment[12].

There is no agreement of whether the vector R, teacher and school characteristics, matter for academic achievement in the United States (Hanushek 1986) but evidence suggests that it does in Latin America (Marshall 2009; McEwan and Trowbridge 2007; McEwan 2004). Since Peru's poor population exhibits high variance in academic achievement (Crouch 2007), school quality factors may be important in the Peruvian context. I include controls for student-teacher ratio, number of classrooms, teacher's sex and years of experience, principal's education and student absenteeism, and whether the school is private. Although, there exists no consensus on which school and teacher level variables are most important for achievement in developing countries.

3.2.4 Endogeneity Issues

Nonrandom program assignment is a potential source of endogeneity in the academic achievement literature, which researchers account for by using instrumental variables (Bóo and Canon 2013), estimating fixed-effects with panel data (Burke and Sass 2013; Hanushek and Rivkin 2009), or taking advantage of natural experiments (Hastings and Weinstein 2008). Endogeneity is potentially a problem for this study if indigenous parents are more likely to put either their high, or low, achieving children in EIB schools. Qualitative evidence suggests that Amazonian indigenous parents exert some influence over the EIB curriculum and welcome the program, while Quechua speaking parents express their disapproval since they fear that Quechua-medium instructions impede children's Spanish acquisition (Garcia 2010). In an effort

[12] Specifically, I use variables for the number of books in the household, if the household has a dictionary, how often the parents encourage the child to read, and whether the parents want the child to attain university education.

to reduce positive selection bias, and the possibility that the EIB program impacts different indigenous children differently, I exclude the 33 non-Quechua speaking indigenous children from the sample[13].

To investigate the potential for selection bias further, I analyze the subsample of 496 children for whom lagged test-scores are available from the Young Lives Household Survey collected in 2006. The children were administered the Cognitive Development Assessment (CDA), which focuses on quantitative ability, and the Peabody Picture Vocabulary Test (PPVT), which tests language achievement, approximately one year before entering school. I use the same model and identification strategy as specified above, to examine whether indigenous children in EIB schools have different pre-school achievement than indigenous children in other schools. If parents who are more inclined to endow their children with mathematics and language abilities selected into EIB schools, we would expect the model to estimate a positive and significant coefficient on bilingual education when the outcome variable is CDA or PPVT scores. This is not the case[14]. This indicates that, conditional on child, household, and school-level controls, the indigenous children who would attend EIB schools did not have higher cognitive achievement as compared to indigenous children who would not attend EIB schools, prior to starting school. Assuming that PPVT and CDA scores capture some variance in innate

[13] Including all children with parents who speak any native language in the definition of 'indigenous' only increases the size of the coefficient on 'EIB School' and 'Teachers are Trained in EIB Teaching' for the mathematics achievement, and does not affect the coefficients for language achievement.

[14] When the outcome variable of the full model is CDA scores, the coefficient on 'Teachers Are Trained in EIB Teaching' is negative, with p-value 0.82. For 'EIB School' the coefficient is positive with p-value 0.18. The high significance is likely due to an outlier problem rather than selection into bilingual schools: dropping just the lowest nine achievers from the 496 observations increases the p-value to 0.38. The coefficients obtained when explaining the PPVT scores with the full model are positive, but with p-values of 0.41 and 0.46, for 'EIB School' and 'Teachers Are Trained in EIB Teaching', respectively.

ability[15], μ, these results imply that excluding μ from the estimation does not cause the error term to be nonrandom.

If indigenous children drop out of school at different rates in EIB schools than in Spanish-medium schools, that could bias the effect of attending an EIB school. Since Peru has about 98% primary education completion rate (Crouch 2007) and evidence suggests that EIB education does not affect school drop out in Peru (Rodriguez Lozano 2012), this is likely not a problem for this research. In Latin America, female students are more susceptible to dropping out of school than male students (Rodriguez Lozano 2012; Marshall 2011). As presented in Table 2, there is no significant difference in the gender balance between EIB, and non-EIB schools, among the indigenous children. This indicates that there is not likely any difference in dropout rates between bilingual and Spanish-medium schools for indigenous children when other factors are not controlled for. If EIB education in fact does affect drop out rates, the only evidence suggests that bilingual schools are better at retaining indigenous students (Parker et al. 2005; Marshall 2011). In this scenario, we would expect an underestimate of the coefficient on bilingual education since parents are less likely to prioritize education for their academically weaker children.

If indigenous children in EIB schools are significantly more, or less, likely to attend school at any given day than indigenous children in Spanish-medium schools, this would be a potential source of endogeneity. This since the achievement tests that are used as outcome variables in this research were administered at school, during school time. Since we would expect parents to prioritize education for their

[15] The PPVT has been shown to measure scholastic aptitude, while mixed results have been obtained for the correlation between the PPVT and intelligence tests (Spreen and Strauss 2006). The CDA test administered to the children was developed by the International Evaluation Association in order to test young children's quantitative ability (Cueto et al. 2009).

academically stronger children, a lower attendance rate among indigenous children in EIB schools, than in Spanish-medium schools, could bias the coefficients upward. As indicated in Table 2, indigenous children who attend EIB schools are significantly more likely to have repeated at least one grade than indigenous children in Spanish-medium schools. This could indicate that EIB schools have lower rates of attendance. On the other hand, when the mathematics teachers were asked about student absenteeism, there was no statistically significant difference between Spanish-medium schools attended by indigenous children, and EIB schools. This is indicated by 'Students Absent Past 30 Days' in Table 2. It is therefore unlikely that different rates of attendance would alter the results qualitatively, or affect the level of statistical significance.

4. Data

This research uses Young Lives International Study of Childhood Poverty's (YL) data collected in Peru. YL has administered three rounds of household level surveys, collected in 2002, 2006, and 2009 and one school level survey, collected in 2011, in Peru, India, Ethiopia and Vietnam. In each country, YL follows one younger cohort born 2001-2002, and one older cohort born 1996-97, of about 2000 and 1000 children, respectively. In Peru, the school level survey included a subsample of 572 of the younger cohort children, attending 132 different schools, and 1207 of those children's peers. The peers were not part of the previous household level surveys. The school level survey thus represents 1779 children (Guerrero et al. 2012). Due to the small number of children that took part in each household level survey and the school level survey, this research primarily uses the contemporaneous data collected during the school round. As part of the school survey, YL administered student, principal, and teachers' questionnaires, covering a wide range of information including the schools' resources, institutional management, school and classroom environment and student and teachers' attitudes (Guerrero et al. 2012).

To construct the younger cohort sample in Peru, YL used a pro-poor sampling approach which purposefully excluded the five richest percent of the population. Due to logistical feasibility and budget constraints, some areas with worse access to public services were also excluded (Escobal and Flores 2008). To select the subsample of children to be included in the school survey, YL used a random sampling approach, but excluded those observations with missing school-related information in the household rounds, included all children who attended EIB schools and, in the cases where several younger cohort children attended a school selected for sampling, YL included all those children. In each school, YL randomly selected up to 20 peers in grade four, since most younger cohort children were in that grade at the time of the school survey (Guerrero et al. 2012). YL's school level data is not representative of all Peruvian children, but it does provide adequate information to investigate the effects of specific policies.

4.1 Variables

Table 1 summarizes the data used in the analysis, and shows the mean for indigenous and non-indigenous students, and the difference between those two groups. Children in different grades were administered different achievement tests in both mathematics and language. I therefore only include children who were in grade four of primary school during the school level round. The final sample includes 1077 children, where 18 percent, or 197 children, are indigenous. Table 2 summarizes the data for the indigenous children only, divided into the 91 children who attend EIB schools, and the 106 children who attend Spanish-medium schools.

4.1.1 Outcome Variables

The outcome variables used in this research are the students' scores on mathematics and language tests administered during the school round. Both tests were administered in Spanish (Guerrero et al. 2012). To simplify interpretation, I have transformed the achievement scores to z-scores with mean zero and standard deviation one.

The mathematics test focused on number and number sense, with 37 items from national standardized tests, national evaluations and YL's previous achievement tests. The children had 60 minutes to finish the test (Guerrero et al. 2012). For each item, the school survey reports whether each student's answer is correct, incorrect, or blank. For the purpose of this research, I record a blank answer as an incorrect answer. Figure 1 shows the distribution of mathematics z-scores for indigenous and non-indigenous children in the sample. Indigenous children's achievement is clearly left-skewed, with a majority of children performing below the sample average. Non-indigenous children's achievement is more evenly distributed across the mean but slightly right-skewed. Table 1 shows that the mean difference between the mathematics scores obtained by indigenous and non-indigenous children in the sample is 0.9 standard deviations, and significant at the one percent level. This is larger than the Peruvian test score gap in mathematics that Sakellariou (2008) finds using data collected in 1997. This may indicate an increasing test score gap in Peru, or it may be due to the fact that the YL school survey is not a representative sample. Table 2 shows that indigenous children in EIB schools score about 0.14 standard deviations worse on the mathematics test, compared to indigenous children in Spanish-medium schools, but this difference is not significant.

The language test focused on written communication, with 27 items from national standardized tests and national evaluations. The children had 60 minutes to finish the test (Guerrero et al. 2012). Like for the mathematics test, the school survey reports whether each student's answer is correct, incorrect, or blank, and I record a blank answer as an incorrect answer. Figure 2 shows the distribution of language z-scores for indigenous and non-indigenous children in the sample. Like for the mathematics scores, indigenous children's language scores are clearly left-skewed, with most children performing below the sample mean. Non-indigenous children's achievement is clearly right-skewed, with most children performing above the sample average. Table 1 shows that the mean difference between the language z-scores obtained by indigenous and non-indigenous children in the sample is 1.14 standard deviations, and that the difference is significant at the one percent level. Like for the mathematics scores, this is larger than the difference of 0.83 standard deviations that Sakellariou (2008) reports for language scores. Table 2 shows that indigenous children in EIB schools score about 0.3 standard deviations worse on the language test than indigenous children in Spanish-medium schools, and the difference is significant at the five percent level.

4.1.2 Bilingual Education

Figures 3-5 show the distribution of children in EIB schools and schools with teachers that are trained in EIB teaching, and the overlap of those two categories. Ninety-one children attend EIB schools. This corresponds to 8 percent of the whole sample, and 46 percent of the indigenous children. Fifty-seven indigenous children attend schools with teachers that are trained in EIB teaching, corresponding to five percent of the whole sample, and 29 percent of the indigenous children.

4.1.3 Control Variables

Table 1 shows that the difference between indigenous and non-indigenous students for control variables is consistent with a priori expectations. Indigenous children are less likely to have attended pre-school, and more likely to have repeated grades. Fewer indigenous children have no siblings, and indigenous parents have lower levels of education in general. Indigenous students attend schools with less educated principals and whose teachers have fewer years of experience. Indigenous students attend schools with more student absenteeism, that are smaller, more likely to be rural, and less likely to be private.

Indigenous students attend schools with worse infrastructure and less access to resources in general, which likely corresponds to Peruvian indigenous people's higher rates of poverty. Controlling for school-quality variables may therefore adequately account for wealth effects. The differences between the resources of the schools that indigenous and non-indigenous children attend exhibit a similar pattern; indigenous children are significantly less likely to attend a school with access to tap water, a phone, the internet, toilets, a library, dictionaries and/or encyclopedias, books, and computers. The indigenous children's school-level wealth and housing quality averages were significantly lower in both 2006 and 2009, compared to non-indigenous children's.

Table 2 shows that indigenous students in EIB schools are generally worse off than indigenous students in Spanish-medium schools. Indigenous students in EIB schools are less likely to have attended pre-school, more likely to have repeated grades, and have parents with fewer years of education in general. The EIB schools' principals are less educated, and the mathematics teachers have fewer years of experience, while there is no significant difference in the years of experience of the language teachers in EIB schools and Spanish-medium schools. EIB schools are smaller and are more likely to be rural.

Table 2 shows that, when comparing the schools that the indigenous children attend, EIB schools have worse infrastructure and fewer resources, except for the quality of floor and roof materials. This suggests that indigenous children in EIB schools on average live in poorer communities and have higher rates of poverty than indigenous children who attend Spanish-medium schools. Indigenous EIB students are less likely to attend a school with access to tap water, a phone, the internet, toilets, or dictionaries and/or encyclopedias. The indigenous children in EIB school's school-level wealth and housing quality averages were lower in both 2006 and 2009, compared to indigenous children in Spanish-medium schools, although the difference in the average household quality index is not significant for 2006.

Table 3 presents the differences of the school-level variables for EIB schools, and Spanish-medium schools that indigenous children attend. In every case where the difference is significant at least at the ten percent level, EIB schools appear to have worse infrastructure and fewer resources, compared to Spanish medium schools. EIB schools tend to be smaller and are more likely to be rural. Spanish-medium schools attended by indigenous children are more likely to have tap water, a phone, toilets, and dictionaries and/or encyclopedias, and have students with higher average wealth indices in 2009, and higher wealth and household quality indices in 2006.

5. Analysis

5.1 Results

5.1.1 Mathematics Scores

Table 4 presents the results for mathematics achievement, when the explanatory variable of interest is whether an indigenous child attends an EIB school. Column one in Table 4 shows that when not controlling for any other variables, attending an EIB school does not affect indigenous children's mathematics achievement significantly, while indigenous children in general score significantly lower than non-indigenous children. The same is true when controlling for student characteristics and parents' level of education, as column two in Table 4 shows. When controls for teacher and school characteristics are added, as in column three in Table 4, the effect of attending an EIB school becomes positive and significant. The positive effect of attending an EIB school on indigenous children's mathematic achievement increases and becomes more significant when wealth controls are also included, as in column four. Since EIB schools in general have worse infrastructure and fewer resources, this indicates that indigenous children in EIB schools achieve significantly better in mathematics, compared to indigenous children who attend Spanish-medium schools with similar levels of wealth. Column four in Table 4 shows that, conditional on all control variables specified for the model, indigenous children who attend EIB schools score 0.48 standard deviations better on the mathematics test, compared to indigenous students in Spanish-medium schools. This corresponds to about half of the difference in mathematics achievement between indigenous and non-indigenous children reported in Table 1. The coefficient is significant at the one percent level. Comparing columns one and four in Table 4 shows that student characteristics, parent's level of education, teacher and school characteristics and wealth account for almost the entire negative effect of indigenous status on mathematics achievement. This corresponds to previous research in Peru, which finds that indigenous status does not affect mathematics test scores negatively, when controlling for student, family, school and peer characteristics (Sakellariou 2008).

Table 5 presents the results for mathematics achievement, when the explanatory variable of interest is whether an indigenous child attends a school whose teachers have been trained in EIB teaching. Columns one, two, three and four in Table 5 exhibit the same pattern as in Table 4, except that the effect of attending a school whose teachers have been trained in EIB teaching is larger and becomes positive and more significant with less control variables compared to when the explanatory variable of interest is whether an indigenous child attends an EIB school. Column four in Table 5 shows that, conditional on all control variables, indigenous children who attend schools with teachers who are trained in EIB teaching score 0.73 standard deviations better on the mathematics test, compared to indigenous students in Spanish-medium schools or in other EIB schools. This corresponds to almost 80 percent of the difference in mathematics achievement between indigenous and non-indigenous children reported in Table 1. The coefficient is significant at the one percent level.

The effect of attending an EIB school, or a school whose teachers are trained in EIB teaching, on the mathematics scores, is not sensitive to the definition of indigenous status[16], and remains at least equally large when restricting the sample to only children with two parents who speak Quechua. The results are not sensitive to the specification of teacher and school characteristics[17] and remain when including location controls[18]. Including the 15 non-indigenous children who attend EIB schools in the estimation and identifying the effect of bilingual education for indigenous

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[16] Changing the definition to include all children with parents who speak any indigenous language strengthens the coefficient on 'EIB School' and 'Teachers Are Trained in EIB Teaching', while changing the definition to include all children with a mother who speaks Quechua, weakens the coefficients. Each coefficient maintains its significance using either definition of indigenous status

[17] Adding additional controls for full grade school, school shift, number of class hours per day, number of weeks that the school is opened per year, and the mathematics teacher's level of education does not affect the coefficient on 'EIB School', decreases the coefficient on 'Teachers Are Trained in EIB Teaching' slightly (-0.056), and does not affect the significance of either coefficient.

[18] The schools in the final sample are located in seven different provinces and nine different departments.

children by interacting 'Indigenous' with 'EIB School' or 'Teachers Are Trained in EIB Teaching' does not change the results qualitatively[19]. Although the outcome variable of interest is likely biased due to collinearity with the main effect.

Analyzing the results obtained for the fully specified model when restricting the sample to only the children who took part in YL's previous household surveys reveals that including the CDA scores obtained before entering school reduces the size of the coefficient on 'EIB School' only slightly[20] and does not affect the coefficient on 'Teachers Are Trained in EIB Teaching'. Including mathematics scores obtained when the children were in second grade reduces the coefficient on 'EIB School' and 'Teachers Are Trained in EIB Teaching' by 38 and 25 percent respectively. This suggests that the coefficients on bilingual education reported in Tables 4 and 5 are the results of benefits accumulated throughout the school years.

In the fully specified model presented in Tables 4 and 5, the signs of the other coefficients that are significant at least at the ten percent level, correspond with a priori expectations. Female students score about 0.13 standard deviations lower on the mathematics test. This is a larger negative effect of being female than previous research finds in Chile, Bolivia and Peru (McEwan 2008; 2004; Sakellariou 2008) but corresponds to that found in Guatemala (Marshall 2008). Students who attended pre-school, or do not live with any siblings, score about 0.2 and 0.15 standard deviations higher, while students who have repeated at least one grade score about 0.12-0.13 standard deviations worse. Students with mothers who have post-secondary education score about a 0.30-0.37 standard deviations higher, while fathers' post-secondary

[19] The interaction between 'EIB School' and indigenous status receives a coefficient of 0.46, and the interaction of 'Teachers Are Trained in EIB Teaching' receives a coefficient of 1.42, both significant at the five percent level. The main effect of 'EIB School' and 'Teachers Are Trained in EIB Teaching' receive statistically insignificant coefficients.
[20] The coefficient changes by -0.034 standard deviations.

education is only significant when the independent variable is 'Teachers Are Trained in EIB Teaching'.

The principal's level of education, and the mathematics teacher's years of experience do not influence mathematics scores. Having a female teacher is associated with about 0.1 standard deviations higher scores. This contradicts previous evidence from Peru (Sakellariou 2008), and is somewhat surprising since the higher fraction of female teachers in general could indicate that the men who do select into teaching are more motivated. Attending a school with students who have been absent during the past 30 days decreases mathematics scores with about 0.21 standard deviations, while attending a larger school, as measured by student-teacher ratio and number of classrooms, increases mathematics scores. Students in private schools score about 0.75 standard deviations better, while students in rural schools score 0.19-0.27 standard deviations worse.

5.1.2 Language Scores

Table 6 presents the results for language achievement, when the explanatory variable of interest is whether an indigenous child attends an EIB school. Column one in Table 6 shows that when not controlling for any other variables, the effects of attending an EIB school and being indigenous are both negative and significant. Column two, three and four in Table 6 show that the effect of attending an EIB school is statistically insignificant, when controlling for student characteristics and parent's level of education, teacher and school characteristics, and wealth. Column four in Table 6 shows that, conditional on all the control variables, indigenous children in EIB schools score 0.21 standard deviations better than indigenous children in Spanish-medium schools. This corresponds to 18 percent of the difference in language scores between indigenous and non-indigenous children reported in Table 1, but the coefficient is significant only at the 14 percent level.

Table 7 presents the results for language achievement when the explanatory variable of interest is whether an indigenous child attends a school whose teachers have been trained in EIB teaching. Column one in Table 7 shows that when not controlling for any other variables, the effects of attending a school whose teachers have been trained in EIB teaching and being indigenous are negative. Column two in Table 7 shows that when controlling for child's characteristics and parent's level of education, the effect of attending a school whose teachers have been trained in EIB teaching becomes positive. This effect becomes stronger and more significant in column three, when also controlling for teacher and school characteristics. Column four in Table 7 shows that, when also including wealth controls, indigenous children in schools whose teachers are trained in EIB teaching score 0.35 standard deviations better than indigenous children in other EIB schools or Spanish-medium schools. This corresponds to almost a third of the difference in language scores between indigenous and non-indigenous children reported in Table 1 and the coefficient is significant at the five percent level.

The level of significance of the coefficient on 'EIB School', presented in Table 6, increases when restricting the sample to only indigenous children, changing the definition of indigenous to having a mother who speaks Quechua, or including location controls. When including all children whose two parents speak any native language in the definition of indigenous status, or including additional school and teacher controls, the significance level decreases, but is never below ten percent.

The results of the fully specified model for 'Teachers Are Trained in EIB Teaching', presented in Table 7, are not sensitive to the definition of indigenous status[21], or to restricting the sample to only include children whose two parents speak Quechua. The magnitude and significance of the coefficient is somewhat sensitive to the specification of school and teacher characteristics[22], but only increases when including location controls.

Including the 15 non-indigenous children who attend EIB schools in the estimation and identifying the effect of bilingual education for indigenous children by interacting ‘Indigenous’ with ‘EIB School’ or ‘Teachers Are Trained in EIB Teaching’ does not change the results qualitatively[23]. Although, the outcome variable of interest is likely biased due to collinearity with the main effect.

Analysis of the results obtained for the fully specified model when restricting the sample to only the children who took part in YL’s previous household surveys reveals that including the PPVT scores obtained before entering school reduces the size of the coefficient on ‘Teachers Are Trained in EIB Teaching’ only slightly[24] and does not affect the coefficient on ‘EIB School’. Including language scores obtained when the children were in second grade reduces the coefficient on ‘‘Teachers Are Trained in EIB Teaching’ and ‘EIB School’ by a quarter and a fifth, respectively. This suggests that the coefficients on bilingual education reported in Tables 6 and 7 are the results of benefit accumulated throughout the school years.

[21] Changing the definition to include all children with parents who speak any indigenous language, or to include all children with a mother who speaks Quechua, weakens the coefficient and significance only slightly.

[22] Including controls for full grade school, school shift, number of class hours per day, number of weeks that the school is opened per year, and language teacher’s level of education decreases the coefficient on ‘Teachers Are Trained in EIB Teaching’ to 0.31 and increases the level of significance to the 8 percent level.

[23] The interaction between ‘EIB School’ and indigenous status receives a coefficient of 0.23, which is statistically insignificant, and the interaction of ‘Teachers Are Trained in EIB Teaching’ receives a coefficient of 0.80, which is significant at the one percent level. The main effect of ‘EIB School’ and ‘Teachers Are Trained in EIB Teaching’ receive statistically insignificant coefficients.

[24] The coefficient changes by -0.032 standard deviations.

Like for the mathematics scores, the signs of the other coefficients in the fully specified model presented in Column 4 in Tables 6 and 7 correspond to a priori expectations. Indigenous children score 0.27 standard deviations worse than their Hispanic counterparts, conditional on all control variables. This indicates that wealth does not fully explain the negative effect of being indigenous on language scores. The fact that indigenous status has no effect on mathematics scores in the fully specified model, but it does for language scores, may indicate that taking a language test in another than one's native language implies a greater disadvantage compared to a mathematics test.

There is no significant difference between male and female students' language achievement. This corresponds with previous research from Bolivia (McEwan 2004), but contradicts previous findings from Peru, which finds that female students achieve better than their male counterparts in language tests (Sakellariou 2008), and research from Guatemala which finds the opposite (Marshall 2009).

Students who have attended pre-school score about 0.14 standard deviations better, while students who have repeated at least one grade score about 0.12 standard deviations worse. Having a mother whose education is one to five years, six to eleven years, or post-secondary, increases the score by about 0.4, 0.4 and 0.6 standard deviations respectively. Father's education does not affect language scores significantly. Having a female language teacher increases language scores by about 0.16 standard deviations. Like for the mathematics scores, this contradicts previous results from Peru (Sakellariou 2008). Attending a school were students have been absent during the past 30 days decreases languages scores by about 0.26 standard deviations, while larger student-teacher ratios increases scores. Private schools are associated with about 0.45 standard deviations higher scores. Comparing column 3 and 4 in Tables 5 and 6 reveals that controlling for wealth accounts for almost the entire negative effect of attending a rural school.

5.2 Robustness

Qualitative evidence suggests that EIB schools often lack sufficient resources to fully implement the program (Garcia 2010; Montoya Rojas 2001; DIGEIBIR 2005; Kudó 2004; Trapnell 2003). Despite this, it is possible that EIB schools, and especially schools that are more invested in implementing the EIB program, have access to resources, or additional support, not accounted for in the fully specified model. I test the hypothesis that the effect of attending an EIB school on indigenous students' achievement presented in Tables 4-7 is explained by additional community, parent and state support[25], teachers' resources[26], superior quality of the principal's management[27], or personnel, materials and other resources not accounted for in the main estimations[28], by including variables accounting for these factors in the full model. Tables 8-11, in Appendix A, present the results.

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[25] The variables used to measure additional community and state support are: dummy variables for whether there is a community organization that helps with the management of the school, if the school has received a visit from the Local Education Management Unit (UGEL), and whether the school has received a visit from the Regional Office of Education (DRE), whether the school receives private or public support, whether the school has a parent's association, and continuous variables of the frequency of visits from educational experts, meetings in the parent's association, and annual payment to the parents' association.

[26] Variables used to measure teacher's support are: dummy variables for whether there is a teacher's association and an institutional education council (CONEI), a continuous variable of how often the teacher's association meets, and whether the mathematics (language) teacher has received training during the past two years, have access to teacher assistance and whether the mathematics (language) teacher entered the teachers' professional career.

[27] Variables used to measure the quality of management are: dummy variables for the frequency of principal's meeting with the teachers and whether the principal has been absent from the school during the past 30 days and eleven continuous variables measuring the principal's managerial qualities, as indicated by the mathematics teacher (The mathematics teacher answered eleven questions about the principal in the form "In meetings, the headmaster discusses educational goals with teachers: 1: never, 2: seldom, 3: quite often, 4: very often").

[28] The variables included measuring additional resources are: dummy variables for whether the school offers lunch and breakfast, whether the school has nurses, whether

Table 8 presents the results for the effect of attending an EIB school on mathematics achievement. Columns 1-4 show that the coefficient on ‘EIB School’ decreases by 0.03 standard deviations when variables accounting for community, parents’ and state support are included, but only increases when including variables measuring teachers’ support, the quality of the school’s management, and availability of personnel, materials and other resources. Each coefficient on ‘EIB School’ in Columns 1-4 is significant at the one percent level.

Table 9 presents the results for the effect of attending a school whose teachers are trained in EIB teaching on mathematics achievement. Columns 1-4 show that the coefficient on ‘Teachers Are Trained in EIB Teaching’ only strengthens when controls for community, parent and state support, teachers’ resources, the quality of the school’s management, and availability of personnel, materials and other resources are included in the estimation. Each coefficient on ‘Teachers Are Trained in EIB Teaching’ in Columns 1-4 is significant at the one percent level.

Table 10 presents the results for the effect of attending an EIB school on language achievement. Columns 1-4 show that the effect is rather stable both in size and significance when introducing additional controls. None of the robustness estimations cause the coefficient to be statistically significant.

Table 11 presents the results for the effect of attending a school whose teachers are trained in EIB teaching on language achievement. Column 1 shows that including controls for community, parents’ and state support decreases the coefficient by 0.01 standard deviations, and increases the level of significance to the ten percent level. Significance and the size of the coefficient only increase when including variables measuring teachers’ support, the quality of the school’s management, and availability of personnel, materials and other resources.

6. Conclusion

This research investigates the effect of the Peruvian EIB program on the academic achievement of indigenous children in fourth grade of primary school. The results show that indigenous children who attend EIB schools score about 0.48 standard deviations better in mathematics than indigenous children who attend Spanish-medium schools. Indigenous children who attend schools whose teachers are trained in EIB teaching score 0.73 standard deviations better in mathematics than indigenous children who attend Spanish-medium schools or EIB schools whose teachers are not trained in EIB teaching. The effect of attending an EIB school corresponds to about half of the difference in mathematics achievement between indigenous and non-indigenous children. The effect of attending a school whose teachers are trained in EIB teaching corresponds to about four fifths of that difference.

The results of attending an EIB school, or a school whose teachers are trained in EIB teaching, on mathematics achievement are not sensitive to the definition of indigenous status or specification of the control variables. Although lagged test scores are only available for a subset of the children in the data, there is no evidence that quantitative ability achieved prior to entering school would explain the effect of attending an EIB school on mathematics scores. Including test scores attained when the children were in second grade reduces the magnitude of the coefficient obtained for 'EIB School' and 'Teachers Are Trained in EIB Teaching' by 38 and 25 percent, respectively. This suggests that the positive effect that bilingual education has on indigenous students' mathematics achievement in grade four, may be the result of benefit accumulated over time. Further research into this topic is needed in order to make firm conclusions about this.

The magnitude and significance of the coefficients obtained for 'EIB School' and 'Teachers Are Trained in EIB Teaching' for the mathematics scores are robust. When adding additional controls measuring community and state support, teachers' resources, the quality of the principal's management, or additional personnel, materials and other resources, only the coefficient on 'EIB School' decreases by 0.03 standard deviations and only when controlling for additional community and state support.

This research finds only a weakly significant positive effect of attending an EIB school on indigenous children's language achievement. These results are not sensitive to the definition of indigenous status, specification of the control variables, or the additional controls investigated in the robustness analysis.

This research finds that indigenous children who attend a school whose teachers are trained in EIB teaching have 0.35 standard deviations higher language achievement than indigenous children in Spanish-medium schools or EIB schools without teachers who are trained in EIB teaching. This corresponds to almost a third of the difference in language scores between indigenous and non-indigenous children. The effect of attending a school whose teachers are trained in EIB teaching on language achievement is not sensitive to the definition of indigenous status, but is somewhat sensitive to the specification of the control variables. The size of the coefficient decreases by 0.04 standard deviations and the statistical significance increases to the eight percent level when including controls for full grade school, school shift, number of class hours per day, number of weeks that the school is opened per year, and language teacher's level of education. The magnitude of the effect of attending a school whose teachers are trained in EIB teaching on indigenous children's language achievement is robust, but its level of significance increases to the ten percent level when including controls for support from the community, parents and the state.

Although lagged test scores are only available for a subset of the children in the data, there is no evidence that language ability achieved prior to entering school would explain the effect of attending a school whose teachers are trained in EIB teaching on language achievement. Including test scores attained when the children were in second grade reduces the coefficient on 'Teachers Are Trained in EIB Teaching' by a quarter, suggesting that the positive effect on language achievement found for fourth grade students may be the result of benefit accumulated over time.

The presented results have several implications for the EIB program in Peru. Firstly, this is, to my knowledge, the first quantitative analysis of the program's impact on indigenous students' academic achievement. According to my results, the EIB program, and especially schools with teachers that are trained in EIB teaching, has the potential to contribute significantly to indigenous students' academic achievement, and closing the indigenous test score gap, in both mathematics and language. Despite the positive results, the obstacles of implementing the program discussed above seem to be present in YL's school sample. Fifteen of the sixteen EIB principals that YL surveyed agreed that bilingual teaching materials were lacking, and all agreed that more bilingual teacher-training was needed. In fourteen of the sixteen EIB schools, lacking parents' support was an obstacle for implementation.

Several other Latin American countries with large indigenous populations implement their own versions of the EIB program, with varying degrees of community and parental involvement (Garcia 2010). To my knowledge, the economic literature has as of yet not analyzed these programs' results. Comparative analysis of the different systems could reveal which style of implementation increases academic achievement the most.

The results presented above suggest that the positive effect of attending EIB schools on mathematics achievement is larger when including indigenous children of several native languages, as opposed to only Quechua speaking children, in the estimation. Since only 33 indigenous children are non-Quechua speakers, it would be premature to conclude that the EIB program has stronger positive effects on indigenous children of other native languages than Quechua. Further research should investigate whether there is evidence for this, and whether the higher level of community involvement in other indigenous communities contributes to higher test scores.

In order to further investigate the effect of bilingual education on language abilities, researchers should aim to use language tests in the children’s native language. Since the tests used for this research were administered in Spanish, they may be measuring to what extent the children have acquired Spanish as a second language, as opposed to developed general language and communication skills.

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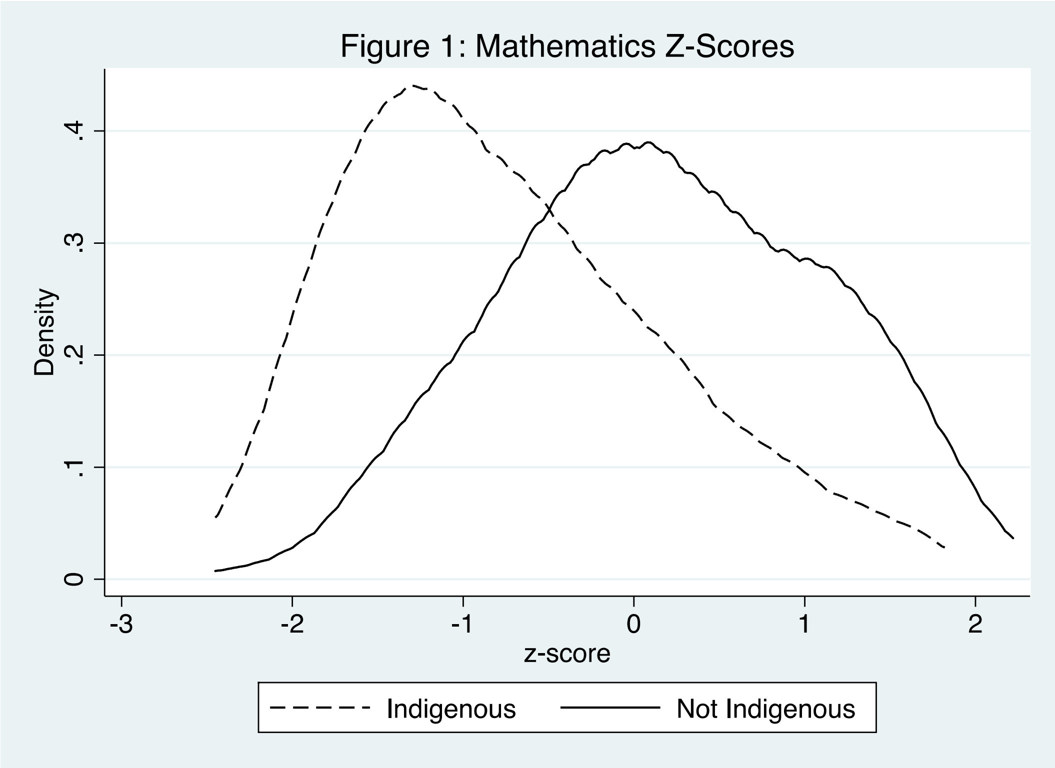
Figure 1: Mathematics Z-Scores
Density
0
.1
.2
.3
.4
-3
-2
-1
0
1
2
z-score
Indigenous
Not Indigenous

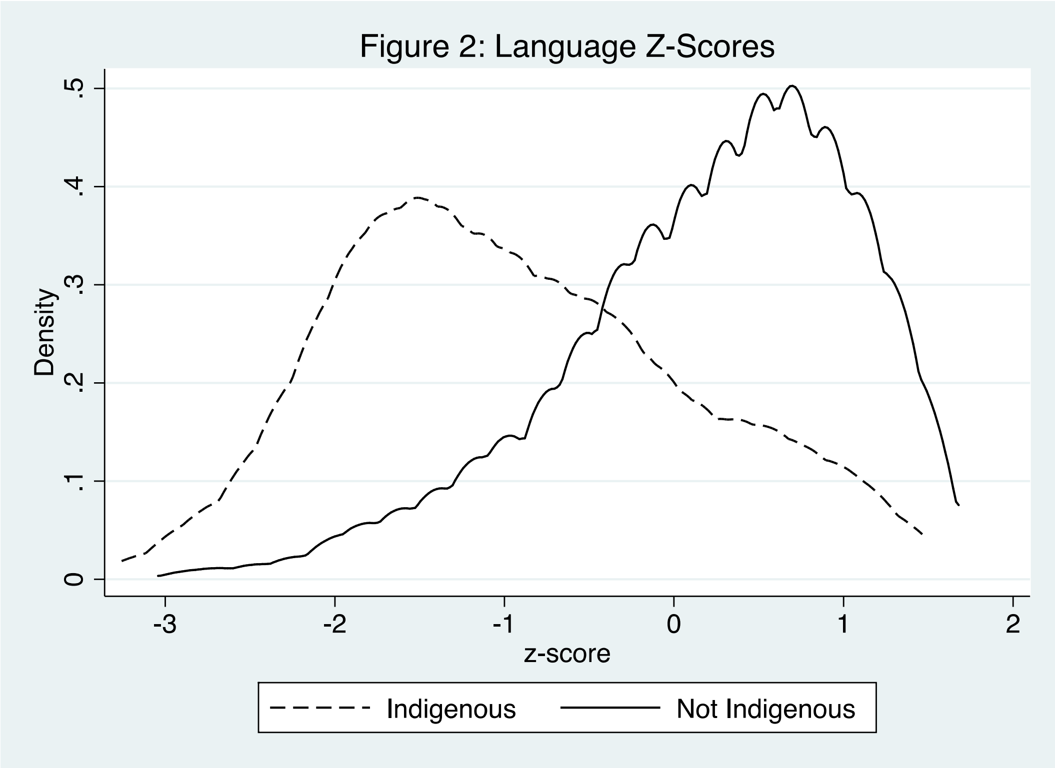
Figure 2: Language Z-Scores
Density
0
.1
.2
.3
.4
.5
-3
-2
-1
0
1
2
z-score
Indigenous
Not Indigenous

Table 1: Summary Statistics

	All Children		Not Indigenous		Indigenous		
Variables	**Obs.**	**Mean**	**Obs.**	**Mean**	**Obs.**	**Mean**	**Difference**
Math Z Score	1077	0	880	0.167	197	-0.748	0.915***
Language Z Score	1077	0	880	0.209	197	-0.934	1.143***
Indigenous	1077	0.183	880	0	197	1	-1***
EIB School	1077	0.084	880	0	197	0.462	-0.462***
Teachers Are Trained in EIB Teaching	1077	0.053	880	0	197	0.289	-0.289***
Female Student	1077	0.509	880	0.503	197	0.533	-0.03
Student Attended Pre-School	1077	0.798	880	0.852	197	0.553	0.299***
Repeated At Least One Grade	1077	0.173	880	0.131	197	0.360	-0.230***
No Co-Habitational Siblings	1077	0.124	880	0.135	197	0.076	0.059**
Mother Has 1 to 5 Years of Education	1077	0.260	880	0.226	197	0.411	-0.185***
Mother has 6 to 11 Years of Education	1077	0.500	880	0.551	197	0.269	0.282***
Mother Has Post-Secondary Education	1077	0.158	880	0.191	197	0.010	0.181***
Father Has 1 to 5 Years of Education	1077	0.233	880	0.189	197	0.432	-0.243***
Father has 6 to 11 Years of Education	1077	0.539	880	0.567	197	0.416	0.151***
Father Has Post-Secondary Education	1077	0.190	880	0.225	197	0.036	0.189***
Principal has Post Secondary Education	1077	0.401	880	0.440	197	0.228	0.211***
Math Teacher's Years of Experience	1077	11.759	880	12.236	197	9.624	2.612***
Language Teacher's Years of Experience	1077	11.702	880	11.933	197	10.67	1.263**
Math Teacher is Female	1077	0.657	880	0.644	197	0.716	-0.071*
Language Teacher is Female	1077	0.664	880	0.635	197	0.792	-0.157***
Students Absent Past 30 Days	1077	0.496	880	0.494	197	0.503	-0.008
Student-Teacher Ratio	1077	22.11	880	22.794	197	19.10	3.694***
Number of Classrooms	1077	16.53	880	18.111	197	9.498	8.614***
Private School	1077	0.100	880	0.122	197	0.005	0.117***

Rural	1077	0.217	880	0.126	197	0.624	-0.498***
Floor: Cement	1077	0.857	880	0.842	197	0.924	-0.082***
Floor: Tile	1077	0.116	880	0.142	197	0.000	0.142***
Roof: Cement	1077	0.480	880	0.563	197	0.112	0.451***
Roof: Wood	1077	0.458	880	0.39	197	0.761	-0.372***
Roof: Cane	1077	0.018	880	0.022	197	0.000	0.022**
Roof: Tile	1077	0.045	880	0.026	197	0.127	-0.101***
Wall: Brick or Treated Wood	1077	0.865	880	0.965	197	0.421	0.544***
Pilón de Agua	1077	0.020	880	0.014	197	0.051	-0.037***
Water Well	1077	0.124	880	0.057	197	0.426	-0.369***
Tap Water	1077	0.855	880	0.93	197	0.523	0.407***
School Has Electricity	1077	0.993	880	0.992	197	0.995	-0.003
School Has Phone	1077	0.661	880	0.759	197	0.223	0.536***
School Has Internet	1077	0.639	880	0.700	197	0.366	0.335***
School Has Toilet	1077	0.782	880	0.877	197	0.355	0.522***
School Has Library	1077	0.526	880	0.566	197	0.350	0.216***
School Has Dictionary and/or Encyclopedia	1077	0.831	880	0.867	197	0.670	0.197***
School Has Books	1077	0.766	880	0.777	197	0.716	0.062*
School Has Computers	1077	0.765	880	0.802	197	0.599	0.203***
School Has Calculators	1077	0.421	880	0.411	197	0.462	-0.051
Average Wealth Index 2009	1077	0.602	880	0.646	197	0.403	0.244***
Average Housing Quality Index 2009	1077	0.484	880	0.526	197	0.295	0.231***
Average Wealth Index 2006	1077	0.524	880	0.571	197	0.315	0.256***
Average Housing Quality Index 2006	1077	0.434	880	0.468	197	0.285	0.183***

Note: Significance at the 1, 5, and 10 percent levels indicated by ***, ** and *, respectively.

Source: Young Lives Peru 2011 School Survey, and Young Lives Peru 2009 and 2006 Household Level Survey

Table 2: Summary Statistics

	All Indigenous Children		Spanish Medium School		EIB School		
Variables	**Obs.**	**Mean**	**Obs.**	**Mean**	**Obs.**	**Mean**	**Difference**
Math Z Score	197	-0.748	106	-0.685	91	-0.822	0.137
Language Z Score	197	-0.934	106	-0.797	91	-1.092	0.295**
Indigenous	197	1	106	1	91	1	0
EIB School	197	0.462	106	0	91	1	-1
Teachers Are Trained in EIB Teaching	197	0.289	106	0	91	0.626	-0.626***
Female Student	197	0.533	106	0.547	91	0.517	0.031
Student Attended Pre-School	197	0.553	106	0.623	91	0.473	0.150**
Repeated At Least One Grade	197	0.360	106	0.264	91	0.473	-0.208***
No Co-Habitational Siblings	197	0.076	106	0.066	91	0.088	-0.022
Mother Has 1 to 5 Years of Education	197	0.411	106	0.453	91	0.363	0.090
Mother has 6 to 11 Years of Education	197	0.269	106	0.330	91	0.198	0.132**
Mother Has Post-Secondary Education	197	0.010	106	0.019	91	0.000	0.019
Father Has 1 to 5 Years of Education	197	0.431	106	0.340	91	0.539	-0.199***
Father has 6 to 11 Years of Education	197	0.416	106	0.491	91	0.330	0.161**
Father Has Post-Secondary Education	197	0.036	106	0.047	91	0.022	0.025
Principal has Post Secondary Education	197	0.228	106	0.406	91	0.022	0.384***
Math Teacher's Years of Experience	197	9.624	106	11.019	91	8.000	3.019***
Language Teacher's Years of Experience	197	10.670	106	11.000	91	10.286	0.714
Math Teacher is Female	197	0.716	106	0.726	91	0.703	0.023
Language Teacher is Female	197	0.792	106	0.745	91	0.846	-0.101*
Students Absent Past 30 Days	197	0.503	106	0.481	91	0.528	-0.046
Student-Teacher Ratio	197	19.100	106	20.931	91	16.967	3.964***
Number of Classrooms	197	9.497	106	12.170	91	6.385	5.785***

Private School	197	0.005	106	0.009	91	0.000	0.009
Rural	197	0.624	106	0.500	91	0.769	-0.269***
Floor: Cement	197	0.924	106	0.877	91	0.978	-0.101***
Floor: Tile	197	0.000	106	0.000	91	0.000	0.000
Roof: Cement	197	0.112	106	0.189	91	0.022	0.167***
Roof: Wood	197	0.761	106	0.736	91	0.791	-0.055
Roof: Cane	197	0.000	106	0.000	91	0.000	0.000
Roof: Tile	197	0.127	106	0.076	91	0.187	-0.111**
Wall: Brick or Treated Wood	197	0.421	106	0.566	91	0.253	0.313***
Pilón de Agua	197	0.051	106	0.094	91	0.000	0.094***
Water Well	197	0.426	106	0.293	91	0.582	-0.290***
Tap Water	197	0.523	106	0.613	91	0.418	0.196***
School Has Electricity	197	0.995	106	0.991	91	1.000	-0.009
School Has Phone	197	0.223	106	0.396	91	0.022	0.374***
School Has Internet	197	0.365	106	0.425	91	0.297	0.128*
School Has Toilet	197	0.355	106	0.472	91	0.220	0.252***
School Has Library	197	0.350	106	0.349	91	0.352	-0.003
School Has Dictionary and/or Encyclopedia	197	0.670	106	0.887	91	0.418	0.469***
School Has Books	197	0.716	106	0.745	91	0.681	0.064
School Has Computers	197	0.599	106	0.632	91	0.560	0.072
School Has Calculators	197	0.396	106	0.387	91	0.407	-0.020
Average Wealth Index 2009	197	0.403	106	0.425	91	0.378	0.047**
Average Housing Quality Index 2009	197	0.295	106	0.327	91	0.258	0.069***
Average Wealth Index 2006	197	0.315	106	0.339	91	0.287	0.052**
Average Housing Quality Index 2006	197	0.285	106	0.294	91	0.276	0.018

Note: Significance at the 1, 5, and 10 percent levels indicated by ***, ** and *, respectively.

Source: Young Lives Peru 2011 School Survey, and Young Lives Peru 2009 and 2006 Household Level Survey

Table 3: Summary Statistics, Schools Attended by Indigenous Children

	Spanish-medium Schools		EIB Schools		
	Obs.	**Mean**	**Obs.**	**Mean**	**Difference**
Student-Teacher Ratio	27	20.872	13	17.410	3.462*
Number of Classrooms	27	14.370	13	5.923	8.447**
Private School	27	0.037	13	0.000	0.037
Rural	27	0.482	13	0.769	-0.288*
Floor: Cement	27	0.889	13	0.923	-0.034
Floor: Tile	27	0.074	13	0.077	-0.003
Roof: Cement	27	0.296	13	0.077	0.219
Roof: Wood	27	0.630	13	0.846	-0.217
Roof: Cane	27	0.000	13	0.000	0.000
Roof: Tile	27	0.074	13	0.077	-0.003
Wall: Brick or Treated Wood	27	0.630	13	0.231	0.399**
Pilón de Agua	27	0.037	13	0.000	0.037
Water Well	27	0.185	13	0.539	-0.353**
Tap Water	27	0.778	13	0.462	0.3162**
School Has Electricity	27	0.963	13	1.000	-0.037
School Has Phone	27	0.482	13	0.077	0.405**
School Has Internet	27	0.482	13	0.231	0.251
School Has Toilet	27	0.593	13	0.231	0.362**
School Has Library	27	0.407	13	0.231	0.177
School Has Dictionary and/or Encyclopedia	27	0.889	13	0.462	0.427***
School Has Books	27	0.778	13	0.692	0.086
School Has Computers	27	0.593	13	0.539	0.054
School Has Calculators	27	0.482	13	0.385	0.097
Average Wealth Index 2009	27	0.372	13	0.243	0.129*
Average Housing Quality Index 2009	27	0.308	13	0.250	0.058
Average Wealth Index 2006	27	0.464	13	0.347	0.116*
Average Housing Quality Index 2006	27	0.361	13	0.248	0.114*

Note: Significance at the 1, 5, and 10 percent levels indicated by ***, ** and *, respectively.
Source: Young Lives Peru 2011 School Survey, and Young Lives Peru 2009 and 2006 Household Level Survey

Figure 3: Distribution of Children in EIB and Spanish-medium Schools

	Not Indigenous	Indigenous	Total
Spanish-medium School	880	106	986
EIB School	0	91	91
Total	880	197	1,077

Figure 4: Distribution of Children in Schools With Teachers That Are Trained in EIB Teaching

	Not Indigenous	Indigenous	Total
Spanish-medium School	880	140	1,020
Teachers Are Trained in EIB Teaching	0	57	57
Total	880	197	1,077

Figure 5: Overlap of EIB School and Teachers Are Trained in EIB Teaching

	Spanish-medium School	EIB School	Total
Teachers Are Not Trained in EIB Teaching	986	34	1,020
Teachers Are Trained in EIB Teaching	0	57	57
Total	986	91	1,077

Table 4: Math Z Scores

Variables	(1)	(2)	(3)	(4)
EIB School	-0.137	0.054	0.281**	0.484***
	(0.132)	(0.130)	(0.126)	(0.151)
Indigenous	-0.852***	-0.534***	-0.362***	-0.149
	(0.097)	(0.099)	(0.086)	(0.096)
Female Student		-0.115**	-0.137***	-0.139***
		(0.053)	(0.051)	(0.049)
Student Attended Pre-School		0.331***	0.235***	0.186***
		(0.074)	(0.071)	(0.071)
Repeated Grade Once		-0.280***	-0.187**	-0.134*
		(0.079)	(0.074)	(0.072)
No Co-Habitational Siblings		0.135	0.131*	0.153**
		(0.084)	(0.076)	(0.073)
Mother Has 1 to 5 Years of Education		0.124	0.083	0.033
		(0.107)	(0.108)	(0.105)
Mother has 6 to 11 Years of Education		0.243**	0.194	0.149
		(0.121)	(0.120)	(0.119)
Mother Has Post-Secondary Education		0.553***	0.433***	0.302**
		(0.152)	(0.149)	(0.147)
Father Has 1 to 5 Years of Education		-0.143	-0.107	0.001
		(0.150)	(0.148)	(0.138)
Father has 6 to 11 Years of Education		0.001	-0.047	0.081
		(0.159)	(0.156)	(0.146)
Father Has Post-Secondary Education		0.271	0.153	0.254
		(0.177)	(0.173)	(0.163)
Principal has Post Secondary Education			0.155**	0.104
			(0.060)	(0.071)
Math Teacher's Years of Experience			0.00691*	0.004
			(0.004)	(0.004)
Math Teacher is Female			0.112**	0.101*
			(0.055)	(0.061)
Students Absent Past 30 Days			-0.206***	-0.206***
			(0.053)	(0.058)
Student-Teacher Ratio			0.0132***	0.0289***
			(0.005)	(0.005)
Number of Classrooms			0.0147***	0.0191***
			(0.003)	(0.004)
Private School			0.577***	0.764***
			(0.111)	(0.126)
Rural			-0.213***	-0.185*
			(0.082)	(0.109)
Constant	0.167***	-0.340**	-0.883***	-1.430***
	(0.032)	(0.154)	(0.198)	(0.413)
Wealth Controls	No	No	No	Yes
Observations	1077	1077	1077	1077
R-squared	0.13	0.25	0.33	0.40

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 5: Math Z Scores

Variables	**(1)**	**(2)**	**(3)**	**(4)**
Teachers Are Trained in EIB Teaching	0.019	0.303**	0.614***	0.734***
	(0.153)	(0.152)	(0.151)	(0.177)
Indigenous	-0.921***	-0.577***	-0.368***	-0.139
	(0.082)	(0.087)	(0.079)	(0.094)
Female Student		-0.112**	-0.132***	-0.131***
		(0.053)	(0.051)	(0.049)
Student Attended Pre-School		0.335***	0.239***	0.204***
		(0.074)	(0.070)	(0.071)
Repeated Grade At Least Once		-0.280***	-0.174**	-0.122*
		(0.078)	(0.073)	(0.072)
No Co-Habitational Siblings		0.129	0.123	0.148**
		(0.085)	(0.075)	(0.073)
Mother Has 1 to 5 Years of Education		0.194*	0.185*	0.103
		(0.110)	(0.108)	(0.105)
Mother has 6 to 11 Years of Education		0.305**	0.279**	0.211*
		(0.123)	(0.119)	(0.117)
Mother Has Post-Secondary Education		0.614***	0.517***	0.373**
		(0.153)	(0.149)	(0.146)
Father Has 1 to 5 Years of Education		-0.152	-0.104	0.045
		(0.142)	(0.138)	(0.131)
Father has 6 to 11 Years of Education		0.005	-0.026	0.142
		(0.150)	(0.145)	(0.140)
Father Has Post-Secondary Education		0.272	0.167	0.310**
		(0.169)	(0.164)	(0.158)
Principal has Post Secondary Education			0.151**	0.113
			(0.059)	(0.071)
Math Teacher's Years of Experience			0.00612*	0.004
			(0.003)	(0.004)
Math Teacher is Female			0.126**	0.102*
			(0.055)	(0.060)
Students Absent Past 30 Days			-0.226***	-0.234***
			(0.053)	(0.057)
Student-Teacher Ratio			0.0127***	0.0263***
			(0.005)	(0.005)
Number of Classrooms			0.0147***	0.0185***
			(0.003)	(0.004)
Private School			0.570***	0.755***
			(0.111)	(0.126)
Rural			-0.265***	-0.271**
			(0.083)	(0.113)
Constant	0.167***	-0.408***	-0.962***	-1.356***
	(0.032)	(0.144)	(0.192)	(0.409)
Wealth Controls	No	No	No	Yes
Observations	1077	1077	1077	1077
R-squared	0.13	0.26	0.34	0.40

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6: Language Z Scores

Variables	**(1)**	**(2)**	**(3)**	**(4)**
EIB School	-0.295**	-0.049	0.089	0.214
	(0.142)	(0.129)	(0.128)	(0.145)
Indigenous	-1.006***	-0.694***	-0.542***	-0.278***
	(0.112)	(0.109)	(0.102)	(0.103)
Female Student		0.051	0.038	0.022
		(0.051)	(0.050)	(0.049)
Student Attended Pre-School		0.287***	0.224***	0.142*
		(0.079)	(0.077)	(0.077)
Repeated Grade At Least Once		-0.254***	-0.176**	-0.128*
		(0.086)	(0.082)	(0.077)
No Co-Habitational Siblings		0.021	0.028	0.024
		(0.077)	(0.071)	(0.070)
Mother Has 1 to 5 Years of Education		0.438***	0.382***	0.377***
		(0.115)	(0.114)	(0.115)
Mother has 6 to 11 Years of Education		0.543***	0.467***	0.417***
		(0.123)	(0.121)	(0.123)
Mother Has Post-Secondary Education		0.799***	0.661***	0.609***
		(0.151)	(0.147)	(0.147)
Father Has 1 to 5 Years of Education		-0.044	-0.037	-0.019
		(0.145)	(0.144)	(0.140)
Father has 6 to 11 Years of Education		0.047	-0.005	0.023
		(0.155)	(0.153)	(0.146)
Father Has Post-Secondary Education		0.255	0.143	0.175
		(0.169)	(0.168)	(0.161)
Principal has Post Secondary Education			0.060	0.078
			(0.061)	(0.068)
Language Teacher's Years of Experience			0.000	0.001
			(0.004)	(0.004)
Language Teacher is Female			0.085	0.171***
			(0.056)	(0.061)
Students Absent Past 30 Days			-0.227***	-0.258***
			(0.054)	(0.059)
Student-Teacher Ratio			0.00740*	0.0154***
			(0.004)	(0.006)
Number of Classrooms			0.00780**	0.003
			(0.003)	(0.004)
Private School			0.470***	0.463***
			(0.094)	(0.115)
Rural			-0.334***	-0.075
			(0.085)	(0.114)
Constant	0.209***	-0.657***	-0.771***	-1.880***
	(0.029)	(0.154)	(0.197)	(0.477)
Wealth Controls	No	No	No	Yes
Observations	1077	1077	1077	1077
R-squared	0.20	0.31	0.36	0.41

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7: Language Z Scores

Variables	(1)	(2)	(3)	(4)
Teachers Are Trained in EIB Teaching	-0.292*	0.111	0.386***	0.353**
	(0.152)	(0.139)	(0.142)	(0.168)
Indigenous	-1.058***	-0.738***	-0.578***	-0.276***
	(0.093)	(0.093)	(0.089)	(0.100)
Female Student		0.053	0.041	0.026
		(0.051)	(0.050)	(0.049)
Student Attended Pre-School		0.290***	0.228***	0.152**
		(0.079)	(0.077)	(0.078)
Repeated Grade At Least Once		-0.257***	-0.171**	-0.123
		(0.085)	(0.081)	(0.077)
No Co-Habitational Siblings		0.018	0.023	0.022
		(0.077)	(0.071)	(0.070)
Mother Has 1 to 5 Years of Education		0.475***	0.458***	0.410***
		(0.119)	(0.116)	(0.118)
Mother has 6 to 11 Years of Education		0.577***	0.532***	0.446***
		(0.126)	(0.122)	(0.125)
Mother Has Post-Secondary Education		0.832***	0.724***	0.641***
		(0.153)	(0.148)	(0.149)
Father Has 1 to 5 Years of Education		-0.055	-0.047	0.001
		(0.143)	(0.142)	(0.140)
Father has 6 to 11 Years of Education		0.041	-0.002	0.052
		(0.153)	(0.150)	(0.147)
Father Has Post-Secondary Education		0.248	0.140	0.201
		(0.167)	(0.166)	(0.161)
Principal has Post Secondary Education			0.061	0.079
			(0.060)	(0.067)
Language Teacher's Years of Experience			0.000	0.001
			(0.003)	(0.004)
Language Teacher is Female			0.084	0.163***
			(0.056)	(0.061)
Students Absent Past 30 Days			-0.239***	-0.272***
			(0.054)	(0.058)
Student-Teacher Ratio			0.00752*	0.0142**
			(0.004)	(0.006)
Number of Classrooms			0.00792**	0.003
			(0.003)	(0.004)
Private School			0.469***	0.454***
			(0.094)	(0.116)
Rural			-0.368***	-0.116
			(0.086)	(0.119)
Constant	0.209***	-0.686***	-0.824***	-1.823***
	(0.029)	(0.154)	(0.195)	(0.480)
Wealth Controls	No	No	No	Yes
Observations	1077	1077	1077	1077
R-squared	0.20	0.31	0.37	0.41

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Appendix A: Robustness Results

Table 8: Math Z Scores

Variables	**(1)**	**(2)**	**(3)**	**(4)**
EIB School	0.451***	0.500***	0.777***	0.502***
	(0.149)	(0.155)	(0.181)	(0.159)
Indigenous	-0.168*	-0.188*	-0.280***	-0.125
	(0.095)	(0.097)	(0.100)	(0.098)
Female Student	-0.138***	-0.138***	-0.119**	-0.123**
	(0.050)	(0.049)	(0.051)	(0.050)
Student Attended Pre-School	0.171**	0.185***	0.216***	0.205***
	(0.072)	(0.070)	(0.075)	(0.072)
Repeated Grade Once	-0.129*	-0.135*	-0.108	-0.131*
	(0.073)	(0.073)	(0.075)	(0.073)
No Co-Habitational Siblings	0.148**	0.160**	0.150*	0.167**
	(0.073)	(0.073)	(0.078)	(0.074)
Mother Has 1 to 5 Years of Education	-0.008	0.04	0.053	-0.018
	(0.106)	(0.106)	(0.108)	(0.105)
Mother has 6 to 11 Years of Education	0.107	0.15	0.136	0.109
	(0.120)	(0.118)	(0.122)	(0.119)
Mother Has Post-Secondary Education	0.234	0.261*	0.308**	0.256*
	(0.149)	(0.147)	(0.152)	(0.148)
Father Has 1 to 5 Years of Education	0.025	0.027	0.051	0.028
	(0.134)	(0.141)	(0.114)	(0.137)
Father has 6 to 11 Years of Education	0.139	0.115	0.155	0.115
	(0.140)	(0.149)	(0.125)	(0.144)
Father Has Post-Secondary Education	0.311*	0.279*	0.259*	0.302*
	(0.159)	(0.164)	(0.144)	(0.162)
Principal has Post Secondary Education	0.046	0.142*	0.108	0.079
	(0.075)	(0.074)	(0.081)	(0.079)
Math Teacher's Years of Experience	0.003	0.006	0.003	0.003
	(0.004)	(0.004)	(0.005)	(0.004)
Math Teacher is Female	0.083	0.124**	-0.042	0.128**
	(0.061)	(0.062)	(0.073)	(0.063)
Students Absent Past 30 Days	-0.156**	-0.221***	-0.221***	-0.216***
	(0.065)	(0.059)	(0.072)	(0.060)
Student-Teacher Ratio	0.033***	0.026***	0.033***	0.023***
	(0.006)	(0.006)	(0.007)	(0.006)
Number of Classrooms	0.016***	0.017***	0.025***	0.022***
	(0.005)	(0.005)	(0.005)	(0.006)
Private School	0.419**	0.787***	0.903***	0.893***
	(0.185)	(0.149)	(0.139)	(0.174)
Rural	-0.032	-0.119	0.055	0.291
	(0.118)	(0.116)	(0.128)	(0.280)
Constant	-0.787	-1.895***	-2.650***	-1.685***
	(0.482)	(0.360)	(0.539)	(0.368)
Wealth Controls	*Yes*	*Yes*	*Yes*	*Yes*
Support from Community, State, Parents	*Yes*	*No*	*No*	*No*
Additional Support for Teachers	*No*	*Yes*	*No*	*No*
Quality of School Management	*No*	*No*	*Yes*	*No*
Personnel, Materials and Other Resources	*No*	*No*	*No*	*Yes*
Observations	1077	1076	1007	1077
R-squared	0.41	0.41	0.43	0.41

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 9: Math Z Scores

Variables	**(1)**	**(2)**	**(3)**	**(4)**
Teachers Are Trained in EIB Teaching	0.742***	0.818***	0.914***	0.827***
	(0.176)	(0.177)	(0.223)	(0.170)
Indigenous	-0.167*	-0.188**	-0.244**	-0.127
	(0.092)	(0.094)	(0.099)	(0.095)
Female Student	-0.130***	-0.128***	-0.116**	-0.114**
	(0.050)	(0.049)	(0.051)	(0.050)
Student Attended Pre-School	0.195***	0.205***	0.229***	0.225***
	(0.072)	(0.070)	(0.074)	(0.072)
Repeated Grade Once	-0.113	-0.125*	-0.094	-0.115
	(0.072)	(0.072)	(0.075)	(0.072)
No Co-Habitational Siblings	0.148**	0.157**	0.148*	0.158**
	(0.073)	(0.073)	(0.078)	(0.074)
Mother Has 1 to 5 Years of Education	0.057	0.117	0.128	0.064
	(0.104)	(0.105)	(0.112)	(0.103)
Mother has 6 to 11 Years of Education	0.165	0.218*	0.196	0.184
	(0.117)	(0.116)	(0.124)	(0.116)
Mother Has Post-Secondary Education	0.298**	0.335**	0.387**	0.333**
	(0.147)	(0.147)	(0.154)	(0.146)
Father Has 1 to 5 Years of Education	0.084	0.078	0.091	0.072
	(0.128)	(0.134)	(0.115)	(0.128)
Father has 6 to 11 Years of Education	0.212	0.184	0.205	0.177
	(0.135)	(0.142)	(0.126)	(0.137)
Father Has Post-Secondary Education	0.371**	0.339**	0.313**	0.358**
	(0.154)	(0.159)	(0.146)	(0.155)
Principal has Post Secondary Education	0.07	0.170**	0.124	0.082
	(0.076)	(0.074)	(0.081)	(0.078)
Math Teacher's Years of Experience	0.002	0.005	0.002	0.002
	(0.004)	(0.004)	(0.005)	(0.004)
Math Teacher is Female	0.078	0.133**	-0.011	0.124**
	(0.061)	(0.062)	(0.072)	(0.062)
Students Absent Past 30 Days	-0.187***	-0.247***	-0.236***	-0.243***
	(0.064)	(0.058)	(0.072)	(0.060)
Student-Teacher Ratio	0.030***	0.024***	0.030***	0.020***
	(0.006)	(0.006)	(0.007)	(0.006)
Number of Classrooms	0.016***	0.016***	0.023***	0.022***
	(0.005)	(0.004)	(0.005)	(0.006)
Private School	0.418**	0.706***	0.857***	0.862***
	(0.185)	(0.147)	(0.137)	(0.174)
Rural	-0.125	-0.225*	-0.064	0.248
	(0.123)	(0.119)	(0.127)	(0.266)
Constant	-0.769	-1.594***	-2.170***	-1.489***
	(0.474)	(0.359)	(0.528)	(0.356)
Wealth Controls	*Yes*	*Yes*	*Yes*	*Yes*
Support from Community, State, Parents	*Yes*	*No*	*No*	*No*
Additional Support for Teachers	*No*	*Yes*	*No*	*No*
Quality of School Management	*No*	*No*	*Yes*	*No*
Personnel, Materials and Other Resources	*No*	*No*	*No*	*Yes*
Observations	1077	1076	1007	1077
R-squared	0.42	0.42	0.43	0.42

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 10: Language Z Scores

Variables	**(1)**	**(2)**	**(3)**	**(4)**
EIB School	0.173	0.230	0.293	0.247
	(0.146)	(0.147)	(0.194)	(0.163)
Indigenous	-0.252**	-0.283***	-0.358***	-0.251**
	(0.107)	(0.104)	(0.110)	(0.110)
Female Student	0.004	0.028	0.045	0.017
	(0.049)	(0.049)	(0.050)	(0.049)
Student Attended Pre-School	0.144*	0.135*	0.175**	0.158**
	(0.079)	(0.078)	(0.082)	(0.078)
Repeated Grade Once	-0.119	-0.133*	-0.08	-0.122
	(0.078)	(0.078)	(0.079)	(0.078)
No Co-Habitational Siblings	0.024	0.037	0.019	0.026
	(0.069)	(0.070)	(0.072)	(0.071)
Mother Has 1 to 5 Years of Education	0.375***	0.380***	0.314**	0.373***
	(0.117)	(0.115)	(0.125)	(0.115)
Mother has 6 to 11 Years of Education	0.412***	0.412***	0.312**	0.399***
	(0.125)	(0.123)	(0.134)	(0.124)
Mother Has Post-Secondary Education	0.587***	0.595***	0.578***	0.577***
	(0.153)	(0.149)	(0.154)	(0.150)
Father Has 1 to 5 Years of Education	-0.037	-0.014	0.053	0.005
	(0.143)	(0.141)	(0.141)	(0.138)
Father has 6 to 11 Years of Education	0.021	0.032	0.121	0.052
	(0.149)	(0.148)	(0.148)	(0.144)
Father Has Post-Secondary Education	0.169	0.176	0.204	0.181
	(0.165)	(0.162)	(0.162)	(0.160)
Principal has Post Secondary Education	0.099	0.097	0.108	0.138*
	(0.072)	(0.071)	(0.081)	(0.076)
Language Teacher's Years of Experience	0.002	0.002	0.005	0.001
	(0.004)	(0.004)	(0.005)	(0.004)
Language Teacher is Female	0.170***	0.204***	0.088	0.170***
	(0.061)	(0.061)	(0.073)	(0.063)
Students Absent Past 30 Days	-0.260***	-0.256***	-0.239***	-0.263***
	(0.064)	(0.060)	(0.072)	(0.060)
Student-Teacher Ratio	0.019***	0.012**	0.019***	0.013**
	(0.006)	(0.006)	(0.007)	(0.006)
Number of Classrooms	-0.001	0.004	0.001	0.002
	(0.005)	(0.004)	(0.005)	(0.005)
Private School	0.569***	0.431***	0.508***	0.470***
	(0.189)	(0.141)	(0.136)	(0.165)
Rural	-0.06	-0.087	0.046	0.32
	(0.123)	(0.121)	(0.141)	(0.320)
Constant	-1.760***	-1.974***	-2.370***	-2.152***
	(0.549)	(0.505)	(0.648)	(0.451)
Wealth Controls	*Yes*	*Yes*	*Yes*	*Yes*
Support from Community, State, Parents	*Yes*	*No*	*No*	*No*
Additional Support for Teachers	*No*	*Yes*	*No*	*No*
Quality of School Management	*No*	*No*	*Yes*	*No*
Personnel, Materials and Other Resources	*No*	*No*	*No*	*Yes*
Observations	1077	1076	1007	1077
R-squared	0.42	0.42	0.43	0.42

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 11: Language Z Scores

Variables	(1)	(2)	(3)	(4)
Teachers Are Trained in EIB Teaching	0.340*	0.417**	0.559**	0.423**
	(0.177)	(0.171)	(0.223)	(0.169)
Indigenous	-0.259**	-0.288***	-0.364***	-0.254**
	(0.104)	(0.102)	(0.108)	(0.107)
Female Student	0.008	0.034	0.05	0.022
	(0.049)	(0.049)	(0.050)	(0.049)
Student Attended Pre-School	0.157**	0.146*	0.183**	0.169**
	(0.079)	(0.078)	(0.081)	(0.079)
Repeated Grade Once	-0.113	-0.129*	-0.072	-0.114
	(0.078)	(0.077)	(0.078)	(0.078)
No Co-Habitational Siblings	0.024	0.036	0.017	0.022
	(0.069)	(0.070)	(0.072)	(0.071)
Mother Has 1 to 5 Years of Education	0.405***	0.419***	0.363***	0.414***
	(0.119)	(0.117)	(0.128)	(0.118)
Mother has 6 to 11 Years of Education	0.439***	0.446***	0.353***	0.437***
	(0.126)	(0.124)	(0.135)	(0.126)
Mother Has Post-Secondary Education	0.616***	0.630***	0.627***	0.614***
	(0.154)	(0.150)	(0.155)	(0.151)
Father Has 1 to 5 Years of Education	-0.011	0.011	0.072	0.027
	(0.143)	(0.140)	(0.141)	(0.139)
Father has 6 to 11 Years of Education	0.055	0.068	0.143	0.084
	(0.149)	(0.147)	(0.148)	(0.145)
Father Has Post-Secondary Education	0.196	0.206	0.227	0.21
	(0.165)	(0.162)	(0.161)	(0.160)
Principal has Post Secondary Education	0.109	0.108	0.105	0.137*
	(0.072)	(0.072)	(0.082)	(0.075)
Language Teacher's Years of Experience	0.001	0.002	0.004	0
	(0.004)	(0.004)	(0.005)	(0.004)
Language Teacher is Female	0.160***	0.198***	0.085	0.162**
	(0.061)	(0.061)	(0.073)	(0.064)
Students Absent Past 30 Days	-0.276***	-0.270***	-0.248***	-0.278***
	(0.064)	(0.059)	(0.071)	(0.060)
Student-Teacher Ratio	0.018***	0.011*	0.018***	0.011*
	(0.006)	(0.006)	(0.007)	(0.006)
Number of Classrooms	0	0.004	0.001	0.002
	(0.005)	(0.004)	(0.005)	(0.005)
Private School	0.566***	0.393***	0.490***	0.453***
	(0.189)	(0.142)	(0.136)	(0.166)
Rural	-0.104	-0.142	-0.01	0.299
	(0.127)	(0.127)	(0.144)	(0.313)
Constant	-1.725***	-1.861***	-2.155***	-2.050***
	(0.549)	(0.512)	(0.640)	(0.440)
Wealth Controls	*Yes*	*Yes*	*Yes*	*Yes*
Support from Community, State, Parents	*Yes*	*No*	*No*	*No*
Additional Support for Teachers	*No*	*Yes*	*No*	*No*
Quality of School Management	*No*	*No*	*Yes*	*No*
Personnel, Materials and Other Resources	*No*	*No*	*No*	*Yes*
Observations	1077	1076	1007	1077
R-squared	0.42	0.42	0.43	0.42

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1