ENGLISH AS A SECOND DIALECT POLICY AND ACHIEVEMENT OF ABORIGINAL STUDENTS IN BRITISH COLUMBIA*

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1 Introduction

Compared to non-Aboriginal people in Canada, Aboriginal Canadians face a substantially higher risk of poverty (Mendelson 2006), poor health outcomes, drug and alcohol addiction, and suicide (Health Canada 2003). While features of the education system, such as residential schooling, may have contributed to these problems in the past (Royal Commission on Aboriginal Peoples 1996), many analysts argue that the key to breaking the cycle of poverty among Aboriginal Canadians lies in improving educational attainment among Aboriginal children and youth (e.g. Richards and Vining 2004). This view is supported by evidence from other populations that education is associated with better health behaviours and outcomes (Kenkel 1991), substantially lower rates of incarceration (Lochner and Moretti 2003), higher earnings (Card 1999), reduced teen childbearing, criminal propensity, child abuse and neglect, and improved educational attainment and health outcomes of children (Greenwood 1997), increased voter and civic participation (Dee 2003), and reduced reliance on public transfers (Wolfe and Haveman 2001).

Identifying effective strategies for improving educational outcomes is therefore of great policy significance. British Columbia (B.C.) began in the 1980's to allocate funds under the province's English as a Second Language (ESL) policy framework to support students who "speak variations of English that differ significantly from the English used in the broader Canadian society and in school" (B.C. Ministry of Education 2009). In practice, the non-standard dialect speakers who receive "English as a Second Dialect" (ESD) funding under this policy are almost exclusively students who also self-report Aboriginal identity. B.C. is not unique in taking this approach: Australia has provided ESD funding to Aboriginal speakers of non-standard dialects since the 1990's (Eades and Siegel 1999). Several U.S. school districts have also developed ESD programs aimed primarily at African-American children, the leading example being the Los Angeles Unified School District's English Mastery program (Adger 2008), which dedicates regularly scheduled teaching blocks and frequent "language breaks" to "mainstream English language development"

(Los Angeles Unified School District 2009).[1] Although socio-linguists and educators have argued that appropriate educational programs may be effective in supporting the language development of speakers of non-standard dialects (e.g. Rickford 1999; Ball, Bernhardt and Deby 2006), we are aware of no systematic evaluations of such policies.

We implement a strategy that exploits the staggered uptake of ESD funding across B.C.'s public school districts between 1999 and 2004 to measure its' relationship to test score gains. Our results indicate that the provision of ESD funding has been associated with improved reading test score gains of Aboriginal students between grades 4 and 7. Quantile regressions suggest that this benefit is concentrated among students in the lower quantiles of the distribution of reading test scores gains. In contrast, we find no association between ESD funding and the numeracy test score gains of Aboriginal students. Since these funds are intended to support services designed to help students become proficient in English, the absence of any relationship to numeracy test score gains may not be surprising. Similarly, we find no relationship between ESD funding and the reading or numeracy test score gains of non-Aboriginal students. These negative results increase our confidence that we have identified a true policy effect on the reading scores of Aboriginal students.

1.1 Related literature

The supplemental funding that districts receive under the ESD policy that we evaluate differs from general funding because it is allocated in recognition of the needs of specific students. At the same time, the province does not dictate which services are offered to these students, and some of the funds may be directed to other uses so long as an adequate program is in place to address the identified needs. Our paper therefore is related to, but distinct from, two literatures: one interested in measuring the effects of overall

[1] An attempt by the Oakland Unified School District to access federal funds by recognizing African-American Vernacular English (AAVE) as a distinct language (Oakland Unified School District 1997) failed spectacularly while sparking the acrimonious "Ebonics debate" in the late 1990's (see Ramirez et al. 2005).

education funding levels on academic achievement (e.g. Barrow and Rouse 2004; Guryan 2001), and one that evaluates the effects of specific programs or pedagogical practices (e.g. Angrist and Lavy 2001; Lavy and Schlosser 2005). Within this second literature, our work is perhaps most closely related to Machin and McNally's (2008) study of the effect of a structured literacy program on reading and English skills. Machin and McNally find that an inexpensive pedagogical intervention was highly effective at improving skills among English primary school children. While the intervention that we evaluate is also aimed at improving literacy skills, the program studied by Machin and McNally involves few resources and specific pedagogy. In contrast, the program we examine involves substantial supplementary funding aimed at a particular group of students to address a particular learning issue, but without prescribing pedagogy.

The nature of the funding supplement that we evaluate is perhaps most similar to special education funding, which is also allocated in recognition of the needs of specific students. Several studies examine the effects of special education programs on academic achievement. Hanushek et al. (2002) use an individual fixed effects framework to estimate the effects of moving into or out of special education programs on elementary school test score gains in mathematics. They find that being placed in special education has a substantial positive effect on math test score gains in the first year, but that much of this benefit is lost in the following year. Cohen (2007) uses the variation in rates of learning disabilities induced by the Chicago accountability framework to measure the effect of special education placement on student outcomes. Her results indicate that being placed in special education in elementary school reduces high school absenteeism and drop-out rates; her results for high school GPA are inconclusive.

2 Institutions and Data

2.1 Organization and funding of the B.C. education system

In B.C., the Ministry of Education establishes curricula and provides operating and capital grants to district school boards, who then allocate funds to individual schools. The per-student funding formula over the period of our study is summarized in Table 1. In addition to a basic grant for each regular student enrolled, districts receive supplementary grants for self-identified Aboriginal students, for students with assessed disabilities and for students who are deemed to be eligible under B.C.'s ESL policy. Our primary interest is in this last policy, which provides a 21% supplement to the base grant for a maximum of five years for each eligible student.

2.2 English as a Second Dialect policy in B.C.

Districts that receive ESD funding for Aboriginal students under B.C.'s ESL Policy Framework have substantial discretion in terms of the services provided, subject to meeting several broad criteria (B.C. Ministry of Education 1999). For each designated student, districts are required to conduct an annual assessment of proficiency in Standard English, and to design an annual instruction plan that lists specific services the student will receive in order to improve that proficiency. An ESL specialist must be involved in service planning and delivery, and districts are encouraged to use culturally relevant resources to provide services (B.C. Ministry of Education 1999). The Ministry does not specify which services must be provided, and there is no requirement that the funding be dedicated exclusively to services for the designated student.

This flexibility allows districts to use these funds in a variety of ways. Examples include supporting the use of specific pedagogical strategies for vocabulary development (Nechako Lakes 2006), hiring specialist teachers that provide support to classroom teachers and develop program materials (Cariboo-Chilcotin

2009), offering specialized oral language instruction on a weekly pull-out basis and acquiring reading materials with Aboriginal content (Vancouver Island North 2008), and integrating strategies for oral language development into regular literacy programs (Haida Gwaii/Queen Charlotte 2008).

2.3 The Foundation Skills Assessment exams

We are interested in investigating the effect of ESD funding on student achievement, as measured by B.C.'s Foundation Skills Assessment (FSA) exams. The FSA exams have been administered to students in grades 4 and 7 in all public and provincially-funded private schools since 1999. They are based on a variety of questions, both multiple-choice and open-ended, and are graded by accredited B.C. teachers. All students except those whose English skills are not sufficiently developed that they can respond to the test, and some disabled students, are expected to participate. Assignment to ESD does not in itself affect the expectation that students will participate in the FSA exams. The exams are relatively low-stakes for all parties: students' scores do not contribute to their school grade and play no role in grade completion, and the results do not affect school or district funding or teacher pay. However, school- and district-level results are made public and are widely discussed within both the educational system and the news media (e.g. Cowley and Easton 2003).

2.4 Data

Our data are drawn from the B.C. Ministry of Education's enrollment database,[2] and its FSA exam database. These cross-sectional data sets cover all public school students in grades 4 through 7 between 1999 and 2004. We use the unique identification code assigned to each B.C. student to link records across the

[2] Since responsibility for on-reserve Aboriginal education falls under federal jurisdiction, our data do not include the approximately 7.5% of B.C. Aboriginal students who attend on-reserve schools (Friesen and Krauth 2010).

enrollment and FSA exam databases, and to construct a longitudinal record for every public school student who is in grade 7 in B.C. from 2002 through 2004, and who was in grade 4 in B.C. three years earlier.[3]

The enrollment record includes the student's current grade, school and district identifiers, year, gender, self-reported Aboriginal identity, enrollment in a language program (e.g. ESL, French Immersion, Francophone education), enrollment in a special needs program, and self-reported language spoken at home. Records in the FSA exam database include the student's score on each exam subject, along with a flag indicating whether the student was excused from writing a given exam.

3 Patterns of achievement and use of English as a Second Language funds in B.C. public schools

3.1 Characteristics and achievement of Aboriginal and non-Aboriginal students

As Table 2 shows, 9.6% of students in the grade 7 student population in our sample period self-report Aboriginal identity. Aboriginal students tend to be sorted into particular schools. Although they make up less than 10% of the grade 7 student body, the average Aboriginal student attends a school in which almost 24% of their grade 7 peers are Aboriginal; the average Aboriginal student in ESD attends a school in which almost half of their grade 7 peers are Aboriginal.[4] Although only 1% of Aboriginal students report speaking a language other than English at home, over 9% are funded under B.C.'s ESL policy. In contrast, a smaller proportion (5.8%) of non-Aboriginal students receives ESL funding in Grade 7, although over 21% report speaking a language other than English at home.

[3] A minority of students who are observed in both Grades 4 and 7 repeat grades, skip grades, or are out of province or in a private school for one or more of the intervening years. We keep these students in our analysis whenever possible. If the student repeats either Grade 4 or Grade 7, we use the last year in Grade 4 and the first year in Grade 7.

[4] Friesen and Krauth (2010) provide a detailed assessment of school-level sorting of Aboriginal and non-Aboriginal students and examine the effects of peer composition on Aboriginal students' test score gains.

The administrative data provide a number of indications that Aboriginal students, and particularly those in ESD programs, face significant challenges. The lower panel of Table 2 shows that the incidence of assessed disabilities among Aboriginal students is two and half times as high as the non-Aboriginal population, and is almost four times as high among Aboriginal students in ESD programs. The incidence of assessed giftedness shows the reverse pattern.

Table 3 presents our measures of academic achievement for the sub-sample of students with FSA exam results in both grades. Aboriginal students in grade 7 score close to 0.6 standard deviations on average below non-Aboriginal students on both exams. Aboriginal students in ESD programs score a full standard deviation below the mean in numeracy and 1.3 standard deviations below the mean in reading. In comparison, the mean test score gap between blacks and whites on standardized tests in Texas elementary schools is about 0.7 standard deviations (Hanushek et al. 2002). The next two rows of the table show that Aboriginal students on average continue to fall behind in numeracy between grades 4 and 7, and to an even greater extent in reading. Aboriginal students in ESD programs actually catch up in numeracy between grades 4 and 7, but their reading test scores decline by a further 0.13 standard deviations relative to non-Aboriginal students.

The use of test scores to measure achievement levels or gains has the drawback that it restricts attention to those students who participated in the exam in one or both grades, and is thus subject to bias from endogenous participation. This problem will be particularly acute when studying a population that has relatively low academic achievement. The exam participation statistics in Table 4 show that, although non-Aboriginal exam participation rates in B.C. are high, they are considerably lower among Aboriginal students, and lower still among Aboriginal students in ESD. About half of those who do not participate have been excused from the exam. The other half simply do not take the exam, either because they are

absent from school on exam day or because they do not respond to the exam. This high nonparticipation rate results in a high proportion of Aboriginal students with missing gain score data: about 25% of Aboriginal students overall and 44% of ESD participants do not have valid reading gain score data. The number of missing gain scores is slightly higher for the numeracy exams.

3.2 Patterns of ESD assignment

Although ESD funds were available under B.C.'s ESL policy as early as the 1980's (B.C. Ministry of Education 1981), few districts took advantage of this source of funding before the late 1990's. Table 5 illustrates the rapid expansion in the uptake of ESD funding between 1999 and 2004. In 1999, only 2.7% of grade 7 Aboriginal students in the province were identified as eligible for ESL funding; by 2004, this proportion had risen to 10.7%. The number of districts assigning at least 5% of grade 7 Aboriginal students to ESD (and at least 10 grade 7 students in total) grew from 4 in 1999 to 16 in 2004.[5] Figure 1 shows the proportion of grade 7 Aboriginal students in ESD in the first year that services were offered to more than 5% of Aboriginal students, in each of the twelve districts where we observe this (arbitrary) threshold being crossed. In nine of these twelve districts, the proportion of Aboriginal students assigned to ESD jumped from fewer than 5% to more than 20% in a single year. In Nisga'a and Stikine, the proportion leapt from less than 5% to over 60% from one year to the next. The scale of this within-district variation is clearly greater than any plausible variation in underlying student characteristics, and is therefore likely to reflect changes in district ESD policy.

[5] The incidence of Aboriginal students in ESL programs must be computed from micro data, because the Ministry of Education does not publish the numbers. The micro data to which we have access for this study does not extend beyond 2004, so we are unable to determine whether ESD programs have continued to expand since then. However, our discussion with various Ministry staff have provided no indications of any significant changes to the pattern of uptake of this policy.

Even in districts with well-established ESD programs, year-to-year variation in the proportion of Aboriginal students assigned to ESD occurs on a greater scale and at a higher frequency than the likely variation in student characteristics. Figure 2 shows the variation over time in the proportion of grade 7 Aboriginal students in ESD for four illustrative districts. Vancouver is one of four districts that assigned more than 5% of Aboriginal students to ESD in 1999; in this case we observe considerable year-to-year variation in the proportion of students in ESD, but no clear trend. The other three districts show large discrete jumps, along with considerable year-to-year variation in subsequent years.

4 Methodology

Section 3.2 shows that the proportion of Aboriginal students assigned to ESD varied substantially both within and between districts during our sample period. This section describes how we exploit this variation to measure the relationship between ESD funding and student achievement, and attempt to identify the causal effects of ESD funding. Section 4.1 presents our empirical model and discusses the substance of our identifying assumptions. Section 4.2 presents the estimating equations that we derive from this model.

The population under analysis is Aboriginal students attending B.C. public schools for grades 4 through 7 during our sample period. Because our models include district fixed effects, we also restrict attention to students who are in the same district from grade 5 to grade 7.

4.1 Our empirical model

This section describes an empirical model that incorporates the three regression specifications that we estimate below. We do not estimate this model directly. Instead, we use the model to define the effects we are aiming to measure and to discuss the substantive conditions under which the fairly simple regressions we estimate will consistently measure these effects.

Index students by *i*, districts by *d*, and time by *t*. Let *t(i)* be the school year in which student *i* takes grade 7, and let d*(i)* be the student's district between grades 5 and 7. Our model features an outcome equation and an ESD assignment equation:

$$y_i = b_{d(i)} + \gamma_{t(i)} + \beta_x X_i + \beta_D \overline{ESD}_i + \beta_I \bar{p}_i + u_i \quad (1)$$

$$ESD_{i,t} = a_{d(i)} + \delta_t + \pi_X X_i + \pi_p p_{d(i),t} + v_{i,t} \quad (2)$$

In the assignment equation (2), $ESD_{i,t}$ is an indicator of student *i's* ESD assignment in year *t*, $a_{d(i)}$ and δ_t are district and time fixed effects, $X_i$is a vector of background characteristics, and $p_{d,t}$ is the proportion of Aboriginal students assigned to ESD in district *d(i)* in year t. In the outcome equation (1), y_i is a grade 7 outcome of interest, b_d and γ_t are district and time fixed effects, $\overline{ESD}_i \equiv \frac{(ESD_{i,t(i)} + ESD_{i,t(i)-1} + ESD_{i,t(i)-2})}{3}$ is the proportion of years that student *i* was in ESD in grades 5 through 7, and $\bar{p}_i \equiv \frac{(p_{d(i),t(i)} + p_{d(i),t(i)-1} + p_{d(i),t(i)-2})}{3}$ is the average proportion of Aboriginal students assigned to ESD in district *d(i)* over the years that student *i* was in grades 5 through 7. We are primarily interested in two parameters: β_D captures the direct effect of ESD on students who are themselves assigned to ESD, and β_I captures the indirect effect of the district-level proportion of Aboriginal students assigned to ESD on the average Aboriginal student. The indirect effect could take the form of general fiscal/resource spillovers (since districts receive additional funds for each ESD student), program spillovers (since district ESD programming may include development of new learning materials that benefit all students), or peer effects (since academic improvements by high-risk ESD students may improve the classroom learning environment).

In order to identify any parameters of interest, we require that our measure of the district-level proportion of Aboriginal students assigned to ESD be strictly exogenous conditional on the fixed effects:

$$E\left(u_i|\{X_j,\bar{p}_j\}_{d(j)=d(i)}a_{d(i)},b_{d(i)}\right)=0 \quad (3)$$

$$E\left(v_{i,t}|\{X_j,\bar{p}_j\}_{d(j)=d(i)}a_{d(i)},b_{d(i)}\right)=0\,, \qquad t\in\{t(i),t(i)-1,t(i)-2\} \quad (4)$$

Equations (3) and (4) mean roughly that, given the district, variation in the district proportion of Aboriginal students assigned to ESD while a student was in grades 5-7 is unrelated to variation in unobserved factors affecting either student outcomes (3) or student ESD assignment (4).

Equation (4) would be violated if we were to measure the district ESD assignment rate using students in our estimation sample, as $\bar{p}_j$ would be a function of $v_{i,t}$. Instead, we use available data on assignment rates in grades outside of our estimation sample to construct these measures.[6] Specifically, we measure the district ESD assignment rate using grade 7 Aboriginal students in 1999 to 2001 and grade 4 Aboriginal students in 2002 to 2004.[7]

Although using students from grades outside of our estimation sample to construct our measure of district ESD assignment rates eliminates any mechanical relationship between this measure and the unobserved characteristics of students in our sample, equation (4) would still be violated if within-district changes in ESD assignment policies were driven by trends in student needs for such programming that are common

[6] While our estimation sample covers the three cohorts of students who complete grade 7 between 2002 and 2004, our complete data set includes grade 4 and grade 7 data for all years from 1999 to 2004.

[7] More specifically, we define program size as:

$$p_{d,t}\equiv\begin{cases}1.66\frac{\sum_i ESD_{i,t}I(t(i)=t,d(i)=d)}{\sum_i I(t(i)=t,d(i)=d)}, & t<2002\\ \frac{\sum_i ESD_{i,t}I(t(i)=t+3,d(i)=d)}{\sum_i I(t(i)=t+3,d(i)=d)}, & t\geq 2002\end{cases}$$

where I(.) is the indicator function and 1.66 is a scaling constant to account for the fact that grade 4 ESD rates are about 66% higher (province-wide over the period 1999-2004) than grade 7 ESD rates.

across grades. Here we refer to Section 3.2 and note that there are a number of discrete jumps in ESD designation rates, and that changes in student needs are unlikely to match these jumps in timing or magnitude. Even within districts that have assigned substantial proportions of Aboriginal students to ESD for many years, we do not observe any clear trends in ESD assignment that might suggest changes in the underlying composition of student characteristics within a district that are common across grades.

Equation (3) would be violated if within-district changes in district ESD assignment policy were systematically implemented in combination with other outcome-relevant changes. Changes in district ESD practices may have been precipitated in some cases by idiosyncratic factors that raised district awareness of the provincial policy or of other districts' implementation of ESD. However, if changes in district ESD assignment rates were precipitated by changes in school district leadership or shifting district priorities, or if other relevant policies were introduced at the same time, the effects of these changes will be confounded with the effects of interest. While we cannot rule out these possibilities, we are aware of no specific policy changes that coincided with ESD assignment practices. In addition, Section 5 develops some evidence on the question by looking at multiple outcomes. One sign of unobserved policy variation would be if we were to find substantial "effects" of district ESD policy on outcomes unrelated to ESD services.

4.2 Regressions

Reduced form model: Given equations (1)-(4), it is simple to derive the reduced form regression model by substituting equation (2) into equation (1) to get:

$$y_i = \left[b_{d(i)} + \beta_D a_{d(i)}\right] + \left[\gamma_{t(i)} + \beta_D \bar{\delta}_{t(i)}\right] + \left[\beta_X + \pi_X \beta_D\right] X_i + \left[\beta_I + \pi_p \beta_D\right] \bar{p}_i + \left[u_i + \beta_D \bar{v}_i\right]$$

$$= c_{d(i)} + \lambda_{t(i)} + \alpha_X X_i + \alpha_{RF} \bar{p}_i + \epsilon_i \qquad \text{(RF1)}$$

Apply (3) and (4) to get:

$$E\left(\epsilon_i|\{X_j,\bar{p}_j\}_{d(j)=d(i)}c_{d(i)}\right) = E\left(\bar{v}_i + u_i|\{X_j,\bar{p}_j\}_{d(j)=d(i)}c_{d(i)}\right) = 0 \quad \text{(RF2)}$$

Equations (1)-(4) imply that the regression model (RF1) consistently estimates the reduced form effect, $\alpha_{RF} = \beta_I + \pi_p\beta_D$. Although the reduced form regressions provide no distinction between direct and indirect effects, they represent our primary results because they derive from the most plausible identifying assumptions.

Instrumental variables model: We also report estimates that use the district-level ESD designation rate as an instrumental variable for a student's own ESD assignment. The IV regression model is:

$$y_i = b_{d(i)} + \gamma_{t(i)} + \beta_X X_i + \beta_D\overline{ESD}_i + u_i \quad \text{(IV1)}$$

$$E\left(u_i|\{X_j,\bar{p}_j\}_{d(j)=d(i)}b_{d(i)}\right) = 0 \quad \text{(IV2)}$$

The parameter β_D can be interpreted as the direct effect of ESD assignment on student outcomes. Given equations (1)-(4) and the instrument relevance condition, $\pi_p \neq 0$, consistency of the IV estimator also requires that there are no indirect effects:

$$\beta_I = 0 \quad (5)$$

Equation (IV1) follows from substitution of (5) into (1), while equation (IV2) follows directly from (3). The no-indirect-effects condition (5) is not testable. The examples of ESD implementation in Section 1.1

include several cases where districts used ESD funds to pay for learning materials or other resources that would benefit all students. The IV results therefore should be interpreted with caution.

OLS model: Finally, we also report OLS estimates of the model:

$$y_i = b_{d(i)} + \gamma_{t(i)} + \beta_x X_i + \beta_D \overline{ESD_i} + \beta_I \bar{p}_i + u_i \quad \text{(OLS1)}$$

$$E\left(u_i | \{X_j, \bar{p}_j, \overline{ESD_j}\}_{d(j)=d(i)} b_{d(i)}\right) = 0 \quad \text{(OLS2)}$$

The parameter β_D can be interpreted as the direct effect of own ESD assignment (as in the IV regression), and the parameter β_I can be interpreted as the indirect effect of the district ESD designation rate on the average Aboriginal student. In order for the OLS estimator to be consistent, we need equation (OLS2) to hold. Given the ESD assignment equation (2), this implies that:

$$E\left(u_i | \{X_j, \bar{p}_j, \overline{ESD_j}\}_{d(j)=d(i)} b_{d(i)}\right) = E\left(u_i | \{X_j, \bar{p}_j, \bar{v}_j\}_{d(j)=d(i)} b_{d(i)}\right) = 0 \quad (6)$$

Equation (OLS1) is identical to (1), while substitution of (2) into (OLS2) yields (6). Equation (6) is violated if there are unobserved factors that affect a student's ESD assignment and are related to unobserved factors that affect his or her exam results. This is highly likely; for example, skills in Standard English are an important determinant of both exam outcomes and ESD assignment. The results from the OLS model therefore should be interpreted as descriptive only.

5 Results

5.1 Test participation

If the introduction and/or expansion of ESD within districts coincided, by accident or design, with changes in exam participation patterns, ESD may be associated with improvements in measured test scores even in the absence of improvements in academic achievement. Nothing about ESD assignment itself has a direct effect on the ability of schools to keep students out of the exams, and B.C. does not have a formal test-based accountability system that would create incentives for schools to exclude low-achieving students from tests. However, the publication of "school report cards" by an independent think tank (e.g. Cowley and Easton 2003) provides some incentives for schools to raise test scores. [8] In order to address this concern, we explore the relationship between test participation and ESD assignment rates before turning to our models of test score gains. We do so by implementing the three econometric models described in Section 4.2, but with participation in the grade 7 exam as the outcome variable. We control for grade 4 participation and introduce an interaction term to allow for the effect of ESD to vary by grade 4 participation. These controls have been added to the model because participation in grade 7 only affects the availability of data on test score gains for students who participated in grade 4. Results for a simplified model without these variables (see Appendix Table A2) are similar to those reported here.

The results are presented in Table 6. The OLS regression (equation OLS1 in Section 4.2) treats both the number of years the student spent in ESD between grades 5 and 7 and the average district ESD assignment rate as exogenous explanatory variables. As discussed in Section 4.2, this regression provides a biased estimate of the policy effect due to endogenous assignment, and should be interpreted as descriptive only.

[8] Jacob (2006) and Figlio and Getzler (2006) have both found evidence that schools in jurisdictions with test-based accountability systems use disability designations to strategically reduce exam participation by low-achieving students.

The OLS estimates show that Aboriginal students with ESD designations are somewhat less likely than other Aboriginal students to write both the reading and numeracy exams.

The IV regression (equation IV1 in Section 4.2) uses the district ESD rate as an instrument for the number of years the student spent in ESD, and aims to measure the effect of one year of ESD funding under the assumption there are no indirect effects. The reduced form regression (equation RF1 in Section 4.2) uses the district ESD assignment rate as an explanatory variable rather than as an instrument. The coefficient on the assignment rate can be interpreted as capturing both direct and indirect effects of ESD policy on participation among Aboriginal students. The signs of the OLS point estimates are reversed in the IV and reduced form estimates, implying that the introduction or expansion of ESD is associated with increased grade 7 exam participation in both subjects. This association is weak, and is only statistically significant in one case: numeracy exam participation for students who did not take the grade 4 numeracy exams.

While these results indicate that ESD assignment rates are not associated with overall reductions in exam participation by Aboriginal students, we cannot rule out an association between district ESD assignment policy and a change in the composition of the test-taking group. However, any such compositional change would have to leave the size of the test-taking group either unchanged or larger.

5.2 Test score gains: main results

Table 7 presents our results for the value-added model of test score gains. For each exam subject we estimate the same three regressions. All regressions control for the student's gender and for district and year fixed effects. The reported standard errors are clustered by district.

The OLS results show that ESD and non-ESD students have similar value-added reading exam outcomes, while ESD students have better value-added numeracy exam outcomes than non-ESD students. Again,

these results should be interpreted as descriptive only; they are consistent with districts targeting students who are facing particular difficulties in language-related subjects for assignment to ESD.

The IV results, which measure the effect of one year of ESD funding under the assumption there are no indirect effects, suggest that the policy is quite effective in achieving its goals. The estimated effect of ESD assignment on value-added reading exam outcomes is positive, statistically significant, and quite large: a 0.33 standard deviation improvement in test scores from a single year in ESD. The corresponding effect on value-added numeracy exam outcomes is nearly zero, as one might expect of a policy that primarily targets language development.[9]

The RF results for reading show that the reading test score gain of the average Aboriginal student is greater when the district receives funding for a greater proportion of Aboriginal students. As with the IV estimates, the implied effect is statistically significant and fairly large: a 10 percentage point increase in the proportion of ESD students in the district is associated with an average increase in test score gains of 0.048 standard deviations. Our estimates imply that being in a district with an average ESD assignment rate while in grades 5, 6 and 7 is associated with an average increase in the reading test score gain of Aboriginal students of around 0.1 standard deviations.[10] This is a sizeable effect, and it corresponds to a decrease of around 20% in the gap between Aboriginal and non-Aboriginal students in British Columbia. The corresponding estimates for the numeracy exam indicate no statistically significant relationship between the proportion of ESD students in a district and value-added numeracy exam outcomes.

These results in Table 7 suggest that ESD funding has been used in B.C. to support services that are effective. Districts that increased the proportion of Aboriginal students that they deemed eligible for ESD

[9] Estimates from the first-stage regressions are presented in Appendix Table A1.
[10] On average, districts that offer ESD assign 22 percent of their grade 4 Aboriginal students to ESD; the estimated effect of such a program is (0.48)(0.22)=0.11.

funding saw improved reading exam outcomes for Aboriginal students. These improved outcomes can be attributed to a large direct effect on program participants, or to a combination of direct and indirect effects. Given the magnitude of the IV estimate, the latter interpretation is more plausible.

5.3 Test score gains: quantile regression results

A natural additional step is to investigate the effects of ESD funding across the distribution of reading and numeracy test score gains. In particular, ESD services are meant to target students with weak Standard English skills, so we might expect the improved reading outcomes documented in the previous section to appear primarily in the lower end of the outcome distribution. We use quantile regression to develop some evidence on this question.

Table 8 presents regression results for three quantile regressions, for the 25th percentile, median and 75th percentile. These regressions have the same specifications as the reduced form regressions in Table 7, and include district and year dummy variables. Standard errors are estimated by the simple bootstrap, i.e. without adjustment for clustering, and will be biased downwards. Caution should also apply to interpreting the coefficient estimates. The econometric model described in Section 4 does not imply that the conditional quantiles identify causal effects. The results in Table 8 provide additional information on the statistical relationships underlying our main effect estimates, and are thus suggestive but not definitive about the effects of ESD programs.

The results in Table 8 are consistent with the large average effects on reading test score gains discussed in the previous section, and suggest that the effects of ESD are stronger at the bottom of the reading test score gain distribution. For the bottom quartile, the coefficient on district % ESD is around 0.6 standard deviations. The corresponding coefficient for the median quartile is also larger than the average effect presented in Table 7, while the coefficient for the top quartile is smaller. The results in Table 8 for

numeracy are also consistent with the results in Table 7: ESD funding has little relationship with numeracy test score gains.

5.4 Test score gains: non-Aboriginal students

The analysis in Section 5.2 essentially interprets any association between the introduction or expansion of ESD and movements in the test scores of Aboriginal students as evidence of a causal effect of ESD funding. This interpretation is problematic if ESD is correlated with unobserved district policy changes that affect test scores. While we cannot rule out all alternative explanations of this form, we can evaluate whether some consequences of our interpretation hold in the data. As shown in Table 7, we find that ESD improves Aboriginal students' reading scores but has no effect on their numeracy scores. Similarly we would expect to find little effect, if any, of ESD on the reading or numeracy scores of non-Aboriginal students. Results from our reduced form model for non-Aboriginal students in Table 9 show that the proportion of Aboriginal students assigned to ESD within a district has no substantial or statistically significant effect on the reading or numeracy test scores of non-Aboriginal students, in either numeracy or reading.

6 Conclusion

While there is widespread agreement among researchers and policymakers about the importance of improving educational outcomes for low-achieving students, there is little consensus about which policies are most likely to bring about the desired improvements. Our results indicate that supplemental funding targeted towards Aboriginal students in British Columbia who speak non-standard forms of English provides highly effective support for their literacy skill development. Since non-standard dialect speakers in other jurisdictions arguably face similar challenges at school, these results may be of considerable interest to policy-makers elsewhere.

However, while our approach produces a clear result with respect to the success of this policy, it does not reveal the mechanism through which that success is achieved. Our results therefore can provide little guidance to educators who are developing specific programs and services for non-standard dialect speakers. Finally, we cannot rule out the possibility that it is not the funding *per se,* but rather changes to leadership or priority-setting that coincided with changes in ESD designation rates, which is the underlying causal factor. The clear lesson that we can draw from our results is that targeting additional attention and resources to Aboriginal students within the education system can have a substantial effect on their learning outcomes.

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Tables

Table 1: Per student operating grants to B.C. public school districts.

Category	before March 2002	after March 2002
Base amount	3,042	5,308
Aboriginal supplement	755 – 1,030*	950
ESL/ESD supplement	1,230 (Year 1) 1,060 (Years 2-5)	1,100
Special needs supplements		
Dependent	31,910	30,000
Low incidence/high cost	12,460	15,000
Severe behaviour	6,014	6,000
High incidence/low cost	3,132	0
Gifted	341	0

*amount per student depends on total number of Aboriginal students in the District

Source: B.C. Ministry of Education (2002), page 4.

Table 2: Characteristics of grade 7 students 2002-2004.

Variable	Non-Aboriginal	Aboriginal	Aboriginal in ESD
# of observations	125,956	13,414	1,206
% of total	90.4	9.6	0.87
% Aboriginal peers	8.1	23.9	46.0
% speaking non-English language at home	21.2	1.0	5.1
% currently ESL/ESD	5.8	9.0	100.0
% disabled	7.9	19.0	30.8
% gifted	2.6	0.8	0.3

Table 3: Achievement levels and growth, grade 7 students 2002-2004.

Variable	Non-Aboriginal	Aboriginal	Aboriginal in ESD
Grade 7 numeracy score	0.01	-0.57	-0.99
Grade 7 reading score	0.01	-0.58	-1.26
Gain in numeracy score	-0.05	-0.09	0.02
Gain in reading score	0.00	-0.08	-0.13

Table 4: Participation in FSA exams, grade 7 students 2002-2004.

Variable	Non-Aboriginal	Aboriginal	Aboriginal in ESD
% taking grade 7 numeracy exam	90.2	77.2	61.6
% taking grade 7 reading exam	91.1	80.4	66.3
% excused from grade 7 numeracy exam	4.5	11.2	21.8
% excused from grade 7 reading exam	4.5	10.4	21.3
% without numeracy gain data	12.6	28.4	48.1
% without reading gain data	11.1	25.5	43.6

Table 5: District ESD programs and students in ESD, grade 7 Aboriginal students 2002-2004.

	Aboriginal students in ESD		Districts with > 5% ESD[a]	
	Percent	Number	Percent	Number
1999	2.7	121	6.8	4
2000	3.4	152	6.8	4
2001	3.8	165	6.8	4
2002	6.5	292	11.9	7
2003	9.5	400	18.6	11
2004	10.7	529	27.1	16

[a]Districts where at least 5% of (and at least 10) grade 7 Aboriginal students are in ESD.

Table 6: Effect of ESD programming on grade 7 exam participation, grade 7 Aboriginal students 2002-2004.

Variable	Numeracy exam participation			Reading exam participation		
	OLS	IV	Reduced Form	OLS	IV	Reduced Form
Grade 4 exam participant	0.42***	0.42***	0.42***	0.42***	0.42***	0.42***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Years in ESD*Grd 4 participant	-0.08***	0.05		-0.07***	0.03	
	(0.02)	(0.06)		(0.01)	(0.07)	
District % ESD*Grd 4 participant	0.27*		0.10	0.20		0.07
	(0.14)		(0.12)	(0.14)		(0.13)
Yrs in ESD*Grd 4 nonparticipant	-0.05***	0.07*		-0.05**	0.05	
	(0.02)	(0.04)		(0.01)	(0.05)	
District % ESD*Grd 4 nonparticipant	0.46**		0.28*	0.41*		0.21
	(0.19)		(0.16)	(0.21)		(0.17)
Male	-0.03***	-0.03***	-0.03***	-0.04***	-0.04***	-0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
# Students	10291	10291	10291	10291	10291	10291
# Districts	59	59	59	59	59	59

Standard errors (clustered by district) in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All regressions include district and year fixed effects.
IV regressions use district % ESD as an instrument for years in ESD.

Table 7: Effect of ESD programming on exam results, grade 7 Aboriginal students 2002-2004.

Variable	Numeracy gain score			Reading gain score		
	OLS	IV	Reduced Form	OLS	IV	Reduced Form
Years in ESD	0.06***	-0.09		-0.02	0.33*	
	(0.02)	(0.27)		(0.02)	(0.18)	
District % ESD	-0.22		-0.13	0.51*		0.48*
	0.39		(0.38)	(0.27)		(0.27)
Male	-0.02	-0.01	-0.02	-0.10***	-0.10***	-0.10***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
First-stage F-statistic		48.00			31.70	
(p-value)		(0.00)			(0.00)	
# students	7507	7507	7507	7803	7803	7803
# districts	59	59	59	59	59	59

Standard errors (clustered by district) in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All regressions include district and year fixed effects.
IV regressions use district % ESD as an instrument for years in ESD.

Table 8: Quantile regressions for reduced form effect of ESD programming on exam results, grade 7 Aboriginal students 2002-2004.

	Numeracy gain score			Reading gain score		
Variable	**.25 quantile**	**Median**	**.75 quantile**	**.25 quantile**	**Median**	**.75 quantile**
District % ESD	-0.22	0.17	0.17	0.59**	0.54*	0.34
	(0.52)	(0.29)	(0.38)	(0.29)	(0.29)	(0.29)
Male	-0.03	-0.00	-0.00	-0.09***-	-0.07***	-0.10***
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
# Students	7510	7510	7510	7806	7806	7806
# Districts	59	59	59	59	59	59

Bootstrap standard errors (not clustered) in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All regressions include district and year fixed effects.

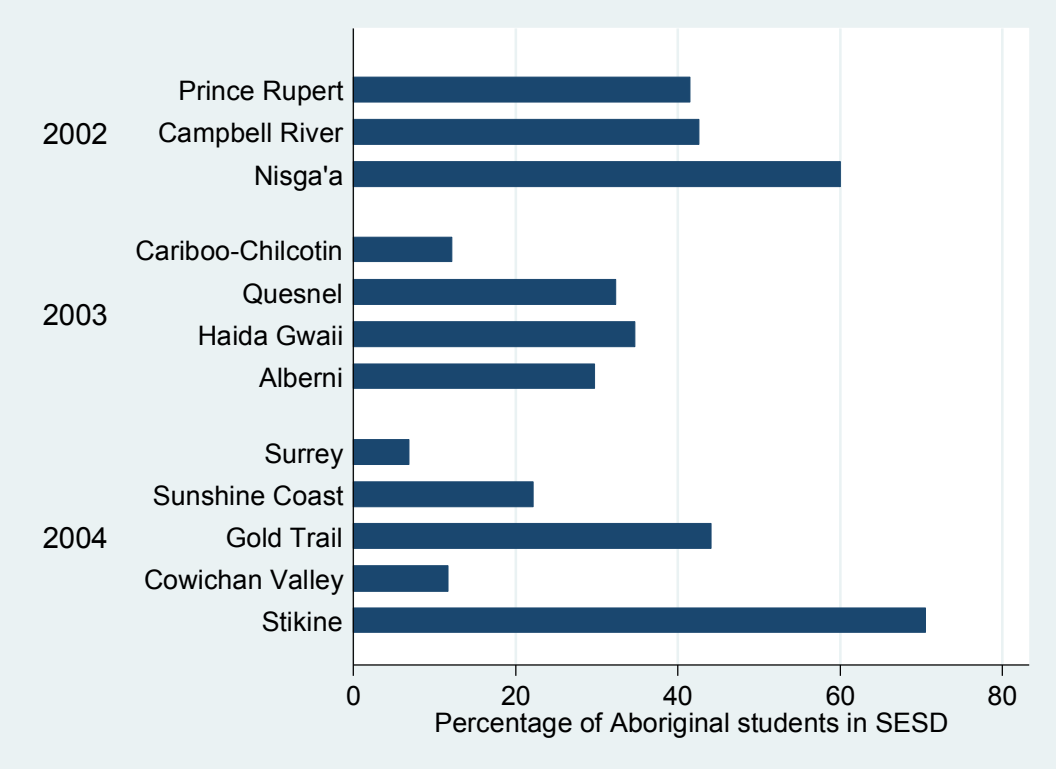
Table 9: Reduced form effect of ESD programming on exam results, grade 7 non-Aboriginal students 2002-2004.

Variable	**Numeracy gain score**	**Reading gain score**
District % ESD	0.05	0.03
	(0.20)	(0.22)
Male	0.02***	-0.09***
	(0.01)	(0.01)
# Students	89697	91219
# Districts	59	59

Standard errors (clustered by district) in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All regressions include district and year fixed effects.

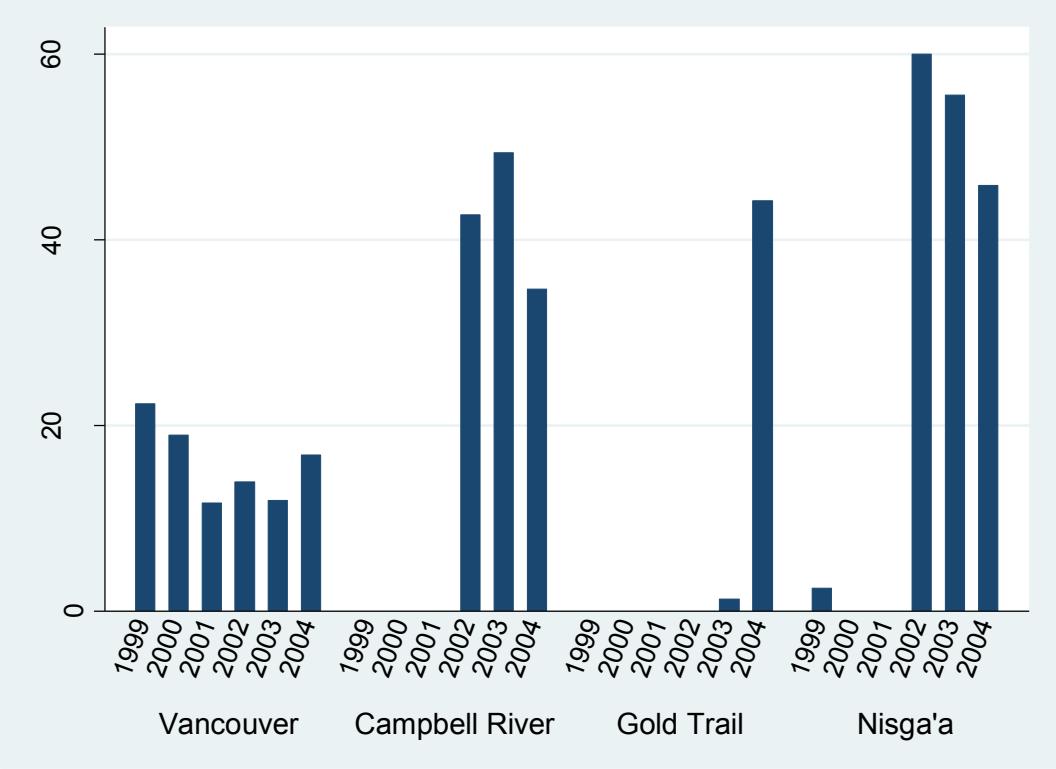
Figures

Figure 1: Percentage of grade 7 Aboriginal students in ESD in first year that district assigns more than 5%* to ESD, 2002-2004.



***and more than 10 grade 7 students in total**

Figure 2: Percentage of grade 7 Aboriginal students in ESD 1999-2004, selected districts.



Appendix

Table A1: First stage regression results

Variable	First stage regression
Male	0.04*
	(0.02)
% ESD in district	2.36***
	(0.33)
Observations	10290
R-squared	0.26

Standard errors (clustered by district) in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Includes district and year fixed effects.

Table A2: Effect of ESD on probability of taking the FSA exam, grade 7 Aboriginal students 2002-2004.

	Numeracy exam participation			Reading exam participation		
Variable	OLS	IV	Reduced Form	OLS	IV	Reduced Form
Years in ESD	-0.11***	0.08		-0.09***	0.05	
	(0.02)	(0.06)		(0.02)	(0.05)	
% ESD in district	0.44***		0.19	0.34**		0.12
	(0.16)		(0.13)	(0.13)		(0.12)
Male	-0.05***	-0.05***	-0.05***	-0.06***	-0.07***	-0.07***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	10291	10291	10291	10291	10291	10291

Standard errors (clustered by district) in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All regressions include district and year fixed effects.
IV regressions use district % ESD as an instrument for years in ESD.