Sorting, peers and achievement of Aboriginal students in British Columbia[1]

Jane Friesen
Simon Fraser University
Brian Krauth
Simon Fraser University

April 2009

Abstract

We use administrative data on students in grades 4 and 7 in British Columbia to examine the extent to which differences in the characteristics of provincial schools attended by Aboriginal and non-Aboriginal students contribute to the achievement gap between these two groups as measured by standardized test scores. We find that segregation of Aboriginal and non-Aboriginal students is substantial, and that differences in the distribution of Aboriginal and non-Aboriginal students across schools account for roughly half the overall achievement gap on the Foundation Skills Assessment tests in grade 7. The substantial school-level segregation of Aboriginal and non-Aboriginal student across schools means that Aboriginal students on average have a higher proportion of peers who are themselves Aboriginal, and who have disabilities. We estimate the effect of peer composition on value-added exam outcomes, using longitudinal data on multiple cohorts of students together with school-by-grade fixed effects to account for endogenous selection into schools. We find that having a greater proportion of Aboriginal peers, if anything, improves the achievement of Aboriginal students. We find limited evidence that having a greater proportion of peers with disabilities adversely affects the achievement of Aboriginal students.

JEL Codes: I21
Keywords: Aboriginal education, school choice, peer effects

[1] Edudata Canada provided the data used in this research, assembled from B.C. Ministry of Education records by Maria Trache. Funding for this project provided by Human Resources and Skills Development Canada through the Canadian Skills and Labour Market Research Network and by Simon Fraser University's Community Trust Endowment Fund is gratefully acknowledged. Michele Battisti provided excellent research assistance.
Corresponding author: Jane Friesen (friesen@sfu.ca).

1 Introduction

Aboriginal Canadians have an above-average incidence of almost every marker of social and economic deprivation, including poverty (Mendelson 2006), poor health outcomes, drug and alcohol addiction, and suicide (Health Canada 2003). Improving the educational outcomes of Aboriginal children and youth provides one potential avenue for breaking the cycle of poverty among Aboriginal Canadians. 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).

Inspired in part by similar debates in the United States regarding school choice and African-American youth, several commentators (Richards and Vining 2004; Cowley 2005) have suggested that school choice is a potentially important avenue to improving educational outcomes among Aboriginal youth in B.C. While Canadian provinces have not gone as far as many U.S. jurisdictions in pursuing choice-based education reforms, some provinces have moved in the direction of greater accountability and choice. B.C. in particular has moved to encourage parents to make informed school choices through changes to enrolment policies and by making school-level standardized test results available to parents (British Columbia Ministry of Education 2003).

Proponents of school choice policies argue that these policies will improve the academic outcomes of disadvantaged students by both broadening access to the most effective schools (U.S. Department of Education 2004, p. 9), and increasing the overall supply of effective schools through increased competition (Hoxby 2003). Improving access to high quality schools has been a cornerstone of educational policies in the United States designed to improve the educational achievement of African American students since the landmark decision in *Brown v. Board of*

Education.[2] More recently, the *No Child Left Behind Act* of 2001 requires that districts allow students who attend persistently low-achieving schools be offered the opportunity to attend higher-achieving schools. School choice in the U.S. occurs in the context of a substantial and persistent black/white achievement gap, pronounced racial segregation across U.S. public schools, and differences in the quality of schools that blacks and whites typically attend. Substantial differences in school quality may arise in jurisdictions where school districts rely on local taxation for revenue, and where African-American students are more likely to attend schools that have relatively few resources because they are more likely to live in low-income neighborhoods. Moreover, African-American students may be disadvantaged when they attend school with peers who are themselves low-achieving (e.g. Hoxby 2000, Hanushek and Rivkin 2006a, Card and Rothstein 2007).

Our objective is to contribute to establishing a similar evidence base that can inform discussions about the potential for school choice policies to benefit Aboriginal students in Canada. We use a newly available administrative data set provided by the B.C. Ministry of Education to document the achievement gap between Aboriginal and non-Aboriginal students in B.C. as measured by standardized test scores in grades 4 and 7, and to investigate the relationship between this gap and student characteristics, particularly differences in rates of assessed disabilities. We next measure the extent to which Aboriginal students are segregated from non-Aboriginal students at school. B.C.'s school funding rules provide districts with roughly similar resource levels, so this source of variation in school quality is not as salient as in the U.S. context.[3] However, if peer effects are important, differential sorting of Aboriginal and non-Aboriginal students may lead to systematic differences in the quality of the learning environments of Aboriginal and non-Aboriginal students. We provide econometric estimates of the effects of peer group composition on Aboriginal students' achievement as measured by B.C.'s Foundation Skills Assessment tests. We focus in particular on the share of peers who are Aboriginal or who are classified as disabled.

Our main results are as follows. We find that the grade 7 test score gap is large in both reading and numeracy, with most of the gap developing by grade 4. We find that differences in rates of

---

[2] *Brown v. Board of Education* 347 U.S. 483 (1954).

[3] Even with the same funding levels, schools that serve Aboriginal populations may have greater difficulty attracting and retaining teaching and administrative staff if they are geographically isolated.

identified disability do not explain much of the test score gap. We find a substantial degree of segregation between Aboriginal and non-Aboriginal students, suggesting that school environments can in principle play an important role in the achievement gap. We decompose the mean grade 7 test score gap into across-school (the extent to which Aboriginal students tend to attend schools in which both Aboriginal and non-Aboriginal students do poorly on the exams) and within-school (the extent to which Aboriginal students do worse on the exam than non-Aboriginal students in the same school) gaps. We find that about half of the gap takes the form of within-school variation. The segregation of Aboriginal and non-Aboriginal students implies that the average Aboriginal student has a substantially higher proportion of Aboriginal peers and a somewhat higher proportion of peers with disabilities. However, we do not find that the characteristics of Aboriginal students' peers that result from this sorting contribute significantly to the relatively low test scores of Aboriginal students. If anything, Aboriginal students perform better when they attend school with a greater proportion of peers who are themselves Aboriginal, and experience limited if any disadvantage from attending school with a greater proportion of peers with disabilities.

2 Data and institutional background

2.1 Access and funding

All students in B.C. are guaranteed placement in their neighborhood or "catchment area" public school. In addition, most public school districts offer magnet programs. French Immersion is the most popular magnet program in the province, enrolling about 5 percent of elementary school students. Prior to 2003, if a student wanted to register at a non-catchment public school other than through a magnet program, permission was required from both the principal of the catchment area school and the principal of the school of registration. In 2003, the Province instituted an official "open boundaries" policy that allows any student in B.C. to attend any public school if there are spaces available after local students have enrolled. It is not known whether this policy change has had a quantitatively important effect on cross-boundary enrolments. In addition, approximately 10 percent of students in the province attend a private school. Some Aboriginal students who live on reserves also have the option of attending a band-run school on reserve land. These schools are not included in the provincial school system and are outside of the scope of our analysis.

With the exception of on-reserve Aboriginal schools, funding for elementary and secondary education in Canada is the responsibility of the provinces and territories. In B.C., the provincial Ministry of Education establishes curricula and provides operating and capital grants to the district school boards, who then allocate funds to individual public schools. District funding levels are based on a number of factors, including per-school allocations and per-student allocations, with supplementary funding based on the presence and number of students in several categories. In particular, districts receive supplemental funding for each Aboriginal student enrolled, for students with special educational needs, and for students who require English as a Second Language (ESL) services. Per student funding levels before and after 2002, when several major changes to the funding formula were introduced, are summarized in Table 1.

This provincial public school funding formula means that districts do not have to rely on local sources of revenue, with the result that poorer districts are funded as well as richer districts. Indeed, because supplementary funding is targeted towards students with greater educational needs, districts with a greater number of disadvantaged students receive more generous funding than those with fewer disadvantaged students.

Private schools also receive per-student operating grants of 35-50% of the base public school rate, and are responsible for both teaching the provincial curriculum and meeting various provincial administrative requirements (B.C. Ministry of Education 2005).

2.2 Data description

The administrative data used in this study are drawn from the Ministry's enrolment database and its Foundations Skills Assessment (FSA) exam database. B.C. administers the FSA tests in May of each year to students in grades 4 and 7 in all public and provincially funded private schools in British Columbia, beginning in the 1999/2000 school year.[4] These exams are based on a variety of questions, both multiple-choice and open-ended, and are graded by accredited B.C. teachers. All students are expected to participate in the FSA tests, with the exception of students in ESL programs who have not yet developed sufficient English skills to respond to the test, and some

[4] FSA tests were also administered to grade 10 students between 2000 and 2004; these low-stakes assessments were replaced by high-stakes Provincial examinations beginning in 2005.

special needs students. The FSA exams are relatively low-stakes for all parties. Students' scores do not contribute to their classroom grades and play no role in grade completion. The results do not affect school or district funding. However, school and district-level results are made public and are widely discussed within both the educational system and the news media. In particular, the Ministry of Education posts school-level results on its website, and a private research and advocacy organization produces a widely-publicized and much-discussed annual 'report card' that ranks all of the elementary schools in the province using a methodology based on FSA results (e.g. Cowley and Easton 2004).

Each B.C. student has a unique identification code, and we use an encrypted version of this code to link records across the enrolment and FSA exam databases, and to construct a longitudinal record for each student. Records in the enrolment database are based on Form 1701, the annual enrolment form collected for each student on September 30 of each year. These forms are used by the Ministry to determine school-level operational funding in accordance with the funding formulas described in Section 2.1. The enrolment record includes the student's current grade, school and district identifiers, year, gender, self-reported Aboriginal identity, enrolment in a language program (e.g. ESL, French Immersion, Francophone education), enrolment in a special needs program, and language spoken at home.[5] Records in the FSA exam database include the student's score on each exam, along with a flag indicating whether the student was excused from writing a given exam.[6]

Our data set covers all grade 4 and grade 7 students from the 1999-2000 through 2003-2004 school years. As a result, we observe the first three cohorts from the time they entered grade 4 in

[5] Because of confidentiality restrictions, our study is based on an extract from the original administrative data. The extract differs from the original data in the following ways: (1) enrolment records are provided only for students in grades 4 through 7; (2) student, school, and district identification codes are encrypted in such a manner as to allow for within-database linkage, but not linkage with external information; (3) language spoken at home is aggregated from the over 100 languages in the administrative data into English, Chinese (including Cantonese and Mandarin), Punjabi, and Other; and (4) both language spoken at home and Aboriginal status are provided based on the student's entire history rather than on the current year's self-report. In particular a student is categorized as Aboriginal if he/she ever self-reports as Aboriginal. A student is categorized as speaking English if he/she always self-reports as English, and is otherwise categorized by his/her most frequently reported home language other than English.

[6] Exam scores are calculated from item-level responses based on an item response theory (IRT) model constructed by the Ministry. The IRT scores are provided by the Ministry on a continuous scale with roughly zero mean and unit standard deviation. We normalize the scores in each year, grade, and subject to have exactly zero mean and unit standard deviation across the province.

1999, 2000 or 2001 through the end of their anticipated grade 7 year three years later. Using the unique student identifier, we link the records of students across multiple years to construct a panel of students who were in grade 7 between 2002 and 2004.[7]

3 The test score gap between Aboriginal and non-Aboriginal students

Over 9% of the students in our data are reported by their parents or guardians as having Aboriginal identity. The extent to which this figure is an over- or under-estimate of the true proportion is unclear. On one hand, the availability of supplementary funding may lead schools to encourage parents and guardians to identify their children as Aboriginal. On the other hand, anecdotal reports suggest that some parents and guardians are reluctant to identify their children as Aboriginal within the school system because of concerns about stigma or discrimination. The proportion of students identified as Aboriginal in our data is roughly comparable to Census-based figures; 8.2% of B.C. children aged 5-14 were identified as Aboriginal by their parents or guardians in the 2006 Census (Statistics Canada 2006).

Table 2 presents our measures of academic achievement for Aboriginal and non-Aboriginal students. Aboriginal students in grade 7 score more than 0.6 standard deviations on average below non-Aboriginal students on both exams. Among students who wrote the FSA numeracy test in both grades, the gap between the mean test scores of Aboriginal and non-Aboriginal students grew by an additional 0.05 standard deviations between grades 4 and 7, and the reading test score gap grew by 0.09 standard deviations. To put this difference in comparative context, the mean test score gap between blacks and whites on standardized numeracy tests in Texas elementary schools is about 0.76 standard deviations in grade 8, and grows by about 0.06 standard deviations between grades 3 and 8 (Hanushek and Rivkin, 2006a, Table 3).

The use of test scores to measure achievement and of test score gains to measure academic progress has the limitation that it restricts attention to those students who participated in the

[7] A minority of students who are observed in both grades 4 and 7 repeat grades, skip grades, or are out of province 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.

exam, and is thus subject to bias from endogenous participation. This problem can be particularly acute when studying groups that have relatively low average achievement. Table 3 provides exam participation statistics on the population of grade 7 students in B.C. from 2002 through 2004. Aboriginal students are more than twice as likely to miss each grade 7 exam as non-Aboriginal students. About half of exam non-participants are excused from the exam. The other half simply do not take the exam, either by being absent from school on exam day or by being non-responsive to the exam. This high nonparticipation rate results in a high proportion of Aboriginal students with missing gain score data: about 29% on the numeracy exam and about 26% on the reading exam. While this is certainly a sufficiently high nonparticipation rate to be concerned about bias, it should be noted that it is not out of line with the literature. For example, Hanushek et al. (2002) report exam participation rates for non-disabled and non-bilingual students in the well-known and heavily-used Texas Schools Project data. For that relatively high-participation subgroup, they report grade 4 and grade 7 participation rates of 81.5% and 81.9% respectively.

Table 4 shows a clear trend towards both lower FSA participation[8] of Aboriginal students and a higher proportion of Aboriginal students being excused from the exams. Most of the growth in the proportion of students excused occurred between 1999 and 2001, but the downward trend in overall participation has continued. Table 5 provides information on the related question of who exactly is missing the exams. As might be expected, nonparticipation in the grade 7 exam is not random. Students who failed to take the grade 7 exam without being excused were about five times more likely to have also missed the grade 4 exam than were grade 7 exam participants. Grade 7 unexcused nonparticipants that took the grade 4 exam scored 0.3 standard deviations below average. Among those that were excused from the grade 7 exam, about 38% were also excused from the grade 4 exam, and another 16% simply failed to take it. The average score on the grade 4 exam among those that were subsequently excused from the grade 7 exam was 1.2 standard deviations below average. Finally, students with disabilities account for a majority (about 62%) of excused absences from the exams, and a substantial proportion (about 28%) of unexcused absences.

[8] Tables 4 and 5 report participation rates for the numeracy exam. Participation rates for the reading exam are quite similar.

In order to address our concerns about patterns of nonparticipation, we construct an alternative binary indicator of progress that covers anyone who takes a test in either year and is in the provincial school system for both years. A student who takes a given exam in both years is considered to have made progress if his or her test score increases between grade 4 and grade 7. A student who misses the exam in grade 4 but takes it in grade 7 is also considered to have made progress. Students whose test scores decrease, or who move from taking the exam in grade 4 to missing the exam in grade 7 are considered not to have made progress. Students who miss the exam in both grades are treated as missing outcomes, and students who are out of the provincial school system during either grade 4 or grade 7 are simply outside the population under analysis. Table 6 shows that our binary indicator of progress from grade 4 to grade 7 has a much smaller proportion of missing values, especially for Aboriginal students: about 9% for numeracy and about 8% for reading.

This binary indicator of progress confirms our finding that a lower proportion of Aboriginal students experience improved exam outcomes in grade 7 relative to grade 4, but the difference in progress rates is small relative to the difference in achievement levels. Table 6 shows that about 44% of Aboriginal students improve on the numeracy exam, versus about 48% of non-Aboriginal students. The gap in reading is larger: 44% of Aboriginal students experience improved exam outcomes, versus about 51% of non-Aboriginal students. Again, it seems that though the pattern of relative underachievement among Aboriginal students is established by grade 4, there is no sign of convergence towards non-Aboriginal achievement levels between grades 4 and 7; rather, Aboriginal students continue to fall further behind during these middle school years.

Some insight into the student-level factors underlying the relatively low participation rates and test scores of Aboriginal students is provided in Table 7. The incidence of assessed disabilities is two and half times higher in the Aboriginal population than in the non-Aboriginal population, and Aboriginal students are only one-third as likely as non-Aboriginal students to be assessed as gifted. Aboriginal students are overrepresented in every category of disability, but most dramatically in the severe behavioural disorder category. Almost 7% of Aboriginal students are

found to have a moderate or severe behavioural disorder, compared to fewer than 2% of non-Aboriginal students.

Table 8 presents results from OLS regressions where the dependent variable is the level of the individual student's test score on the grade 7 numeracy or reading exam. The first column reproduces the difference in mean test scores of Aboriginal and non-Aboriginal students. The second column includes controls for gender and whether a student has a disability. The regression coefficients in column 2 show that, as expected, students with disabilities have much lower achievement levels than those who do not. Given their high rate of disabilities, developing effective programs for these special populations is of particular importance for Aboriginal students. However, in spite of these results, and in spite of the higher disability rates among Aboriginal children, the Aboriginal test score gap remains at almost 0.6 standard deviations on both tests when we condition on disability. This analysis indicates that improving outcomes for disabled students would have a limited effect on the overall Aboriginal/non-Aboriginal test score gap. The third column of Table 8 adds school fixed effects to the previous specification. We return to a discussion of the fixed effects results below.

Table 9 presents estimates from a similar set of specifications where the dependent variable is the change in the student's reading or numeracy test score between grades 4 and 7. The results show that about 6% of the test score gap in numeracy in grade 7 and 14% of the test score gap in reading emerges after grade 4 (computed by dividing the coefficient on the Aboriginal dummy from column 1 in Table 9 by the same coefficient from column 1 in Table 8). Although policies that focus attention on the years before grade 4 have significant potential to improve later outcomes, Aboriginal children do continue to fall further behind on average between grades 4 and 7. When we include the additional control variables in this value-added specification in column 2, we again find that disabled students warrant particular policy attention. Conditional on these characteristics, Aboriginal students continue to fall behind their non-Aboriginal schoolmates at a rate that is of considerable policy significance.

The third columns of Tables 8 and 9 add school fixed effects to the previous specifications. The results in Table 8 show that the average within-school conditional (on student characteristics) test score gap, measured from the schools that have both Aboriginal and non-Aboriginal

students, is about 60% as large as the overall gap (0.35/0.58) in numeracy, and about 67% as large as the overall gap in reading. The results in Table 9 show that the average growth in the numeracy test score gap is about half (.02/.04) as large as the overall growth rate when the comparison is made between Aboriginal and non-Aboriginal students who attend the same school. The average growth in the test score gap in reading between Aboriginal and non-Aboriginal students who attend the same school is about two-thirds as large as the growth in the overall reading test score gap. These substantial within-school gaps in both the levels and growth rates of the reading and numeracy exams imply that school choice policies that reallocate students across schools could only go so far towards eliminating the test score gap. However, it is not possible to use these regression results to be more precise about the potential role of within- versus across-school effects. As shown in Hanushek and Rivkin (2006a), the overall mean test score gap cannot be simply decomposed into the sum of the within-school gap as measured by the regression coefficient in the fixed effects specification, and the across-school component, except in the special circumstance of identical enrolment shares of Aboriginal and non-Aboriginal students across schools. We next examine the issue of sorting across schools and the magnitude of the across-school component of the test score gap.

4 Sorting across schools

Aboriginal and non-Aboriginal students are likely to exhibit different school attendance patterns for several reasons. First, Aboriginal and non-Aboriginal students tend to live in different communities. Aboriginal students in Canada are disproportionately located in small rural communities and a handful of urban centres (Statistics Canada 2008). Second, differential patterns of attendance at magnet and private schools also contribute to the overall pattern of sorting. Non-Aboriginal students are almost twice as likely to attend private schools as Aboriginal students: 10.6% of non-Aboriginal students in our data attend private schools, compared to 5.7% of Aboriginal students. Another 6.2% of non-Aboriginal students are enrolled in French Immersion programs, compared to 2.4% of Aboriginal students.

Figure 1 shows the frequency distribution of the proportion of Aboriginal students among the grade 7 cohorts at all B.C. public and private schools in 2002, 2003 and 2004. In over 22% of cases, no Aboriginal students were enrolled in grade 7 within a school and year. Private schools

and magnet schools play an important role in the sorting process: almost two-thirds of the cohorts that had no Aboriginal students were found in either private schools or French Immersion magnet programs.[9] In the modal grade 7 school cohort in our sample, at least one student and fewer than 10% of students are Aboriginal; over 42% of all cohorts fall into this category. In another 17% of cohorts, between 10% and 20% of students are Aboriginal. At the other extreme, almost 3% of our cohorts include no non-Aboriginal students. The overall picture that emerges is one in which over 25% of the grade 7 school cohorts between 2002 and 2004 are fully segregated, and Aboriginal students are dispersed widely across schools that enroll both Aboriginal and non-Aboriginal students.

Figures 2 and 3 provide frequencies of the percentage of a student's peers who are Aboriginal, for Aboriginal and non-Aboriginal students respectively. Figure 2 shows that almost 5% of the Aboriginal students in our sample have no Aboriginal same-grade peers. More than 27% of Aboriginal students have more than zero but less than 10% Aboriginal peers. Another 23% of Aboriginal students attend schools where between 10% and 20% of their same-grade peers are Aboriginal. A substantial fraction of Aboriginal students attend schools in which Aboriginal students are more heavily concentrated, and over 5% of Aboriginal students have no non-Aboriginal peers. Figure 3 shows that, in contrast, almost 75% of non-Aboriginal students attend schools where less than 10% of same-grade peers are Aboriginal. The proportion of non-Aboriginal students who attend schools in which Aboriginal students are the majority is negligible.

The extent to which Aboriginal and non-Aboriginal students are distributed differently across schools can also be summarized with a standard dissimilarity index (Duncan and Duncan 1955). According to this measure, slightly fewer than half of Aboriginal students would have to change schools in order to achieve an equal distribution of the two groups across schools.[10]

---

[9] In schools that house both regular and French Immersion programs, we define the French Immersion program as a distinct "school" in all of our analysis.

[10] The dissimilarilty index is calculated as $D = \frac{1}{2}\sum_{s=1}^{S}\left|\frac{n_s^A}{n^A} - \frac{n_s^{NA}}{n^{NA}}\right|$, where n_s^A is the number of Aboriginal students attending school s; n^A is the total number of Aboriginal students; n_s^{NA} is the number of non-Aboriginal

The unequal distribution of Aboriginal and non-Aboriginal students across schools means that we cannot use a simple linear decomposition based on our earlier regression results to decompose the overall test score gap into within-school and across-school components. In order to evaluate the potential contribution that the observed sorting across schools may contribute to the test score gap, we use the formula in Hanushek and Rivkin (2006a, equation 1). Table 10 shows that about 50% of the mean gap in numeracy in grade 7 and about 55% of the gap in reading is accounted by the across-school component. About 50% of the growth in the numeracy test score gap and 40% of the growth in the reading test score gap between grades 4 and 7 is accounted for by the across-school component. Across-school factors appear to be somewhat less important in B.C. than in Texas, where Hanushek and Rivkin (2006a) report that over 75% of the growth between grades 3 and 8 in the black/white test score gap is accounted for by across-school factors.

5 How important are peers?

Given the substantial amount of sorting of Aboriginal and non-Aboriginal students across schools, the differences in their achievement levels and growth, and the sizable across-school component of the overall mean test score gap, the hypothesis that differences in school quality contribute to the relatively low achievement levels of Aboriginal students warrants serious consideration. Hanushek and Rivkin (2006a,b) find that observable school-level factors including teacher experience, student turnover and the racial composition of the student body explain a significant proportion of the black/white achievement gap in Texas. Our data do not include measures of school inputs such as teacher salaries, accreditation and experience or class size. In any case, the provincial funding formula described earlier implies that variation in the quality of teaching inputs across schools is likely to be considerably smaller in B.C. than in U.S. jurisdictions that rely on local taxation to support schools. However, if peer effects are important, differences in peer group composition may be an important dimension along which Aboriginal and non-Aboriginal students experience differences in average school quality.

---

students attending school s; and n^{NA} is the total number of non-Aboriginal students. The index values for our data in all three years are very similar; the 2004 value is 48.5.

The peer environment may create challenges for Aboriginal students through a variety of avenues: students may learn from one another and thus learn less when in contact with low-achieving peers; parents with limited resources of time, money, or skills may be unable to supply public goods to their child's classroom; and students with behavioral disorders or learning disabilities may take instruction time or attention away from classmates. On the other hand, more homogeneous classes may facilitate efficiency through specialization; for example, Aboriginal children with special learning needs may be better supported in schools where more of their classmates have similar needs. Moreover, when Aboriginal children have more Aboriginal classmates, they may be less exposed to racism and may find more support for a positive cultural identity. A growing body of evidence with respect to the role of racial segregation and peer effects in the U.S. has produced mixed results (e.g. Rivkin and Welch 2006, Card and Rothstein 2007). In the Canadian context, Friesen and Krauth (2008) find significant peer effects associated with some home language groups on the test scores of non-Aboriginal students in data from British Columbia drawn from the same administrative file used in this paper. We are aware of no previous econometric analysis of the effects of peers on the outcomes of Aboriginal students.

5.1 Model specification and research design

Manski (1993, 2000) demonstrates that peer effects are in general not identified from cross-sectional data whenever the assignment of individuals to groups is nonrandom. Whether through private schooling or housing markets, family income and education also influence the quality of a child's school. Either of these factors will lead to nonzero correlation between peer group composition and unobserved school or student factors relevant to educational outcomes. In order to distinguish between peer effects and these unobserved factors, we use a now-standard method for estimating peer effects in education that uses individual student-level panel data from multiple cohorts of students within each school,[11] and exploits the small but plausibly random

[11] Like both Hoxby and Hanushek et al., we measure peer composition at the grade rather than the classroom level and therefore avoid selection effects associated with classroom assignment. Betts and Zau (2005) are able to distinguish between classroom and grade-level peer effects in their administrative data set from San Diego. Their results indicate that most of the effect of peers' achievement on individual achievement is related to classroom peers

year-to-year variation in peer group composition within a school to consistently estimate school-by-grade level peer effects, while allowing for systematic cross-school variation in school or student quality. This approach has been used by a number of authors in varying contexts (e.g. Hoxby 2000, Hanushek and Rivkin 2006a,b, Cooley 2007, Lavy, Paserman and Schlosser 2007).

The model is constructed as follows. Students are indexed by $i=1,2,\ldots,n$; schools by $s=1,2,\ldots,S$; grades by $g=4,7$; and time by $t=1,2,\ldots,T$. FSA exam subjects (i.e. reading and numeracy) are indexed by $j=1,2$. Let $y^j_{i,g}$ be the score of student i on exam j in grade g. Let $t(i,g)$ be the school year in which the student takes grade g, and let $s(i,g)$ be the school student i attends in grade g. Let $X_{i,g}$ be a vector of student i's individual background characteristics in grade g, and let the vector $\overline{X}_{i,g}$ be the average value of X among student i's same-grade schoolmates in grade g. The simple value-added (SVA) model takes the form:

$$y^j_{i,7} - y^j_{i,4} = \beta^j X_{i,7} + \lambda^j \overline{X}_{i,7} + \delta^j_{t(i,7)} + \alpha^j_{s(i,7)} + \nu^j_{s(i,7),t(i,7)} + u^j_{i,7}$$
$$E\left(\nu^j_{s(i,7),t(i,7)} + u^j_{i,7} \middle| X_{i,7}, \overline{X}_{i,7}, \delta^j_{t(i,7)}, \alpha^j_{s(i,7)}\right) = 0 \qquad (1)$$

where β^j and γ^j are vectors of parameters to be estimated, $\delta^j_{t(i,7)}$ is an unobserved year-specific fixed effect, $\alpha^j_{s(i,7)}$ is an unobserved school-specific fixed effect, $\nu^j_{s(i,7),t(i,7)}$ is an unobserved school-and-year-specific effect and $u^j_{i,7}$ is an unobserved individual-specific effect.[12]

The content of our identifying assumption is similar to that in the related literature; while the overall composition of a school may be systematically related to unobserved school and student characteristics, the small cohort-to-cohort fluctuations in composition within a school may be

---

in mathematics, and to both classroom and grade level peers in reading. They find that including only grade level peer effects results in somewhat smaller coefficient estimates, but does not change the overall pattern of the results.

[12] The simple value-added model (SVA) that we estimate is one of two econometric models of the educational production function that are standard in the education literature (Todd and Wolpin 2005). In the simple value-added model, the dependent variable is the change in test scores between grades 4 and 7. In the alternative model, known as the modified value-added (MVA) model, the dependent variable is the grade 7 test score, and grade 4 test scores (in both subjects) are included as control variables. Both models are generally interpreted as reduced-form estimating equations for a structural model in which the current test score is a function of cumulative inputs to the student's educational production function. For either model, this interpretation requires the strong assumption that the earlier test score is a sufficient statistic for all relevant prior inputs. An SVA model implies that past inputs should enter into current performance with no "decay." That is, the SVA model is a special case of the MVA model. While the MVA model thus has the advantage of being more general, it has the disadvantage of being subject to attenuation bias from measurement error in the earlier test score.

considered essentially random and thus unrelated to cohort-to-cohort fluctuations in other unobserved factors. Note that we allow for within-group common shocks like, for example, an instructor being replaced with a lower-skilled substitute while on parental leave, provided these shocks are unrelated (in conditional mean) to the observed composition of the group.

A further complication in interpreting our regression coefficients as parameters of a cumulative-input education production function is introduced by the fact that there is a three-year gap between exams. Our main regressions only include measures of grade 7 inputs, including both peer characteristics and the school fixed effect. With unlimited data it would be preferable to include grade 5 and 6 inputs as well, including grade-specific school fixed effects. As such an approach would rapidly exhaust degrees of freedom in our regressions, we prefer to estimate models with grade 7 inputs only. These results should be interpreted with the caveat that grade 7 peer characteristics are also acting as a proxy for grade 5 and 6 peer characteristics.[13]

We also estimate a second value-added model that uses the binary indicator of progress reported in Table 6 and discussed in Section 3. As described earlier this binary indicator is based on the idea that exam nonparticipation is itself an outcome of interest, and treats nonparticipation as a negative outcome. Because the binary indicator of progress is much more likely to be observed than the test score gain, regressions using this outcome variable provide a robustness check on the main results.

5.2 Results

The population in our regression analysis is B.C. public and private school students who attended grade 7 between 2002/2003 and 2004/2005, and who were enrolled in grade 4 in B.C. in 1999/2000 or later. All specifications are estimated from the population of Aboriginal students for whom the relevant outcome is observed, while the school-grade compositional variables are based on the entire population of enrolled students, including both non-Aboriginal students and students who do not take the exam. The individual-level control variables include gender and current special needs category, if applicable, and the peer measures include the proportion of

[13] Note that this issue would still be present (though to a substantially lesser degree) in data with annual testing: students change schools during the year, and the peer group measured on a particular day during the year is used as a proxy for the peer group during the year as a whole.

same-grade peers who are Aboriginal, male, and classified as having various types of disabilities. Table 11 provides means of these regressors for Aboriginal and non-Aboriginal students.

Our regression results for the simple value-added model, in which the dependent variable is the test score gain, are reported in Table 12. School and year fixed effects are included in all specifications, and estimated standard errors are robust to clustering at the school-year level. Peer group composition is being reported in decimal rather than percentage units, so each coefficient can be interpreted as the exam score increase (in standard deviations) associated with the percentage of peers in a given category increasing from 0% to 100%. The specification in column (1) includes individual controls along with the percent male and percent Aboriginal. The specification in column (2) adds percent learning/behavioural disability and percent other disability.[14]

The coefficients for the individual characteristics differ in some cases from the estimates in Table 9. In particular, the coefficient on behavioural disabilities is smaller and statistically insignificant when peer characteristics are included in the model and the sample includes Aboriginal students only. On the other hand, having a disability in the "other" category appears to have a larger effect on reading scores.

Turning to the peer effects estimates, our results are consistent with those found elsewhere in the literature that male peers are associated with lower test score gains (e.g. Hoxby 2000, Lavy and Schlosser 2007). This result is statistically significant in the case of the numeracy exam. Interestingly, the effect of Aboriginal peers is positive in all specifications, and it is statistically significant in our base specification for the numeracy exam. Peers with learning or behaviour disabilities are associated with lower test score growth in numeracy, although these estimates again are statistically insignificant. Moreover, they are quite small in magnitude given the range of variation in our data. Peers who have other disabilities have a positive influence on Aboriginal students' test score gains. This result is consistent with other research for non-

[14] This disaggregation of special needs into three categories follows work by Hanushek, Kain and Rivkin (2002) and Friesen, Hickey and Krauth (2008). Learning and behavioural disabilities together account for about 70% of disabled students in B.C.

Aboriginal students in B.C. that finds a positive effect of students with "other" disabilities on the test scores of disabled non-Aboriginal students (Friesen, Hickey and Krauth 2008).

Table 13 presents parameter estimates from an alternative value-added model in which the outcome variable is the binary indicator of progress reported in Table 6. Note that because the scale of the outcome variable is different, the coefficients will not be comparable in magnitude to those reported in Table 12. However, the two sets of regressions display a very similar pattern of results. There is no evidence that Aboriginal peers have a negative effect on the probability that Aboriginal students make progress as measured by our indicator. The negative effect of peers with learning disabilities or behavioural disorders is now statistically significant in the case of numeracy. The point estimate suggests a moderate effect, given the range of variation we observe in the data. A one standard deviation (6.2 percentage point) increase in the share of peers with learning disabilities or behavioural disorders would reduce by 1.4 percentage points the probability that the achievement of an Aboriginal student improves, as measured by our binary progress indicator.

6 Conclusion

Our estimates show that about half of the growth in the test score gap between Aboriginal and non-Aboriginal students between grades 4 and 7 can be accounted for by across-school factors, so the potential role of differences in school characteristics in explaining the overall achievement gap is substantial. However, the funding formula used in B.C. directs greater resources into school districts with greater numbers of Aboriginal students and students with special needs, so it seems unlikely that the achievement gap between Aboriginal and non-Aboriginal students is explained by a relative lack of financial resources in schools that Aboriginal students attend. It is possible that these schools are less successful at attracting skilled teachers; unfortunately, our data do not allow us to explore this hypothesis. Aboriginal and non-Aboriginal students are sorted across schools so that the average Aboriginal student has a substantially higher proportion of Aboriginal peers and peers with disabilities, and we implement a methodology that allows us to measure plausibly causal effects of small variations in peer composition on student test score growth.

Our econometric evidence provides little support for the hypothesis that peer composition contributes to the across-school component of the growth in the test score gap between Aboriginal and non-Aboriginal students. If anything, Aboriginal students may benefit from attending school with higher concentrations of Aboriginal students and higher concentrations of students with some disabilities, perhaps because these students bring additional funds. We find weak evidence that Aboriginal students' disproportionate exposure to students with learning disabilities and behavioural disorders may have a moderate adverse impact on their achievement. These results are consistent with the results of other research on peer effects associated with disabled students (Hanushek et al. 2002, Friesen, Hickey and Krauth 2008). Given the absence of evidence that Aboriginal students' peers have a substantial influence on their academic performance, it is tempting to conclude that school choice policies, such as voucher systems, could not contribute much to the academic achievement of Aboriginal students. However, it is important to bear in mind that our methodology uses small year-to-year changes in peer composition within a school to identify peer effects, and the results may not generalize to larger differences across schools in peer composition.

References

B.C. Ministry of Education, 2002. *2002/03 Operating Grants Manual to British Columbia School Boards.* Available at http://www.bced.gov.bc.ca/k12funding/funding/02-03/estimates/operating-grants-manual.pdf

British Columbia Ministry of Education, 2003. *Interpreting and communicating British Columbia Foundation Skills Assessment results.* http://www.bced.gov.bc.ca/assessment/fsa/pdfs/fsa_interpretation_2003.pdf

_____, 2005. *Overview of Independent Schools in British Columbia*. http://www.bced.gov.bc.ca/independentschools/geninfo_05.pdf

Betts, Julian R. and Andrew Zau, 2005. Peer groups and academic achievement: Panel evidence from administrative data. Working paper, University of California, San Diego.

Card, David, 1999. The causal effect of education on earnings, in Orley Ashenfelter and David Card eds., *Handbook of Labor Economics, Volume 3A.* Amsterdam: Elsevier North-Holland.

Card, David and Rothstein, Jesse, 2007. Racial segregation and the black-white test score gap, *Journal of Public Economics* 91(11-12): 2158-2184.

Cooley, Jane, 2007. Desegregation and the achievement gap: Do diverse peers help? Working paper, University of Wisconsin-Madison.

Cowley, Peter, 2005. Give Native students the freedom to choose, *National Post*, March 28, A20.

Cowley, Peter and Steven Easton, 2004. *Report Card on British Columbia Elementary Schools*. Vancouver: Fraser Institute.

Dee, Thomas S., 2004. Are there civic returns to education? *Journal of Public Economics* 88: 1696-1712.

Duncan, Otis D. and Beverly Duncan, 1955. A methodological analysis of segregation indexes, *American Sociological Review* 20: 210–217.

Friesen, Jane and Brian Krauth, 2008. Enclaves, peer effects and student learning outcomes in British Columbia, Working Paper, Simon Fraser University.

Friesen, Jane, Ross Hickey and Brian Krauth, 2008. Disabled peers and academic achievement, Working Paper, Simon Fraser University.

Greenwood, Daphne T., 1997. New developments in the intergenerational impacts of education, *International Journal of Education Research* 27: 503-512.

Hanushek, Eric A., John F. Kain, and Steven G. Rivkin, 2002. Inferring program effects for special populations: Does special education raise achievement for students with disabilities? *Review of Economics and Statistics* 84: 584-599.

Hanushek, Eric A. and Steven G. Rivkin, 2006a. School quality and the black-white achievement gap, NBER Working Paper No. 12651, National Bureau of Economic Research.

Hanushek, Eric A. and Steven G. Rivkin, 2006b. New Evidence about Brown v. Board of Education: the complex effects of school racial composition on achievement, University of Texas at Dallas.

Health Canada, First Nations and Inuit Branch, 2003. *A Statistical Profile of the Health of First Nations in Canada.*

Hoxby, Caroline M., 2000. Peer effects in the classroom: Learning from gender and race variation. NBER Working Paper 7867, National Bureau of Economic Research.

_____, 2003. School choice and school productivity: Could school choice be a tide that lifts all boats?, in Caroline M. Hoxby, ed., *The Economics of School Choice*, Chicago: University of Chicago Press.

Kenkel, Donald S., 1991. Health behavior, health knowledge and schooling, *Journal of Political Economy* 99: 287-305.

Lavy, Victor and Analia Schlosser, 2007. Mechanisms and impacts of gender peer effects at school, NBER Working Paper No. 13292, National Bureau of Economic Research.

Lavy, Victor, M. Daniele Paserman and Analia Schlosser, 2007. Inside the black box of peer ability effects: Evidence from variation of high and low achievers in the classroom, Working Paper.

Lochner, Lance and Enrico Moretti, 2004. The effect of education on crime: Evidence from prison inmates, arrests and self-reports, *American Economic Review* 94: 155-189.

Manski, Charles F., 1993. Identification of endogenous social effects: The reflection problem, *Review of Economic Studies* 60: 531-542.

_____, 2000. Economic analysis of social interactions, *Journal of Economic Perspectives* 14: 115-136.

Mendelson, Michael, 2006. *Aboriginal Peoples and Post-Secondary Education in Canada*. Ottawa: Caledon Institute of Social Policy.

Richards, John and Aidan Vining, 2004. *Aboriginal Off-reserve Education: Time for Action*. Toronto: C.D. Howe Institute.

Rivkin, Steven and Finis Welch, 2006. Has school desegregation improved academic and economic outcomes for blacks?, in Eric Hanushek and Finis Welch, eds., *Handbook of Economics of Education, Volume 2*. Amsterdam: Elsevier North-Holland.

Statistics Canada, 2006. *Census of Population*. Statistics Canada Catalogue No. 97-551-XCB2006005.

_____,2008. Aboriginal Peoples in Canada in 2006: Inuit, Métis and First Nations, 2006, *The Daily*. http://www.statcan.ca/Daily/English/080115/d080115a.htm

Todd, Petra E. and Kenneth I. Wolpin, 2003. On the specification and estimation of the production function for cognitive achievement: Home, school and racial test score gaps, *The Economic Journal* 113: F3–F33.

U.S. Department of Education, 2004. *Public School Choice.* http://www.ed.gov/policy/elsec/guid/schoolchoiceguid.pdf.

Wolfe, Barbara and Robert Haveman, 2001. Accounting for the social and non-market benefits of education, in John Helliwell, ed., *The Contribution of Human and Social Capital to Sustained Economic Growth and Well-being*. Vancouver: University of British Columbia Press.

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 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

Source: B.C. Ministry of Education (2002), page 4.
*amount per student depends on total number of Aboriginal students in the district.

Table 2: Achievement levels and growth, grade 7 students 2002-2004.

Variable	Non-Aboriginal	Aboriginal	Total
Grade 7 numeracy score	0.05	-0.57	0.00
	(0.99)	(0.87)	(1.00)
Grade 7 reading score	0.06	-0.58	0.00
	(0.98)	(1.01)	(1.00)
Gain in numeracy score	-0.03	-0.08	-0.04
	(0.81)	(0.76)	(0.81)
Gain in reading score	0.01	-0.08	0.01
	(0.79)	(0.78)	(0.79)

Standard deviations in parentheses

Table 3: Participation in FSA exams, grade 7 students 2002-2004.

Variable	Non-Aboriginal	Aboriginal	Total
% taking grade 7 numeracy exam	90.7	77.2	89.4
% taking grade 7 reading exam	91.6	80.4	90.6
% excused from grade 7 numeracy exam	4.2	10.9	4.8
% excused from grade 7 reading exam	4.2	10.1	4.7
% without numeracy gain data	12.4	28.7	14.0
% without reading gain data	10.9	25.8	12.3

Table 4: Trends in numeracy exam participation, grade 4 and 7 Aboriginal students 1999-2004.

Year	Grade 4 Numeracy		Grade 7 Numeracy	
	% Taking	% Excused	% Taking	% Excused
1999	83.6	7.9	83.6	6.7
2000	82.8	7.8	80.5	9.7
2001	81.7	11.4	77.6	12.8
2002	79.4	9.8	77.9	10.7
2003	78.2	10.8	76.4	11.8
2004	79.0	9.8	74.8	11.1

Table 5: Characteristics of Aboriginal students by participation in grade 7 numeracy exam, 2002-2004.

Variable	Participation in grade 7 exam			
	Took exam	Unexcused absence	Excused absence	Total
Grade 4 numeracy score	-0.5	-0.8	-1.2	-0.5
% excused from grade 4 numeracy exam	3.2	15.2	37.9	8.2
% took grade 4 numeracy exam	91.3	73.7	46.4	84.6
% male	49.0	52.0	61.9	50.8
% with identified disability in grade 7	10.2	28.2	62.4	18.0

Table 6: Binary progress indicators, grade 7 students 2002-2004.

Variable	Non-Aboriginal	Aboriginal	Total
% without numeracy progress indicator	3.0	8.7	3.5
% without reading progress indicator	2.8	7.9	3.3
% showing progress in numeracy	48.0	43.5	47.6
% showing progress in reading	51.5	44.4	50.8

Table 7: Characteristics of grade 7 students 2002-2004 (percent).

Variable	Non-Aboriginal	Aboriginal	Total
% taking grade 7 numeracy exam	90.7	77.2	89.4
# of observations	139,610	14,167	153,777
total	90.8	9.2	100.0
currently in special education	9.5	18.7	10.4
physical/sensory disability	1.1	2.2	1.2
intellectual disability or autism	1.1	3.3	1.3
severe behavioral disorder	0.8	3.4	1.0
moderate behavioral disorder	1.1	3.4	1.3
learning disability	3.0	5.8	3.3
Total disabled	7.1	18.0	8.1
gifted	2.4	0.7	2.2

Table 8: Levels regression (dependent variable is grade 7 exam score), all grade 7 students 2002-2004.

Variable	Numeracy exam			Reading exam		
	(1)	(2)	(3)	(1)	(2)	(3)
School fixed effects	N	N	Y	N	N	Y
Aboriginal	-0.62***	-0.58***	-0.35***	-0.64***	-0.60***	-0.40***
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)
Male		0.14***	0.15***		-0.24***	-0.24***
		(0.01)	(0.01)		(0.01)	(0.01)
Learning disability		-0.76***	-0.70***		-0.84***	-0.80***
		(0.02)	(0.01)		(0.02)	(0.02)
Behavioural disorder		-0.62***	-0.51***		-0.58***	-0.48***
		(0.02)	(0.02)		(0.02)	(0.02)
Other disability		-0.62***	-0.55***		-0.68***	-0.61***
		(0.03)	(0.03)		(0.03)	(0.03)
Observations	138745	138744	138744	140457	140456	140456
R^2	0.03	0.05	0.19	0.03	0.08	0.17

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Year fixed effects in all regressions.

Table 9: Value-added regression (dependent variable is difference between grade 7 and grade 4 exam score), all grade 7 students 2002-2004.

Variable	Numeracy exam			Reading exam		
	(1)	(2)	(3)	(1)	(2)	(3)
School fixed effects	N	N	Y	N	N	Y
Aboriginal	-0.04***	-0.04***	-0.02*	-0.09***	-0.09***	-0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Male		0.02***	0.02***		-0.09***	-0.09***
		(0.00)	(0.00)		(0.01)	(0.00)
Learning disability		-0.01	0.02		-0.01	0.00
		(0.02)	(0.02)		(0.02)	(0.02)
Behavioural disorder.		-0.09***	-0.06***		-0.08***	-0.07***
		(0.02)	(0.02)		(0.02)	(0.02)
Other disability		-0.07**	-0.04		-0.13***	-0.11***
		(0.03)	(0.03)		(0.03)	(0.03)
Observations	122438	122438	122438	124761	124761	124761
R^2	0.00	0.00	0.12	0.00	0.00	0.06

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Year fixed effects in all regressions

Table 10. Decomposition of Aboriginal/non-Aboriginal test score gaps, all grade 7 students, 2002-2004.

	Numeracy exam			Reading exam		
	Grade 4	Grade 7	Growth	Grade 4	Grade 7	Growth
Overall	0.584	0.619	0.035	0.580	0.638	0.058
Between schools	0.291	0.306	0.015	0.265	0.287	0.022
Within schools	0.293	0.313	0.020	0.315	0.351	0.036

Table 11: Mean characteristics of grade 7 students 2002-2004.

Variable	Non-Aboriginal	Aboriginal	Total
Male	51.3	50.8	51.3
Learning disability	3.0	5.8	3.3
Behavioural disorder	1.9	6.7	2.3
Other disability	2.2	5.5	2.5
% Male peers	51.2	51.7	51.3
	(10.0)	(10.4)	(10.1)
% Aboriginal peers	7.5	26.0	9.2
	(9.5)	(26.3)	(13.2)
% English-language peers	80.0	90.6	80.9
	(25.0)	(17.4)	(24.6)
% ESL peers	5.7	6.4	5.7
	(9.4)	(12.4)	(9.7)
% disabled peers	7.8	11.1	8.1
	(6.5)	(9.2)	(6.9)
% peers with learning/behavioral disability	4.4	5.8	4.5
	(4.5)	(6.2)	(4.7)
% peers with other disability	3.4	5.3	3.6
	(4.0)	(6.3)	(4.3)

Standard deviations in parentheses

Table 12: Value-added regression for effect of peer background characteristics (dependent variable is difference between grade 7 and grade 4 exam score), grade 7 Aboriginal students 2002-2004.

Variable	Numeracy exam		Reading exam	
	(1)	(2)	(1)	(2)
Male	-0.03	-0.02	-0.10***	-0.10***
	(0.02)	(0.02)	(0.02)	(0.02)
Learning disability	-0.01	-0.01	0.05	0.05
	(0.05)	(0.05)	(0.05)	(0.05)
Behavioural disorder	-0.03	-0.03	-0.06	-0.06
	(0.04)	(0.04)	(0.04)	(0.04)
Other disability	0.09	0.09	-0.21***	-0.21***
	(0.08)	(0.08)	(0.08)	(0.08)
% male peers	-0.18*	-0.18*	-0.11	-0.12
	(0.11)	(0.11)	(0.10)	(0.10)
% Aboriginal peers	0.26*	0.24	0.11	0.09
	(0.15)	(0.15)	(0.13)	(0.13)
% learning/behavioral disability		-0.22		0.10
		(0.22)		(0.23)
% other disability		0.22		0.15
		(0.25)		(0.25)
Observations	9611	9611	10006	10006
R^2	0.21	0.21	0.17	0.17

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
School and year fixed effects in all regressions.

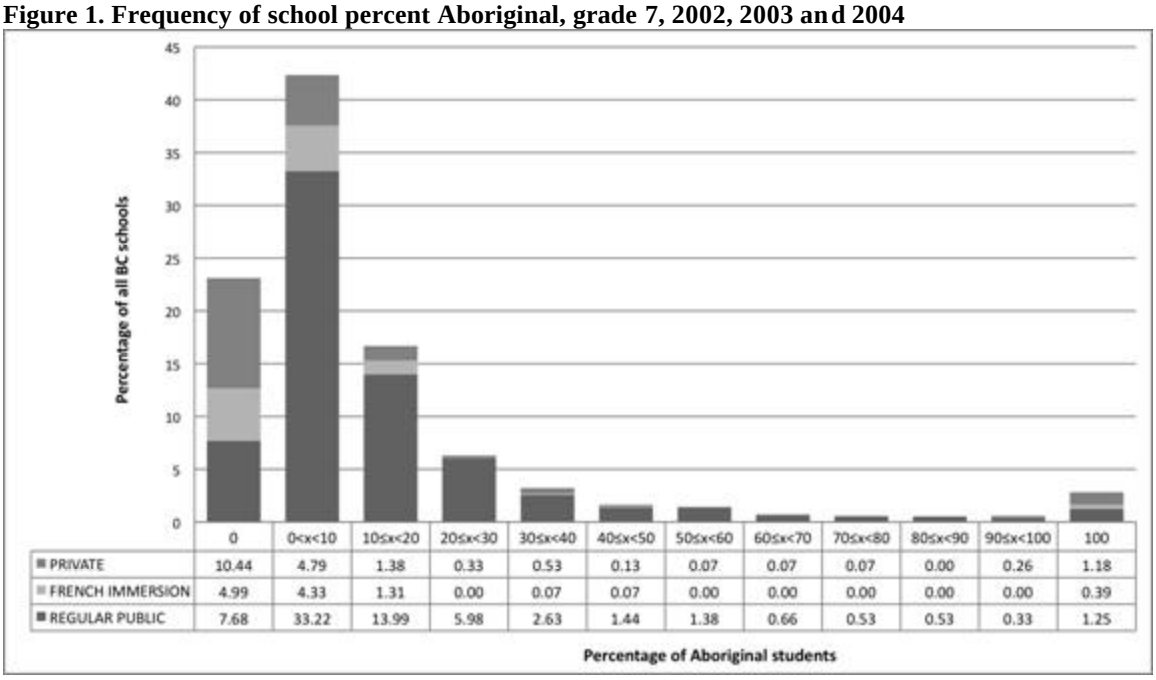
Table 13: Value-added regression for effect of peer background characteristics (dependent variable is binary indicator of progress between grade 4 and grade 7), grade 7 Aboriginal students 2002-2004.

Variable	Numeracy exam		Reading exam	
	(1)	(2)	(1)	(2)
Male	-0.00	-0.00	-0.02**	-0.02**
	(0.01)	(0.01)	(0.01)	(0.01)
Learning disability	-0.03	-0.03	0.03	0.03
	(0.02)	(0.02)	(0.02)	(0.02)
Behavioural disorder	-0.05***	-0.06***	-0.06***	-0.06***
	(0.02)	(0.02)	(0.02)	(0.02)
Other disability	-0.05	-0.05	-0.10***	-0.10***
	(0.03)	(0.03)	(0.03)	(0.03)
% male peers	-0.02	-0.01	-0.00	-0.00
	(0.05)	(0.05)	(0.06)	(0.06)
% Aboriginal peers	0.01	0.01	0.08	0.07
	(0.07)	(0.08)	(0.07)	(0.07)
% learning/behavioral disability		-0.21*		-0.03
		(0.11)		(0.12)
% other disability		0.07		0.03
		(0.13)		(0.12)
Observations	12322	12322	12428	12428
R^2	0.14	0.14	0.13	0.13

Cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
School and year fixed effects in all regressions.

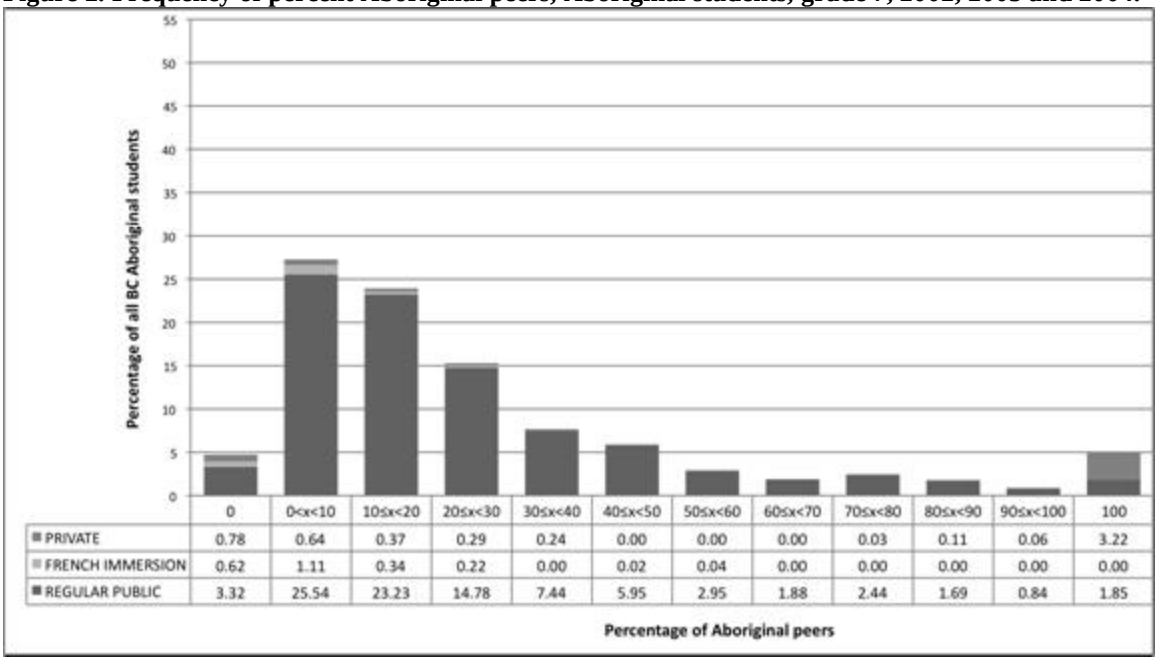
Figures

Figure 1. Frequency of school percent Aboriginal, grade 7, 2002, 2003 and 2004



	0	0<x<10	10≤x<20	20≤x<30	30≤x<40	40≤x<50	50≤x<60	60≤x<70	70≤x<80	80≤x<90	90≤x<100	100
PRIVATE	10.44	4.79	1.38	0.33	0.53	0.13	0.07	0.07	0.07	0.00	0.26	1.18
FRENCH IMMERSION	4.99	4.33	1.31	0.00	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.39
REGULAR PUBLIC	7.68	33.22	13.99	5.98	2.63	1.44	1.38	0.66	0.53	0.53	0.33	1.25

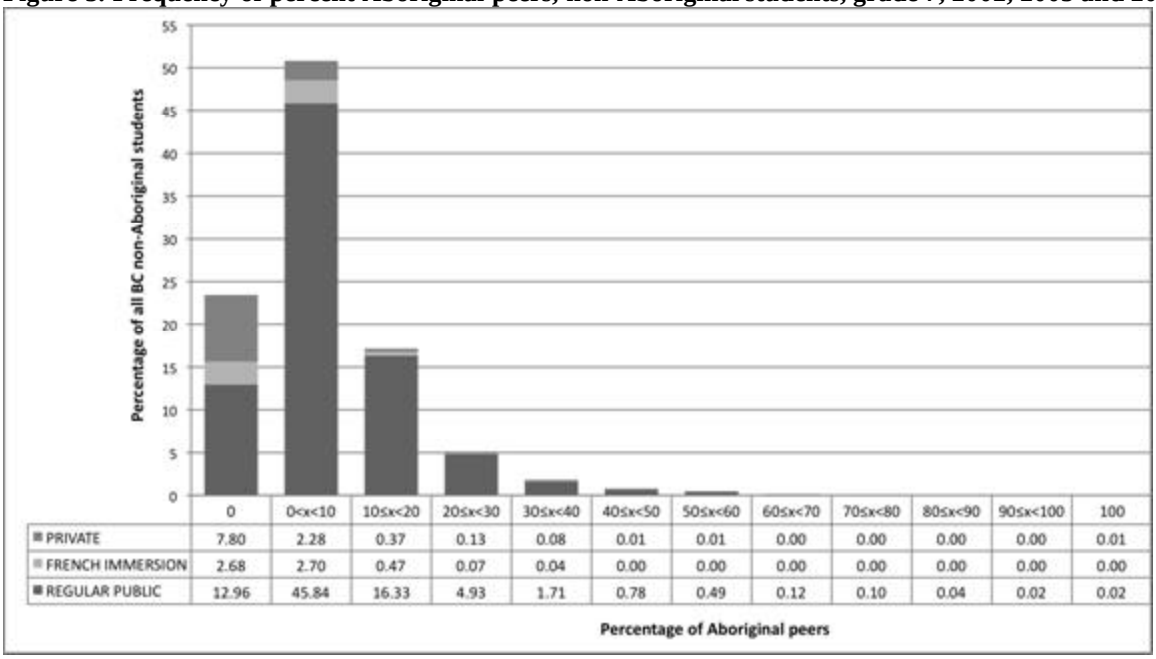
Figure 2. Frequency of percent Aboriginal peers, Aboriginal students, grade 7, 2002, 2003 and 2004.



	0	0<x<10	10≤x<20	20≤x<30	30≤x<40	40≤x<50	50≤x<60	60≤x<70	70≤x<80	80≤x<90	90≤x<100	100
PRIVATE	0.78	0.64	0.37	0.29	0.24	0.00	0.00	0.00	0.03	0.11	0.06	3.22
FRENCH IMMERSION	0.62	1.11	0.34	0.22	0.00	0.02	0.04	0.00	0.00	0.00	0.00	0.00
REGULAR PUBLIC	3.32	25.54	23.23	14.78	7.44	5.95	2.95	1.88	2.44	1.69	0.84	1.85

Percentage of Aboriginal peers

Figure 3. Frequency of percent Aboriginal peers, non-Aboriginal students, grade 7, 2002, 2003 and 2004.



	0	0<x<10	10≤x<20	20≤x<30	30≤x<40	40≤x<50	50≤x<60	60≤x<70	70≤x<80	80≤x<90	90≤x<100	100
PRIVATE	7.80	2.28	0.37	0.13	0.08	0.01	0.01	0.00	0.00	0.00	0.00	0.01
FRENCH IMMERSION	2.68	2.70	0.47	0.07	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
REGULAR PUBLIC	12.96	45.84	16.33	4.93	1.71	0.78	0.49	0.12	0.10	0.04	0.02	0.02