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## EDUCATION PAPERS

# British Columbia's Best Schools: Where Teachers Make the Difference

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I N D E P E N D E N T • R E A S O N E D • R E L E V A N T

- This study compares student outcomes at British Columbia elementary schools where students come from similar socio-economic backgrounds, thus revealing "good" schools where principals, teachers and staff are making a positive difference to student performance.
- This alternative means of identifying the best schools in the province shows that there are both public and independent schools among the top performers.
- The resulting school ratings by percentile are useful not only to parents, but also to teachers, school board administrators and education officials who wish to identify schools whose practices deserve imitation.

How do parents, teachers, taxpayers and school administrators know how well individual elementary schools in British Columbia perform in teaching students? This *e-brief* compares outcomes at schools where students come from similar backgrounds, and identifies top performing schools whose practices deserve investigation and, perhaps, imitation.

British Columbia conducts the Foundation Skills Assessment (FSA) in numeracy, reading and writing for students in grades 4 and 7 at all schools in the province. In previous work (Johnson 2008), I showed that in British Columbia about half of the variation in school test scores (averaged over many tests over many years) is associated with differences in students' socio-economic and educational environments.<sup>1</sup> It is reasonable to infer that much of the remaining variation reflects factors specific to a school, such as the quality of the principal, teachers and other staff.

By adjusting test score data to remove the influence of socio-economic factors, as well as considering the issues around students designated as special education (not gifted) students, I have constructed relative school performance indicators that are more representative of a school's actual effectiveness than rankings based on raw annual results. This *e-brief* and the associated database present a set of school ratings using FSA Grade 4 and Grade 7 results from the three academic years 2005/06, 2006/07 and 2007/08.

**MEASURING SCHOOL PERFORMANCE:** The first step in creating the ratings is to determine how schools did on these FSA assessments relative to the rest of the province. Only schools where there are at least 15 students in each year of the assessment are included.<sup>2</sup> I call, for convenience, the percentage of all students in

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John Richards, Jane Friesen and an anonymous reviewer provided excellent comments on a previous draft. Maria Trache at Edudata was very helpful in providing BC education data. All remaining errors are my own.

1 Similar school ratings are also published by the C.D. Howe Institute for schools in Alberta and Ontario.

2 A rating is created for 966 schools with Grade 4 and 769 schools with Grade 7. These totals include 116 independent schools with Grade 4 and 110 independent schools with Grade 7.

a grade in a year that meet or exceed FSA expectations, the school ‘pass rate.’ Note the pass rate I use is a percent of all students in the grade not just those who wrote the test. Otherwise, schools that excluded weaker students from writing the test would have a higher pass rate than schools that did not exclude their weaker students.<sup>3</sup>

Next, I calculate the adjusted pass rate in each year on each type of assessment. This is the school pass rate minus the provincial average pass rate; a positive value is a value greater than the provincial average, a negative value is lower than the provincial average.<sup>4</sup> The results are then averaged over the three years and the three tests. A value of 5, for example, indicates that 5 percentage points more Grade 4 students at a school, relative to the provincial average, met or exceeded expectations on the Grade 4 FSA. (Figure 1 plots this success measure on the vertical axis for a set of Grade 4 schools.)

Using information on the postal codes of students’ homes, we can use detailed socio-economic data from the most recent Census to draw an accurate picture of the family backgrounds of students at any elementary school in British Columbia.<sup>5</sup> Some individual characteristics of test takers are also reported directly in the FSA and school administrative data.<sup>6</sup> (**Click here** for more detailed social, economic and educational profiles of schools in British Columbia.)

The last step is to estimate the statistical relationship between school performance, measured by the school’s adjusted pass rate and socio-economic factors of students at the school (see the appendix for details). The diagonal set of upward-sloping school results (Figure 1) is the estimated relationship between adjusted pass rates and a subset of variables from the school profiles. The horizontal axis of Figure 1 is labelled the predicted adjusted pass rate.<sup>7</sup> The schools along the upward-sloping line are the schools where the actual adjusted pass rate and the predicted adjusted pass rate take the same value, ranging from 10 percentage points below the provincial average to 15 points above the provincial average. About 40 percent of the variation in FSA results across schools in British Columbia is associated with socio-economic factors. The difference between school outcomes at, for example, Westerman Elementary and Laronde Elementary, a gap of 18 percentage points, is accounted for by the composition of students attending these schools.

The 43 schools on the vertical line of data points in Figure 1 either outperformed or underperformed predicted results. All 43 of these schools share similar social and economic advantages and have a predicted adjusted pass rate between 3.5 and 4.5 percentage points. All of these schools are predicted to be slightly better than the provincial average. Both Windemere and École Pauline Haarer are predicted to get similar FSA results because they draw a similar mix of students. Since the actual pass rate at Pauline Haarer is 20 percentage points better than at Windemere, this strongly suggests Pauline Haarer is a better school. If you conducted the imaginary experiment of moving 100 Grade 4 students from Windemere to Pauline Haarer, 20 more students would meet or exceed expectations on the Grade 4 FSA. It is in this sense that Pauline Haarer is a better school than Windemere.

3 The pass rate as defined above is not the only possible measure of school success. However, the pass rate dominates measures that depend only on results from FSAs written. Suppose the average score on exams written is used as the measure of school success. If a school wants to increase its ranking using average scores as the measure of success, the simplest strategy is to exclude students who are likely to get low scores from writing. If the pass rate is measured as the percentage of exams written that students pass, you would exclude students who might fail as a way of raising the pass rate. These issues were discussed in Johnson (2008).

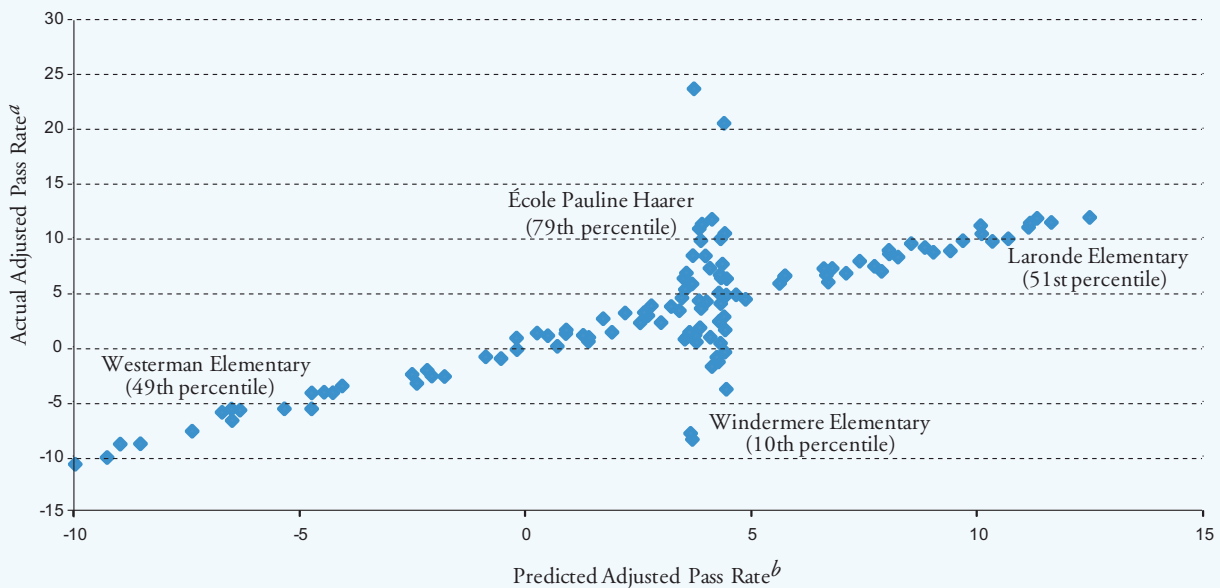
4 It is important to subtract the provincial average pass rate from the school’s pass rate in each year on each assessment. The average pass rate varies greatly across the reading, writing and numeracy tests, both within and across the grades and years of assessment. Using the deviation from the provincial pass rates makes the results comparable across years and across type of assessment. The actual adjusted pass rate is zero for the average school in the province.

5 The census-based variables are: the percentage of lone parents; the percentage of persons born outside Canada; the percentage of persons who immigrated to Canada in the past five years; the percentage of persons who are Aboriginal; the percentage of those over 20 years of age without a high-school diploma; the percentage of those over 20 years of age who have some university education; the percentage of those over 20 years of age with a university degree; the percentage of persons who moved in the last calendar year and in the last five calendar years; the percentage of persons living in detached dwellings; the percentage of persons who speak an official language as their mother tongue; the unemployment rate of adults with children and average household income.

6 The following student characteristics are known: gender; enrolled in French Immersion; enrolled in English as a Second Language; Aboriginal; special education (not gifted); gifted; English speaking at home.

7 The regressions that produce the predicted adjusted pass rate include three types of variables. With respect to students actually participating in the FSA, they are: the percentage of girls, the percentage of students speaking English at home, the percentage of Aboriginals in the grade, the percentage of special education students (not gifted) in the grade. With respect to students attending the schools and the students’ census location, they are: the percentage who moved in the last year, the percentage of lone parents, the unemployment rate in households with children and the percentage of adults over 20 associated with the school who have some university education. In predicting Grade 7 FSA results, there are additional indicator variables that ask if the school in question begins in Grade 6 or begins in Grade 7. The details of the prediction equation are found in the appendix.

Figure 1: Actual and Predicted Test Scores of Selected British Columbia Grade 4 Schools



Sources: Author's calculations from 2006 Census; FSA.

*a* School pass rate on FSAs minus the provincial average pass rate.

*b* Expected pass rate at school given the socio-economic backgrounds of students.

### Interpreting the Relative School Performance Measures

The relative performance measures for grades 4 and 7 for all schools in British Columbia could be placed on a figure like Figure 1. However, the result would be difficult to interpret graphically since the figure would contain about 1,000 dots. The solution is to express the amount by which a school is above or below its predicted adjusted pass rate as a percentile. A percentile score near 50 indicates that, compared to schools with students that have similar socio-economic characteristics, a school is at the median: half of other schools are better and half are worse. On the other hand, a percentile score of 90 says that a school is better than 90 percent of schools whose students have similar social and economic characteristics. This would be a very good school. There is no meaningful difference in a statistical sense between a school with a percentile rating of 50 and of 51. This emphasizes that percentile numbers are not a school ranking system. The percentile is information about the likelihood that, with students from similar environments, one school is producing students with better FSA results than another similar school. A low percentile number is an indication that that school produces a smaller proportion of students who passed the FSA relative to a similar school. A school with a low participation rate in the FSA will receive a lower percentile score.

The percentile scores are shown in parentheses for four schools in Figure 1. Westerman (percentile score 48) and Laronde (percentile score 51) are similar and are on the upward sloping line. Percentile scores from 40 to 60 indicate school results that are quite similar to results at other schools where students come from the same background. But the gap between the percentile score for Pauline Haarer (79) and Windemere (10) is large enough to identify a difference in school performance.

### Identifying British Columbia's Best Schools

Seventeen schools in British Columbia achieved above the 90th percentile in both the Grade 4 and 7 FSA (Table 1).<sup>8</sup> The list includes schools with many Aboriginals and very few Aboriginals, many well-educated parents and very few well-

<sup>8</sup> The 90th percentile is an admittedly arbitrary cutoff used only for the purpose of constructing this table.

Table 1: Schools Above the 90th Percentile in Both Grades 4 and 7, 2005/06, 2006/07, 2007/08

School District	School Type	School Name	Neighborhood Characteristics	GRADE 4						GRADE 7					
				Percent Aboriginal	Percent Special Needs	Actual Pass Rate	Predicted Pass Rate	Percentile All Schools	Percentile Public Schools Only	Percent Aboriginal	Percent Special Needs	Actual Pass Rate	Predicted Pass Rate	Percentile All Schools	Percentile Public Schools Only
Surrey	Public	Cloverdale Traditional	Some University	2	10	8	-6	93	95	2	6	13	0	92	94
Surrey	Independent	Khalsa School (Surrey)		0	0	14	-2	96		0	0	16	0	95	
Surrey	Independent	Our Lady of Good Counsel		0	0	24	9	95		0	0	23	8	95	
Vancouver	Public	Britannia Community Elementary		43	9	-6	-19	92	95	47	22	-5	-27	99	99
Vancouver	Independent	Corpus Christi School		0	0	23	7	96		0	0	29	10	97	
Vancouver	Public	Grandview Elementary		60	31	-23	-39	96	94	43	35	-14	-31	97	92
Vancouver	Independent	Khalsa School (Vancouver)		0	0	17	-1	97		0	0	26	4	99	
Vancouver	Independent	St Augustine's		0	0	24	11	92		0	0	26	13	92	
Vancouver	Independent	St Francis Xavier		0	0	19	-1	99		0	0	19	3	96	
Vancouver	Independent	St Francis of Assisi		2	0	17	-3	99		3	0	23	2	99	
Vancouver	Independent	St Patrick's Elementary		0	0	11	-1	91		0	0	17	2	94	
Maple Ridge	Independent	Meadowridge School		0	0	26	11	95		0	0	28	14	93	
Prince Rupert	Public	Pineridge Elementary		48	21	-10	-27	97	97	36	24	-6	-23	96	94
Prince Rupert	Public	Roosevelt Park Elementary		90	32	-36	-51	95	90	85	32	-29	-47	97	93
Prince Rupert	Public	Westview Elementary		34	12	5	-13	97	98	25	12	9	-9	97	98
Nanaimo-Ladysmith	Public	Forest Park Elementary		9	12	10	-5	95	95	14	9	10	-3	91	93
Conseil scolaire francophone	Public	l'ecole Victor Brodeur		4	10	7	-5	91	94	3	9	14	-1	95	96
<b>Provincial Average</b>			<b>28</b>	<b>8</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>50</b>	<b>50</b>	<b>8</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>50</b>	<b>50</b>

Sources: Author's calculations from 2006 Census; FSA.

educated parents. The list includes eight public and nine independent schools.<sup>9</sup> All independent schools are listed with zero special needs (not gifted) students. Since there is no funding attached to special needs (not gifted) students in independent schools, these schools all report zero special needs students. As explained in the appendix, a higher percentage of special needs students predicts a lower adjusted pass rate.<sup>10</sup> The (clearly incorrect) assumption that every independent school has no special needs students makes it harder, not easier, for independent schools to have high percentile values. It is interesting that such a large proportion of the best performing schools in Table 1 are independent schools and mainly Catholic schools in Vancouver. This is a result that requires further investigation.

To be absolutely certain that the percentiles for public schools are not changed by including independent schools in the statistical comparisons, the percentiles are recalculated using only public schools (the last columns of each grade in Table 1). The percentiles using only the public schools are virtually identical. A reader who is only interested in public schools could use the second percentile rating for comparisons entirely within the public school system.

## Conclusion

This analysis solves, to a very large degree, the problem of using FSA results to make a fair comparison between schools, both public and independent. The outcomes compare schools where students are from similar social and economic backgrounds. There remain substantial differences in the performance of students in FSA tests across similar schools. Schools with high percentile rankings merit praise and, potentially, emulation by their lower performing counterparts.

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9 There are four independent schools in British Columbia that are all boys (St. Georges and Vancouver College) or all girls (York House School and Crofton School). These schools are not included in the analysis since there are not enough single-gender schools in the province to allow a fair comparison and thus construct a percentile.

10 Consider two schools, one independent and one public, where all social, economic and education factors are identical. The public school reports 5 percent special needs (not gifted) students and its predicted adjusted pass rate falls. The independent school, which in this example, actually has 5 percent special needs students but does not report them, has a higher predicted adjusted pass rate. So in constructing the percentile ratings, the private school would receive a lower rating.

The other way to interpret the special needs variable is to take it literally. Then the variable indicates that every single independent school has no special needs (not gifted) students. There is no evidence that this is the case. If we imagine that it is the case, then the predicted adjusted pass rates are exactly correct and the comparison between public with special needs students and independent without special needs students is exactly correct. All special needs students are in the public system and the public system's predicted adjusted pass rate is lower. One conclusion from this analysis is that it would be helpful if independent schools reported if students were special needs students using the same criteria used in the public system, whether or not they receive funding for such students. It is also important to report that the percentile ratings are very similar with and without the special needs variable.

The values of the predicted adjusted pass rates (shown in Figure 1 of the study, as well as in the percentile table) are the fitted values from regressions of the actual adjusted pass rate on a set of social, economic and educational. Table A1 below presents these regressions and provides details of their construction and interpretation. All variables that describe schools, constructed either from administrative data based on students who wrote the FSA or the census data, were considered as potential explanatory variables to measure the association of FSA results and social, economic and educational variables across schools. Table A1 presents two regressions in each grade, one regression estimated using all schools, both private and public, and one regression estimated using the public schools only.

### *Student-Specific Effects on FSA Scores*

Panel 1 of Table A1 shows the association between variables created using the administrative data for students from the grades at the school writing the FSA over the three years studied. The first row presents coefficients on the percentage of girls in the grade at the school over the three years. In Grade 4, holding all other factors constant, a grade at a school with one percentage point more girls is predicted to have a 0.07 (all schools) or 0.08 (public schools only) percentage point increase in the adjusted 'pass rate' (the percentage meeting or exceeding expectations). The association is not significant at the 10 percent level of significance in Grade 4. However in the Grade 7 FSA, an additional one percentage point of girls is associated with a 0.18 (0.17 in the second regression using only public schools) percentage point increase in the percent of students meetings or exceeding expectations. The Grade 7 effect is precisely estimated; that is, is statistically significant. There are four single-gender independent schools in British Columbia, two all-boys schools and two all-girls schools. Because the percentage of girls at such schools is either 0 or 100, there are no comparable schools. These four schools are not included in the regression model or in the percentile calculations. The percentage of students reporting English as the language at home is also positively associated with higher FSA results. An increase in the percent of Aboriginal students is associated with lower FSA results. The effect of having more Aboriginal students in a class is very large. If a school contains an additional percentage of Aboriginal students, then the adjusted pass rate is predicted to fall by between 0.27 and 0.33 percentage points depending on the grade and exact regression.

The use of the percentage of students in a grade who are designated special education students requires further explanation. As discussed in the text, all independent schools report zero special education students. They are not required to report numbers of such students. This means that in the regressions including all schools, the prediction equation is making the assumption that there are no students in the independent system that would be classified as special education students in the public system. After making this assumption, the regression coefficients show that if the percentage of special education students is one percentage point higher, the predicted pass rate is 0.71 percentage points lower in both Grade 4 and Grade 7. In creating the percentiles that rate the schools, using the regression including all schools creates an advantage to the public school system in the percentile calculations; that is, the independent schools get lower percentiles. Imagine two identical schools, a public school with 5 percent students in special education and an independent school with the same percentage of actual special education students but a reported percentage of zero special education students. Thus the private school predicted pass rate would be 3.5 percentage points higher (0.71 times 5) higher than that in the public school with the identical characteristics. Since the method compares actual pass rates to predicted pass rates, constructing the all-schools regression places the independent schools at a significant disadvantage.

A second reason to include the special education percentage as a prediction variable in the all-schools regression, even when we know there must be some special education students in independent schools, is that this model takes literally the frequently heard proposition that independent schools do not service special education (not gifted) students to the same extent as the public system. The regression estimated in this way assumes that all special education students are in the public system and none are in the private system and calculates percentiles

based on that assumption. It would be useful for future analysis if independent schools reported special needs students using the same criteria as public schools.

One check on the role of the special education variable is to re-estimate the regression using only the public schools. The coefficients on the other variables do not change very much. However when the regression is estimated only with public schools, the magnitude of the special education coefficient falls. The predicted pass rate falls by 0.51 percentage points in Grade 4 and 0.42 percentage points in Grade 7 per additional percentage point of special education students rather than the 0.71 in the all-schools regression. The correlation coefficients between the percentiles calculated as described in the text in the pairs of regressions using public schools in Table 2 are 0.99 in Grade 4 and 0.98 in Grade 7. The percentile tables at [www.cdhowe.org](http://www.cdhowe.org) include percentiles from both regressions. To be clear, removing independent schools from the comparison group does not change the percentile score of public schools within the public school list to any significant degree.

The other check on the role of the special education variable is to estimate the model without the special education variable for all schools. The correlation coefficient between percentiles is 0.92 in both grades. There are very few schools that fall into either very high or very low percentiles using the regression with the special education variables that do not fall in a similar percentile range using the other regression.<sup>11</sup>

### *Census Characteristics and FSA Scores*

The second panel of Table A1 shows the association of school profile variables using the census and the school's adjusted pass rate. The first variable is the percentage of households who moved in the last year in the areas from which the school draws students based on the postal codes of all students in the school, not the postal codes by grade. If that percentage rises by one percentage point the percentage of students who pass falls by 0.16 percentage points in Grade 4 and 0.32 percentage points in Grade 7. The former coefficient is not statistically significant; the latter coefficient is statistically significant. The second census-based variable is the percentage of lone-parent households in all households with children. If the percentage of lone parents rises by 1 percentage point, the predicted pass rate falls by 0.16 percentage points in Grade 4 and 0.32 percentage points in Grade 7. The latter effect is statistically significant, the former is not. A higher unemployment rate in households with children is associated with lower predicted pass rates. The effect is quantitatively large but statistically significant only at a 10 percent level of significance.

The last variable in the model is one of the measures of education from the census: the percentage of adults over 20 with some university education. This variable is not statistically significant in predicting Grade 4 results. There is quite a strong and significant relationship between a more educated population of adults associated with the school and the school pass rate in Grade 7 where an additional percentage point of adults with some university increases the percentage passing by 0.12 percentage points.

### *School Structure and FSA Scores*

The school-structure variables are used only for the Grade 7 FSA prediction model. There are 769 schools with Grade 7 FSA results. Most schools with Grade 7 offer no higher grade levels. Indicator variables are included in the Grade 7 regressions for schools that start in Grade 6 (51 schools) and in Grade 7 (26 schools). The large negative coefficient on the indicator variable for schools where Grade 7 is the initial grade measures the performance gap, controlling for the other variables, between a school that begins in Grade 7 rather than Grade 8 or Grade 6. The gap is very large, the adjusted pass rate is 6 percentage points lower for a Grade 7 school that starts in Grade 7 compared to other schools. This suggests a need for a better understanding of how the transition from elementary to secondary school is

11 These results and other robustness checks on the specifications of these regressions are available on request from the author.

managed. The school-structure variables mean that the percentile scores for Grade 7 are calculated within the following groups (i) schools that end at Grade 7 are compared to other schools that end at Grade 7; (ii) schools that end at Grade 6 are only being compared to schools that end at Grade 6; (iii) all other grade ranges. Grade ranges are reported in the website material.<sup>12</sup>

### *The Importance of Controlling for Student Background*

The last three rows of Table A1 give basic information on the regressions. The number of schools in each regression is presented. The explanatory power of the regression is a value that falls between zero and one, an indicator of the strength of the relationship between the variables that describe the schools and the adjusted pass rate. If that value were 1.0, then all of the schools in Figure 1 would fall exactly on the upward sloping line. There would be no schools on the vertical line of dots. All of the variation in school results would be associated with variation in the background and educational classifications of students attending schools. The values in the table which lie between 0.37 and 0.44 indicate that between 37 and 44 percent of the variation in adjusted pass rates is associated with variation in observable characteristics of students as measured in the FSA administrative data or in the census. Thus schools where students come from similar backgrounds get very different FSA results. These differences are interpreted as identifying where FSA results are much better than at similar schools and much worse.

It is important that the prediction regression are estimated separately for Grade 4 and Grade 7 FSA because, as already noted, the weights placed on the different prediction variables do clearly differ by grade. It is also important to incorporate the grade structure variables in the Grade 7 prediction regression.

12 This is simply an observation that there is a strong negative association between lower FSA results in Grade 7 and the students attending a school that starts in Grade 7. For example, this study does not identify whether these weaker Grade 7 students produce stronger results later in secondary school or in post-secondary education. More research is needed on the transition from elementary to secondary school.



Table A1

The Regressions Behind the Predicted Adjusted Pass Rates and Percentiles

Variable	Coefficient in Grade 4 Regression (standard error)		Coefficient in Grade 7 Regression (standard error)	
	All schools	Only Public Schools	All schools	Only Public Schools
The percentage of girls	0.07 (.05)	0.08 (.05)	0.18 (.05)**	0.17 (.06)**
The percentage of students speaking English at home	0.13 (.01)**	0.15 (.01)**	0.10 (.02)**	0.11(.02)**
The percentage of aboriginals	-0.33 (.04)**	-0.33 (0.03)**	-0.27 (.05)**	-0.28 (.04)**
The percentage of special education students	-0.71 (.07)**	-0.51 (.07)**	-.71 (.07) **	-0.42 (.08)**
<b>Variables above derived from individual data in the classes at the schools writing the FSA. Variables below derived from student location of residence and census data using all students at the school average over the 3 years studied.</b>				
The percentage of those who moved in the last year	-0.16 (.08)	-0.10 (.08)	-0.32 (.11)**	-0.28 (.11)*
The percentage of lone parents	-0.16 (.04)**	-0.18 (.04)**	-0.11 (.06)	-0.15 (.06)**
Unemployment rate in households with children	-0.24 (.13)	-0.23 (.13)	-0.28 (0.17)	-0.28 (.17)
The percentage of those over 20 years of age who have some university education	0.05 (.04)	0.052 (.03)	0.13 (.04)**	0.12 (.04)**
<b>School structure variables in the FSA regressions</b>				
Indicator that school begins in Grade 6	NA	NA	-.41 (1.04)	0.12 (1.05)
Indicator that school begins in Grade 7	NA	NA	-6.24 (1.44)**	-5.79 (1.47)**
<b>Regression Statistics</b>				
Number of schools in the regression	966	854	769	663
Explanatory power of the regression	0.43	0.40	0.44	0.37
Number of independent schools in regression	116	0	110	0
* statistical significance at 5 percent. ** statistical significance at 1 percent. Sources: Author's calculations from 2006 Census; FSA.				

## References

Johnson, David. 2008. School Grades: Identifying British Columbia's Best Schools. C.D. Howe Institute Commentary. Toronto.

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