

Ontario Grade 3 student achievement

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This article is adapted from "Factors affecting Grade 3 student performance in Ontario: A multilevel analysis." *Education Quarterly Review*, Statistics Canada Catalogue no. 81-003, Vol. 7, no. 4, 2001.

An important measure of children's well-being is their academic performance. Previous research has shown that the socio-economic status of students and features of the home environment may have a large impact on academic achievement. Teaching practices, class size, parental involvement with the school and school neighbourhood characteristics may also exert incremental effects on academic performance.¹

This study identifies factors that influenced Ontario Grade 3 student achievement in reading, writing and mathematics in 1996-97. An "ecological" approach is taken to examine these factors including characteristics of individual students and their families (student level); teachers and classrooms (class level); and schools and school neighbourhoods (school level).²

The face of Grade 3 in Ontario

In 1997, few Grade 3 Ontario students had a first language that was not English (5%) and few were enrolled in French immersion programs (4%), yet nearly one-quarter came from homes where a language other than English was spoken. More than half the students (54%) had home computers, but 70% of Grade 3 classes had limited or no access to computers in their school. About 59% had more than 100 books available to them at home. Grade 3 classes were frequently split-grade (47%) and were often taught by

teachers with no more than 10 years of teaching experience (63%). Most schools were public schools (69%) and were in urban areas (83%).

Based on this profile, a reference group was created to assess the impact on test scores of changes in student, class and school characteristics. The reference group embodies the most common characteristics of Grade 3 students: that is, it represents an English-speaking girl in a public school, with a reference score of 51 out of 100 who is not in a split-grade class and whose school is located in an urban neighbourhood with a median household income of \$42,500 (among other characteristics).³ The model developed for this study shows how test scores change when a student's characteristics deviate from that of the reference group. Thus, for example, being a boy would reduce the test score by 3 points to 48, compared with 51 for the reference group, even when all other characteristics remain the same.

Data in this article come from two sources. The 1996-97 Education Quality and Accountability Office (EQAO) database for Ontario provides data on province-wide standardized academic achievement tests. The EQAO data used in this study consist of student scores on 14 performance assessments in mathematics, writing and reading; information on four background questionnaires completed by students, parents/guardians, teachers and principals; and a student information form completed by teachers. These questionnaires provide information on student, family, teacher, class and school factors related to student performance.

The 1996 Census of Population collects data about the socio-economic status of residents in the school's neighbourhood (e.g. educational attainment) and whether the school is located in an urban or rural environment. In urban areas, school neighbourhoods are defined as the area within walking distance of the school, measuring a 1.6-kilometre radius. In rural areas, "neighbourhood" is defined as the census subdivision in which the school is located.¹

Target population and sample size

The target population consisted of all Grade 3 students enrolled in English-speaking schools in Ontario for 1996-97 (typically children about 8 years old). Excluded were those students who were

exempted from the test or whose records had missing information. The sample used for analysis represented nearly 116,000 Grade 3 students in over 6,900 classrooms in almost 3,300 schools. Tests were administered during April 1997 to assess the knowledge and skills that students had acquired in Grade 3 and earlier grades.

Achievement measure

The standardized test scores consisted of 14 performance assessments: 8 in mathematics, 3 in writing, and 3 in reading. The performance assessments were scaled using a logit transformation. The average achievement measure used in this analysis combines mathematics, writing and reading assessments into one score for each Grade 3 student.

The model

Student performance is thought to be influenced by numerous factors at different levels. Therefore, multilevel regression modeling was used to permit the simultaneous analysis of the influence of student, class and school characteristics on student achievement. The final model explains 21% of the variation in Grade 3 students' test scores, which falls into the typical range for this type of analysis.

1. A census subdivision is a geographic area representing a municipality or its equivalent, such as Indian reserves or settlements, or unorganized territories.

Girls with computers and books at home do better

Students' sex, language and socio-economic background were all significantly associated with student achievement on the tests. For example, girls scored 3 points higher than boys. These results generally echo those of other researchers.⁴ Grade 3 students whose second language was English recorded performances 3 points lower than those whose mother tongue was English. If English was not the dominant language spoken at home, the students' performance was about 1 point lower than that of students from English-speaking homes.

French immersion programs had no effect on test results.

The socio-economic status of students' families were approximated by two proxy measures: the availability of more than 100 books and a computer at home. Students who had both of these resources scored an average of 6 points higher than those who had neither. This implies that socio-economic status plays a significant role in student achievement.

Past studies have suggested that parental involvement in children's education is associated with a wide range of positive outcomes for elementary school children, including higher

student achievement.⁵ Grade 3 students whose parents were not involved with the school scored 1 point less than the rest. Interpreting the meaning of the association between parental involvement and student achievement, however, is not straightforward. It may be that parental involvement is a marker for parental enthusiasm and positive parenting style.⁶

Experienced teachers and small classes are associated with higher test scores

After accounting for other variables influencing achievement, students scored 1 point higher when taught

by teachers who had more than 10 years of teaching experience in the lower elementary school grades or who were comfortable with the curriculum. Also, the more closely the teachers reported following the current curriculum, the better the students performed.

Smaller class size, proxied by the number of Grade 3 students in the class, can positively influence achievement.⁷ On average, 17.3 children were in each class, but class sizes were often much larger because nearly half of Grade 3 classes were split grades. By adding 8 more Grade 3 students to a class, students performed almost 1 point lower than students in classes of average size. Evidence about the relationship between class size and student performance in the United States has been mixed.⁸ Research suggests that even though teachers do not change their teaching strategies in smaller classrooms, students are more readily engaged in the learning process.⁹ While the size of a Grade 3 class was important in Ontario, having access to a computer in the classroom did not affect test outcomes. This mirrors results of a large U.S. study, which also found that computers in the classroom had no effect on student achievement at the Grade 4 level.¹⁰

Students at urban schools and higher income neighbourhoods achieved higher scores

The location of a school and the socio-economic profile of its neighbourhood were also linked to student achievement on the tests. Students from rural schools scored 2 points lower than those from urban schools. This contrasts starkly with U.S. research showing that elementary students in urban schools perform below their non-urban counterparts, even after accounting for the higher concentration of low-income students in urban U.S. schools.¹¹ As expected though, students attending schools located in neighbourhoods with

Base test score for reference group	51
Student-level characteristics	Change in base test score
Sex (male)	-3
English is the student's second language	-3
French immersion	0
No computer at home	-3
Less than 100 books at home	-3
Language other than English spoken at home	-1
Parents not actively or somewhat involved with school	-1
Class-level characteristics	
Teacher characteristics	
More than 10 years teaching experience	1
Comfortable with curriculum	1
Teaching practice ¹	1
Class environment	
Average number of grade 3 students in class ²	-1
Limited access to computer in class	0
No access to computer in class	0
School-level characteristics	
School environment	
Small school – less than 230 students	0
Large school – more than 471 students	0
School neighbourhood	
Rural ³	-2
% of population with less than high school ⁴	-1
Less than 0.6% of population are recent immigrants ⁵	-1
More than 8.2% of population are recent immigrants ⁵	3
Median income ⁶	1

1. Change in student achievement when teachers followed the curriculum more closely by one standard deviation.
2. Change in student achievement when eight more Grade 3 students are added.
3. Rural schools include those in towns, villages and other populated places with less than 1,000 population, and rural fringes of census metropolitan areas and census agglomerations that may contain estate lots and agricultural or undeveloped land with a population density of less than 400 people per square kilometre.
4. Change in student achievement when the percentage of the population with less than high school graduation increases by 13 points.
5. Recent immigrants are those who entered Canada between 1991 and 1996.
6. Change in student achievement when median school neighbourhood income is increased by \$10,000.

Sources: Education Quality and Accountability Office, 1996-97; and Statistics Canada, Census of Population, 1996.

	Sample size	%
Student-level characteristics	115,712	
Sex (female)		50
English is the student's second language		5
French immersion		4
Computer at home		54
More than 100 books at home		59
Language other than English spoken at home		24
Home language not reported		2
Parental involvement with school (actively or somewhat involved)		51
Class-level characteristics	6,929	
Teacher characteristics		
10 years or less teaching experience		63
Not comfortable with curriculum		25
Teaching practice (score) ¹		0 [†]
Class environment		
Average number of Grade 3 students in class		17 [†]
Split-grade with Grade 2		22
Split-grade with Grade 4		22
Other split grade		3
Limited access to computer in class		69
No access to computer in class		2
School-level characteristics	3,285	
School environment		
Public		69
Small school: less than 230 students		24
Large school: more than 471 students		25
School neighbourhood		
Urban		83
Population with less than high school graduation		31
Less than 0.6% of population are recent immigrants ²		24
More than 8.2% of population are recent immigrants ²		25
Median age under 33		23
Median age over 37		21
Median income (\$ 000)		42.5 [†]

[†] Numbers are not percentages.

1. Teaching practice was a standardized measure of 68 items with mean 0 and standard deviation 1, representing how closely the teacher followed the suggested curriculum. The teaching practice scores ranged from -3.02 to 5.87.

2. Recent immigrants are those who entered Canada between 1991 and 1996.

Sources: Education Quality and Accountability Office, 1996-97 and Statistics Canada, Census of Population, 1996.

affluent and well-educated populations outperformed those in less-advantaged neighbourhoods. A \$10,000 increase in the neighbourhood median household income is associated with a 1-point increase in student scores.

Also, after accounting for other characteristics, students living in a school neighbourhood with a high proportion of recent immigrants performed 3 points better than those who did not. Other studies have found that immigrant students perform as well as or better than native-born students.¹²

Student characteristics account for two-thirds of variation in test scores

The variation in students' achievements may be attributed to a number of factors, such as student characteristics (67% of the variation), classroom environment (20%), and school environment or neighbourhood (13%).¹³

While factors that students "bring to the classroom" (i.e. their natural academic ability, their motivation) can explain the bulk of student achievement, a surprisingly large amount of variation was attributable to types of classes and schools. Variation at these levels was similar to that found in American studies, yet the popular perception is that Canada probably has smaller differences in school environments than the United States.¹⁴

Summary

Girls, students with computers and books at home, and students whose first language was English outperformed their peers. Other important characteristics affecting test scores were not examined and may help to explain variations in test scores. These factors include students' past achievement, parents'/guardians' education levels, and students' use of cognitive resources in the home.

Tangible and intangible community resources can also have an effect.¹⁵ Students from urban schools, in school

neighbourhoods with high incomes and with many recent immigrants scored higher on the Grade 3 achievement tests after accounting for other factors in the model. The influences of schools and neighbourhoods on child performance are particularly important from a policy perspective because they are amenable to change through policy intervention.

Families and neighbourhoods can influence how well Grade 3 students perform in school. However, factors such as socio-economic status represent only one dimension of influence on achievement. General family functioning, parents' involvement with school-related issues, and strength of social ties among neighbourhood residents are not examined in this article and may be the subject of future research.

Endnotes

1. Ryan, B.A. and G.R. Adams. 1999. "How do families affect children's success in school?" *Education Quarterly Review* (Statistics Canada Catalogue no. 81-003) 6, 1: 30-43; Sun, Y. 1999. "The contextual effects of community social capital on academic performance." *Social Science Research* 28: 403-426; Valenzuela, A. and S.M. Dornbusch. 1994. "Familism and social capital in the academic achievement of Mexican origin and Anglo adolescents." *Social Science Quarterly* 75, 1: 18-36.
2. Willms, D. 1992. *Monitoring School Performance: A Guide for Educators*. Washington, D.C.: The Falmer Press.
3. The reference group is defined as the group with the most prevalent characteristics. If the factor is continuous then the characteristic used to form the reference group is the average. Otherwise, the mode (most common category of a factor) is the characteristic used to form the reference group. One exception to this rule involved girls, who represented a minority (49.7%) of the Grade 3 class but were defined as the reference characteristic in the model.
4. Connolly, J.A., V. Hatchette and L.E. McMaster. 1999. "Academic achievement in early adolescence: Do school attitudes make a difference?" *Education Quarterly Review* (Statistics Canada Catalogue no. 81-003) 6, 1: 20-29; Willms, D. 1996. "Indicators of mathematics achievement in Canadian elementary schools." *Growing Up in Canada*. (Statistics Canada Catalogue no. 89-550-MPE96001.) In national assessments of 9-year-olds in the United States, girls scored consistently higher in reading than did boys, but there was no significant difference between the sexes for mathematics. Federal Interagency Forum on Child and Family Statistics. 1998. *America's Children: Key National Indicators of Well-Being*. Washington D.C.: U.S. Government Printing Office.
5. Zellman, G.L. and J.M. Waterman. 1998. "Understanding the impact of parent-school involvement on children's educational outcomes." *The Journal of Educational Research* 91: 370-380; Brody, G.H., Z. Stoneman and D. Flor. 1995. "Linking family processes and academic competence among rural African-American youths." *Journal of Marriage and the Family* 57: 567-579.
6. Zellman and Waterman. op. cit.
7. Alexander, K.L. 1997. "Public schools and the public good." *Social Forces* 76, 1: 1-30; Ravitch, D. 1999. "Student performance." *Brookings Review*. Winter: 12-16.
8. Class size was shown to have a large influence on achievement for children in the early grades: Finn, J.D. and C.M. Achilles. 1990. "Answers and questions about class size: a statewide experiment." *American Educational Research Journal* 27: 557-575; Mosteller, F. 1995. "The Tennessee study of class size in the early school grades." *Critical Issues for Children and Youths* 5: 113-127. Others argue that there is no class size effect: Akerhielm, K. 1995. "Does class size matter?" *Economics of Education Review* 14: 229-241; Hanushek, E.A. and S.G. Rivkin, 1996. *Understanding the 20th Century Growth in U.S. School Spending*. National Bureau of Economic Research (NBER). Working Paper #5547 NBER. Washington, D.C.
9. Finn, J.D. and C.M. Achilles. 1999. "Tennessee's class size study: Findings, implications, misconceptions." *Education Evaluation and Policy Analysis* 21, 2: 97-109.
10. Johnson, K.A., Ph.D. 2000. *Do computers in the classroom boost academic achievement? A report of the Heritage Center for Data Analysis*. www.heritage.org/library/cda/cda00-08.html. (Accessed August 13, 2001).
11. U.S. Department of Education, National Center for Education Statistics. 1996. *Urban Schools: The Challenge of Location and Poverty*. Washington, D.C.
12. Gibson, M.A. 1987. "The school performance of immigrant minorities: A comparative view." *Anthropology and Education Quarterly* 18, 4: 262-275. Ogbu, J.U. 1983. "Minority status and schooling in plural societies." *Comparative Education Review* 27, 2: 168-190.
13. Variation accounted for by this model is in the typical range for this type of analysis. Gray, J. 1989. "Multilevel models: issues and problems emerging from their recent application in British studies of school effectiveness." *Multilevel Analysis of Educational Data*. R.D. Bock (ed.). San Diego: Academic Press. p. 127-142; Organisation for Economic Co-operation and Development (OECD). 1998. *Education at a Glance: OECD Indicators 1998*. France: Centre for Educational Research and Innovation.
14. *ibid.*
15. Brooks-Gunn, J., P. Duncan, P.K. Klebanov and N. Sealand. 1993. "Do neighbourhoods influence child and adolescent development?" *American Journal of Sociology* 99, 2: 353-395; Kohen, D.E., C. Hertzman and J. Brooks-Gunn. 1999. "Neighbourhood affluence and school readiness." *Education Quarterly Review* (Statistics Canada Catalogue no. 81-003) 6, 1: 44-52. Lev-anthal, T. and J. Brooks-Gunn. 2000. "The neighbourhoods they live in: the effects of neighbourhood residence of child and adolescent outcomes." *Psychological Bulletin* 126, 2: 309-337.



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